SEAFARING IN THE BRONZE AGE MEDITERRANEAN: THE PARAMETERS INVOLVED IN MARITIME TRAVEL

Introduction

This paper is part of a study which examines what seem to be the most important parameters that influence Bronze Age seafaring and which may be traceable one way or another in the archaeological, meteorological and other records, as well as in the written evidence. The purpose of such an inquiry is to establish a set of significant criteria for the collective and especially quantitative evaluation wherever possible, of the relevant evidence available and its application to specific Bronze Age marine transportation problems.

Three classes of parameters are examined:

First, all those which determine the physical possibilities of maritime travel, such as surface currents both coastal and open sea, the prevailing wind patterns, the kinds of ships used, the probable coastal settlements of the Bronze Age, etc.

Second, all those parameters which help detect the mechanism of foreign trade contacts and distinguish between the agents responsible for this traffic, in other words the various countries, cities, peoples, ruling authorities or private enterprises involved, through parameters such as the provenance and dating of boat lumber, details of ship construction, crew items, but also literary evidence, etc.

And third, significant remaining testimonials of this traffic against which the above parameters may be checked, such as shipwrecks, stone anchors, and written evidence. This paper will not emphasize the actual exchangeable objects, since artefacts themselves cannot reveal much about the transport means used, the people responsible for this traffic, or the actual trade routes followed.

This study will attempt to organize the methodology for a logical, systematic and quantitative approach. Needless to say, it is not possible to discuss extensively each of these factors in this paper. Instead, the various parameters are applied for the purpose of illustration to a single example: the direct seafaring possibilities between Crete and Egypt during the Bronze Age. This particular example was chosen because of the recent suggestion that Egyptian pottery at Kommos [1], on the southern coast of Crete, and Minoan sherds at Marsa Matruh [2], near the Egyptian-Libyan border, are an indication of direct trade contacts between these two regions [3], and also because there is at least some information available on most of the parameters examined. As a result, the application of such criteria may be better illustrated.

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1 *Nestor*, vol. 13.7. November 1986.

2 D. WHITE, "Excavations at Mersa Matruh, Summer 1985", *American Research Center in Egypt, Newsletter* 130, 3ff.

3 V. WATROUS, paper delivered at the 6th International Colloquium on Aegean Prehistory, Athens, September 1987.

The probable journey: Crete to Egypt

It seems appropriate to start with the prevaling wind patterns. The N and NW winds suitable for the voyage from Crete to Egypt for Bronze Age sailing ships which had to have the wind blowing more or less from astern, represent by far the largest frequency percentage for all five functioning weather stations on Crete, that is Palaiohora, Ierapetra, Sitia, Iraklion, and Chania (Tables 1-5). But these percentages are averages for the whole year. It is well known that ancient mariners travelled mainly during the summer, particularly when it came to long voyages, in order to avoid the harsh conditions and dangerous storms of the winter months.

Taking again the N and NW winds for the same five weather stations in Crete, but only for the six warm months from May to October, the calculated averages allow some obvious deductions (Tables 1-5). The N and NW winds would have been perfectly suitable for the summer voyage from Crete to Egypt, blowing for at least half the days of the summer months, this large frequency of the northern winds known as the Etesian Winds in antiquity and *ta meltemia* in modern times. In fact, the ancients must have crossed to Egypt from the promontories of Eastern Crete, such as Cape Samonium as Strabo says [4], the modern Akrotiri Sideros, in which case the Sitia Meteorological Station would better represent the prevailing wind conditions. This table shows that the N and NW winds suitable for the southbound journey blow for nearly 70% of the days around Sitia, during the 6-month interval from May to October.

Equally, inspection of the summertime currents in the South Aegean and the Eastern Mediterranean [5], shows that these currents would tend to carry a ship toward the SE (Pl. I), at velocities ranging from 12 to 24 miles per 24-hour period [6]. In combination with the Etesians, this would help explain the Minoan sherds in Marsa Matruh near the Libyan border. In addition, it will also explain why Egyptians placed Kaphtor somewhat vaguely, but invariably, towards the West [7]. This is from where the ships carrying the Keftiu always appeared.

