

Magnetic Indications of the Position of the Mouth of the Old Canopic Branch on the Northwestern Nile Delta of Egypt

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Abstract

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A magnetic survey in the northwestern Nile Delta coast defines the position of the mouth of the old Canopic branch. The total magnetic intensity recovered from three coastal zones (Rosetta promontory, Idku outlet and west of Alexandria) was tested in this study. The study has revealed that the northern limits of extension of the old Canopic branch lies west of Idku outlet. This branch has been considered one of the seven extinct Nile distributaries during late Quaternary.

ADDITIONAL INDEX WORDS: *Total magnetic intensity, black sand, abandoned Nile branches.*

INTRODUCTION

The Nile delta in Egypt is one of the world's earliest recognized deltaic systems discussed by Herodotus at about 450 B.C. According to SAID (1981) the Nile Delta coastal zone (Figure 1) probably located 50 Km to the north of the modern (present day) delta and there were numerous distributary channels of the Ne Nile. During early late Pleistocene and Holocene at least seven major former branches of the delta are mentioned in various historical documents and in ancient maps. These, from west to east are: Canopic, Saitic, Sebennitic, Atribic, Mendesian, Tanitic and Pelusiatic branches. Five of these degenerated and silted up, whereas two; the present day Damietta (Bucolic) and Rosetta (Bolbitic) branches, remain active. The Canopic river branch was one of the most important, it was named after an old city 'Canope' (the main port before Alexandria) whose location was on the western side of Abu Qir peninsula. The Canopic branch existed in the second half of the fourth century AD and had disappeared at the beginning of the seventh century (UNDP/UNESCO 1978). The Rosetta branch is consid-

ered to have been an active branch since about 1500 years (UNDP/UNESCO 1973). The existence and history of these abandoned branches (Figure 1) have been discussed by RUSSEL (1852), CAMERON (1898), TOUSSOUN (1922), DARESSY (1928), BALL (1942), SNEH and WEISSBROD (1973), LEVY (1974), ABDEL KADER (1982), and COUTELLIER and STANLEY (1987), among others. In most of these publications the detection of these old branches was based on land topography, old historical documents, archaeological observations, air and satellite photos as well as sedimentological evidence. With respect to the earlier detection of the old Canopic branch, it has been traced by following a ridge of raised land combined with historical data (TOUSSOUN, 1923 and 1934) and from rugged ridges incised by small channels in the bottom morphology of Abu Qir Bay (MISDORP and SESTINI, 1976). Moreover, EL BOUSSELY and FRIHY (1984) have recorded relict coarser sands enriched in heavy minerals in the beach sands of Idku outlet, which may derived from the reworking of the remnant Canopic sediments imbedded in the sea bottom off this area.

The Canopic branch silted up as a result of the reexcavation of the Bolbitic Canal which

