59. CYPRUS EVAPORITES

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ABSTRACT

The island of Cyprus is divisible into three major stratigraphic and tectonic zones. The Troodos zone in the south, consists of an igneous massif which occupies the core of the mountain range and has gently dipping sediments which are peripheral to the massif.

The Pentadaktylos (Kyrenia) zone, in the north, in contrast to the Troodos massif, is strongly folded and thrusted zone comprised almost wholly of sedimentary rocks. The central core of Pentadaktylos (Kyrenia) range consists of crystallized and semicrystallized limestones and dolomites overthrust on younger chalky sediments and turbidites.

The Mesaoria Plain, separating these two zones, is a subsided area, which probably continuously received sediments from Campanian to late Miocene time. Deep drilling here has shown that there are Troodos pillow lavas at the base of this succession, at least in its southern part.

The Miocene sediments of the Troodos zone are middle Miocene marls and chalks with calcarenite layers, fragmented limestones, and paper shales (Pakhna Formation). The top of this unit is defined by a prominent stratigraphic marker of up to 5 meters thick of bright white porcellaneous chalks (interbedded with shaly limestone). The porcellaneous chalk has conchoidal fracture and contains the gigantic foraminifer *Discospirina italica* (Costa). The top of the Pakhna sequence includes bioclastic algal and reef limestones (Koronia Formation) which grade upwards and laterally into evaporites consisting mainly of gypsum (Kalavasos Formation). Salt has been found only in the northern part of this zone underlying Pliocene sediments.

The gypsum in the evaporites is of three main varieties: (1) the common medium- to coarse-grained saccharoidal type, (2) selenite, forming translucent bladed folia or rosettes, and (3) the marmara type, a compact medium-grained gypsum which splits into thin flags and is used by villagers for interior flooring tiles.

The middle Miocene sediments in the Mesaoria and Pentadaktylos (Kyrenia) zones are mainly thick (exceeding 3000 m), strongly folded deposits of the Kythrea Formation. The Kythrea flysch consists of thin-bedded arenaceous sediments (turbidites, graywackes, etc.) interbedded in places with marl and thin-bedded calcarenitic limestones. Basal conglomerates are locally present at the base of this flysch formation.

Overlying the Kythrea turbidites are rather localized outcrops of pale gray and brown marl of the Pakhna Formation capped in some areas by hard porcellaneous chalks interbedded with papery shales of the *Discospirina* Zone. The papery shales are similar to those of the circum-Troodos *Discospirina* Zone.

Numerous gypsum outcrops within the arcuate belt of the Mesaoria zone and the southern periphery of the Pentadaktylos (Kyrenia) range correlate both lithologically and stratigraphically with the circum-Troodos evaporites.

In the northern part of the Pentadaktylos (Kyrenia) zone, the Miocene stratigraphy is similar to that of the southern part of the same zone, but no gypsum crops out in this area.

Post-Pakhna sediments in all three zones consist of lower Pliocene gray and yellowish brown marls, chalky marls, limestones, and calcarenites (Nicosia Formation) and are overlain by Pleistocene sediments.

DISTINCTIVE GEOLOGIC FEATURES OF CYPRUS

The island of Cyprus is dominated by two mountain ranges which are separated by an almost east-west-trending plain (Figures 1, 2). These geomorphological regions coincide with three major stratigraphic and tectonic zones (Figure 3).

The Troodos zone (Figure 3) consists of an igneous massif which occupies the core of the mountain range surrounded by gently dipping sediments. The igneous massif is a typical ophiolite consisting of plutonic dyke and pillow lavas. The plutonic rocks occupy the core of the massif and are enclosed within a diabase dyke intrusive complex. The pillow lavas, believed to be Campanian in age, form the outer periphery of the ophiolitic complex and consist of well-formed pillows including several dykes.

The earliest autochthonous sediments overlying the Troodos massif are comprised of iron- and manganese-rich fine-grained sediments, radiolarites of the sporadically outcropping Perapedhi Formation, and Campanian bentonitic clays and volcanogenic sandstones which crop out extensively in the southwestern part of Cyprus (Moni Formation).

The Moni clays are overthrusted by the Mamonia complex, an assemblage of broken sheets and isolated blocks of variable size consisting of sandstones, manganiferous shales and cherts, lavas intercalated with limestones, serpentinites, amphibolite schists, reef limestones, and pelagic limestone. The age of sediments of the Mamonia complex ranges from Triassic to Jurassic, but its emplacement took place during late Campanian/early Maestrichtian during which time folding, faulting, and slumping resulted in the formation of an extensive melange.

Overlying the pre-upper Maestrichtian sediments is the Lefkara Group of Maestrichtian to early Miocene age. It consists of pelagic marl, bright white chalk with spectacular bedded and nodular cherts, and chert-free bright white massive or cleaved chalks. At the top of the sequence the chert-free chalks are interbedded with coarse-grained bioclastic limestones indicative of a shallow marine depositional environment. In some areas these limestones grade laterally into the reefal limestones of the widespread formation known as the Terra limestones.

Resting on the Lefkara chalks, in most places uncomformably, are cream or light brown middle Miocene marls and chalks with distinctive calcarenite, fragmented limestones, and paper shale layers (Pakhna Formation). The top of the Pakhna sequence includes bioclastic algal limestones and reefal limestones (Koronia Formation) which grade upward and laterally into evaporites (mainly gypsum) of the Kalavasos Formation. Salt has only been found in the northern part of this zone under Pliocene sediments.

Post-Pakhna sediments consist of lower Pliocene gray and yellowish brown marl, chalky marl, limestone, and calcarenite (Nicosia Formation, including Myrtou marls) overlain by Pleistocene sediments (Athalassa and Kyrenia formations). The terrace deposits are conglomerates which fan away from the Troodos massif, and calcarenite or pebble beds which fringe the coast and form several distinct terraces.

The Pentadaktylos (Kyrenia) zone (Figure 3), in contrast to the Troodos massif, is strongly folded and thrusted and is composed almost entirely of sedimentary rocks. The central core of Pentadaktylos consists of crystallized and semicrystallized limestones and dolomites which have been thrust over onto younger chalky sediments and turbidites.

