CHAPTER 2 /

Geomorphological Features

Sakellariou D., Drakopoulou V., Rousakis G., Livanos I., Loukaidi V., Kyriakidou Ch., Morfis I., Panagiotopoulos I., Tsampouraki-Kraounaki K., Manta K.

The Eastern Mediterranean Sea, as defined here, includes the Ionian Sea east of N18°E, the Libyan and Levantine Seas and the Aegean Sea. This rather small oceanic region connects three continents: Europe to the North, Asia to the East and Africa to the South. It belongs to the most active areas on the Earth in terms of plate tectonic movements and seismicity, as it hosts the active convergent margin between Eurasia and Africa. It is also characterized by complex geomorphology, a direct result of the tectonic processes prevailing in this area.

The **East Mediterranean Ridge** is the most striking submarine morphological feature. With a total length of roughly 1500 km and a width ranging between 200 km and 60 km, it constitutes a submarine mountain belt made of deformed sediments that have been compressed between the African plate and the Hellenic Arc [1]. The shallowest summit of the E. Mediterranean Ridge, known as Herodotus Rise or Antaeus High, is located north of Cyrenaica and reaches a water depth of less than 1250 m. The Ionian and Levantine branches of the East Mediterranean Ridge extend into water depths of approximately 3200 and 2200 m respectively. Numerous mud volcanoes occur on the Mediterranean Ridge and its relationship with active tectonic elements has been documented by several researchers[2,1].

The **Hellenic Trench** encompasses a series of deep troughs and basins surrounding the Hellenic Arc. It contains three distinct sectors: The north-western sector marks the steep escarpment and reaches more than 3000 m deep, to the western slope of Kephallinia Island. The western sector, known as the Ionian Trench or Matapan Trench, extends from the Ionian Islands to the south of Gavdos Island. It is a morphological feature characterized by small, discontinuous basins with depths exceeding 4000-5000 m and separated by shallower ridges. The Oinousses Deep (known also as Vavilov Deep), at the north-western edge of the Ionian Trench, is the deepest basin in the entire Mediterranean Sea, with maximum depths reaching 5200 m below the sea-level. The North-western slopes of the Trench are steep and irregular while the South-western slopes towards the Mediterranean Ridge are less steep. The Eastern sector is delineated by three striking features: the WSW-ENE trending Ptolemy Trench south of central Crete and the WSW-ENE to SW-NE trending Pliny and the Strabo Trenches that terminate in the 4000 m deep Rhodes Basin. Complex seafloor topography characterizes the areas between the three trenches.

