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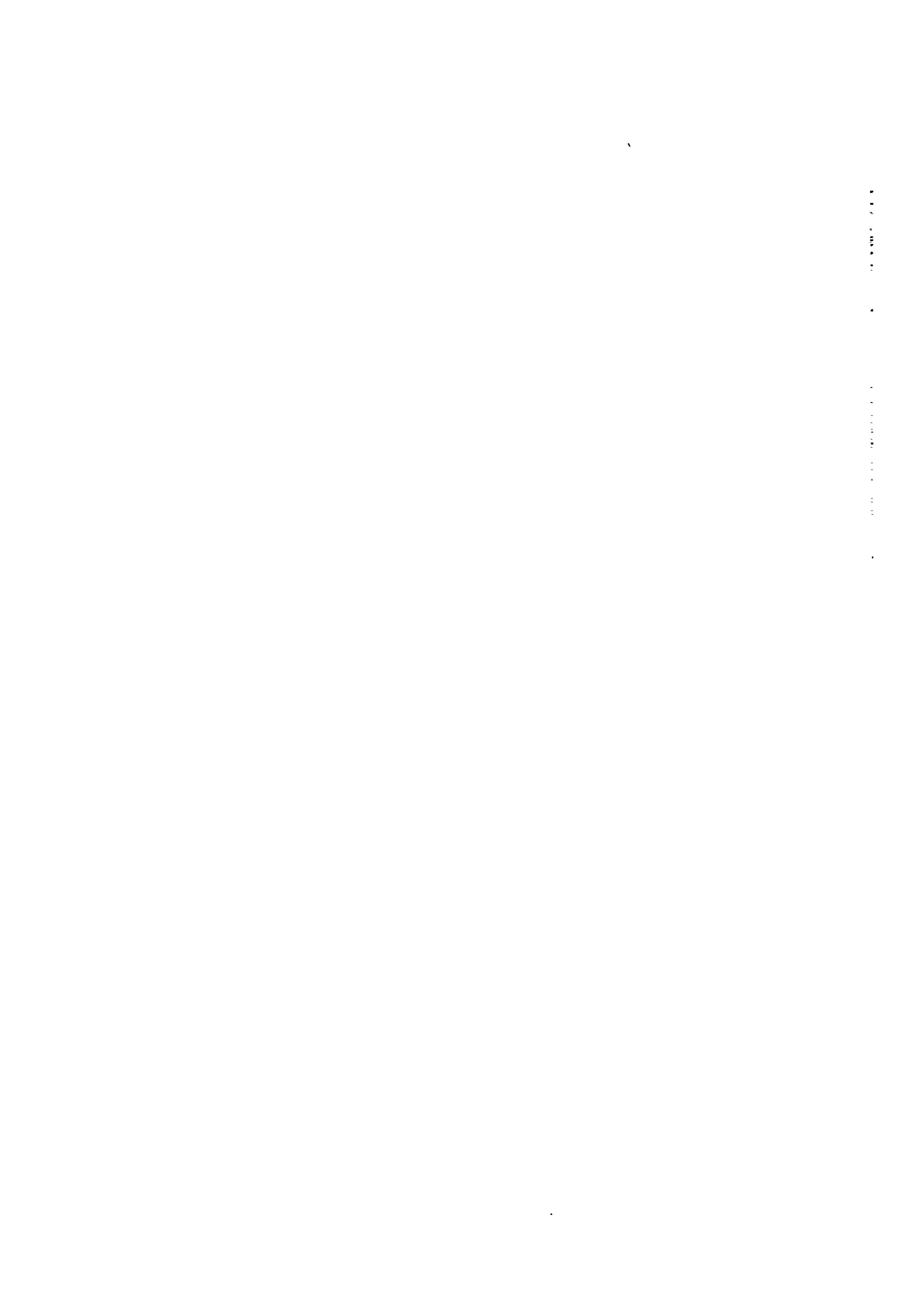
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Editor : Prof Dr. M. EL SAYED GHALLAB.
Editorial Secretary : Dr. M. A. SEOUDY

Contributions to this magazine are welcomed and should be sent to:
Dr. M. A. SEOUDY
33 Misaha Street, Dokki, Cairo Egypt.