The crystallized and semicrystallized limestones and dolomites of the core of Pentadaktylos (Kyrenia) zone are collectively called the Hilarion Limestones. These have recently been found to comprise a number of distinct formations of Triassic, Jurassic, and Early or probably Middle Cretaceous age (Dhikomo, Sykhari, and St. Hilarion formations), together with blocks of Permian limestones.

The Hilarion rocks are thrusted over fine-grained limestones which extend laterally into chalks, marly limestones, and clays, (Lapithos Formation). Sandy limestones and flows or sills of pillow lavas and gabbroic rocks form the base of this Campanian or Maestrichtian succession. The Hilarion rocks also have clays and olistholiths which correlate to the Moni Formation. Upper Eocene-Oligocene coarse-grained limestones occur laterally and at the top of the succession (Ardana-Kalogrea Formation).

Intensely folded turbidite (flysch) deposits fringe the Pentadaktylos (Kyrenia) range. Their deposition began in the late Eocene or Oligocene and continued into middle Miocene time, but most turbidites were deposited in middle Miocene (Vindobonian). The younger turbidites are called the Kythrea Formation.

The upper part of the Kythrea Formation grades laterally and upward into calcareous sediments and evaporites (gypsum deposits) which correlate to the circum-Troodos, Pakhna, Koronia, and Kalavasos formations. Also, the Pliocene and Pleistocene deposits of this zone are similar to the circum-Troodos Pliocene-Pleistocene sediments.

The Mesaoria plain (Figure 1) is a subsided area which probably received sediments continuously during the Campanian to late Miocene time. Deep drilling has shown that Troodos pillow lavas are present at the base of this succession, at least in its southern part. The lower Pliocene and Pleistocene deposits extend to both the northern and southern zones. At the eastern and western parts of the Mesaoria plain two recently formed basins are filled with Recent sands, gravels, and silts. In general, the southern part of Mesaoria is similar to the Troodos zone and the northern part is similar to the Pentadaktylos zone.

MIOCENE-PLIOCENE STRATIGRAPHY AND EVAPORITE FACIES

Deposits Surrounding the Troodos Massif (Figures 1, 2, 3)

The gypsum deposits surrounding the Troodos massif are most extensively developed in the southern part where the Pakhna Formation is best developed. In this

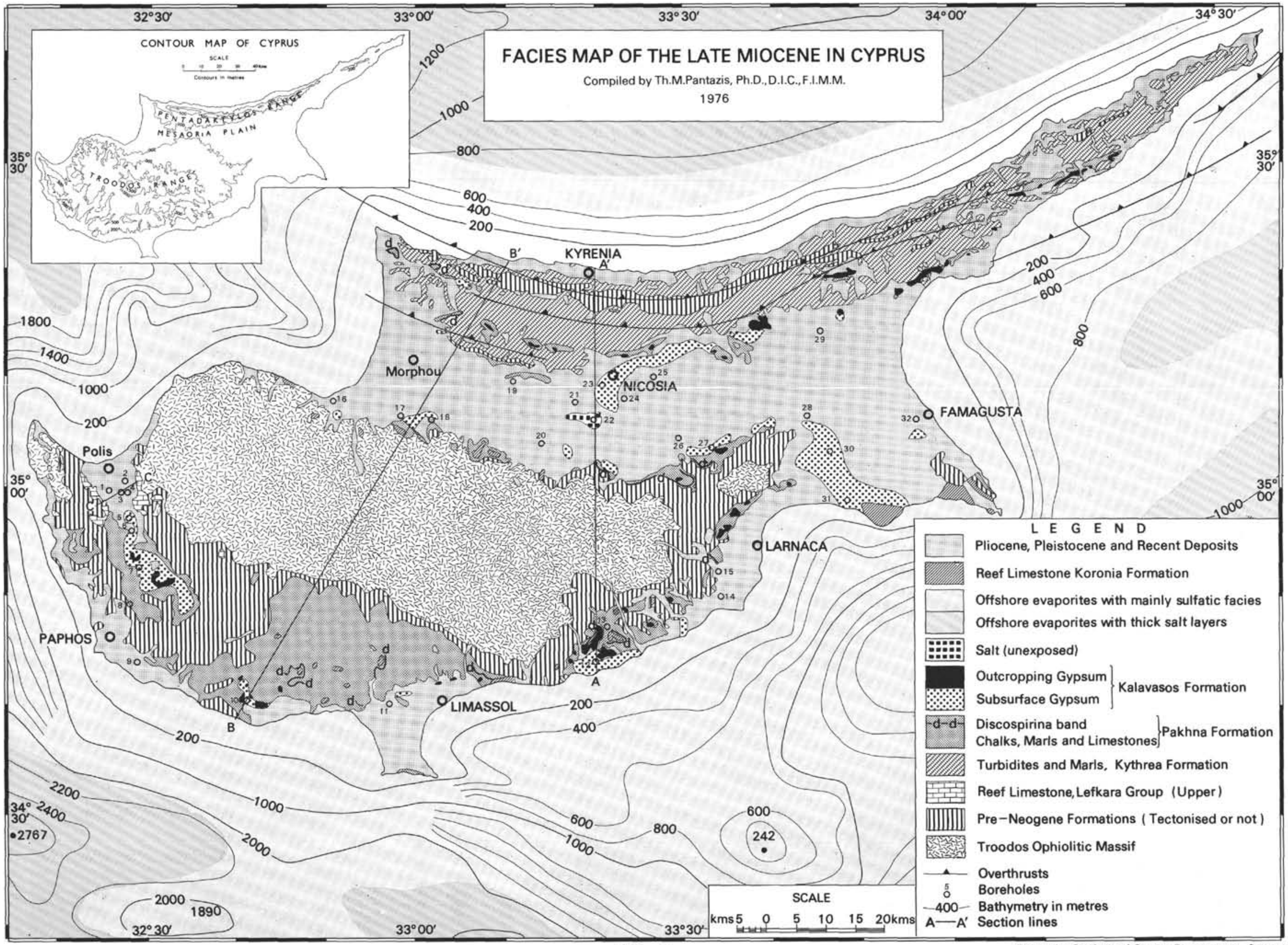

FIG. 1

Drawn by Geological Survey Department, Cyprus.