Now assuming a continuous Etesian wind of Force 4-5, which is the lowest wind velocity that could effectively move a loaded Bronze Age merchantman, blowing for the usual average of 10-12 hours a day, and propelling the ship at a maximum speed of 4 knots, this will give a maximum progress of about 50 miles per day, to which must be added the 12-24 knots of the southeasterly current, giving an approximate total maximum progress of about 75 miles per 24 hours under these conditions [8]. The 305-310 mile journey to a Nile Delta port could be accomplished in approximately four days.

Strabo says about the ships of his own day (which could not have been very different from Bronze Age merchantmen), that the voyage from Cape Samonium to Egypt (the latter left unspecified), "takes four days and four nights, though some say three" [9]. Naturally, if by Egypt he did not mean Alexandria, but Marsa Matruh, or if the voyage took place during the period of the vanguard winds (oi prodromoi anemoi, or freska meltemia in the seaman's vernacular), when they frequently blow all night as well, then the voyage could be accomplished in three days and three nights, as the interlocutors of Strabo claimed.

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4 Strabo 10.4.5.

5 A nearly similar figure for the East Mediterranean in general was obtained from the wind roses of the *Mediterranean Pilot*, vol. 5, NP 49, Sixth Edition, Published by the Hydrographer of the Navy, U.K. 1976, Diagram 8.

6 *Ibid.* Diagram 2.

7 J. STRANGE, *Caphtor/Keftiu* (1980), pp. 108-9.

8 To convert km to nautical miles, multiply km by 1.85.

9 Strabo 10.4.5.

The improbable journey: Egypt to Crete

The journey from Egypt to Crete is a very different story. The S and SE winds, suitable for the northbound voyage, would have been almost entirely disadvantageous. One of the reasons is that the period of their greatest frequency is the winter. No self-respecting sailor, ancient or modern, would knowingly endanger his vessel, his crew, and himself, by going to sea when the south winds blew in winter. For though these are the only winds that could bring him to his destination, that is Crete, they are unfailingly accompanied by bad weather and are also the stormiest and most dangerous winds he was likely to face. Elementary intelligence and caution would have advised to travel in the summer.

The largest frequency percentage of southern winds recorded in Crete blow around Palaiohora, which is, however, at the west end of the island, amounting to 9.5% and respresenting an average of three days per month of S and SE winds (Table 1). A similar but slightly lower figure is obtained from the weather statistics of Alexandria, Egypt [10]. Such a frequency is completely unsuitable for the journey from Egypt to Crete for the following reasons.

First, as shown on the wind force record for Palaiohora, the S and SE winds are particularly weak in the summer (Table 1). Winds of 1-3 Beaufort, that is at best a light breeze, can hardly move modern, light, open sea vessels, never mind the merchantmen of the Bronze Age. A 4 Beaufort and higher velocity, on the other hand, the lowest wind intensity that could move a modern caique, represents a total of S and SE winds just over 2.5 days per month, a completely inadequate propulsion for such a journey.

Second, insufficient as these two and a half days of suitable winds per month may be, there is certainly no guarantee that these would blow continuously. These, like all other frequency percentages presented in the Tables and used in the above calculations, are statistical averages. They are not the number of days in sequence suitable for northbound sailing.

Third, as most Mediterranean sailors know, summer south winds are often followed by periods of stillness, the doldrums, and this could hardly have escaped Bronze Age mariners. In these circumstances a boat becomes a mere piece of flotsam at the mercy of marine currents, save if the vessel may be effectively moved by oars. This was possible with warships, not with merchantmen. The oars in the latter case must have been used for port manoeuvres, not for rowing a heavily laden vessel across the Mediterranean. Besides, the crews were too small for that and the boats (merchantmen) totally unsuitable for protracted rowing [11].

