THE HYDROGRAPHY AND SEDIMENTS OF THE NORTHERN PART OF THE SUEZ CANAL

by

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ABSTRACT

Hydrographic and sedimentological data, collected along the northern part of the Suez Canal in early summer 1979, were analyzed. The results showed a very limited southward extension of the Mediterranean water into the Canal, and a dominant northward movement of the Suez Canal water along the Canal proper. Mixing of Mediterranean and Canal waters occurs rapidly, and mixed water is observed between Km.5 and 15. The depositional pattern of the superficial sediments was examined and correlated to the water mass movements and dynamics in the Canal.

INTRODUCTION

The main aim of this study is to provide information on the hydrographic conditions and the depositional sediment distribution pattern in the Canal following its re-opening in 1975 after being closed for 8 years, and just before completion of the widening and deepening project which took place in 1980.

DATA COLLECTION AND ANALYSIS

During a 3-day cruise (7-9 June 1979), 14 hydrographic stations were occupied along the navigational channel of the northern part of the Canal (Fig. 1(A)), extending for 100km from the Canal entrance at Port Said to the northern tip of the Great Bitter Lake (G.B.L.). In addition, six hydrographic stations were selected in the Mediterranean waters in front of the Canal. At each station, STD data were obtained and a sediment sample was collected using a grab sampler. Grain size analyses were made using standard sieve and pipette techniques and statistical parameters of the sediments were calculated according to Folk and Ward (1957).

RESULTS AND DISCUSSIONS

The hydrographic results indicate the following features of salinity and water mass distribution (Fig. 1(B)):

1. The Mediterranean water of salinity 39* or exceeded by a few decimals, occupies the northern entrance of the Canal at Port Said, with a limited south-

* Following the new Practical Salinity Scale, the salinity is now considered as a dimensionless quantity (Unesco, 1981).

ward extension into the Canal proper. This water, being of lighter density than the Canal waters, enters the Canal as an upper layer of about 10m thickness, beneath which the mixed Suez Canal water penetrates northward into the Mediterranean as a thin layer extending along the bottom of the Canal. This type of two-layer water exchange practically disappears beyond about Km.5 in the Canal proper.

2. The mixing between the Mediterranean and the Suez Canal (G.B.L.) waters, with salinity higher than 44, occurs rapidly within a few kilometers in the northern part of the Canal. The mixed water thus occupies the northernmost part of the northern Canal and extends southwards to Km.15 (Ras El-Ish).