Figure 1. *Facies map of the late Miocene in Cyprus.*

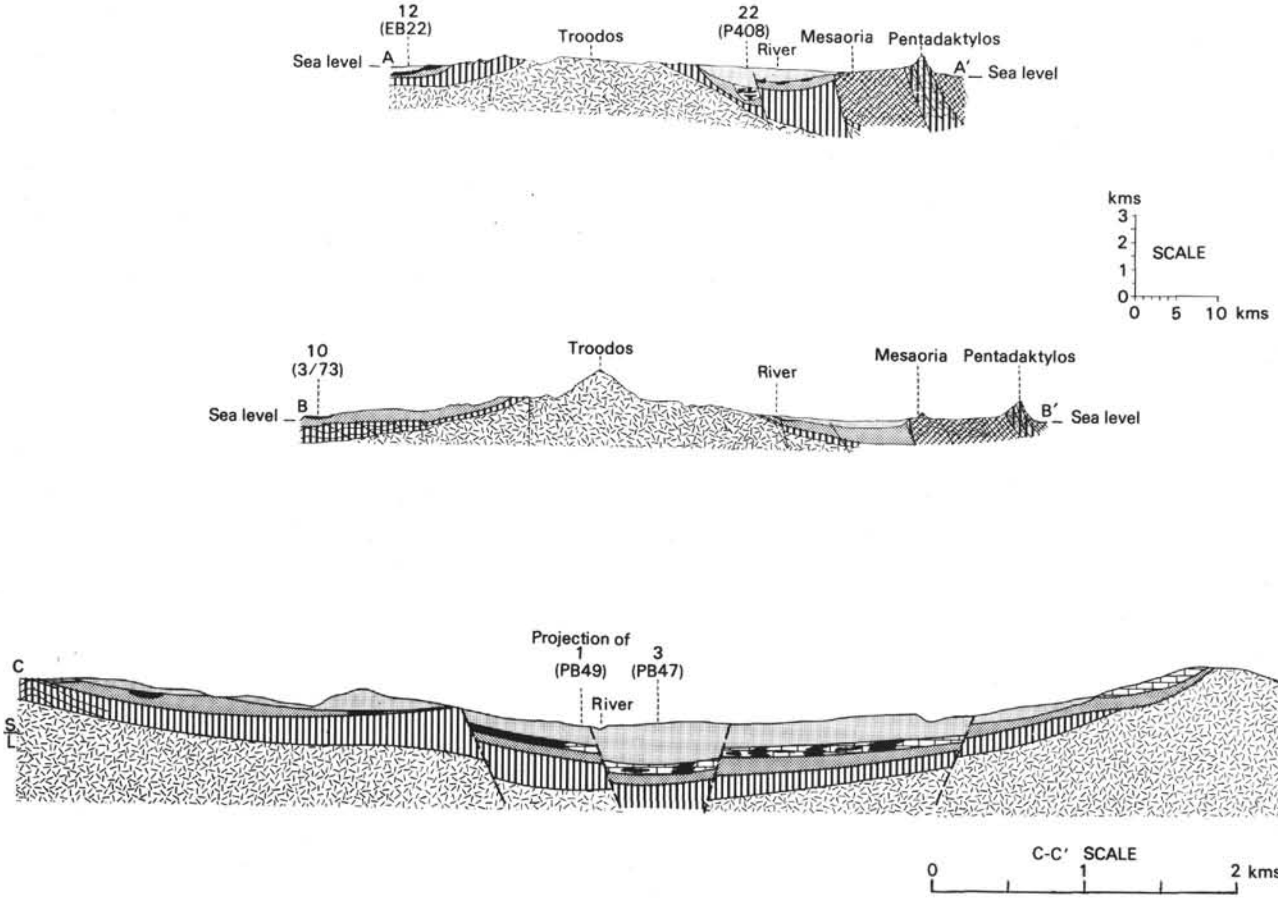

Figure 2. *Diagrammatic geological sections along A-A', B-B', and C-C'.*

region (Figures 1, 2) the Pakhna Formation consists of a thick (up to 600 m) succession of marls, chalks, and limestones. It forms three distinct lithological facies, each of which extend over a large geographical area.

The lowest part of the Pakhna succession is composed of a rhythmic sequence of yellow to buff marls and marly chalks or limestones which unconformably overlie the Lefkara chalks (Gass, 1960; Bagnall, 1959; Bear and Morel, 1960; Pantazis, 1967). The unconformity, however, is not present in areas where deposition of the Lefkara Group sediments continued into the early Miocene (Pantazis, 1967). Further to the west, and particularly in the Polis basin, the Pakhna sediments may also unconformably overlie lower Miocene reef limestones of the Lefkara Group. The basal sediments of the Pakhna Formation are generally fine- to medium-grained with a few coarse-grained shelly beds (bioclastic limestones) containing grains of ferromagnesium silicates identical to those of the Troodos ophiolitic rocks. The percentage of marl in relation to the chalks or limestones varies both laterally and vertically, but the thicker deposits of marls are usually found near the top of the sequence. At the contact between the Troodos tectonic zone and the Mesaoria plain the marls of the Pakhna Formation consist of normal Pakhna sediments mixed with turbidite material. The top of this unit is marked by a prominent 5-meter-thick bed of bright white porcellaneous siliceous chalk interbedded with shaly limestone. The porcellaneous chalk has a characteristic conchoidal fracture and includes the gigantic foraminifer, *Discospirina italica* (Costa). This zone known as a *Discospirina* band is very extensive, traceable for many kilometers, but it may not necessarily be present at every Pakhna exposure.

The chalk-marl sequence grades both vertically and laterally, but most typically vertically into a calcarenitic or fragmental shaly limestone facies.

The calcarenites are massive, coarse-grained, yellowish brown, bioclastic limestones with interbedded clastic Troodos igneous material and shaly limestone.