Fourth, as previously mentiond and shown on the map of the Mediterranean (Pl. I), the surface currents of the summer months would be entirely against the direction leading to Crete, burdening the vessel with a negative velocity which must be subtracted from its actual wind-induced speed, and which could amount to about half of the latter if the winds blew at less than 4 Beaufort.

Fifth, there does not appear to be any evidence at present that Bronze Age seamen knew or used celestial navigation before the age of the historical Phoenicians. But assuming that they did, celestial navigation requires clear skies at night, which when the south winds blow are frequently in want. Extremely unsatisfactory conditions prevail, then, for the northbound voyage, in contrast to the southbound, where even if the winds failed completely, the current would inexorably bring the ship near Egypt.For all these reasons it is greatly doubted that direct sea voyages from Egypt to Crete were undertaken by Bronze Age merchantmen.

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10 *Mediterranean Pilot*, vol. 5, Chap. 1, 1.153.

11 See for example the limited galley facilities of the Cape Gelidonya and Ulu Burun merchantmen, G. BASS, "Cape Gelidonya: A Bronze Age Shipwreck", *Transactions of the American Philosophical Society* 57, part 8; "A Bronze Age Shipwreck at Ulu Burun (Kash): 1984 Campaign", *AJA* 90, p. 269ff.

Confirmation from the cargo of the Ulu Burun shipwreck

Discussing the Cypriot export pottery found stacked in a pithos of the Ulu Burun shipwreck in a popular article, the excavator wrote that, "The pottery's rough-hewn, rustic style may have made it popular export ware, especially to Syria and its neighbours" [12]. In the archaeological paper presenting the 1984 campaign, describing the contents of the same pithos, the excavator mentioned, "stacks of Cypriot pottery of types commonly exported to the Syro-Palestinian Coast" [13]. If this is the case, one has to wonder what was the point of taking a cargo from Cyprus meant for the Syro-Palestinian coast, on the ship's way westwards, which seems to be the direction of the vessel's last voyage [14]. Why not wait until the return journey ? That would have been the logical thing to do, instead of having the ship carry the Cypriot pottery all around the Aegean, with all the danger, inconvenience and extra cost this implies.

That would have been indeed the logical thing to do, provided the ship returned to Syro-Palestine the way it came. But this is a voyage that could have taken months for a sailing ship, considering the winds and currents. This ship, and probably most Near Eastern merchantmen travelling to the Aegean did not return to the East Mediterranean shores via W. Asia Minor and Cyprus, but via Crete or another Aegean station and directly to Egypt, cutting the time required to reach N. Africa to a fraction of that necessary for the alternative route via Cyprus. The winds and currents made this counter-clockwise voyage around the Mediterranean basin a necessity for a merchant tramp vessel.

This is probably the reason why Cypriot pottery destined for the Syro-Palestinian coast was taken on board on the way westwards, and why this ship, and similar craft have such an extraordinary variety of cargo on board; they would pass any one point on their route only once, and they would have to go through all their other destinations before returning to the same point. This was the only voyage possible for a sailing merchantman visiting the Aegean region from the Near East, given the winds and current regimes of the East Mediterranean basin. Then, as now, a quicker voyage meant a greater return on the investment. But that is not the only available confirmation.

Confirmation from Egyptian written evidence

Independent confirmation that the direct voyage from Egypt to Crete was not attempted by merchant ships during the Bronze Age, comes from the existing written evidence. Certain New Kingdom texts which will be mentioned shortly, show that the Egyptians knew or imagined, that the land of the Keftiu was located somewhere to the west. In order to arrive there from Egypt, one had to follow first an eastern course towards Byblos, then north towards the other Near Eastern ports, and finally turn west. If direct voyages from Egypt to Crete, or to any point in the Aegean were at all possible, then surely the above texts would make no sense. In other words, from a superficial view point the Egyptian texts would appear to be just so much gloss. On the contrary, they make excellent sense in view of the evidence from winds, currents, the ships used and the mixed cargo they carried, etc., as exemplified by the two LBA shipwrecks known, the Cape Gelidonya and Ulu Burun merchantmen.

