J. King Saud Univ., Vol. 7, *Science* (2), pp. 257-276 (A.H. 1415/1995)

Interpretation of Geoelectrical Data from an Area of the Entrance of Wadi Qena, Eastern Desert, Egypt

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(Received 30/3/1994; Accepted for publication 9/10/1994)

Abstract. Wadi Qena is one of the most important wadis in Egypt. It represents an ancient tributary of the River Nile. The area under study represents a part of the entrance of the major wadi. It is covered by porous Quaternary alluvium. Such an environment is quite suitable for the groundwater charge from the occasional rainfalls. In this study, forty vertical electric soundings (40 VES-es) measured in the area are re-examined. The sounding data are automatically reduced and analysed using advanced software. Interpretation of each curve model provides the equivalent layering in the form of n-layers with different thicknesses and true resistivities. The interpreted results indicate the possible presence of two wet zones. The first one is very shallow (< 10 m) and formed as lenses. It possibly corresponds to the shallow water-bearing layer present in the area. The second wet zone is of great extension. Its depth ranges from 17 to 35 m and its thickness varies from 24 to 75 m. Possibly this zone corresponds to the quaternary aquifer prevailing in the Nile Valley. The last geoelectric layer below the Quaternary aquifer has remarkably high resistivity values. It possibly corresponds to a dry weathered zone.

Introduction

The investigated area is a part of the dry regions of Upper Egypt. It is located at the entrance of Wadi Qena, between Latitudes 26° 10′ to 26° 30′ N and Longitudes 32° 40′ to 33° 00′ E (Fig. 1).

Wadi Qena is considered by the government to be one of the interesting areas in Egypt. It features in reclamation plans, and committees have been set up to adress problems of a dense population within the valley. The search for water in this wadi represents one of the most important aims of current planning.

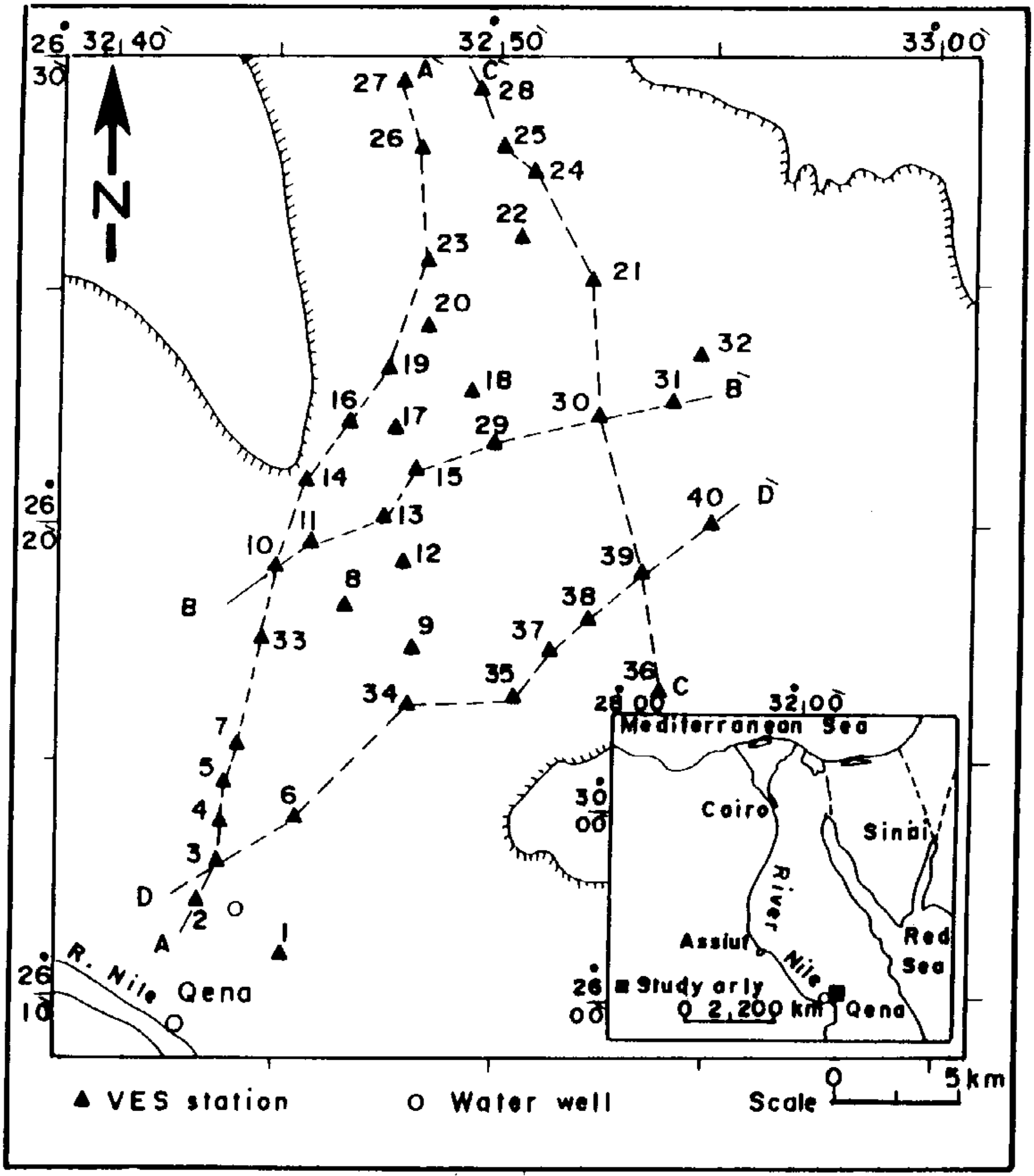

Fig. 1. Map showing the study area, VES stations and profiles

All regional groundwater projects require at various stages the service of geophysics (especially electric resistivity method). It is used mainly as an aid in the determination of the horizontal and vertical distribution of aquifers and their regional boundaries and to locate best sites for drilling new wells. It is also used in tracing fresh and saline water in aquifers with the help of hydrochemical data. A wide range of geophysical methods is available for application in groundwater exploration. Surface electrical methods are still the most widely used for general and detailed subsurface reconnaissance because of the low expense involved and the wide range of applicability.

There has been no hydrogeological study to evaluate the groundwater possibilities in Wadi Qena. Shaaban [1], and Samir and Shibl [2] carried out geophysical studies on some parts of the Eastern Desert away from Wadi Qena. Their studies aimed at getting information about the geologic factors controlling the occurrence of water, and studying the geoelectric sections and resistivity values of the different horizons.

The aim of the present study is to investigate the groundwater potentialities in a part of the entrance of Wadi Qena. The study is based on the re-examination of the VES data obtained by Hassan [3]. He followed the curve smoothing and matching techniques proposed by Orellana and Mooney [4]. The current authors have re-examined the VES curves using new software. The present interpretation takes into account all available information from both geology and available drilled wells within the area. The results of the new study differ from those obtained by Hassan [3].

Geological Background

The study area lies on the eastern bank of the River Nile (Fig. 1). It represents small part of the enterance of Wadi Qena, east of Qena City.

Wadi Qena is considered one of the most interesting wadis in Egypt. It represents an ancient tributary of the Nile River during its geological history. The wadi is bounded on the west by cliffs of a limestone plateau (Fig. 2).

The area under study is formed of a relatively low-lying conspicuous plain covered by alluvial and aeolian sediments of Plio-Pleistocene to Recent age (Fig. 2).