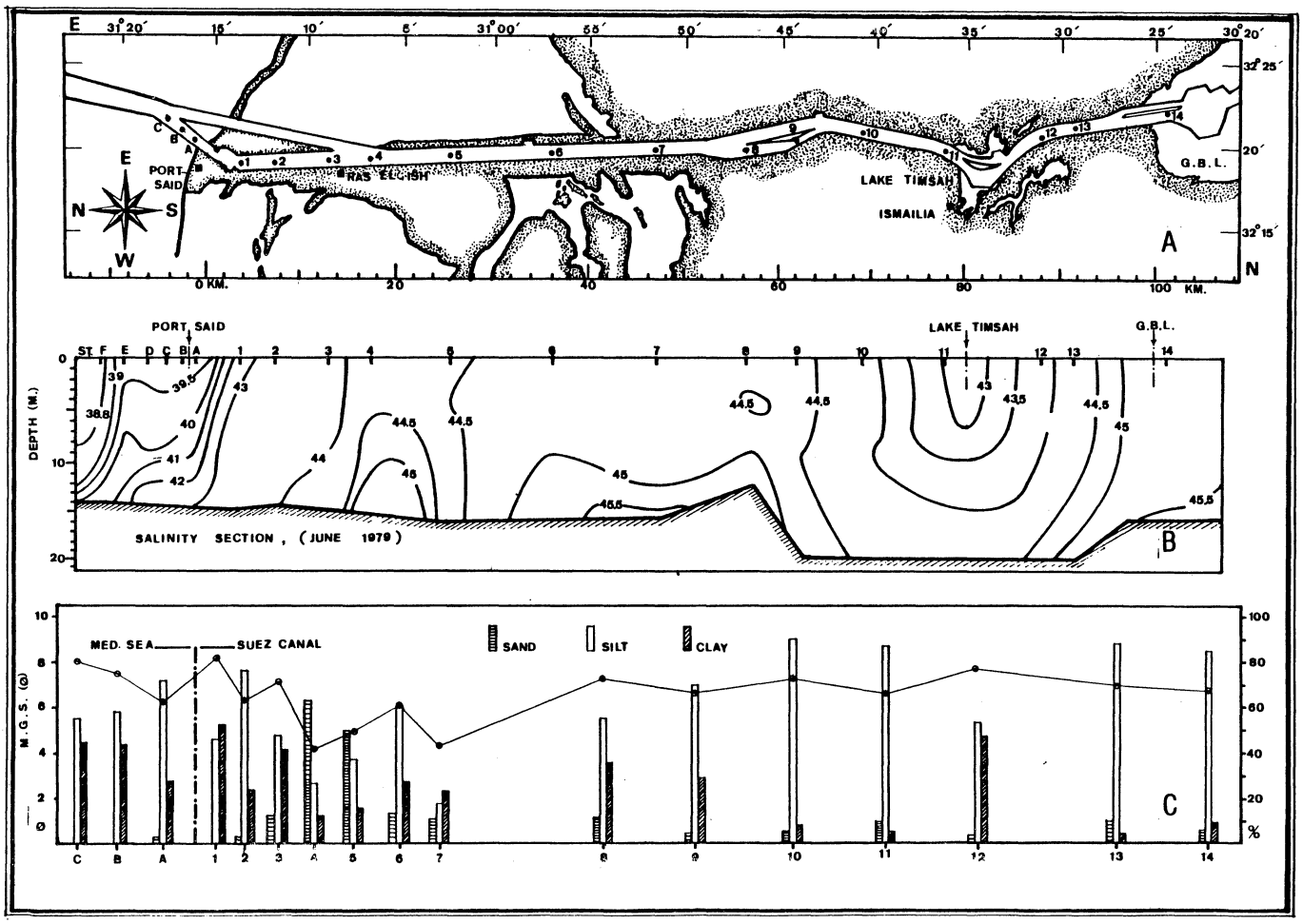

Fig. 1 : A - The Northern Canal, B - Salinity Section, C - Sediment Composition and Mean Grain Size (ø).

3. Salinities higher than 44, typical of the G.B.L. waters, are observed (from about Km.18) in the rest of the northern Canal, with a gradual increase from north to south and from the surface to the bottom. However, the southward increase of salinity is interrupted at Km.65 by a considerable freshwater

discharge from the Ismailia Canal and possibly from the city of Ismailia into Lake Timsah. This causes the salinity to decrease from 44.5 to less than 43. South of Lake Temsah, at Km.85, the salinity starts to increase once again southwards and reaches values as high as 45.5 at Km.101 at the northern tip of the Great Bitter Lake.

The results of our sediment analyses provide the following information:

1. At the entrance of the Canal, sediments are composed of nearly equal amounts of silts and clays with no sand. The mean grain size (M.G.S.) of the sediments in this part ranges from 6.19 to 8.3 ø with an average of 7.5 ø. In the part from the entrance to El-Kantara (Km.45), the sediments contain noticeably increased amounts of sand, and the M.G.S. is coarser, ranging between 4.1 and 6.1 with an average value of 4.8 ø. In the third part from El-Kantara to the Great Bitter Lake, the sediments are dominantly silts with small amounts of both sand and clay. Therein, the M.G.S. ranges from 6.47 to 7.61 ø, with an average value of 6.98 ø. The significance of the data could also be extracted from Fig. 1(C).

2. All the sediments are poorly or very poorly sorted, largely indicating turbulent motion of water resulting from continuous agitation by ship propellers in this shallow water body. At the entrance of the Canal, undercurrents may have considerably greater velocities which are reflected in local scatter in the sorting values. More study needs to be undertaken in the northern reaches of the Canal as to the origin of the transported sediments.

3. The data concerning the skewness of sediments indicate that the current winnowing effects are more active on the sediments of the southern part of the area where all sediments are negatively skewed. On the other hand, the sorting of sediment in the northern part is positively skewed, indicating an excess of fine material which may have been brought in by suspension from the north during stormy periods or from the south by northward flow of current described above.

CONCLUSIONS

1. In early summer (June), except for the northernmost 5km, water movement in the northern part of the Suez Canal is dominantly northward from surface to bottom. Under the action of this northward flow, the G.B.L. water mass is carried northward to fill the greater part of the northern Canal, and reaches to Km.15. Further north, the G.B.L. water mass mixes with the Mediterranean water at Port Said and flows as a bottom current into the Eastern Mediterranean.

2. The observed sediment distribution pattern is a result of the combined effect of currents and ship-induced turbulence, acting on sediments of both local and transported origins.

REFERENCES

FOLK, R.C. and W.C. WARD (1957). Brazors River Bar: A Study on the Significance of Grain Size Parameters. J. Sed. Petrol., 27(1):3-26.

UNESCO (1981). Background papers and supporting data on the Practical Salinity Scale. Unesco Technical Papers in Marine Sciences, No. 37.