INFLUENCE OF THE WINDS ON THE CHANGES IN THE DELTA OF THE DANUBE

by

RADU CIOCARDEL.

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The investigations undertaken in the region of the Delta of the Danube during the period 1933 to 1935 have allowed the fact to be ascertained that the winds have a great influence on its evolution. This fact had also been previously observed in 1913 by Dr. G.-R. ANTIPA, as well as by Commander FUNDATEANU as a result of surveying work carried out by the Hydrographic Service of the Royal Navy during the summer of 1927.

CHARACTERISTICS OF THE WINDS AND THEIR NATURAL CONSEQUENCES.

NNE-NE and SE winds predominate in the region of the Delta of the Danube (see accompanying plate with diagram of the winds of the Sulina region). Their velocity varies from 3 to 5 metres/second, but this speed is frequently exceeded.

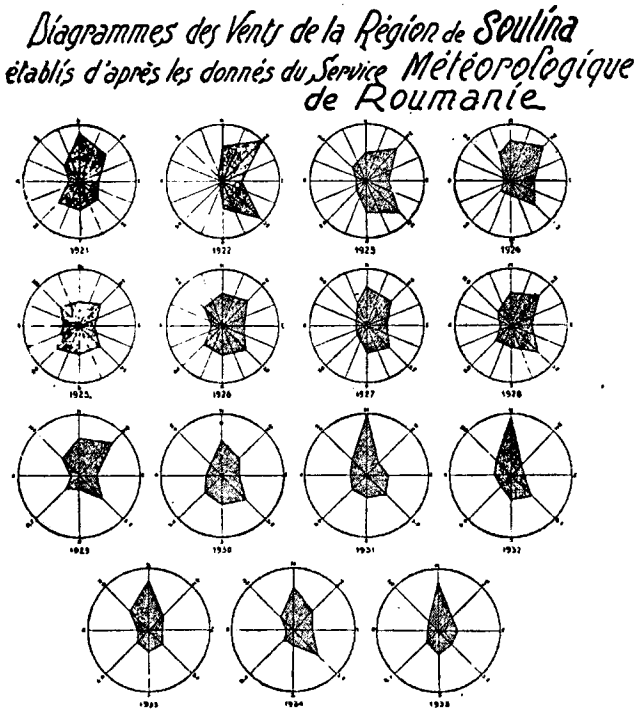

FIG. 1

Diagrams of the Winds in the Sulina Region according to data supplied by the Rumanian Meteorological Service.

In the open sea, the winds give rise to waves the length of undulation of which is between 10 and 16 metres; their amplitude varies from 1 to 2.5 m. It is known that, in proportion to the approach of the waves to the shore, their length of undulation and their amplitude decrease to the same degree but that, in the vicinity of shoals, the waves become curved.

In the open sea, in consequence of the friction which occurs between the waters and the air-currents, sea currents originate, the direction of which is the same as that of the winds which have created them. When the current provoked by the wind encounters an ocean current, it then takes the direction of the strongest current. The depth of the current created by the wind is proportional to its velocity and the latter varies from 1 to 2 metres; at the epoch of the great NE winds it even attains 3 m.

INFLUENCE OF THE WINDS ON THE EVOLUTION OF THE DELTA.

It is known that the winds exercise their influence on the sedimentation in the mouths of the Danube, not by direct action but by the waves and surface currents which they create; it is thus observed that, through the action of the winds in general, the fluvial waters remain in the vicinity of the shores and the velocity of the fluvial currents is thereby greatly decreased, which leads to a considerable increase in the speed of sedimentation. From this there results an alteration or turning aside in the general line of advance of the arms of the delta into the sea. Instead of advancing between

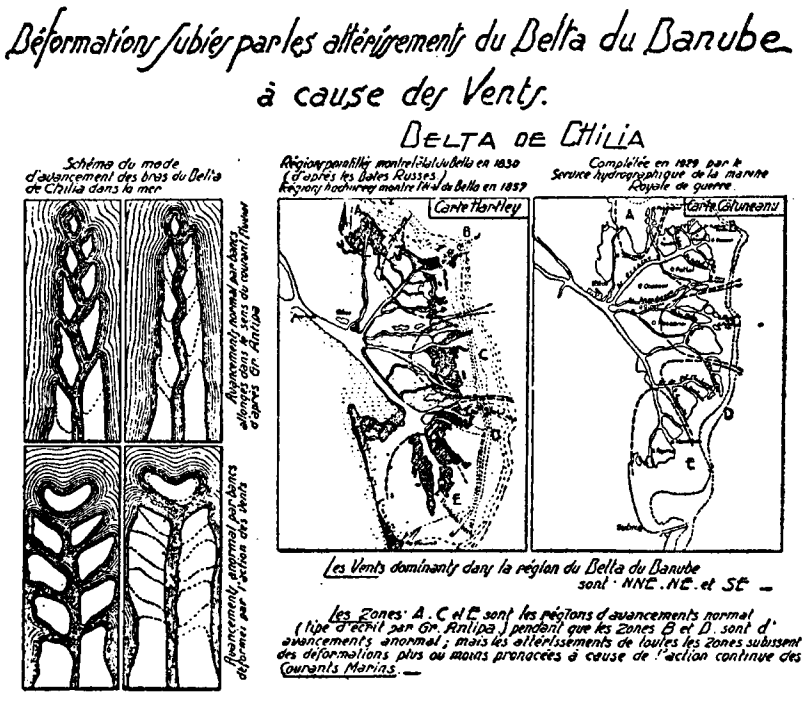

FIG. 2

Alterations undergone by the sedimentation of the Mouth of the Danube caused by the Winds.

banks prolonged in the direction of the river currents as described by Dr. Gr. ANTIPA in his publication: *Wissenschaftliche und Wirtschaftliche Probleme des Donau-Deltas*, page 27, the mouths of the river advance between devious banks as may be seen from the accompanying plate (Diagram of method of advance of the arms of the Delta of the Danube into the sea).

Examination of the charts showing the evolution of the Delta of the Danube — above all that of the Chilian Delta, leads one to observe the existence of several zones (See plate of the Chilian Delta); and subsequently to distinguish areas of normal advance (type described by Dr. Gr. ANTIPA) and areas of abnormal advance (altered by the winds). Areas *A*, *C* and *E* show the regions of normal advance; areas *B* and *D* those of abnormal advance.

These zones, however, undergo very important alterations in consequence of the continuous action of ocean currents.

Another element successfully intervenes in the growth of sedimentation in the mouths of the Danube, namely, the cycloidal waves. These waves hinder the flow of the fluvial

waters across the sand banks, of which they speed up the growth; they have also great influence in the creation of "bars" and even of "grindes".

In general, the NE winds favour the increase of sedimentation in the region North of the Delta (Oceacoff) while the SE winds favour that occurring in the regions Sf. Gheorghe and Stambulul non.

CONCLUSIONS.

It seems to us that, taking as a whole the physico-chemical phenomena which combine in the growth of sedimentation at the mouths of the Danube, the winds play an important rôle through the waves and the surface ocean currents which they create (1) and not by direct action.

(1) A study of the natural consequences of the winds (surface ocean currents and waves in their forms, depth and mpulsion) will be the subject of a publication in the near future; and a study of the permanent ocean currents which have already been mentioned in the note: "Influence of Ocean Currents on the formation of the Delta of the Danube", will form the subject of a publication in collaboration with Dr. N. GAVRILESCU.