Different rock units of the Upper Cretaceous and Lower Eocene are exposed on the southern and northern flanks of the wadi. The succession present at Wadi Qena

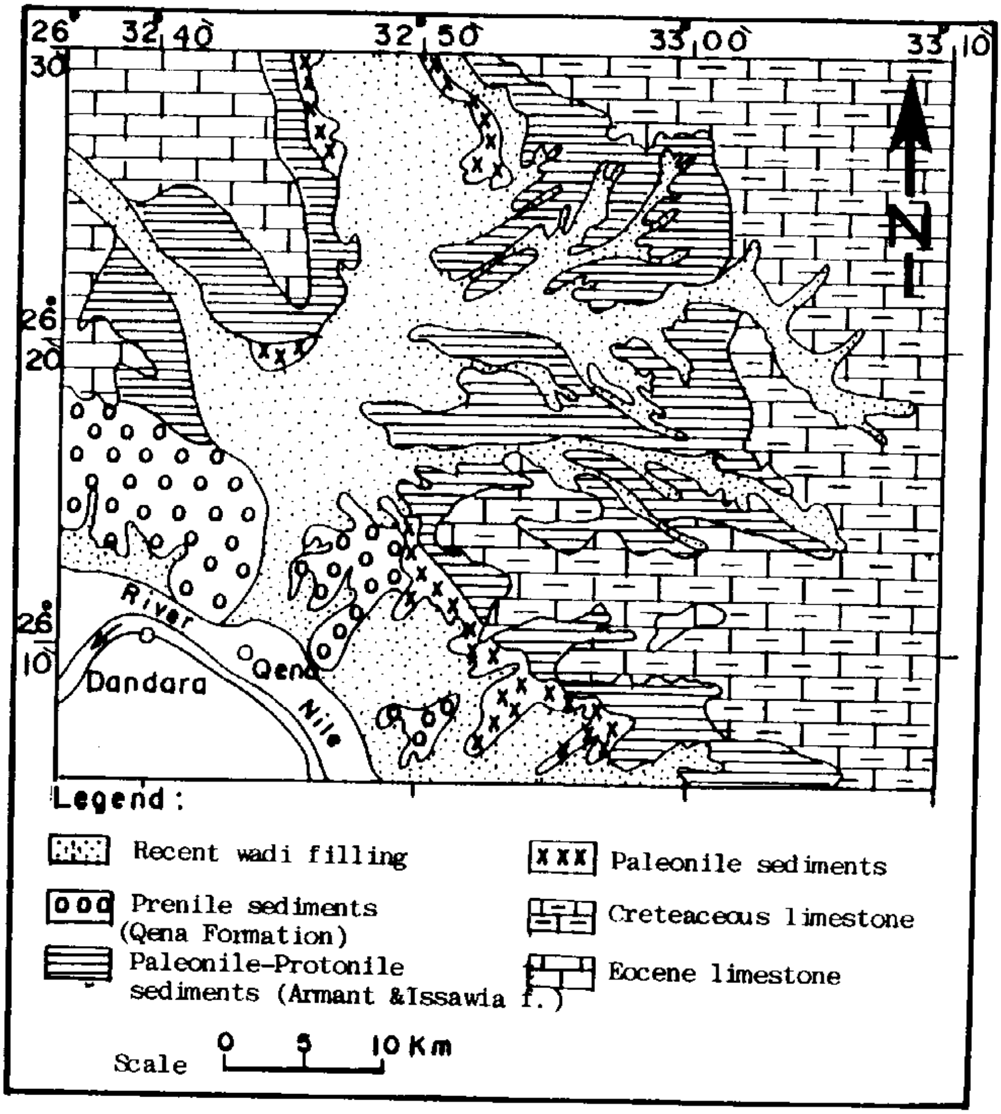

Fig. 2. Simplified geological map of the southern area of Wadi Qena (compiled after Said [5])

area has been studied by many workers including Said [5] and Ahmed [6]. The following is a brief description of the stratigraphy presented by Said [5], (Fig. 2) from base to top:

1) Nubia Sandstone, overlies directly the peneplained surface of the basement complex. It is composed mainly of cross-bedded fine to coarse-grained sandstones with shale intercalations.
2) Qusier Shale, consists of sandstones shales with a few limestone interbeds.
3) Duwi Formation, is composed of phosphorite beds with intercalations of shales, marls, sandstones and Oyster limestone in its top part.

4) Dakhla Shale, consists of marls in its lower part and shales interbedded with calcareous bands in its top part.
5) Tarawan Chalk, consists mainly of chalks.
6) Esna Shale, is composed mainly of shales.
7) Thebes Formation, is composed of white to greyish white limestone with flint nodules. These rocks are assigned Early Eocene age (Early Ypressian) [7].

According to Said [5] the sediments of the Recent, Pleistocene, Pliocene and Miocene ages can be divided into different units. They are as follows from base to top:

1) Paleonile sediments.
2) Paleonile/Protonile sediments (Armant and Issawia Formations).
3) Prenile sediments (Qena Formation).
4) Neonile sediments.
5) Recent to subrecent alluvial cover.

The recent deposits are composed mainly of unconsolidated sediments of the Nile flood plain, wadi filling as well as fanglomerates and sand dunes. The Nile flood plain deposits are represented by muds and silts. Wadi deposits include the alluvial sediments which consist of gravels of different sizes embedded in sandy, silty and clayey matrix.

Structure

The structural elements observed in the cliffs bordering Wadi Qena have been reported by many authors (*e.g.* Said [5] and [9], Schrumann [8], Abdel Razik and Razaliaev [10], and Awad [11]) and include faults, folds and joints. The faults have different trends: NW-SE (Gulf of Suez or Red Sea trend), NNW-SSE, and WNW-ESE, ENE-WSW, NE-SW (less abundant faults). Most of the drainage lines debauching the main channel of Wadi Qena are controlled by and originated along these faults. The NE-SW fault system seems to have controlled the path of the Nile in the area between Qift and Qena (Abdel Razik and Razaliaev, [10]). Most of the drainage lines and some tributaries that join Wadi Qena are controlled partially by fault lines belonging to this trend.

Schrumann [8] proposed that the NW-SE fault system intersects the Paleozoic or even Precambrian rocks in the Eastern Desert. Abdel Razik and Razaliaev [10] mentioned that the dislocation of Cretaceous-Paleocene sediments exposed between Jdfu and Qena is due to the vertical displacement of the basement blocks.

The distribution and accumulation of the Quarternary deposits are believed to be influenced greatly by fault systems dissecting bedrocks of Upper Cretaceous – Upper Tertiary age.

Folds are represented by a very dense system of narrow and long folds having the dominant direction N 115°. Joints show different directions and lengths.

Surface Geoelectric Method

In general, the object of the Vertical Electric Sounding (VES) technique is to determine any variation in the resistivity of the subsurface layers with depth.

Hassan, [3] carried out a geoelectric resistivity survey on small part of the entrance of Wadi Qena (Fig. 1). The resistivity measurements were carried out using Schlumberger array with electrode spacings up to 300 m at most stations. The stations are randomly distributed and their directions are not controlled by any geologic features present.

In this study, a re-examination of the VES curves measured by Hassan is made with the aim of deriving more reliable results from the measured data. These data are here re-examined using a forward modelling technique, instead of the older curve matching approach, because the present technique offers more effective interpretation tool for groundwater exploration.

All re-interpreted VES curves are compared with the results of the manual technique carried out by Hassan [3]. A remarkable difference is observed between the results of the two interpretation methods. The new results show good agreement with the prevailed hydrogeologic conditions in the area.