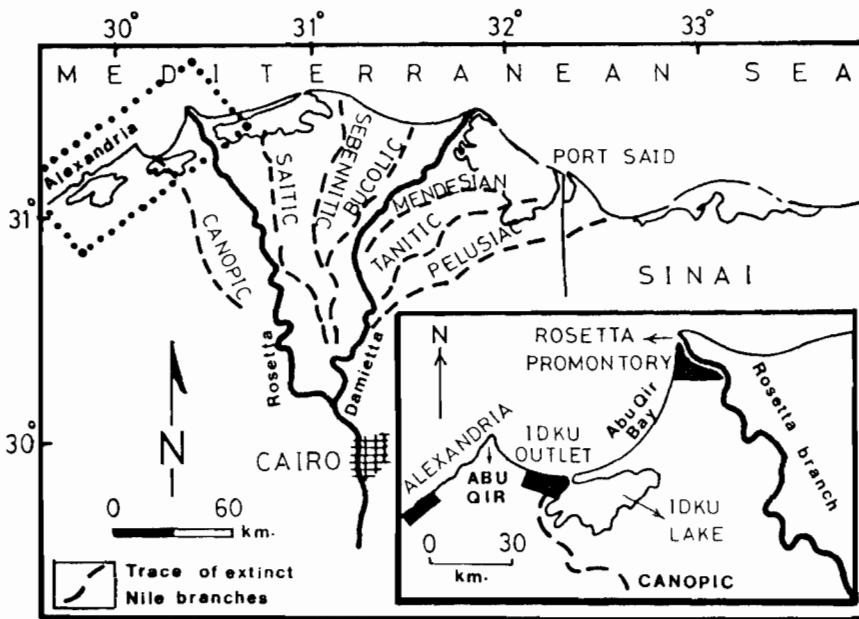


Figure 1. Map of the study area showing the old Nile branches and the three localities subjected to the magnetic survey.

TABLE 1. Minimum and Maximum total magnetic values for the three study localities.

PROFILE NO.		MINIMUM VALUE	MAXIMUM VALUE
ROSETTA PROMONTORY	A	43170	43265
	B	43160	43243
	C	43160	43245
	D	43150	43220
	E	43160	43200
	F	43152	43251
	G	43151	43272
IDKU OUTLET	A	43075	43314
	B	43035	43140
	C	43044	43148
WEST ALEXANDRIA	ABU TALAT PROFILE	42907	42890

today forms the upper reaches of Rosetta branch (SAID, 1981) while the prograding accretion sand ridges are responsible for silting up the mouth of the old Pelusiac distributary (SNEH and WEISSBORD, 1973). No more accounts have been given for the disappearance of the other branches.

In this study the magnetic method of geophysical prospecting is used to provide new

indications about the position of the mouth of the Canopic branch in the northwestern Nile Delta of Egypt (Figure 1). The ultimate purpose of this study is to evaluate a method for tracing the position of the mouth of old rivers. This is based on the variation of the total magnetic field as a function to the concentration of the iron oxides associated with the black sand deposits.

High concentration of heavy minerals (black sand) has accumulated near the river mouth of the Nile Delta by combined action of waves and winds. These deposits enriched in ilmenite and magnetite comprising 65.83% of the total black sands (RITTMANN and NAKHLA, 1958). These two minerals are characterised by their higher magnetic susceptibility value, *i.e.* high magnetic intensity (TELFORD *et al.*, 1976). It would be expected that the magnetic intensity value will be higher near the mouth, where black sands have accumulated. This is the case in the Nile delta, where the black sands concentrated near the river mouths, but in other parts of the world black sands may also accumulated by longshore currents, far away from the river mouths.

Three coastal zones were surveyed (Figure 1):