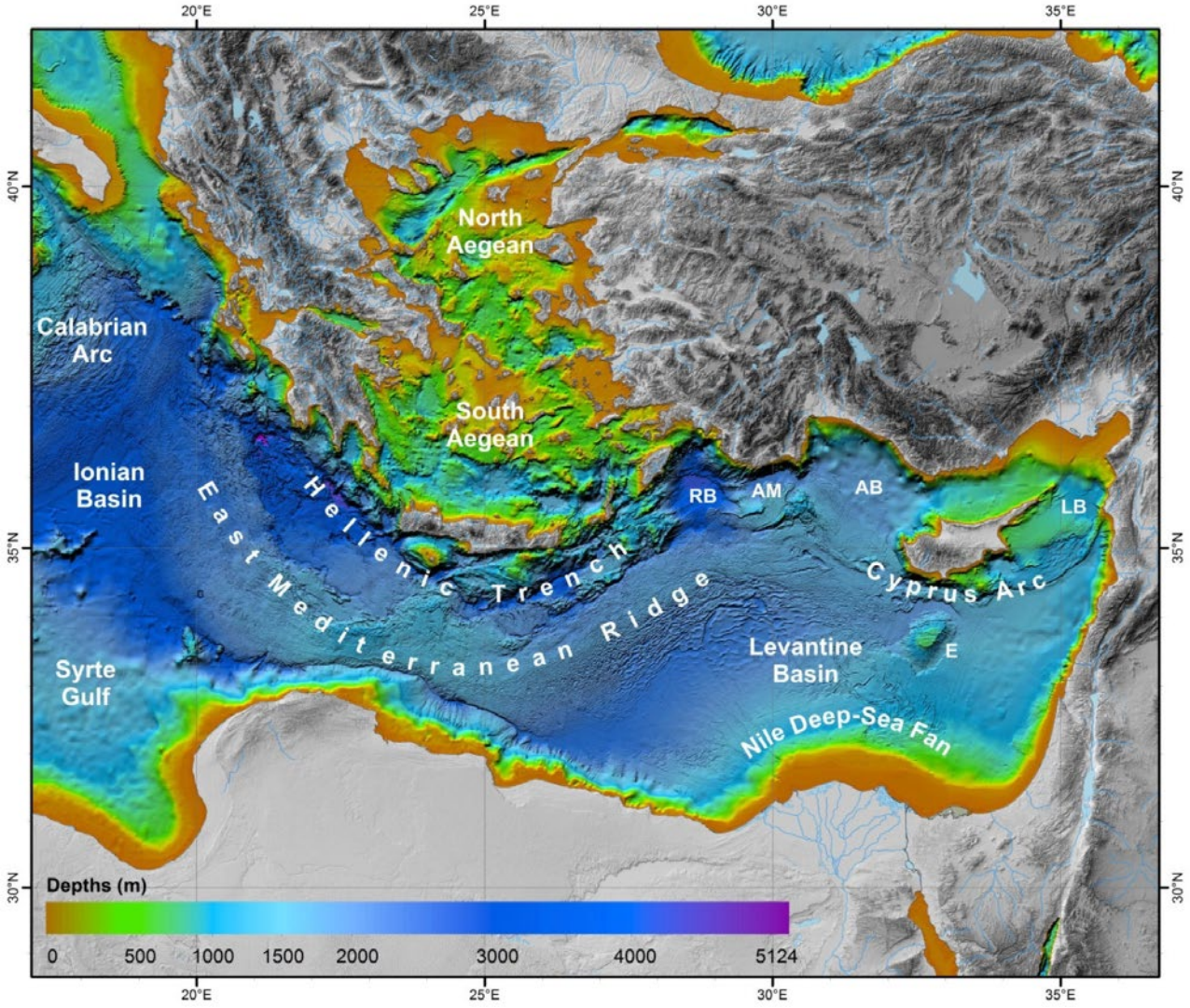


Fig. 2.1. Main geomorphological elements of the Eastern Mediterranean Sea.

AB: Antalya Basin, AM: Anaximander Mountains, E: Eratosthenes Seamount, LB: Latakia Basin, RB: Rhodes Basin. Seafloor topography: "EMODNET Bathymetry" 250 m grid (2016). Land topography: SRTM90

The majority of the morphological basins in the **Aegean Sea** are shallower than 1000 m. Numerous, small and larger basins occur in the North Aegean Sea. The North Aegean Trough, with a 1600 m depth, is the deepest among them. Maximum depths in the South Aegean Sea, between 2000 m and 2500 m, occur only at the south-eastern edge of the Aegean. The rest of the South Aegean is characterized by variably shaped basins with bottom depths ranging between 1000 m and 2000 m, and separated from each other with shallow ridges[3].

The **Levantine Sea** constitutes the easternmost part of the Eastern Mediterranean Sea. Its northern part includes the Anaximander Mountains, the Antalya, Finike and Cilician Basins, the Cyprus Arc and the Latakia Basin and Ridge. The Eratosthenes Seamount and the Nile deep-sea fan are the most prominent morphological features of the southern part of the Levantine Sea. Mud volcanoes and other cold-seep features occur in many places along the Cyprus Arc and the Nile deep-sea fan.

We now recognize the Mediterranean deep-sea as a highly complex and heterogeneous ecosystem comprised of several different and very contrasting habitats. It contains sedimentological and structural features such as continental shelves, sea canyons, seamounts, cold seeps, brine lakes, pockmarks, active volcanic structures, hydrothermal vents, abyssal muddy plains and deep-hypersaline anoxic basins[4]. Habitat mapping and improved knowledge of these deep-sea topography features at different spatial scales is still in its infancy. Nonetheless, gathering and updating this knowledge will facilitate a better understanding of the relevance of these structures in sustaining deep-sea biodiversity as well as provide new insights for defining areas for presentation of deep-sea biodiversity and ecosystem functioning.