Results and Discussion

The form of the VES curves measured at forty locations throughout the surveyed part of Wadi Qena are of different types (*e.g.* QH, QQH, QQQH, KQH and KQQH-type sections) (Table 1). Examples of the measured field VES curves are shown in Fig. 3 (a b). The form of these curves is a function of the resistivities and

Table 1. Results obtained from the present interpretation of the VES curves

VES no.	Type of curve	No. of layer	Resistivities (Ohm.m)					Thickness (m)				Aquifer		
			ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	t_1	t_2	t_3	t_4	Depth (m)	Thick (m)	Resist. (Ohm.m)
1	QH	4	1958	476	56	165	–	1	6	27	–	34	–	165
2	QQH	5	32083	207	17	72	650	3	6	18	30	27	30	72
3		–	–	–	–	–	–	–	–	–	–	–	–	–
4	QH	4	29931	1350	4593	16839	–	4	12	34	–	–	–	–
5	Q	3	17172	165	1223	–	–	21	24	–	–	21	24	165
6	QH	4	428480	5478	129	820	–	3	20	27	–	23	27	129
7	KQH	5	22839	38450	7910	2400	4580	–	–	–	–	–	–	–
8	QQH	5	138870	23870	2313	108	197	2	3	30	65	35	65	108
9	QQH	5	17240	3100	470	142	3055	1	4	19	28	24	28	142
10	QH	4	3875	640	193	489	–	5	30	40	–	35	40	193
11	QH	4	7422	1229	192	2265	–	4	20	51	–	24	51	192
12	QQH	5	62630	3490	299	33	336	2	4	11	59	17	59	33
13	QQH	5	6516	429	113	24	271	2	6	16	51	24	51	24
14	QH	4	23474	583	106	672	–	5	30	66	–	35	66	106
15	QQH	5	4038	280	41	156	1547	2	3	26	36	31	36	156
16	QH	4	57	28	7	120	–	3	14	59	–	–	–	–
17	QQH	5	21250	5188	646	216	562	2	3	20	36	31	36	216
18	QQH	5	1305	132	8	72	782	1	10	25	40	35	40	72
19	QH	4	18757	1320	73	1099	–	3	33	75	–	36	75	73
20	QQH	5	1567	728	126	46	789	2	6	16	52	24	52	46
21	QQH	5	18547	3743	584	40	856	2	4	11	49	17	49	40
22	QH	4	2612	623	39	337	–	4	20	51	–	24	51	39
23	QQH	5	1614	742	288	74	697	2	4	19	51	25	51	74
24	QQH	5	3562	901	433	55	109	2	5	25	68	32	68	55
25	QQH	5	2463	887	313	57	624	2	4	11	59	17	59	57
26	QQH	5	24980	3420	427	106	229	2	5	16	51	23	51	106
27	QQH	5	4147	291	80	30	449	4	4	27	75	35	75	30
28	QQH	5	34512	3419	513	90	1205	5	11	19	40	35	40	90
29	QQH	5	5609	535	208	75	1463	2	4	11	59	17	59	75
30	QQH	5	1339	600	39	225	3268	2	3	17	25	22	25	225
31	QQH	5	1269	354	142	64	1702	2	4	11	59	17	59	64
32	QH	4	5141	323	92	1475	–	4	20	27	–	24	27	92
33	QH	4	1420	304	37	423	–	4	12	35	–	16	35	37
34	QH	4	2439	170	79	587	–	8	17	51	–	25	51	79
35	QH	4	1737	165	55	1367	–	2	22	51	–	24	51	55
36	QH	4	2764	251	52	1055	–	2	5	59	–	17	59	52
37	QQH	5	8377	2089	198	52	367	2	4	6	59	17	59	52
38	QQH	5	1732	444	128	35	630	4	4	9	59	17	59	35
39	QQH	5	4092	365	33	136	1204	2	6	27	40	35	40	136
40	QQH	5	21034	4253	345	68	290	2	6	16	51	24	51	68

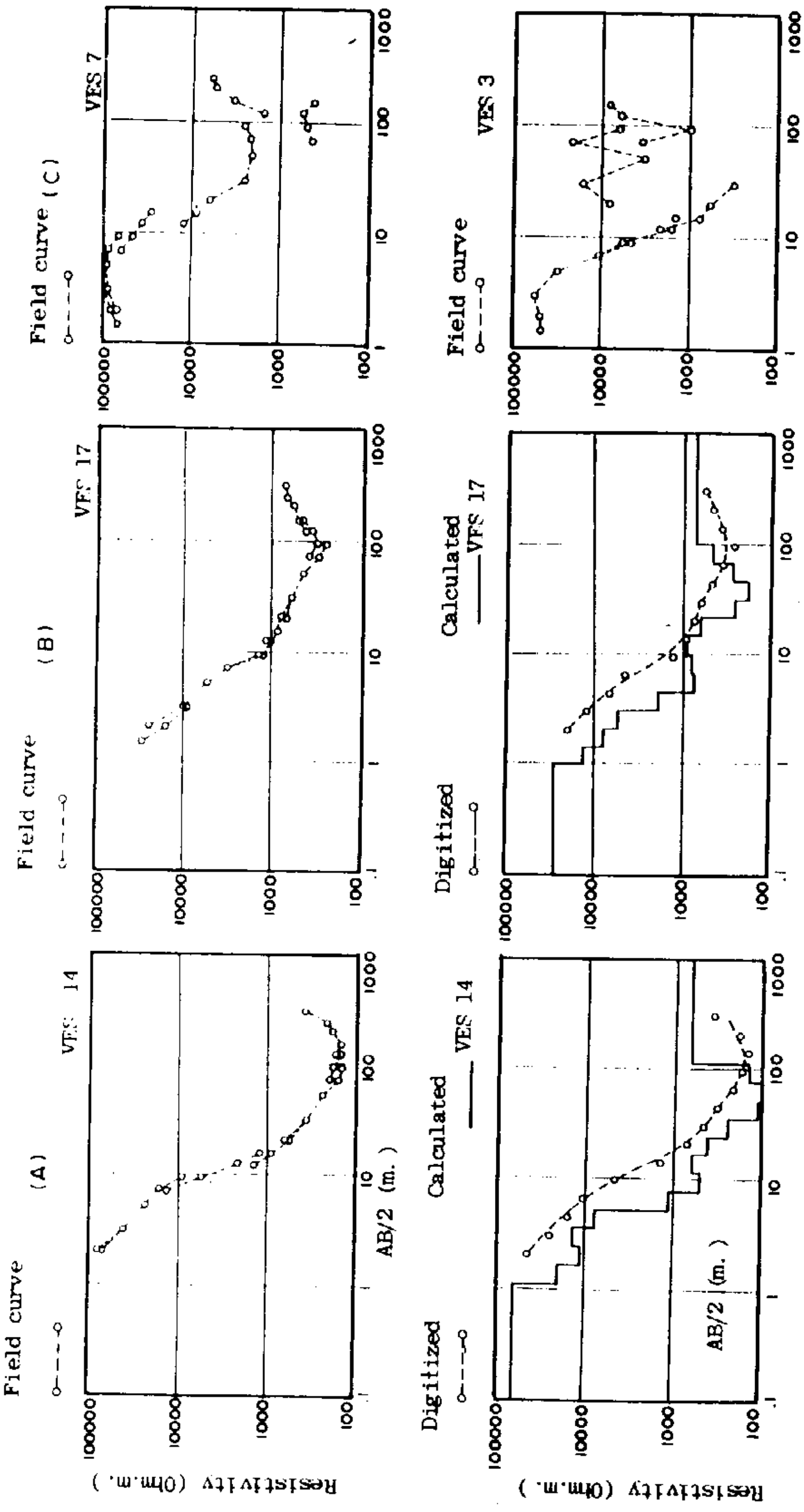

Fig. 3. Interpretation of VES curve 14(A), VES curve 17(B) and VES curve distortion (C)

thicknesses of the subsurface geoelectric layers, as well as the type of array employed (Schlumberger) in the examined area. Details of VES curve characteristics and electrode arrays are presented in many papers (*e.g.* Bhattacharya and Patra [12], and Zohdy *et al.* [13]).

The VES curves obtained in the study area are continuous with the exception of those measured at VES stations 3 and 7 (Fig. 3c). Distortion of VES curves is due to many causes both geological (*e.g.* vertical lithological contacts) and non-geological (*e.g.* buried pipe lines and current leakage) [14]. In the present study, VES distortion recorded at some stations was caused by buried structures (*e.g.* faults) or abrupt lithological changes characterizing the wadi-fill deposits.