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12 G. BASS, *National Geographic*, Dec. 1987, vol. 172, no. 6, p. 711.

13 G. BASS, "A Bronze Age Shipwreck at Ulu Burun (Kash): 1984 Campaign", *AJA* 90, p. 274.

14 G. BASS, "The construction of a seagoing vessel of the Late Bronze Age", *Tropis I, Symposium on Ship Construction in Antiquity*, ed. by H. Tzalas (1989), p. 27.

The possible objections

But then, one may ask, how does one explain that the only Near Eastern Bronze Age stone anchor found in Greece may very well be Egyptian [15]. Furthermore, the Middle Kingdom text "The Admonitions of an Egyptian Sage", mentions that Egyptian ships visited the land of the Keftiu [16]. The "Mit Rahineh" inscription of the 12th Dynasty gives detailed references to distant sea voyages taken by Egyptians of the 20th century B.C [17]. Does not the possible Egyptian anchor support the claims of the texts ?

Perhaps, but not necessarily. Single anchors found outside their usual spatial contexts have only limited weight - no pun intended. An Egyptian ship might have been blown off course by a violent storm. This does not imply that Egyptian merchantmen did not come to the Aegean. What is strongly doubted here is that they followed a direct route to Crete. If they did come, however, all the available evidence points out that they must have followed the course described in the New Kingdom texts quoted above, that is, a course northward along the Syro-Palestinian shore, then westward along the southern coast of Turkey, and thus to Rhodes and the Aegean or Crete.

The significance of the Egyptian objects on Crete

The above evidence on the trade routes followed by Bronze Age merchantmen suggests that the large majority of Egyptian objects found in Crete [18], a mixed bag of mostly luxury items or *objets d'art*, but with exceptions to be examined below, appear not to have been the result of organized, direct, bilateral commerce, but rather the products of partly seasonal, opportune but random trading from port to port. This would have been the natural consequence of the trade routes followed and of the fact that profits could be multiplied by the greater turnover of exchangeable goods. Certainly, the mixed cargo of at least one of the Bronze Age shipwrecks found, the Ulu Burun merchantman, is clear evidence for such trade.

But not all Egyptian objects found in Crete are luxury items. Excavations at Kommos, have brought to light large Egyptian ceramic containers, certainly no luxury items, which apparently contained perishable goods and found in the kitchen areas of various houses. This discovery, together with the few LM III sherds found in Marsa Matruh, have been interpreted as an indication of direct trade contact between Egypt and Crete during the LB III period. In view of what has been said above, this presence in no way indicates a direct contact with Egypt, but rather suggests that by this period, some of the inhabitants of the island had learned to appreciate Egyptian products other than luxury items, and that certain households on Crete could afford them. The quoted evidence tells us nothing about the route followed by the Bronze Age merchantmen which brought these goods to Crete. It is precisely this lack of evidence and this need for factual data, which this paper has attempted to fill.

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15 A. NIBBI, "Egyptian Anchors", *JEA* 61 (1975), p. 38ff., fig. 3; C. LAMBROU-PHILLIPSON, *Hellenorientalia, The Near Eastern Presence in the Bronze Age Aegean, ca. 3000-1100 B.C.* (1990), Catalogue no. 301.