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PRELIMINARY NOTE ON THE OCCURRENCE OF OLD INDURATED SAND DUNES IN THE DISTRICT OF GAMASA NORTHERN NILE DELTA

نبذة مبدئية على تواجد رواسب كثبانية قديمة
بمنطقة جمصة بشمال الدلتا
محمد جابر بركات ومصطفى امام

قسمت منطقة جمصة على الساحل الشمالي لدلتا النيل الى وحدات جيو مورفولوجية مميزة مرتبة من الشمال الى الجنوب على النحو التالي: السهل الساحلي ، مجموعة الكثبان الرملية الحديثة ، بقايا كثبان رمالية قديمة والسهل الداخلي .

وقد وصفت كل وحدة على حده مع التركيز على الكثبان الرملية القديمة من حيث تنوعها الحارجي وعناصره التبايني . ويرجع الباحثان ان الرمال الكثبانية القديمة قد جلبها الفرع الأتريبي " أحد قروع النيل القديمة " وهو ما يعرف حاليا ببحر بسنديله .

ABSTRACT

This note aims to throw light on the occurrence of old indurated sand dunes in Gamasa area, North Nile Delta. The clastics building up these dunes are believed to have been transported by the Atribic branch that was active in classical time. A location map, geomorphic map and illustrative photographs are presented.

INTRODUCTION

The district of Gamasa lies on the Mediterranean coast to the NNE of Cairo by about 220 kms. and to the west of Ras El Bar (Damietta branch mouth) by about 30 kms. This district gains more importance since it is a new summer resort. It is accessible from Mansoura via Sherbin by an asphalt road, as well as from Damietta via Ras El Bar. See location map, Fig.1.

No detailed work has been conducted in this area. It is Planned however, to carry out explanatory geological and geomorphological.

studies in Summer and Autumn 1973 by the Desert Institute field crew. These studies aim at revealing the evolutionary history of the Nile Delta, and at classifying the northern coastal plain to the depth of 20 kms. to the south into a number of geomorphic units and interpreting their mutual relations for the purpose of beach protection research. In the meantime, this area has been the site of land reclamation at the expense of the northern coastal swamps.

FIELD OBSERVATIONS

During the field trips carried by the authors in the periods of 3—6, 17—20 July and 22—23 August 1973, the investigated area which covers about 20 kms.², was subdivided into the following geomorphic units :—

1. Coastal flat and low coastal dunes.
2. Longitudinal dune belt and interdunal plains.
3. Weathered hummocky old indurated dunes.
4. Inland flat and drainage marsh.

A brief review is made to describe each of these geomorphic units with special emphasis on the old indurated dunes. See geomorphic map, Fig.2.

1. *Coastal flat and low coastal dunes* : This geomorphic unit occupies the low land area delineated by the dune belt from the south and by the shore line from the north. It has a levelled surface and the ground elevation does not exceed one meter above sea level. This flat is dotted by a few ill-defined sandy pillows with characteristically chaotic relief. These sand mounds are haphazardly scattered, depending largely on surface irregularities including topographic obstacle or plant cover. *Zygophyllum album* L.f. is characteristic for such sand accumulation. It indicates habitats rich in salts. Generally, this coastal flat is covered by dirty yellow quartz sand, fine to medium grained with a broad berm of coarse sand in few stretches. Sometimes, a thin salt is present. This low land is usually inundated by sea water during the winter season.

2. *Longitudinal dune belt and interdunal plains*: This unit is characterized by wide expanses of dunes migrating inland away from the beach following a direction slightly deviated to the north from that of the prevailing wind. These represent the removed material continually on the move from the sea-margin towards the interior. The rate