The apparent resistivity (ρ_α) values determined at each VES station throughout the area are used to construct four apparent resistivity sections (Fig. 4) along the selected directions AA′, BB′, CC′ and DD′ as shown in Fig. 1. The study of these sections (Fig. 4) shows:

1) The surface and near-surface layers (dry zone) in all studied sections have a very high resistivity (reaching $>$ 1000 Ohm.m). They are made up of dry sands and gravels which are very comnmon sediments covering the area. This dry zone is very common in all arid regions. Values of apparent resistivities in the dry zone tend to decrease with depth and then increase again.
2) A geneal increase of apparent resistivity from north to south (*i.e.* toward areas of more aridity) and from east to west (possibly due to an increase in the thickness of the overburden).
3) Abrupt lateral and vertical changes in apparent resistivity values recorded clearly between VES stations 7 and 33 (Fig. 4a); and between VES stations 6 and 34 (Fig. 4d). These changes may be due to the presence of vertical lithological contacts (*e.g.* faults) or abrupt changes in type of sediments at such localities due to variation in depositional conditions.
4) The presence of an anomalous zone of very high resistivity below station 3 (Fig. 4 a&d) with a maximum value of about 7800 Ohm.m. The origin of such high resistivity values is possibly due to presence of appreciable buried amounts of dry materials, (*e.g.* sand and gravel) at the locality. These resistivity zones are clearly not favourable sites for water accumulations.

Sounding curves which were measured by Hassan [3] in a part of the entrance of Wadi Qena (Fig. 1) are re-examined here using a computer interpretation program

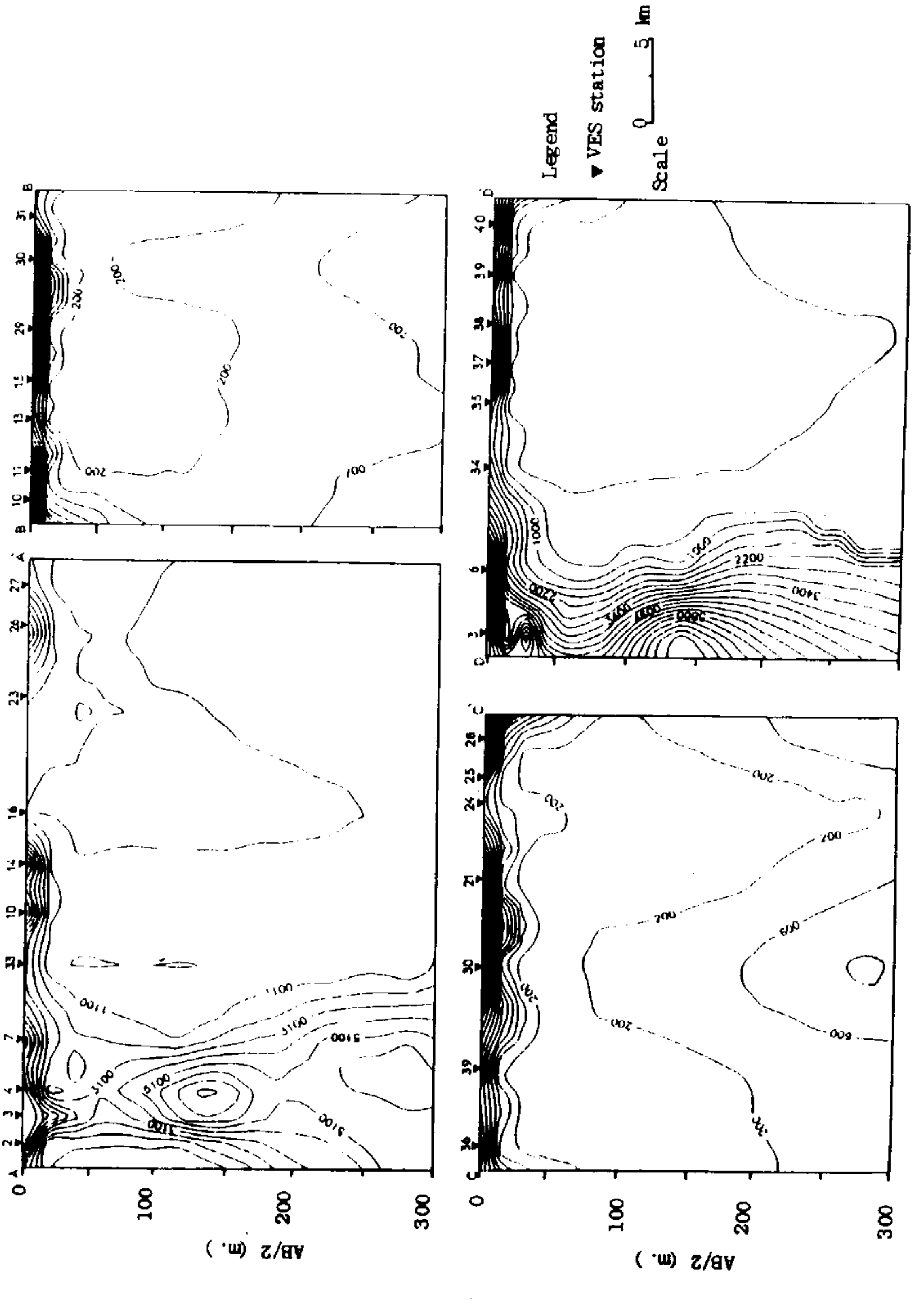

Fig. 4. Apparent resistivity sections

given by Zohdy [15]. The quantitative re-interpretations is shown in Table 1. Two examples showing field Schulmberger sounding curves with their corresponding automatic interpretation are illustrated in Fig. 3 (a&b). Comparing the present results (Table 1) with those obtained by Hassan [3] (Table 2), a distinct difference is clearly observed. Generally, the re-interpreted multilayers in each VES curves are grouped into 4 or 5 layers.

A correlation between the results of the quantitative interpretation of some VES curves measured beside drilled wells and their lithologic logs is given in Fig. 5. From this correlation the true resistivities, depths and thicknesses of the expected water-bearing layers are recognized (Table 1).

Based on the correlation mentioned above, the authors consider that the acceptable true resistivity of the water-bearing layer predominating in the area (possibly the Quaternary aquifer) is less than 200 Ohm.m. Also, they consider localities of low resistivities (< 100 Ohm.m.) and lying at a depth of less than 10 m represent water-bearing lenses which are very common in the area.

Figure 6 shows the variation in depth to the top of the probable water-bearing layer. The depth attains a minimum value (17 m) at VES stations 12,21,36,37 and 38 in the eastern part of the area. It reaches a maximum depth (35 m) at VES stations 10, 14, 17 and 21 lying in the western part. Generally, the depth decreases eastwards, *i.e.*, toward areas in which the main tributaries of the wadi are present, and increases westwards and northwards, *i.e.*, towards the mouth of the wadi. Good correlation is obtained between the depth of the drilled well 1 and those inferred from the re-examination of the VES curves measured at stations 1 and 2 lying beside that well.

The thickness of the expected water-bearing layer, as shown in Fig. 7, varies from 24 to 75 m. The minimum values (24-30 m) are found at VES stations 2,5 and 9 lying in the southern part of the surveyed area (near the Nile Valley). Maximum thicknesses (60-75 m) are found at VES stations 19,27,36 and 38 lying in the north-eastern part (at the convergence of the main tributaries of the wadi).

Figure 8 shows the possible distribution of the true resistivity of the expected aquifer. The resistivity does not exceed 200 Ohm.m. The minimum value of 30 Ohm.m is found in VES station 27 in the most northern part of the study area. The maximum value (> 190 Ohm.m) are found at VES stations 10 and 11 in the central western part. There is a general northward decrease of resistivity values which may be due to the type of water present and/or changes in lithologic facies of the aquifer.