16 J. VERCOUTTER, *L'Egypte et le monde égéen préhellénique* (1956), p. 40ff., 407, 417.

17 S. FARAG, "Une inscription memphite de la XII dynastie", *Revue d'Egyptologie* 32 (1980), 75ff.

18 For these objects see C. Lambrou-Phillipson (note 15), Table 1.

ILLUSTRATION

Pl. I : Currents - predominant direction, constancy and roses - July

TABLE 1
PALAIOHORA WEATHER STATION
WIND (Beaufort scale) Period observed 1952-1972

Month	N	NE	E	SE	S	SW	W	NW
January	30.2	3.1	3.1	13.0	12.2	6.0	19.2	11.2
February	25.3	2.8	2.3	17.8	10.3	4.2	20.5	14.4
March	30.3	2.1	1.6	20.6	8.1	3.5	15.8	13.9
April	20.0	3.7	2.1	18.8	8.8	2.3	24.3	11.1
May	16.2	1.9	2.5	9.5	7.6	1.0	30.1	11.9
June	24.3	4.0	0.7	5.0	3.5	0.1	25.1	15.3
July	40.3	9.3	0.1	0.6	0.2	-	19.1	15.4
August	41.7	12.2	0.2	0.6	0.2	0.2	15.1	11.7
September	33.0	12.8	0.7	2.6	5.0	0.9	16.2	12.2
October	35.6	6.8	1.6	12.0	9.8	2.6	14.3	8.8
November	28.2	1.5	1.3	15.8	13.6	6.3	16.3	11.8
December	29.2	3.6	1.8	14.3	13.7	7.7	16.9	10.2
AVERAGE	29.6	5.3	1.5	10.8	7.7	2.9	19.4	12.3

(after Table A1, *Ναυτιλιακαί Οδηγίαι των Ελληνικών ακτών, Πλοηγός*, volume B, *Νοτιοανατολικαί Ακταί*, 3rd edition, published by the Hydrographic Service of the Navy, Athens, 1976)

TABLE 2
IERAPETRA WEATHER STATION
WIND (Beaufort scale) Period observed 1956-1973

Month	N	NE	E	SE	S	SW	W	NW
January	33.0	5.7	1.6	9.7	3.1	23.3	0.4	7.9
February	25.3	7.8	1.9	12.1	1.8	26.9	0.2	7.3
March	27.6	10.4	2.7	15.8	1.8	18.1	0.6	8.9
April	19.7	14.7	3.9	16.2	1.4	21.5	0.2	5.8
May	19.8	12.8	1.6	13.6	1.9	23.4	0.9	4.4
June	28.8	14.8	1.8	10.1	1.7	18.8	0.2	7.8
July	40.7	18.4	0.3	4.7	1.3	14.2	0.2	10.8
August	44.1	14.7	1.1	3.0	0.5	13.3	0.2	12.0
September	41.8	16.1	0.4	4.8	1.6	15.0	0.2	8.3
October	42.2	10.6	1.2	7.0	1.9	11.5	0.1	7.0
November	32.1	5.6	2.4	8.3	1.8	19.3	0.5	5.6
December	30.7	3.5	1.9	10.3	2.7	27.5	0.7	5.3
AVERAGE	32.2	11.3	1.7	9.6	1.8	19.4	0.4	7.6

(after Table A2, *Ναυτιλιακαί Οδηγίαι των Ελληνικών ακτών, Πλοηγός*, volume B, *Νοτιοανατολικαί Ακταί*, 3rd edition, published by the Hydrographic Service of the Navy, Athens, 1976)

TABLE 3
SITIA WEATHER STATION
WIND (Beaufort scale) Period observed 1953-1967

Month	N	NE	E	SE	S	SW	W	NW
January	7.3	1.7	1.1	6.2	20.2	7.2	10.1	30.8
February	8.5	0.7	0.6	6.9	20.2	7.9	8.2	33.5
March	9.6	1.5	1.2	5.0	17.0	5.1	7.3	40.1
April	9.6	2.7	1.0	3.2	13.8	6.2	6.6	41.2
May	12.6	5.2	1.0	1.6	9.6	3.4	5.5	41.5
June	9.4	4.3	0.7	0.7	5.4	1.2	7.8	58.7
July	9.6	2.0	-	0.1	1.0	0.1	5.0	74.1
August	7.2	1.1	0.1	0.1	1.3	0.4	4.5	74.9
September	7.5	1.9	-	0.2	2.3	1.8	4.2	68.2
October	8.7	3.1	0.8	1.5	10.1	6.6	4.4	45.8
November	10.0	2.0	0.3	3.5	14.3	11.5	5.7	32.7
December	6.6	1.6	0.8	2.4	23.7	10.1	6.5	31.7
AVERAGE	8.9	2.3	0.6	2.6	11.6	5.1	6.3	47.8