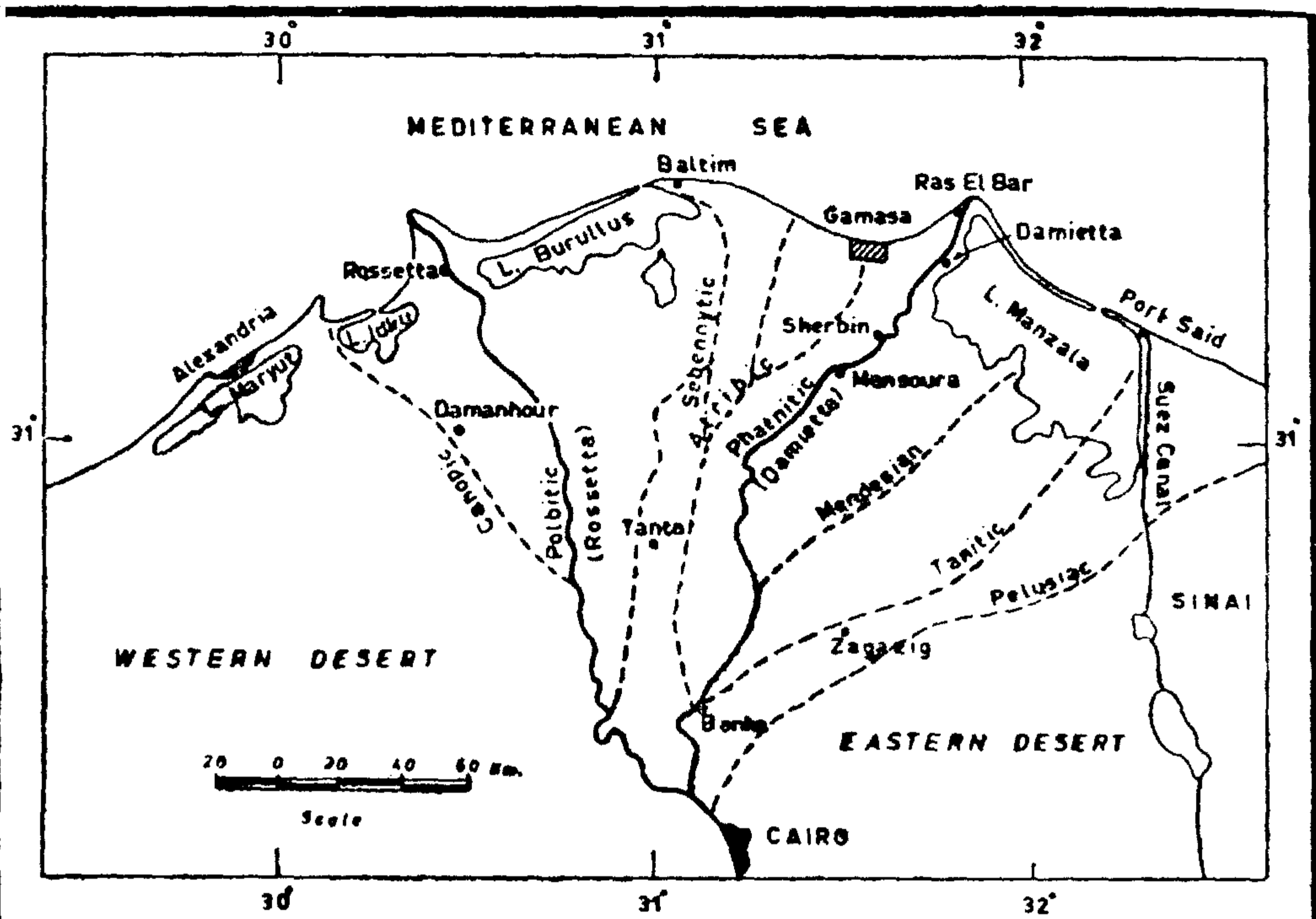


Fig. 1- Key Map showing:

Location of investigated area

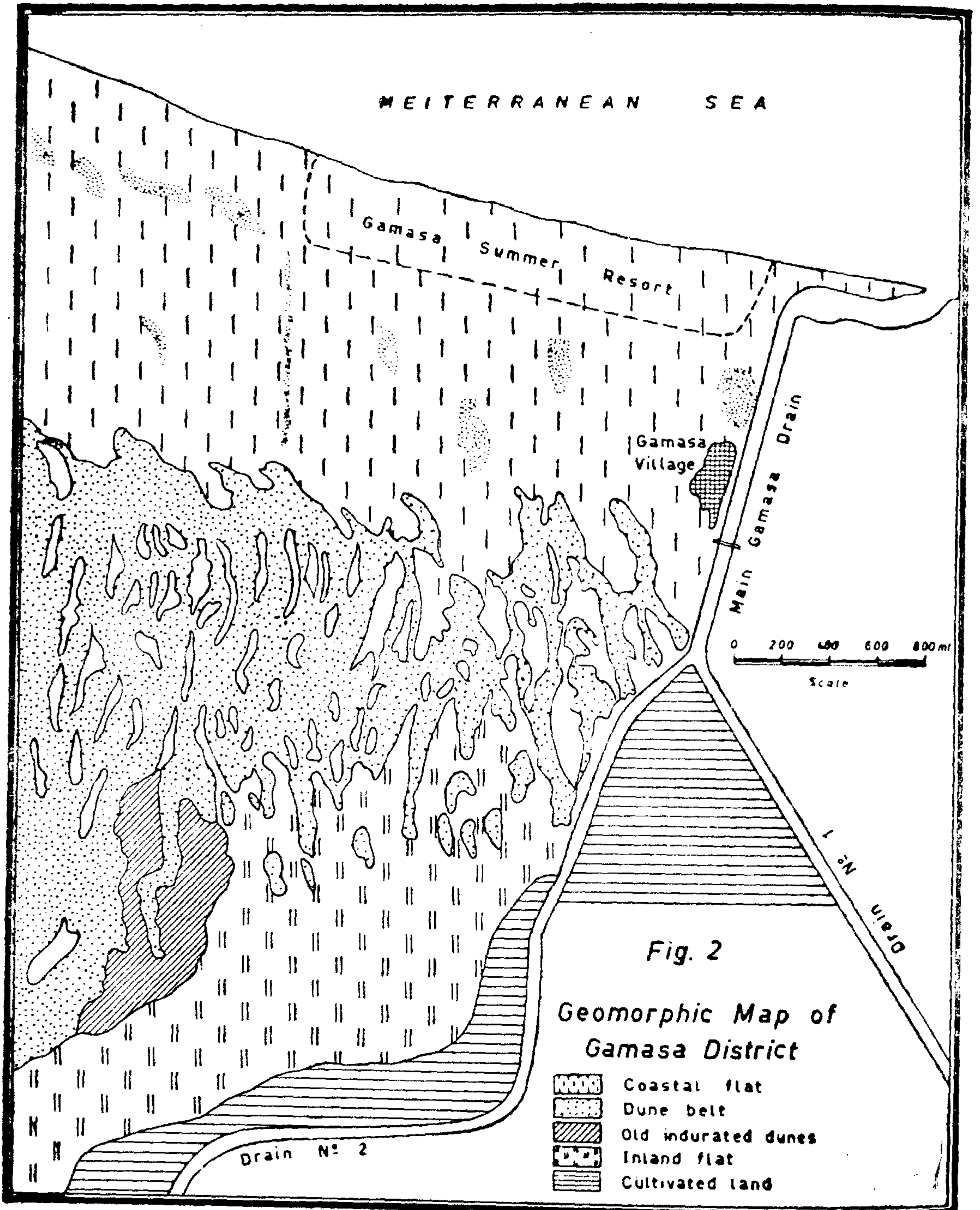


Existing Nile tributaries



Main Old Nile tributaries





of migration varies narrowly and it is estimated to be 1 meter/year. Some however, migrate by a higher rate and they interfere with each other and a continuous but serrated ridge is developed. These long seif dunes are distinguished in their geomorphic pattern from the other sand accumulations along the northern coast. They vary in height, being within the range of 5—8 meters and border bare interdunal plains in between. These are usually oval in shape, perfectly levelled, with thin saliferous crust, soft soil and appear dark grey in colour. Characteristic species of this habitat are : *Zygophyllum album* L.f., *Halocnemon strobilaceum* M. Bieb. and *Arthrocnemon glaucum* (Del.) Ung. Sternb. Some of the dune sand follows the proper direction of the prevailing wind and cross the interdunal plains diagonally bridging the neighbouring belts. These moving sand belts are bare of vegetation cover except at their periferies. *Zygophyllum album* L.f. is the only species growing in such habitats as it can float over moving sand and tolerate high levels of soil salinity. By winter gales and rough sea conditions, sea water invades these low plains and remain inundated during the winter season. Some of these plains act as a corridor for sea water to reach the inland flat and threaten the cultivated land in the interior. Small heaps of pumice and molluscan shell fragments are noticed between, and on the slopes of, these sand bodies. These fragments are drifted by strong wind and high waves as they pass into shallower water. Reed fences are planted in threatened agricultural regions to restrain the advance of this dune belt.