Table 2. True resistivities and thicknesses of geoelectrical layers calculated from the vertical electrical sounding curves in the investigated area [3]

VES no.	True resistivities, ρ_t, (Ohm.m)						Thicknesses, (m)				
	ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	t_1	t_2	t_3	t_4	t_5
1	5800	1160.0	52.5	∞	–	–	0.9	7.2	67.5	–	–
2	22000	550.0	35.0	∞	–	–	1.6	4.8	22.5	–	–
3	46000	235000.0	7200.0	325.0	∞	–	1.2	0.5	1.2	21.0	–
4	60000	12000.0	350.0	∞	–	–	2.0	2.0	16.0	–	–
5	76000	760000.0	15000.0	1100.0	33.8	∞	1.5	3.0	15.0	36.0	140.0
6	460000	46000.0	3625.0	107.5	∞	–	1.5	1.5	14.4	20.0	–
7	70000	700000.0	7500.0	212.5	∞	–	1.6	0.6	10.5	20.7	–
8	800000	80000.0	4500.0	500.0	30.00	∞	1.4	4.2	13.0	24.0	45.0
9	100000	2500.0	130.0	∞	–	–	0.6	6.6	72.0	–	–
10	12200	1200.0	30.0	∞	–	–	1.8	21.6	15.2	–	–
11	55000	1375.0	60.0	∞	–	–	2.3	9.2	45.0	–	–
12	13000	325.0	15.2	∞	–	–	0.8	6.6	40.0	–	–
13	16500	412.5	100.0	2.7	∞	–	0.8	5.5	3.0	7.8	–
14	135000	27000.0	750.0	95.0	∞	–	0.9	3.5	12.0	92.0	–
15	4000	1000.0	31.3	∞	–	–	0.6	2.4	24.0	–	–
16	60	24.0	9.6	∞	–	–	2.2	17.6	33.0	–	–
17	4000	4000.0	50.0	170.0	∞	–	1.0	1.4	36.3	60.0	–
18	22000	1100.0	4.4	∞	–	–	0.8	7.0	16.0	–	–
19	220000	16500.0	1050.0	31.2	∞	–	2.3	2.3	27.0	69.0	–
20	11500	575.0	14.2	∞	–	–	0.5	8.8	27.0	–	–
21	19000	950.0	25.0	∞	–	–	1.3	7.5	56.0	–	–
22	7500	150.0	35.0	∞	–	–	1.1	7.7	100.0	–	–
23	6600	660.0	35.0	∞	–	–	0.6	3.9	36.0	–	–
24	3200	640.0	32.0	∞	–	–	1.2	24.0	99.0	–	–
25	5400	540.0	27.5	∞	–	–	0.8	7.5	49.7	–	–
26	34000	3400.0	87.5	∞	–	–	1.7	6.0	60.0	–	–
27	2400	120.0	12.5	∞	–	–	1.8	14.4	87.5	–	–
28	21000	1050.0	55.0	∞	–	–	2.4	12.0	36.0	–	–
29	14000	700.0	18.1	∞	–	–	1.1	8.6	18.0	–	–
30	17000	850.0	38.0	∞	–	–	2.1	6.3	16.9	–	–
31	3000	300.0	7.8	∞	–	–	1.0	6.5	10.5	–	–
32	20000	2000.0	55.0	∞	–	–	1.3	4.0	28.6	–	–
33	5500	550.0	24.0	∞	–	–	1.8	7.2	56.0	–	–
34	5500	1100.0	46.0	∞	–	–	0.8	6.4	54.0	–	–
35	3900	390.0	20.3	∞	–	–	1.1	5.5	37.5	–	–
36	8000	800.0	20.0	∞	–	–	1.2	7.2	45.0	–	–
37	26500	5300.0	300.0	16.5	∞	–	0.8	3.04	7.5	31.6	–
38	3400	340.0	9.0	∞	–	–	2.7	8.1	34.0	–	–
39	10500	525.0	22.4	∞	–	–	1.1	4.4	33.6	–	–
40	9750	975.0	100.0	52.0	∞	–	1.5	7.5	32.0	102.0	–

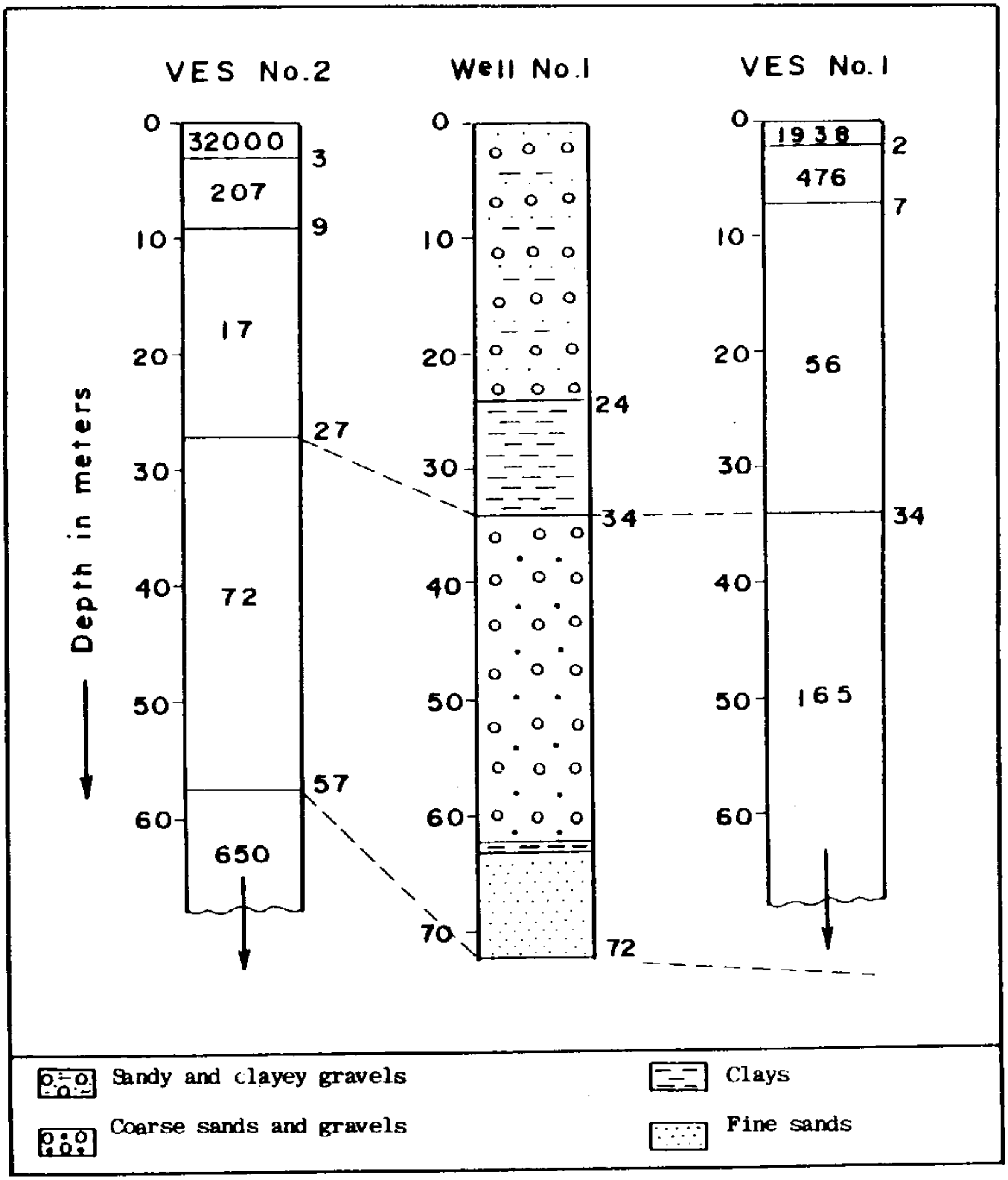

Fig. 5. Correlation between results of quantitative interpretation of VES curves 1&2 and lithologic log of an adjacent drilled well (For location seed Fig. 1).