(after Table A3, *Ναυτιλιακαί Οδηγίαι των Ελληνικών ακτών, Πλοηγός*, volume B, *Νοτιοανατολικαί Ακταί*, 3rd edition, published by the Hydrographic Service of the Navy, Athens, 1976)

TABLE 4
IRAKLION WEATHER STATION
WIND (Beaufort scale) Period observed 1951-1973

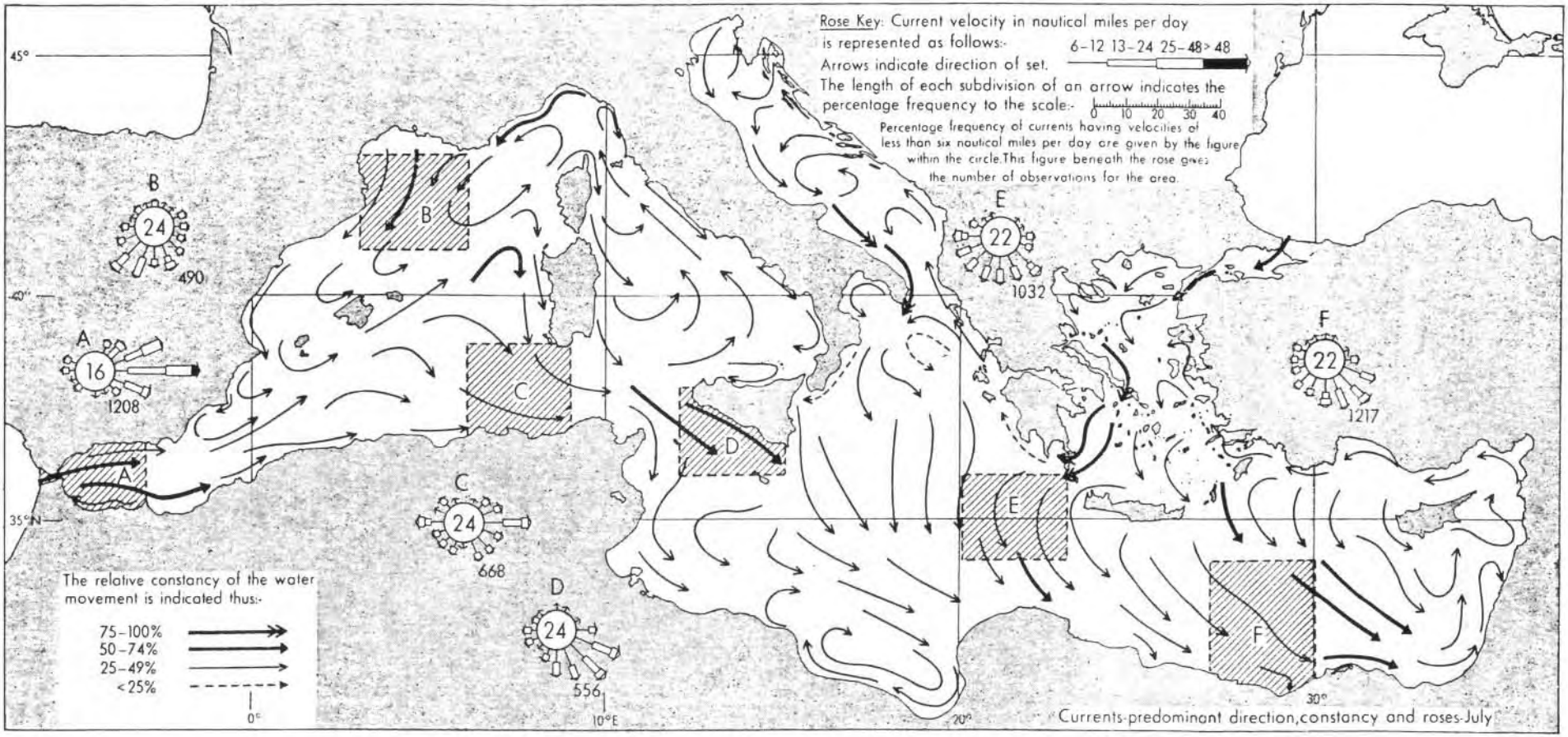
Month	N	NE	E	SE	S	SW	W	NW
January	13.0	3.2	2.0	5.8	27.7	12.1	5.6	14.0
February	12.5	4.3	2.0	5.0	27.6	10.3	5.7	16.3
March	15.8	4.5	3.4	5.0	19.2	6.7	5.1	22.3
April	12.2	4.4	4.6	4.0	15.2	3.9	5.3	26.7
May	13.6	5.9	6.6	2.6	5.1	1.7	4.2	25.7
June	15.1	4.6	4.8	1.4	2.6	0.6	3.1	40.5
July	16.4	2.4	1.5	1.1	0.8	0.2	3.2	57.7
August	17.0	1.9	1.3	1.8	1.3	0.1	3.3	54.9
September	19.5	2.4	1.7	3.2	5.1	1.1	3.3	41.8
October	20.1	5.8	2.6	3.8	15.0	4.1	3.4	24.9
November	16.5	4.1	2.5	6.2	24.8	6.9	3.7	12.2
December	16.4	3.3	1.4	6.3	29.6	9.4	4.6	13.7
AVERAGE	15.7	3.9	2.9	3.9	14.4	4.8	4.2	29.2