3. *Weathered hummocky old indurated dunes* : These are in the form of elongated ridges, oriented parallel to the direction of the prevailing wind (NW-SE). They are coloured pale brown to pale reddish brown, stand prominently among the surrounding low land and cover a wide area with the long axis of each individual hillock oriented to the northwest. They possess a surface crust of variable thickness ranging from a few cms. to more than 2 m. Loose friable sand underlies this indurated mantle. This cohesion phenomenon is also observed as a thin crust parallel to the long axis and over the slopes of some recent dunes.

Some of these hillocks are quite spectacular, mimicking pedestal rocks. These have been partially cut by undercutting by windblown sand. They exhibit an irregular topographic relief through the effect of long acting differential weathering. They manifest thin lamination, cross-bedding and are usually tilted to the east by about 20°. (See Plate 1, Fig. 1).

Fine streaks of heavy mineral fractions are interbedded. Quartz sand, fine to medium grained, is the main building mineral. Fine sand and silt give these sediments their reddish brown colour. Some of these old dunes are concealed below recent dune belts, others are covered by a thin veneer of wind blown sand. This geomorphic unit, in general, stands as an elevated bank, and could be traced to the south and south-west of the investigated area. It rises about 3 meters above sea level. It gradually diminishes in height northwards, south and westwards. Northwards, these old dunes are washed away by the repeated sea invasion in winter. Parallel lineation of variable slightly hard interbeds is faintly noticed in the interdunal plains and beneath the inward migrating recent dunes.

They differ from recent dunes by their slight induration, brown colour, gentle sloping back and less elongated outlines. Shallow seismic holes were drilled along a north-south direction and a dark grey lagoonal clay with brackish molluscan shell fragments was reported with depth. These hummocks are distinguished by a unique green cover characteristic to this soil particularly at the northern tip of each hillock. (See Plate 1, Fig. 2). The green cover of this geomorphic habitat is denser and more rich in species than in the other zones. The most characteristic species are :

Agropyron elongatum (Host) Beauv., *Calligonum comosum* L'Herit, *Salsola kali* L. Del., *Aristida lanata* Forssk., *A. scoparia* Trin. & Rupr. and *A. plumosa* L.

These hummocks build up an outstanding geomorphic feature and drew our attention from the first glance.

4. *Inland flat and drainage marsh* : This unit occupies the low land between the southern boundary of recent dune belt with the hummocky indurated dunes and the cultivated strip along drain No. 2 to the south. It is flat and rises insensibly to the south where the newly reclaimed terrain occurs. This slight rise is attributed to the entrapment of the deflated sand stopped by the cultivated land and increase in moisture. It is dark grey to reddish in colour, with soft sediments and thin salt crust. It is bare of proper dune accumulation and free from topographic or organic obstacles. Some of these washed old dunes are observed extending south wards in this inland flat. *Zygophyllum album* L. f. is common in this habitat.

The lowest strip of this flat is turned to an artificial lagoon where the drainage water is discharged. The high organic content and the fouling nature of this low strip as well as the saliferous impregnation