The fragmented shaly limestone crop out over a considerable area, but is probably the thinnest unit of the Pakhna Formation. These thin bedded limestones resemble paper shales and are interbedded with flaggy limestones and marls. The fragmented shaly limestones are medium- to fine-grained with very distinct current bedding structures. They are fossiliferous and in some places contain large fossilized fish. Hard, compact, bioclastic bioherm and biostrom limestones of the Koronia formation, which mark the end of the calcareous sedimentary cycle of middle Miocene, conformably overlie the Pakhna Formation. The formation is also transgressive and, in places, overlies older formations including igneous rocks. This reef limestone grades upward and laterally into evaporites (gypsum) of the Kalavasos Formation and forms extensive outcrops. All workers agree that the Koronia Formation grades

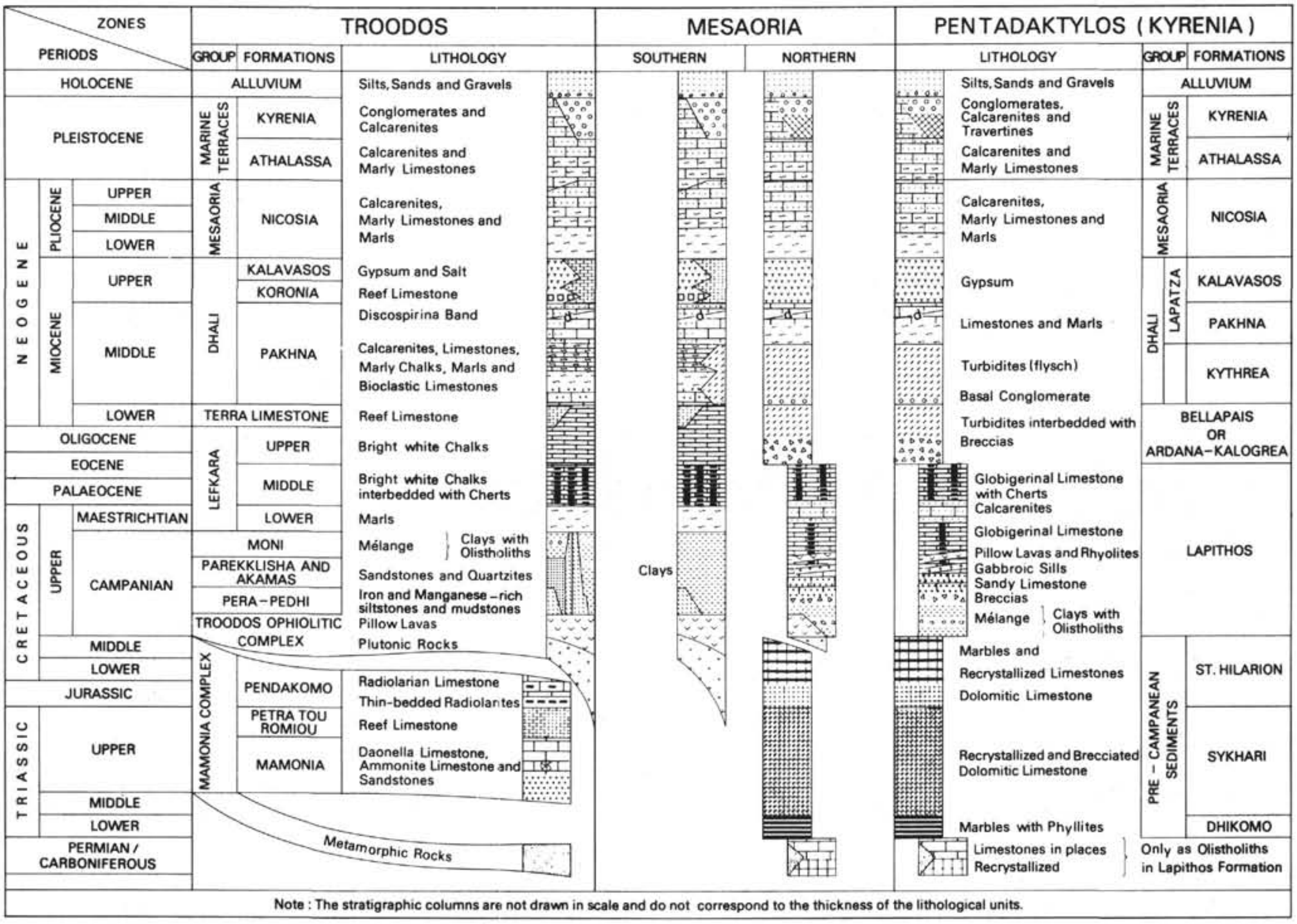

Figure 3. *Stratigraphy of the tectonic zones of Cyprus.*

upward into gypsum deposits, and some (Cleintuar et al., in press) regard the lateral variation of reefs into gypsum as probable. Note, however, that in the south central area, loronia reef limestones were found to interbed with gypsum bands (Pantazis, 1967) and recent drilling in the most western part of the area (Polis basin) showed that gypsum is a lateral facies variation of Koronia reef limestones (Figures 2 and 4).

Four main types of gypsum occur in Cyprus: (1) saccharoidal, (2) selenite, (3) "marmara," and (4) alabaster. The results of chemical analyses of representative samples from all these types of gypsum, including one alabaster type, are given in Table 1.

1) The saccharoidal gypsum is medium- to coarse-grained, dull brownish gray or white, and massively bedded. In thin section it is seen to consist of mutually interfering broad plates and subhedral aggregates of gypsum which usually show a perthitic-like texture and polysynthetic twinning. Some recrystallized platy gypsum also occurs along the bedding or the joint planes. The saccharoidal variety is the most common gypsum in Cyprus and is the main type quarried for export.

2) The selenite gypsum is found closely associated with the saccharoidal variety. It is colorless and translucent and forms bladed folia, aggregates, or "rosettes." The bladed folia are composed of large, (up to about two feet long) glistening, laminated, platy selenite crystals which are flattened parallel to the (010) crystallographic faces. The foliation is very well defined and is a result of prominent cleavage parallel to the (010) crystallographic faces. The aggregates consist of thin unoriented radiating folia of selenite. The "rosettes" are composed of similar thin folia of translucent selenite but radiate from a central point.