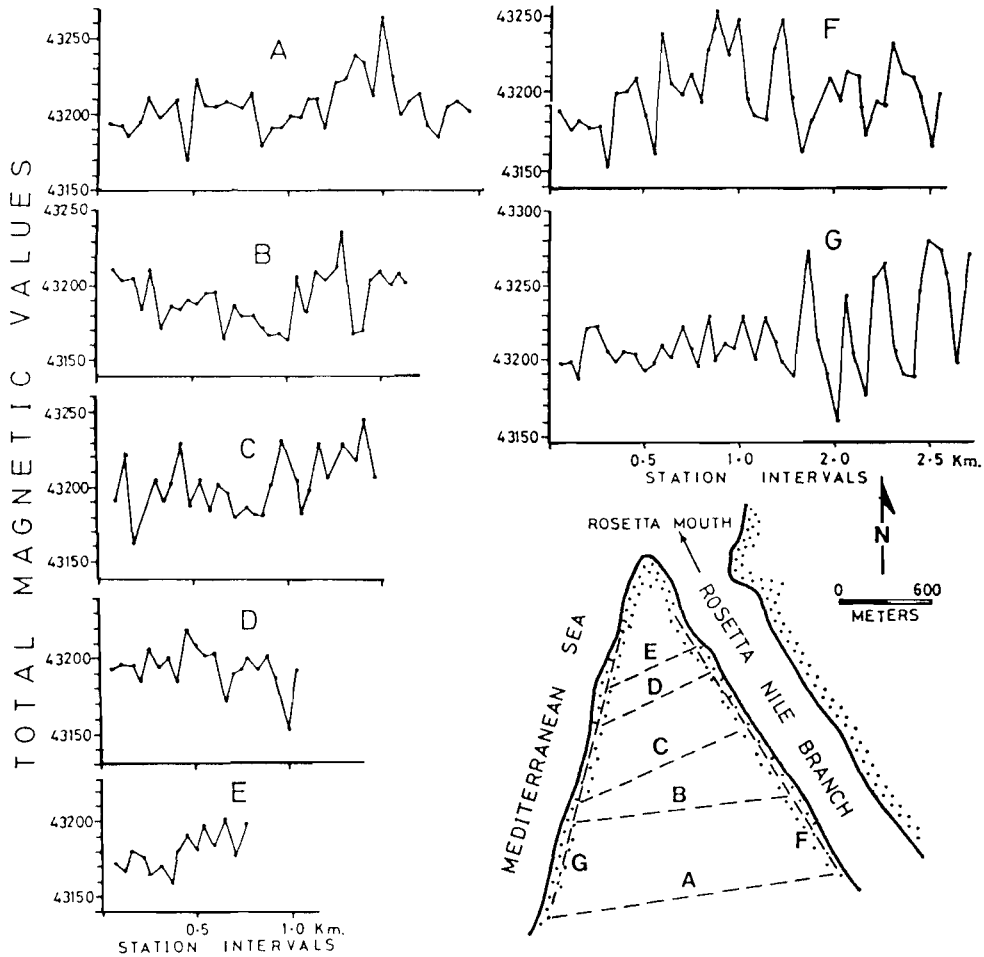


Figure 2 West Rosetta magnetic profiles (A to G) showing change of total magnetic values along each profile.

(1) the present-day Rosetta Nile mouth where black sand deposits were concentrated a long time ago before the construction of Aswan High Dam prior to 1964, (2) the Idku coast as an unknown zone, and (3) the coastal zone 25 Km west of Alexandria, which is free from any deltaic influences (blank area). Our approach was to acquire a large magnetic data set obtained by the study of several profiles recovered in each of the three areas. Numerous magnetic stations were selected along these profiles at 30 meter intervals, at each of these station magnetometer readings were recorded. The magnetic survey was conducted using the Electron Proton Precession Magnetometer with a sensitivity of $1/4 \gamma$ (nT). In each profile the relationships

between the magnetic readings (magnetic intensity) and the position of each station were plotted in Figures 2, 3 & 4.

TREATMENT AND ANALYSIS OF DATA

Numerous magnetic data were obtained from more than 350 stations on several surface profiles in the three studied coastal zones. In some stations more than one reading was recorded and averaged as one individual station. The recorded magnetic readings are not presented but are available upon request from the authors. The minimum and maximum magnetic values for each profile stations are listed in Table 1.