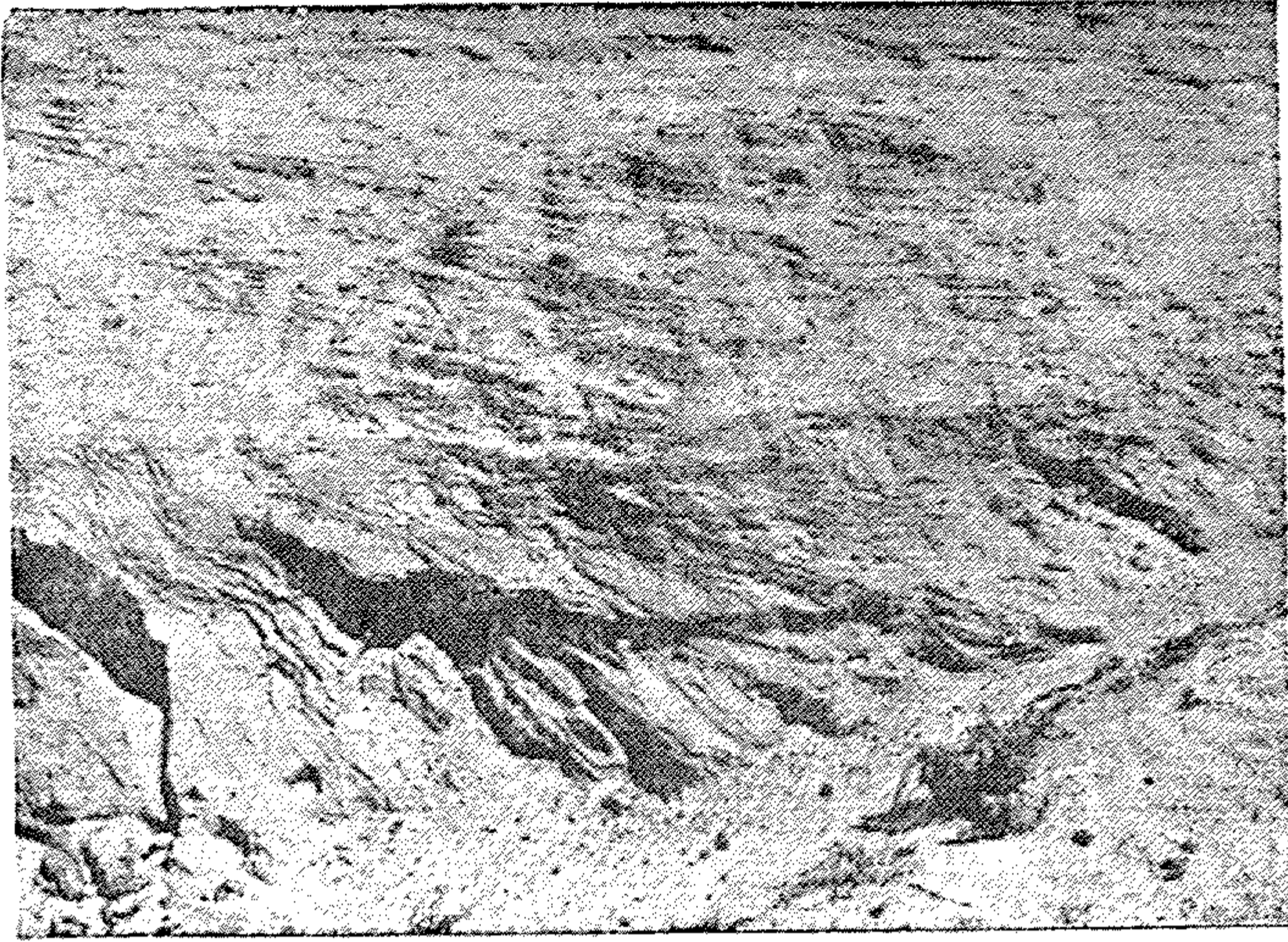


FIG. 1.—Finely stratified and cross-bedded old indurated dunes.