3) The marmara is a compact, generally of grayish or brownish white medium-grained gypsum, which usually splits into flags one to two inch thick. This variety is found in the surveyed area interbedded with the saccharoidal gypsum and may include anhydrite. It is used by the villagers for interior floor tiles and courtyard paving slabs. In thin section the marmara shows textures similar to the saccharoidal type.

The outcrops of the Nicosia Formation are restricted to the southwest part of Cyprus and usually consist of buff colored, fossiliferous, calcarenite and marls. They unconformably overlie the Pakhna Formation or the gypsum deposits. Recent drilling in the area (Figure 3) has shown, however, that all unexposed gypsum deposits underlie lower Pliocene marls.

In many places the Pliocene sediments underlie Pleistocene deposits consisting of calcarenites, sands, gravels, and conglomerates. They form several distinct terrace deposits which fringe the coastline of southern and southwestern Cyprus.

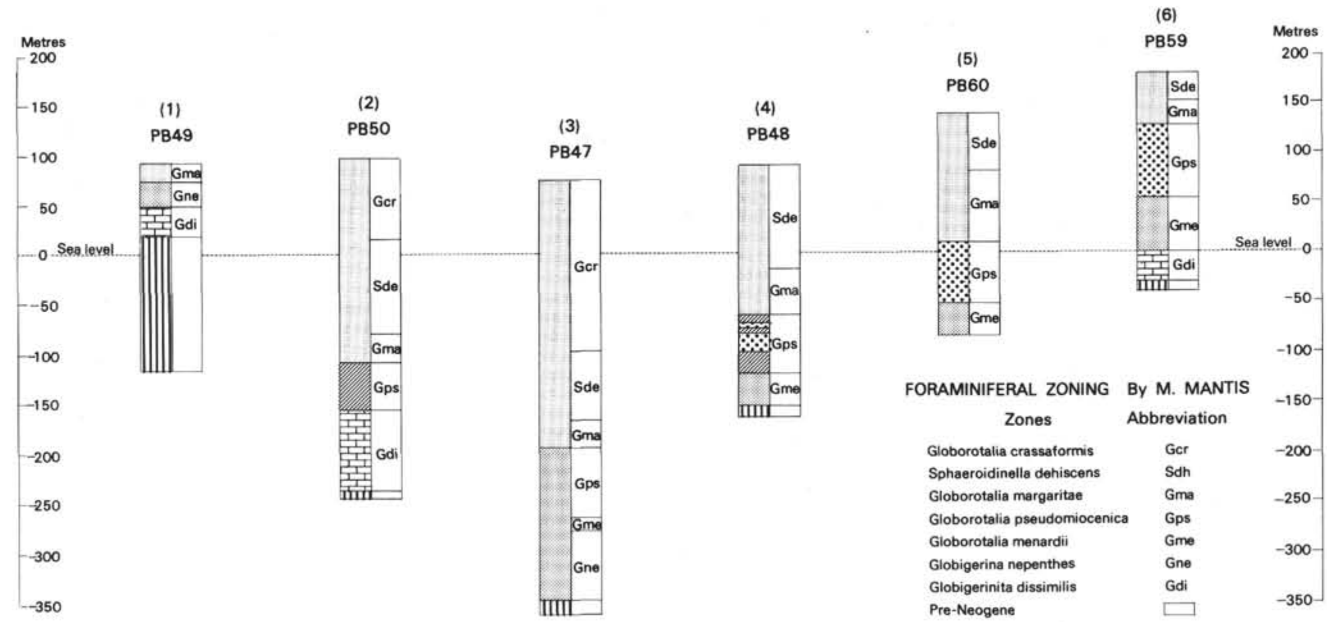

Figure 4. *Detailed borehole records of Polis basin area. Foraminiferal zoning by M. Mantis.*

TABLE 1
Chemical Analyses of Gypsum

	Marmara	Saccharoidal		Selenite	Alabaster
Analysis	2 samples mean value (%)	2 samples mean value (%)	Exported type 17 Samples mean value (%)	2 samples mean value (%)	1 sample (%)
Free water	0.04	0.03	0.01	0.05	0.03
Combined water	19.72	20.35	19.41	20.43	20.58
Carbon dioxide (CO_2)	1.58	0.25	0.97	0.12	0.06
Silicon dioxide (SiO_2) and insoluble matter	1.04	0.88	1.07	0.70	0.70
Iron and aluminum ($Fe_2O_3 + Al_2O_3$)	0.38	0.30	0.20	0.24	0.20
Lime (CaO)	32.32	31.70	32.67	31.75	31.85
Magnesium oxide (MgO)	nil	nil	0.05	nil	nil
Sulfur trioxide (SO_3)	44.89	46.45	45.17	46.95	47.15
Sodium chloride (Nacl)	–	–	0.01	–	–
Total	99.97	99.96	99.56	100.24	100.57
Report of Results					
Gypsum ($CaSO_4.2H_2O$)	94.22	97.23	92.74	97.60	98.33
Anhydrite ($CaSO_4$)	1.82	1.15	3.48	1.55	1.15
Silicon dioxide + insolubles	1.04	0.88	1.07	0.70	0.70
Iron and aluminum (R_2O_3)	0.38	0.30	0.20	0.24	0.20
Calcium carbonate ($CaCO_3$)	1.88	0.20	1.85	nil	nil
Magnesium carbonate ($MgCO_3$)	nil	nil	0.10	nil	nil
Sodium chloride (NaCl)	–	–	0.01	–	–
Total	99.34	99.76	99.45	100.09	100.38

In contrast to the southern region, the Pakhna Formation forms restricted exposures of sediment and gypsum in the northern part of the Troodos range which led earlier authors (Gass and Cockbain, 1962) to believe that occurrence of these formations was extremely localized. As a result of recent drilling, however, thick deposits of both Pakhna sediment and gypsum have been found. The stratigraphic relationship between the Pakhna sediment and gypsum deposits and associated sediments, as shown from the outcrops and the boreholes, is similar to that of the southern region surrounding the Troodos range. The Pakhna sediments show distinct current bedding and the gypsum deposits generally thicken toward the west from about 30 meters in the central north region to about 200 meters at the most northwestern part (Morphou Basin). The gypsum, relative to the Pakhna sediments, also thickens toward the east and is about 100 meters thick at Famagusta. This gypsum includes an increased number of clay bands.