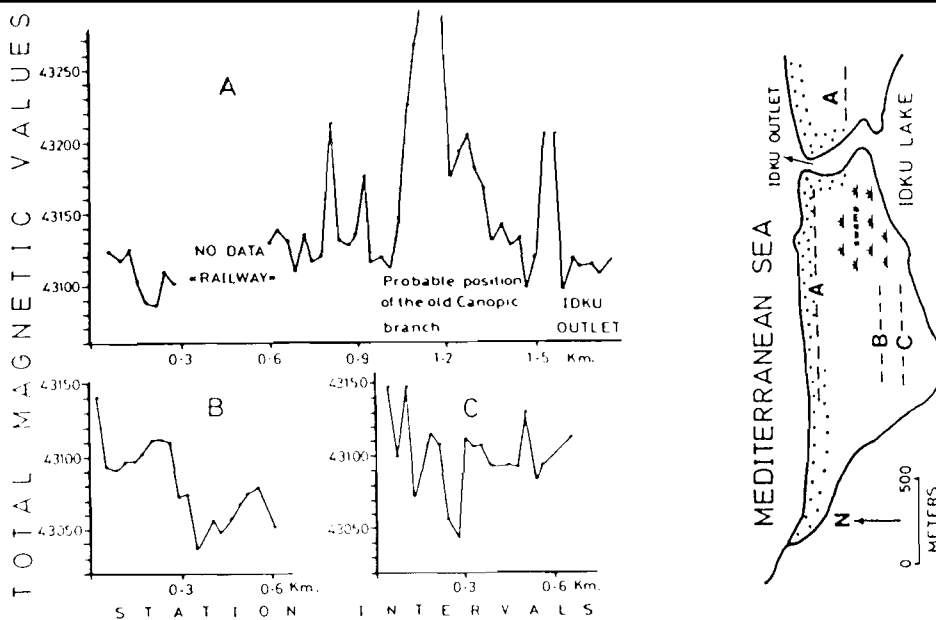


Figure 3 West Idku outlet profiles (A to C) showing change of total magnetic values along each profile.

(1) Present-Day Rosetta Mouth

This area is bounded by the Rosetta Nile branch on the east and the Mediterranean coast on the west. More than 200 stations were surveyed along seven profiles (A to G). The total magnetic readings were plotted along each individual profile (Figure 2) from this distribution it can be seen that the high black sand concentrations were deposited in relative deep channels in the present-day Rosetta branch. This expected pattern was taken as a standard for the purpose of correlation with the other localities.

(2) Idku Coastal Zone

An intermediate coastal zone between the Rosetta Nile mouth and Alexandria was chosen for carrying out the magnetic survey. Geological and archaeological observations have suggested that the Canopic branch of the Nile was located near this area. Therefore, more than 80 stations were tested and provide data for three profiles (A to C), parallel to the shore and to some extent to the south (Figure 3). The magnetic intensity versus station distance show a

remarkable high magnetic values of 43314 in profile A (Figure 3). This magnetic anomaly could be related to the remnant of the old Canopic branch sediments buried in this area.

(3) West Alexandria Coast

To avoid any deltaic influences a third coastal area 25 km to the west of Alexandria was selected. The magnetic survey was conducted at 46 stations along one selected profile parallel to the coast. As expected, the magnetic readings are very low and steady when compared with the other two localities. In other words, this indicates that there are no black sand deposits in this area. This is confirmed from the diagram (Figure 4) which shows a minor fluctuation in the amount of magnetic values.

SUMMARY

The present study serves to identify the northern limit of the extinct Canopic branch in the northwestern Nile Delta of Egypt. This is achieved by conducting extensive magnetic surveys along several profile stations, in three coastal stretches; Rosetta promontory, Idku