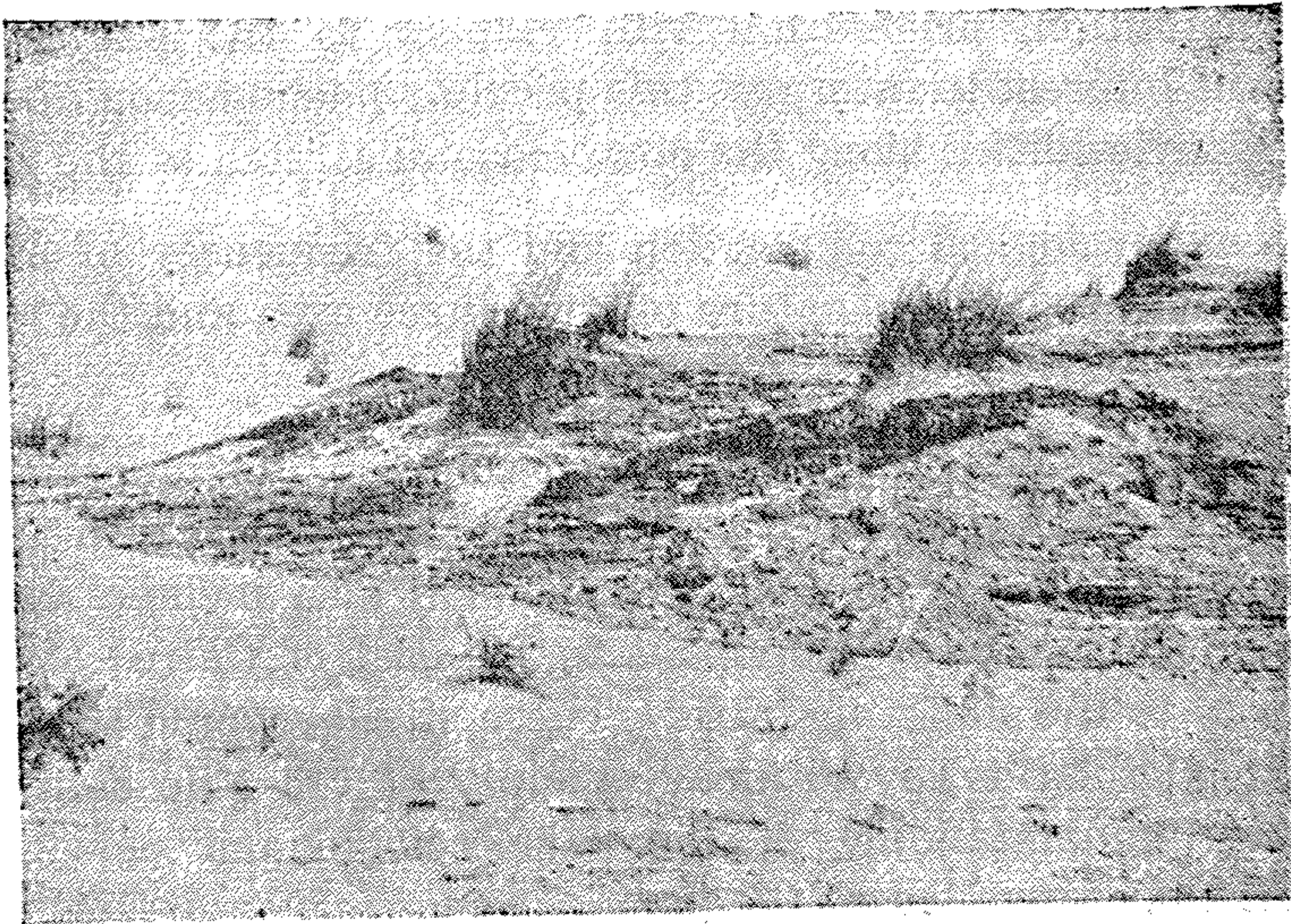


FIG. 2.—Elongate erosional remnants of old indurated dunes with tussocks of *Agropyron elongatum* (Host) Beauv.

of sediments associated with limited green cover rendered it very similar to the coastal swamps (Sabakhas) and those to the south of the northern lakes. The most characteristic plant in this habitat is *Schanginia baccata* Moq.-Tand.

CONCLUSIONS AND RECOMMENDATIONS

The area of Gamasa (Dissa in old maps), represents a wide plain that could be differentiated into a number of geomorphic units. It is one of the famous sites where wide expanses of sandhills have spread inland from the lowlying coast. The occurrence of old indurated dunes in this district is of particular interest to Geologists, Geographers and Botanists. Their plant cover is denser and more rich in species than other zones. These sediments are believed to be transported by one of the old Nile branches that once debouched in the Mediterranean in classical times. This tributary followed the Atribic Canal (Bahr Basandila) traced by Toussoun, 1922. It is considered, as far as the authors are aware, the only site in northern delta where such indurated sediments are recorded. Similar occurrence is met with to the southwest of Gamasa, where another ancient branch was traversing the district of Abu-Madi as illustrated in Toussoun, 1926.

It is recommended that a research work be undertaken to reveal the nature, and delineate accurately the course, of these extinct branches and compare their sediment load with those existing at present. Statistical geomorphological studies of recent dunes, their areal distribution, orientation with respect to the prevailing wind would be of interest to interpret this peculiar phenomenon and compare it with other localities along the north coastal stretch of the Nile Delta.

The mineralogical composition and the frequency of each heavy fraction would reflect the nature of the source area and the load acquired by the main river down to its lower reaches.

It is also recommended to carry out comparative mineralogical and, if possible, palynological studies with other Nile deposits in and around the Nile delta. These investigations should also include ancient Nile deposits in Abbassia and Heliopolis to the east of Cairo; Maadi, Tura and Helwan to the south of Cairo. These studies would emphasize the chronological relation, evolutionary history of the Nile delta and lead to a better understanding of the paleoecologic and paleogeographic conditions that prevailed in the past.

M. G. Barakat and M. Imam

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