All buried gypsum deposits (Figure 3) were found underlying lower Pliocene marls, which form extensive outcrops in this area, and overlying Pakhna marls or reef Koronia limestone. It is clear that the hard porcellaneous chalks interbedded with papery shales (*Discospirina* band) mark the top of the Pakhna marl-chalk sequence and underlie the gypsum deposits (Gass and Cockbain, 1962). In the southern region there are marly bands at the base of the gypsum but because of limited exposure of Pakhna sediments in the northern region, a complete facies study is not possible.

South of Nicosia at Xeri (Figure 2) a borehole (No. 22, P408) penetrated a body of rock salt between 884 meters and 1189 meters. Of this, 296 meters consists of pure salts, the remaining 9 meters is gray marl containing anhydrite (Gass, 1960). The rock salt thus comprises two distinct bands. This deposit underlies lower Pliocene marls which contained shell fragments and a basal unit composed of gray marl with fragments of chalk, igneous rocks, and gypsum. The salt overlies gray marls with anhydrite and shale fragments.

Mesaoria and Pentadaktylos (Kyrenia) Zones

The middle Miocene sediments in the Mesaoria and Pentadaktylos (Kyrenia) zones are mainly thick deposits (exceeding 3000 m) of the strongly folded Kythrea Formation (Figures 1, 2). The Kythrea flysch consists of thin-bedded arenaceous sediments (turbidites, graywackes, etc.) interbedded, in places, with marls and thinly bedded calcarenitic limestones. Basal conglomerates at the base of this flysch occur in some places.

Pale gray and brown marls of the Pakhna Formation overlie the Kythrea turbidites. The Pakhna Formation is capped in some areas by hard porcellaneous chalks interbedded with papery shales of the *Discospirina* Zone which is similar to the circum-Troodos *Discospirina* band. The Pakhna sediments have relatively low dips compared to the dips of the underlying Kythrea beds. There probably is an angular unconformity between the two units. Gypsum in the Mesaoria zone and the southern Pentadaktylos periphery conformably overlies the Pakhna sediments. It is up to 25 meters thick and includes marly material in some places.

Numerous gypsum deposits which extend from the most western part to the most eastern part of Cyprus within the arcuate belt of the Mesaoria zone and the southern periphery of the Pentadaktylos range were included by Henson et al. (1949) under the heading of the "Lapatza gypsum lentil." In this zone the gypsum occurs at the top of a succession of calcareous sediments. In some cases the beds underlying the gypsum are not exposed, and at other localities, although sediments typical of the succession are present, the uppermost gypsum has either been removed by later erosion or was not deposited. A generalized succession by Gass and Cockbain (1962) is as follows:

	Thickness (m)
Gypsum with gray gysiferous marls	0-25
Hard porcellanous chalks (*Discospirina* band) with papery shales	5-9
Pale gray and brown marls	16-55

The gray and brown marls at the base of the succession are particularly well exposed at the type locality and in a few other places. They are soft, poorly bedded, and are of the same color as the sediments of the underlying Kythrea Formation. There is considerable variation in the thickness of marls present. The alternating gray and brown banding is typical of this part of the sequence. The hard porcellaneous chalks occur in a narrow zone and stand out prominently against the smooth slopes formed by the underlying marls. They include three or four bands of hard white chalk separated by pale-gray and buff papery shales with *Discospirina italica* in the uppermost chalk bands. The gypsiferous horizons occur immediately above these beds. At the surface the gypsum is usually in the form of coarsely crystalline selenite which usually overlies the bedded variety of gypsum known locally as marmara. Complex minor plications are commonly present in the bedded gypsum. Detailed mapping of the junction between the Lapatza gypsum outcrops and the underlying turbidites of the Kythrea Formation (Moore, 1960) suggests that this contact is an unconformity. Although no exposure of this junction has yet been found, outcrops within a few feet of the contact indicate that it is probably an angular unconformity. The strike of both formations is conformable but there is a marked discrepancy in the angle of dip between beds of the Lapatza outcrops and those of the underlying Kythrea Formation. The dip of the Kythrea Formation is usually greater than 30°, whereas the dip of the Lapatza sediments, except in a few contorted areas, is well below this figure.

Micropaleontological (Gass and Cockbain, 1962) and stratigraphic evidence indicates that the "Lapatza Gypsum Lentil" can be correlated with the circum-Troodos gypsum (Kalavasos Formation).

PALEONTOLOGY

The foraminiferal faunas from the upper Pakhna Formation and the Lapatza gypsum outcrops have been examined by Gass and Cockbain (1962) in order to determine the age and correlate the two formations. Particular attention was paid to the Pakhna Formation which is on the north side of the Troodos massif, and where the stratigraphical succession is very similar to that of the Lapatza gypsum. Two faunal assemblages were recognized by Gass and Cockbain in the chalks and marls of both formations as follows. The lower beds contain numerous anomalinids and globigerinids, along with lagenids; in the upper part of the sequence a few buliminids are found. The *anomalinid-globigerinid* assemblage occurs throughout the lower portion of both the upper Pakhna Formation on the northern flank of Troodos, and in the Lapatza gypsum outcrops. About 3 to 5 meters below the level of the *Discospirina* band it is replaced by the buliminid assemblage. The fauna is characterized by an abundance of planktonic foraminifers and such benthic species as *Anomalina helicina* and *Cibicides pseudoungerianus*. In addition, several species of *Robulus* occur in the Pakhna outcrops.