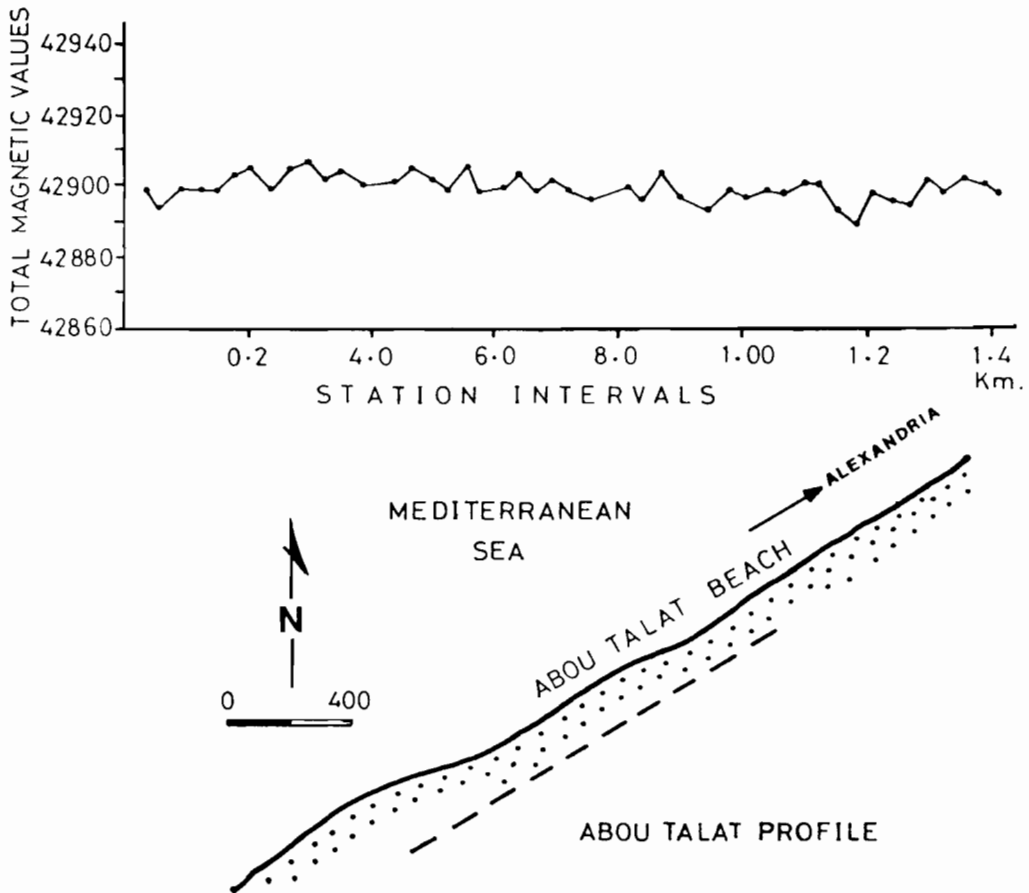


Figure 4 West of Alexandria, Abou Talat profile showing change of total magnetic values along profile stations.

outlet, and west of Alexandria. A remarkable magnetic anomaly was recorded west of Idku outlet, which we believe denotes the position of the northern extension of the former Canopic branch. This interpretation is consistent with earlier studies which suggested that the old Canopic branch was located near this area. The present investigation indicates that a magnetic survey can be used to trace old river branches associated with considerable buried black sand accumulation. We would anticipate that the approach used in the northwestern Nile Delta could also be combined with other available evidence for delineating other abandoned branches along the coast of this delta.

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□ RESUMEN □

Una campaña magnética en la costa noroeste del Delta del Nilo determinó la posición de la desembocadura de la antigua rama Canopic. La intensidad magnética total recogida y analizada en el presente estudio se refiere a 3 zonas costeras (Promontorio Rosetta, Desembocadura Idku y Oeste de Alejandria). El estudio ha relevado que el limite norte donde se extendia el antiguo Canopic se encuentra al Oeste de la Desembocadura Idku. Esta rama del Nilo ha sido considerada como una de las siete extinguidas durante el periodo Cuaternario.—*Department of Water Sciences, University of Santander, Santander, Spain.*

□ ZUSAMMENFASSUNG □

Magnetometer-Untersuchungen an der Küste des nord-westlichen Nil-Deltas haben die Position der Mündung des alten Canopic-Armes erkennen lassen. Dabei wurde die totale magnetische Intensität von 3 Küstengebieten (Rosetta-Vorsprung, Idku-Öffnung und West-Alexandria) für diese Studie getestet. Es ergab sich, daß die Nordgrenze des alten Canopic-Armes westlich der Idku-Öffnung lag. Dieser Mündungsarm wird als einer der 7 während des Spätquartärs verschwundenen Nil-Arme betrachtet.—*Dieter Kellertat, Essen, FRG*

□ RÉSUMÉ □

La position de l'embouchure de l'ancienne branche canopique a été déterminée par une campagne sur le champ magnétique dans le Nord-Ouest du delta du Nil. L'intensité magnétique totale du promontoire de Rosette, de l'émissaire d'Idku et de la côte à l'Ouest d'Alexandrie a été testée. L'étude montre que la limite Nord de l'extension de la branche canopique se situe à l'Ouest de l'émissaire d'Idku. Cette branche a été considérée comme l'un des sept bras du Nil devenu bras mort au Quaternaire ancien.—*Catherine Bressolier, Labo. de Géomorphologie, UA 910, Montrouge, France.*