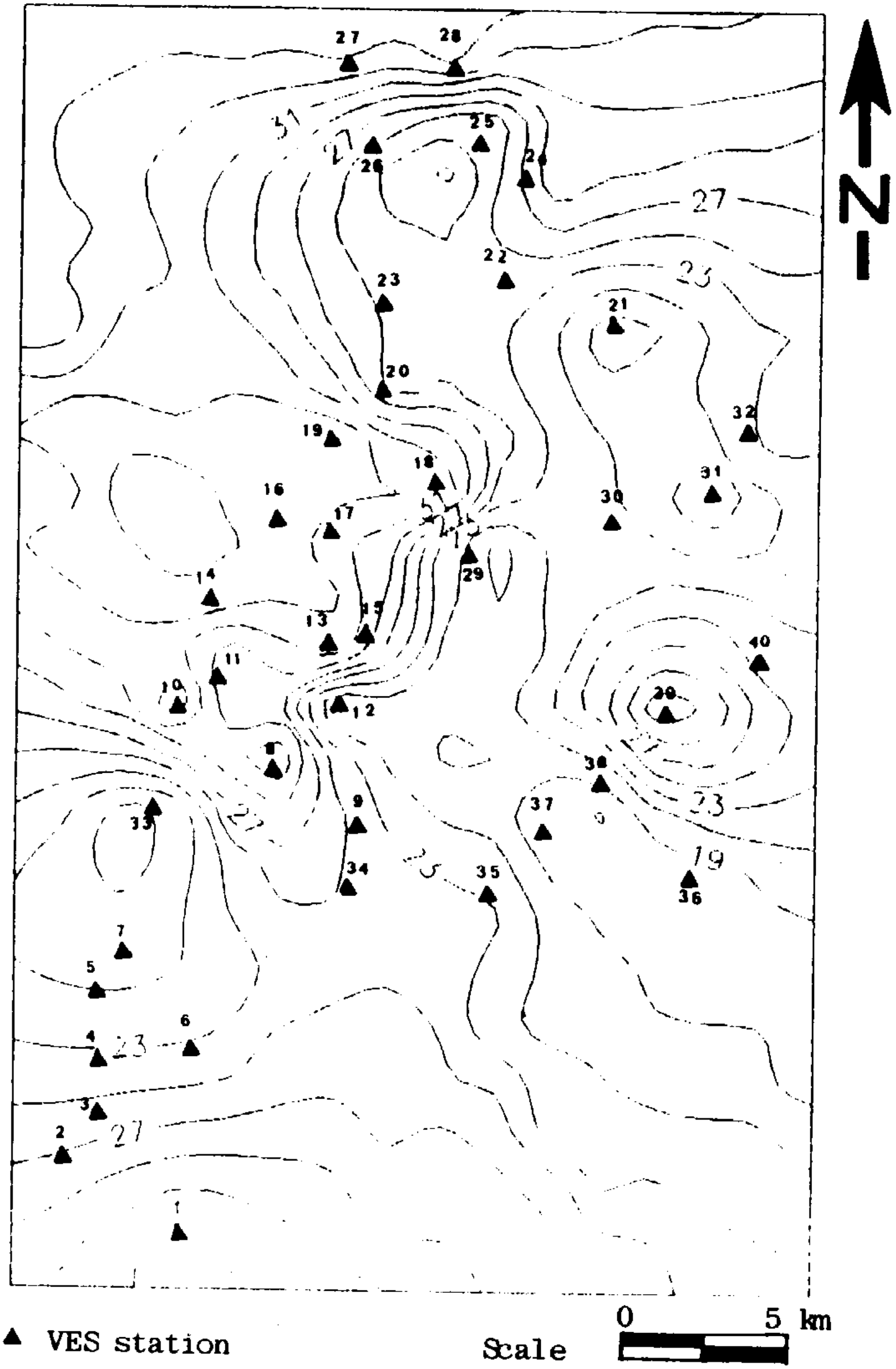

Fig. 6. Depth contour map to the top of the possible water-bearing layer (possibly the Quaternary aquifer).

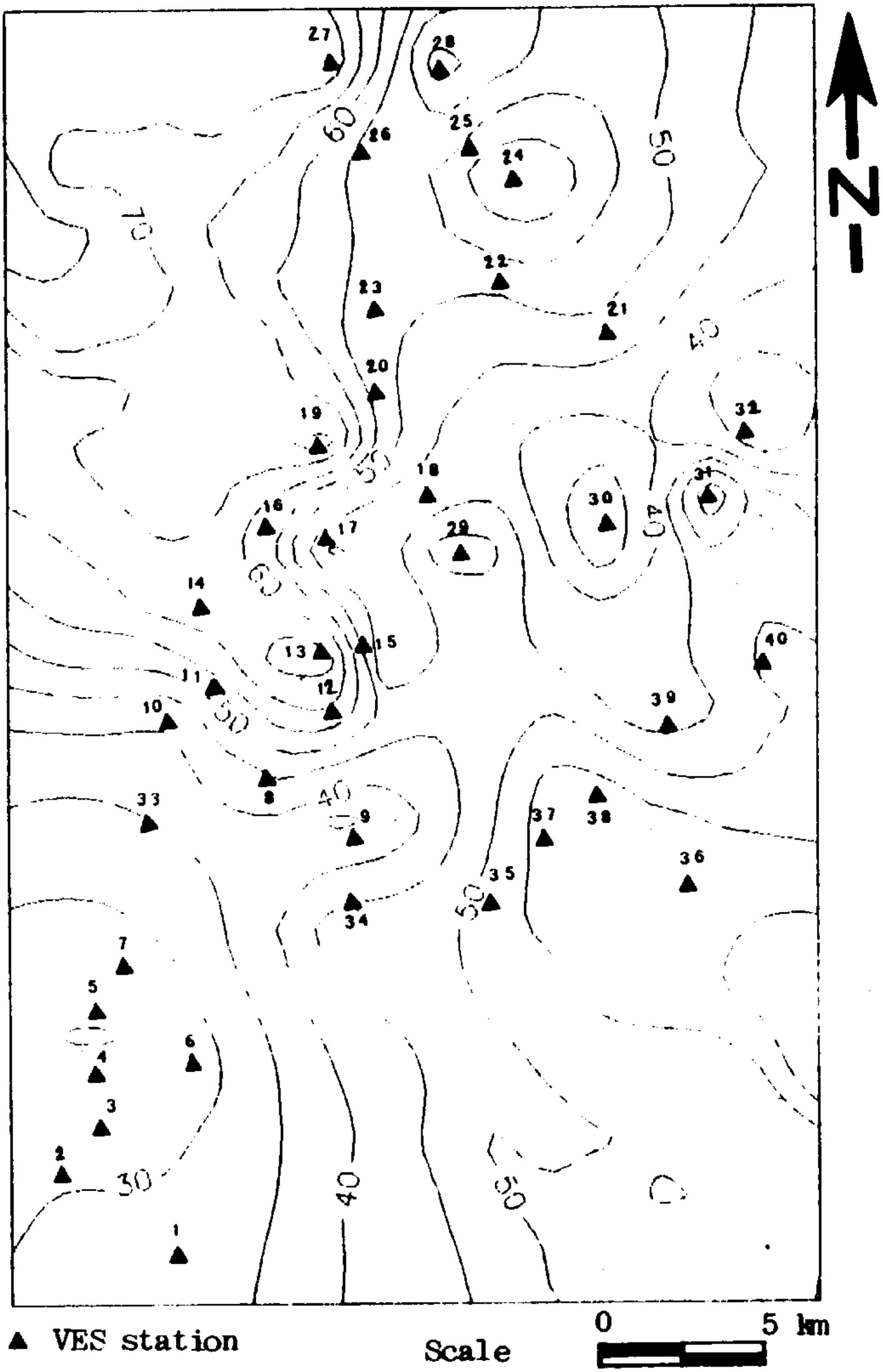

Fig. 7. Thickness map of the possible Quaternary aquifer.