(after Table A4, *Ναυτιλιακαί Οδηγίαι των Ελληνικών ακτών, Πλοηγός*, volume B, *Νοτιοανατολικαί Ακταί*, 3rd edition, published by the Hydrographic Service of the Navy, Athens, 1976)

TABLE 5
CHANIA WEATHER STATION
WIND (Beaufort scale) Period observed 1951-1968

Month	N	NE	E	SE	S	SW	W	NW
January	13.7	7.3	9.9	5.9	4.5	25.0	10.6	5.8
February	12.3	7.3	10.0	5.5	3.1	20.2	11.2	9.1
March	17.1	9.1	12.0	4.1	2.7	15.3	10.8	9.2
April	13.3	7.5	13.2	2.3	1.9	14.1	12.5	12.5
May	15.6	4.8	12.7	1.7	0.8	10.7	12.4	15.4
June	19.6	4.0	8.7	1.2	0.5	6.9	13.8	19.8
July	23.1	3.8	4.9	0.6	0.1	5.0	12.3	22.8
August	22.8	6.2	5.9	1.7	0.7	7.4	9.5	16.4
September	24.3	6.4	8.5	2.5	1.0	8.1	7.0	12.3
October	18.6	11.6	12.1	4.8	1.8	9.3	5.0	7.9
November	12.3	7.8	11.6	5.4	2.8	12.9	9.1	7.4
December	13.7	7.3	11.0	7.1	4.3	21.1	8.5	5.7
AVERAGE	17.2	6.9	10.0	3.6	2.0	13.0	10.2	12.0

(after Table A5, *Ναυτιλιακαί Οδηγίαι των Ελληνικών ακτών, Πλοηγός*, volume B, *Νοτιοανατολικαί Ακταί*, 3rd edition, published by the Hydrographic Service of the Navy, Athens, 1976)



Currents—predominant direction, constancy and roses—July.