The *buliminid* assemblage occurs in the upper 3 to 5 meters of both the Pakhna Formation and the Lapatza gypsum chalks. The upper limit is approximately at the horizon of the *Discospirina* band. *Discospirina* itself is usually confined to the hard chalk band to which it gives its name.

The buliminid assemblage occurs over a wide area and, because of its limited vertical range it provides strong evidence in favor of correlation of the upper Pakhna with the Lapatza gypsum outcrops. Complete faunal lists are found in Gass and Cockbain (1962) and Henson et al. (1949). Both papers recorded essentially the same fauna from the Lapatza gypsum lentil.

A recent stratigraphic and micropaleontologic work on the Neogene sediments of the Pentadaktylos (Kyrenia) and Mesaoria zones by Baroz and Bizon (1974) revealed nine formations ranging in age probably from late Eocene to the evaporitic Messinian and showed that the Pliocene sediments were transgressive and represent a new sedimentation cycle.

Several planktonic foraminiferal biozones have been identified. Their succession is quite similar to that found from the Oligocene to the middle Pliocene in the western Mediterranean.

The Kythrea Formation belongs to two physiographic provinces separated by the large east-west-trending Kythrea fault. In the northern "Pentadaktylian" province, a relatively diversified transgressive series was deposited. In the southern "Mesaorian" province, the sedimentary series lies conformably on chalky deposits which extends southward towards Troodos.

A zonation proposed for the Pentadaktylos and the northern Mesaoria by Bizon (in Baroz and Bizon, 1974) is shown in Figure 5. Figure 6 shows the foraminiferal zoning of Cyprus as proposed by Mantis.

MIOCENE-PLIOCENE TECTONIC HISTORY OF CYPRUS

The three tectonic zones of Cyprus namely the Troodos, Pentadaktylos (Kyrenia), and Mesaoria have distinct tectonic characteristics.

In the Troodos zone there is strong evidence to suggest that the central part of the massif was above sea level at the end of Lefkara Group deposition and remained above sea level since lower Miocene. The sea level however was not stable as a deepening of the middle Miocene basin occurred with the beginning of Pakhna sedimentation which then decreased until a time when the water depth was shallow enough to allow the deposition of reef and algal limestones (Koronia Formation) and evaporite deposits (Kalavasos Formation). The formation of reefs or the deposition of evaporites were controlled by the local conditions which existed at the time around the Troodos Island. The middle Miocene reefs are transgressive overlying, in places, the Troodos volcanic rocks. The gypsum, however has not been found overlying such rocks. The middle Miocene sedimentation was followed by a period of more uplift and erosion of the massif. The next cycle of sedimentation took place in the lower Pliocene after the massif sunk to such a depth that Pakhna sediments and perhaps the outer zone of Lefkara Group rocks were submerged. The lithologies of the lower Pliocene sequence are mainly marls, at the deepest parts, with calcarenite or marly limestone elsewhere.

In the Pentadaktylos zone, forces directed from the north during the Attican phase in late Miocene caused low-angle folding and thrusting of large and elongated slices of Paleozoic rocks, recrystallized lower Mesozoic limestone, and other pre-Miocene rocks (Henson et al., 1949; Moore, 1960). By the end of Miocene the Pentadaktylos (Kyrenia) range emerged from the sea and formed an elongated, arcuate, low-level range. The Pliocene and Pleistocene geological history of this zone is similar to that of the Troodos range.

The Mesaoria zone has been a deep basin between the two other zones probably since Eocene times. The movements which occurred towards the end of Miocene caused intense folding of the sediments into narrow synclines and anticlines. As a result of the folding the Mesaoria base was raised to near the sea level, but its central part (a zone running from east to west) probably remained below sea level continuously until the end of the Pliocene while the other two zones emerged from the sea.

The general uplift of the Troodos and Pentadaktylos (Kyrenia) range at the end of Calabrian was followed by uplift of the Mesaoria plain which brought it above sea level and joined the two islands into one. Further general uplift occurred in all three zones and resulted in the formation of a number of marine terraces fringing the coast lines and river terraces lining the rivers of Cyprus.

Alpine orogenic movements did persist into Pleistocene time, but resulted only in faulting and some tilting of the younger sediments.

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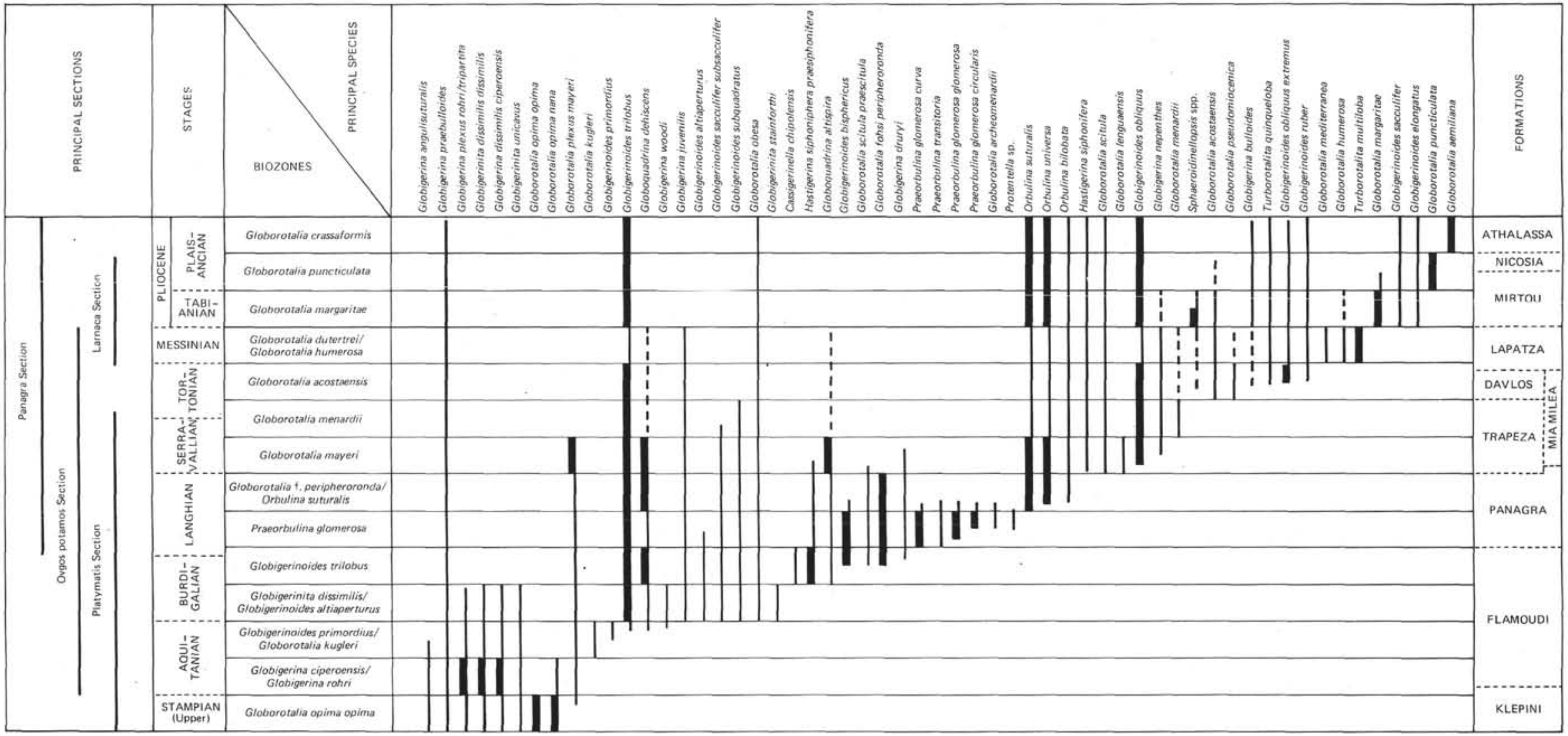