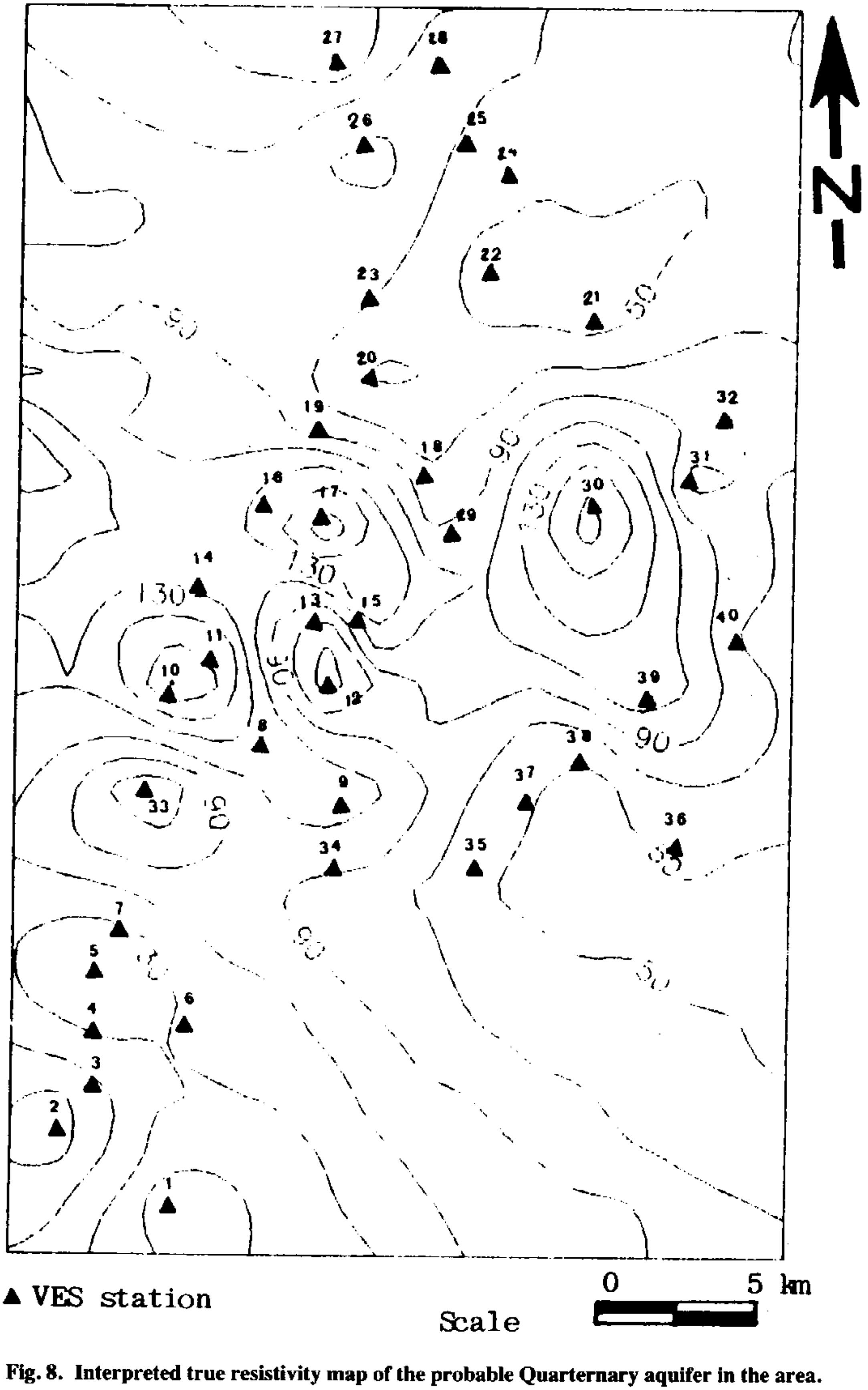

Fig. 8. Interpreted true resistivity map of the probable Quarternary aquifer in the area.

Further illustrations of the recognized geoelectric layers are presented in Fig. 9 and show that:

1) The first geoelectrical layer has a high resistivity, in most cases, ranging from 1000 Ohm.m. to greater than 10,000 Ohm.m. It corresponds to the dry zone which is very common in this part of Wadi Qena, and it consists of dry stands and gravels.
2) The second layer has relatively high resistivities (> 200 Ohm.m) except in certain areas. At VES stations 13,15 (Fig. 9b) and stations 34,35,37 and 38 (Fig. 9c), this layer has a very low resistivity and hence it can be considered to be the first wet zone. It may represent the water-bearing lenses existing in the area and lie at a very shallow depth.
3) The third layer, in the whole area, has a general low resistivity (< 200 Ohm.m). It is the second wet zone which probably corresponds to the major water-bearing layer (possibly the Quarternary aquifer).
4) The last detected geolectric layer is characterized by a remarkable increase of resistivity values (> 300 Ohm.m), representing deeper dry zone in the area. Possibly, materials of that dry zone represent sites of a weathered zone which has been formed during last period.

Conclusions

The results obtained from the present geoelectric study together with information available from geology and the drilled well in this part of Wadi Qena allow evaluation of the groundwater potential in the area. The conclusions obtained can be summarized as:

1) VES curves correspond to multi-layer sections of 4,5 and 6 geoelectric layers.
2) The surface layer, in the whole area, is characterized with a dry zone of high resistivity values (> 1000 Ohm.m). It represents surface dry zone constituting of sands and gravels.
3) The acceptable interpreted true resistivity of the two recognized wet zones is less than 200 Ohm.m. The variation of the resistivity values within the two detected wet zones may be due to the variation in quality of water as well as the type of sediments.
4) The near surface layer (< 10 m in depth) is characterized by very low resistivities. This wet zone can be considered as a water-bearing layer.

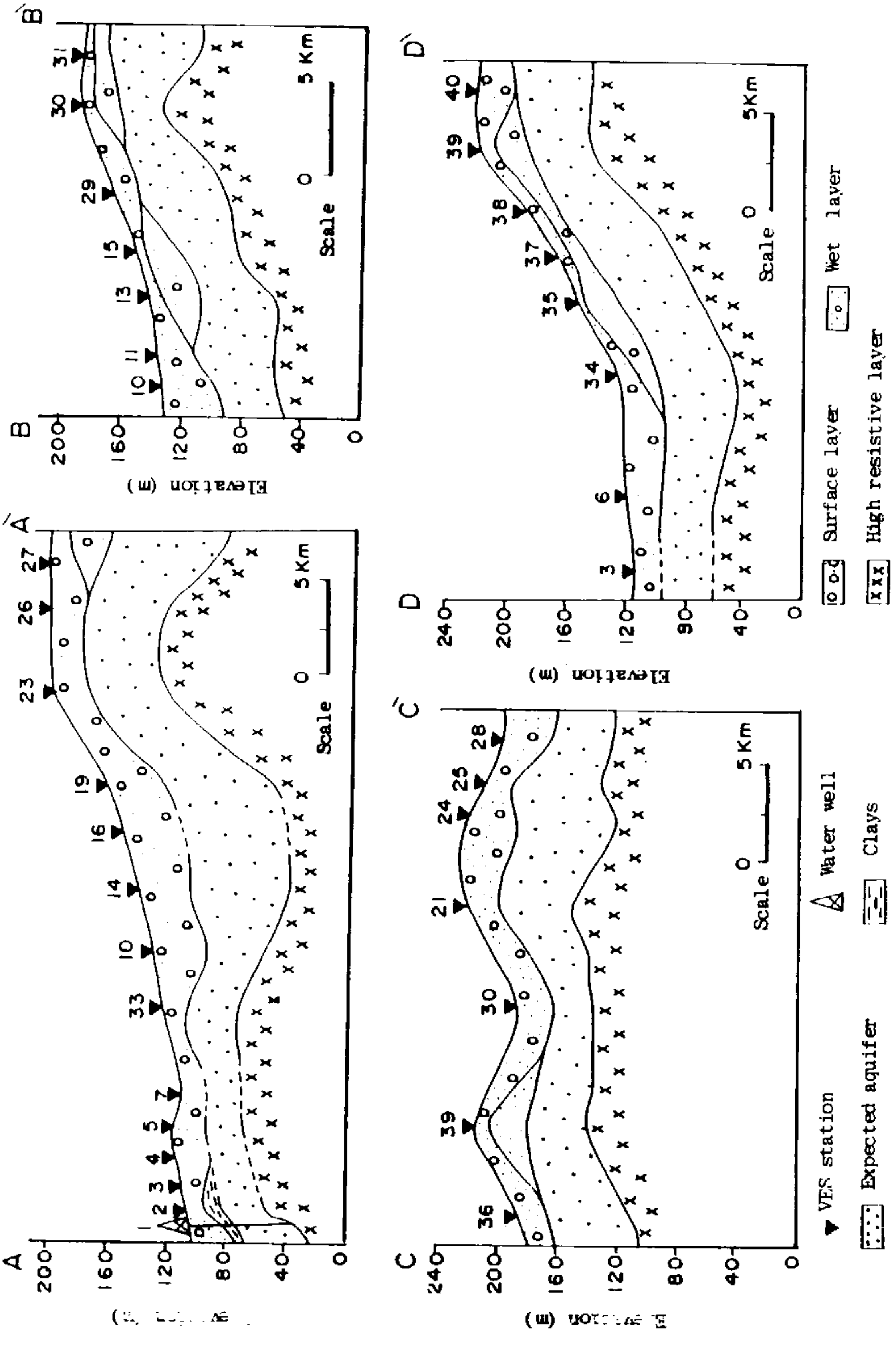

Fig. 9. Subsurface sections along profiles AA, BB and CC and DD.

5) The second wet zone recognized here is of great extension and it has depth ranging from 17 to 35 m and a thickness varying from 24 to 75 m. Possibly this zone corresponds to the Quaternary aquifer prevailed in the whole Nile Valley district.

6) The last detected geoelectric layer, underlying the Quarternary aquifer, has a remarkable high resistivity values. It may represent a dry weathered zone.

7) A possible explanation for the main differences between our results and those obtained by Hassan [3] is an adverse effect of manual smoothing and on the curve matching techniques employed by Hassan. Also he did not calibrate his interpretations with any hydrogeological information.

References

[1] Shaaban, M.A. "Geophysical Investigations for Groundwater Conditions in Wadi Beizah and Quseir areas, Eastern Desert of Egypt." *M.Sc. Thesis,* Faculty of Science, Cairo University, 1967.

[2] Samir, A. and Shibl, A.H. "Report on the Geophysical Work Carried out in Wadi Lahmi, Eastern Desert of Egypt." *Egypt. Geol. Survey and Mining Authority, Internal Report,* 1971.

[3] Hassan, S.O. "Geophysical (Geoelectric) Studies on Wadi Qena Area, Eastern Desert, Egypt." *M.Sc. Thesis,* Geology Dept., Assiut Univ., Qena Branch, 1985.

[4] Orellana, E. and Mooney, H.M. "Master Tables and Curves for Vertical Electrical Sounding over Layered Structures. Madrid: Interciecia, 1966.

[5] Said, R. *The Geological Evolution of the River Nile.* New York: Springer Verlag, 1981.

[6] Ahmed, E.A. "Sedimentological and Tectonic Evolution of Wadi Qena Area, Egypt." *Ph.D. Thesis,* Geology Dept., Assiut Univ., Assiut, 1983.

[7] Kenawy, A.I. "Planktonic Foraminifera of the Lower Tertiary Succession in the Taramsa Section, Qena, Nile Valley, Egypt." *Fragm. Min. Pal.,* 3, (1972), 25-116.

[8] Schurman, H.M. "Das Parkambrin der Arabischen Waste Aegyptens." *Geol. Rundschau,* Bd, 45 (1956), 179-193.

[9] Said, R. *The Geology of Egypt.* Balkema, Rotterdam: Brookfield, 1990.

[10] Abdel Razik, T.M. and Razvaliaev, A.V. "On the Tectonic Origin of the Nile Valley between Idfu and Qena, Egypt." *Egypt. J. Geology,* 16, (1972), 235-244.

[11] Awad, W.K. "Geophysical Investigations for Groundwater at Some Localities within Wadi Qena, Eastern Desert, Egypt." *1st Ann. Meet.,* Egypt, Geoph. Soci., Cairo, 1981.

[12] Bhattacharya, P.K. and Patra, H.P. *Desert Current Geoelectric Sounding, Principles and Interpretation.* Amesterdam: Elsevier, 1968.

[13] Zohdy, A.R.; Eaton, G.P. and Mabey, D.R. *Application of Surface Geophysics to Groundwater Investigations: Techniques for Water Resources Investigations of the U.S. Geol. Surv.,* Book 2, Chap. D1. U.S.A.: U.S.Geol.Surv., 1974.

[14] Zohdy, A.A.A.R. "The Effect of Current Leakage and Electrode Spacing Errors on Resistivity Measurements." *U.S. Geol. Surv. Prof.,* Paper 600 (1968), 258-264.

[15] Zohdy, A.R. "Programs for the Automatic Processing and Interpretation of Schlumberger Sounding Curves in Quick Basic 40." *U.S. Geol. Surv. Open File Rep.,* 1989.

تفسير البيانات الجيوكهربائية على جزء من مدخل وادي قنا، الصحـــراء الشرقيـة، مصـــــر

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(سُلِّمَ في ١٨/١٠/١٤١٤هـ، وقُبل للنشر في ٤/٥/١٤١٥هـ).

ملخص البحث. يعتبر وادي قنا من أهم الوديان القديمة التي تصب في نهر النيل بمصر. تمثّل منطقة الدراسة جزءًا صغيرًا من مدخل هذا الوادي. ويغطي سطح المنطقة رواسب الرمال والحصى (رواسب الرباعي) التي تعتبر صالحة تمامًا كخزّانات جوفيّة.

تهدف الدراسة الحالية إلى دراسة التراكيب التحت سطحية وظروف وجود المياه الجوفيّة بالمنطقة. ولهذا الغرض فقد تمّ إعادة تفسير أربعين جسّةً كهربائية رأسية تمّ قياسها بوساطة حسن عام **١٩٨٥**مَ والتي قام بتفسيرها باستخدام طرق قديمة وقد تمّ إعادة التفسير باستخدام برامج الكمبيوتر المتقدمة في عمليات تفسير المنحنيات الكهربائية وذلك على ضوء المعلومات الجيولوجية والهيدروجيولوجية المتاحة بالمنطقة.

ولقد أوضحت نتائج التفسير احتمال وجود طبقتين حاملتين للماء إحداهما قريبة من سطح الأرض (أقل من ١٠ أمتار) والثانية أكثر عمقًا (١٧-٣٥ مترًا)، ومن المحتمل أن يكون نطاق الماء الجوفي الثاني مقابلاً لخزان الرباعي السائد بمنطقة وادي النيل.

وتشير نتائج الدراسة أيضًا إلى وجود طبقة ذات مقاومة عالية أسفل الخزان الثاني التي من المحتمل أن تمثل نطاقًا قديمًا للتجوية.