Figure 5. *Stratigraphic occurrence of the principal planktonic foraminifera of the Oligocene to lower Pliocene of the Pentadaktylos and northern Mesaoria, Cyprus after Bizon (in Baroz and Bizon, 1974).*

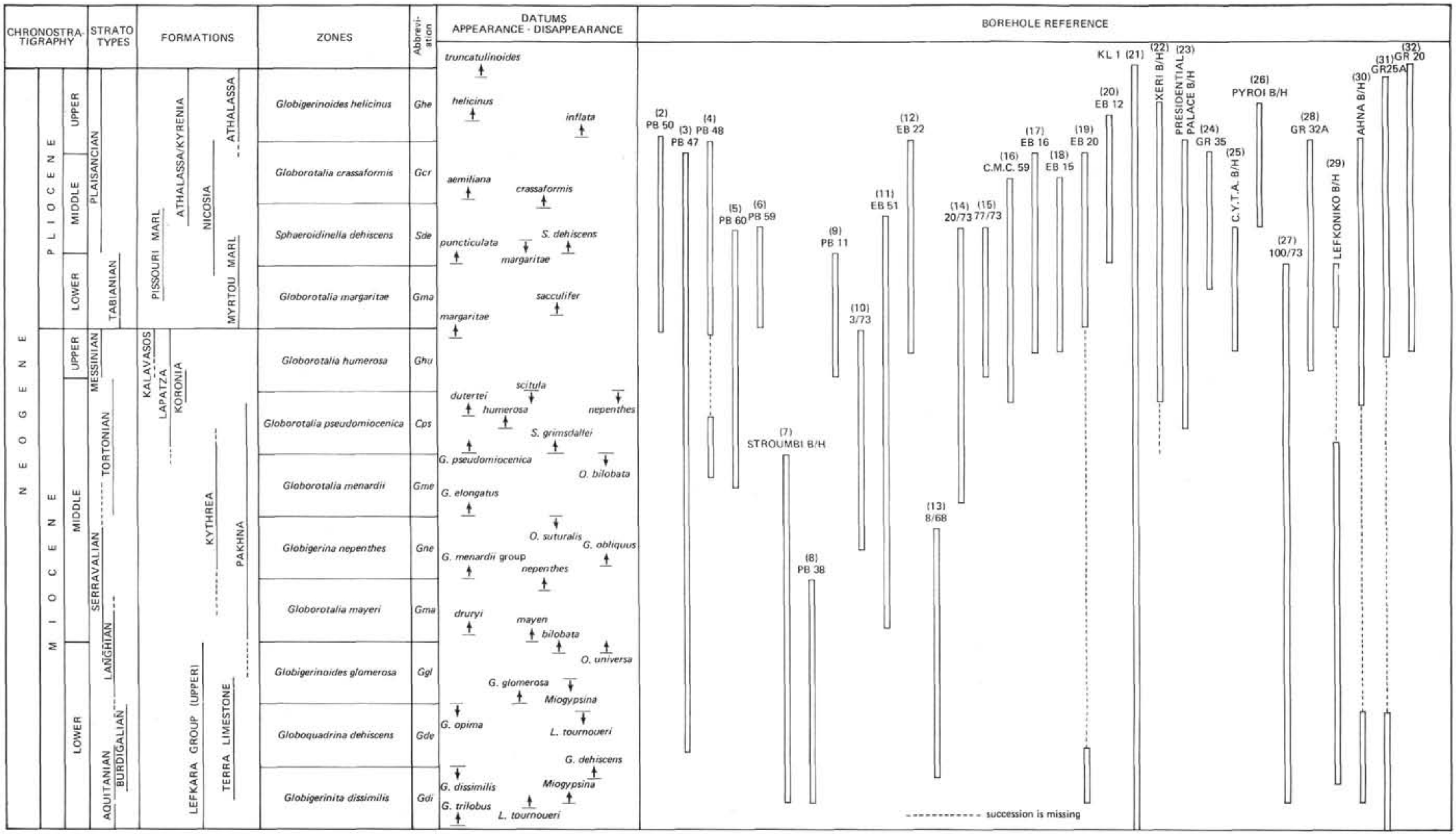

Figure 6. *Cyprus Neogene foraminiferal zoning by M. Mantis.*