Following previous compilations[4,5,6], a detailed description is presented here of the geomorphological features and geological structures and environments in the Eastern Mediterranean, from scientific surveys and literature, in particular of seamounts and canyons. Seamounts and seamount-like features along with canyons have been identified and mapped on the 250 m resolution bathymetry of the Eastern Mediterranean, compiled in 2015 by IUCN[5] and thereafter in 2018 by HCMR within the framework of the EMODNET Bathymetry project (www.emodnet.eu/bathymetry). The recent advancements in swath bathymetry coverage, in particular in the Aegean Sea, and the state of the art EMODNET bathymetry along with the detailed analysis of the seafloor's relief of the Eastern Mediterranean performed during the elaboration of the present work, enriched the previous compilation by IUCN with a large number of new morphological features described or highlighted here for the first time. These new features have been named after the names of localities or archaeological sites on the nearest land or islands and/or names of mythological heroes.

In total, 47 individual or groups of positive morphological features (seamounts, knolls, mounds, ridges) are described below, grouped into five sub-areas: the Eastern Ionian Sea, North Aegean, South Aegean Sea, Libyan Sea, and the Levantine Sea.

Eastern Mediterranean Seamounts

In the Mediterranean basin, over 242 seamounts, bank rises, mounds, knolls, spurs and other kinds of sea floor elevations have been identified and described [5].

1 EASTERN IONIAN SEA

The **East Mediterranean Ridge** is the most striking submarine morphological feature of the Ionian seafloor. With a total length of roughly 1500 km and the width ranging between 200 km and 60 km, the East Ridge constitutes a submarine mountain belt made of deformed sediments that have been compressed between the African Plate and the Hellenic Arc[1]. Its shallowest summit, known as Herodotus Rise or Antaeus High, is located north of Cyrenaica and reaches a water depth of less than 1250 m. The Ionian and Levantine branches of the East Mediterranean Ridge extend into water depths of approximately 3200 and 2200 m respectively.

The western sector of the East Mediterranean Ridge starting from the latitude of the Ionian Islands to the North, displays a maximum width of about 200 km between the Backstop (NE) and the Ionian Abyssal Plain and the Gulf of Sirte (Fig. 2.2). Three different morphostructural provinces have been recognized within this western sector[9]: an outer, south-western, folded front; an almost flat central province; and a northern area in tectonic backthrust contact with the Backstop, that is the flat inner region extending just south of the deep troughs (Matapan Trench or Ionian Trench) that run along the outer slope of the Hellenic Arc (Fig. 2.2).

Numerous mud volcanoes occur on the Mediterranean Ridge. They are located along distinct belts, in close relation with thrust faults along the Ridge and/or transcurrent faults crossing the ridge[1,2].

SEAMOUNTS and SEAMOUNT-LIKE Structures

Following the definition used by the International Hydrographic Organization (IHO, 2008/2013) and the Mediterranean Atlas of Seamounts by IUCN, the following terms are used to define morphological features:

SEAMOUNT: A distinct generally equidimensional elevation greater than 1000 m above the surrounding relief as measured from the deepest isobath that surrounds most of the feature. “Seamount” refers to seafloor elevations rising at least 100 m from the surrounding deep-seafloor. The length/width ratio is < 2 [7,8].

GUYOT: A SEAMOUNT with a comparatively smooth flat top (table mount).

KNOLL: A distinct elevation with a rounded profile less than 1000 m above the surrounding relief as measured from the deepest isobath that surrounds most of the feature.

MOUND: A distinct elevation with a rounded profile generally less than 500 m above the surrounding relief as measured from the deepest isobath that surrounds most of the feature, commonly formed by the expulsion of fluids or by coral reef development, sedimentation and (bio)erosion.

RIDGE: An elongated elevation of varying complexity, size and gradient having a length/width ratio > 2 [7,8].

EASTERN IONIAN SEA SEAMOUNTS

The seamounts in the Eastern Ionian Sea cluster in four main areas (Fig. 2.2, Fig. 2.3).

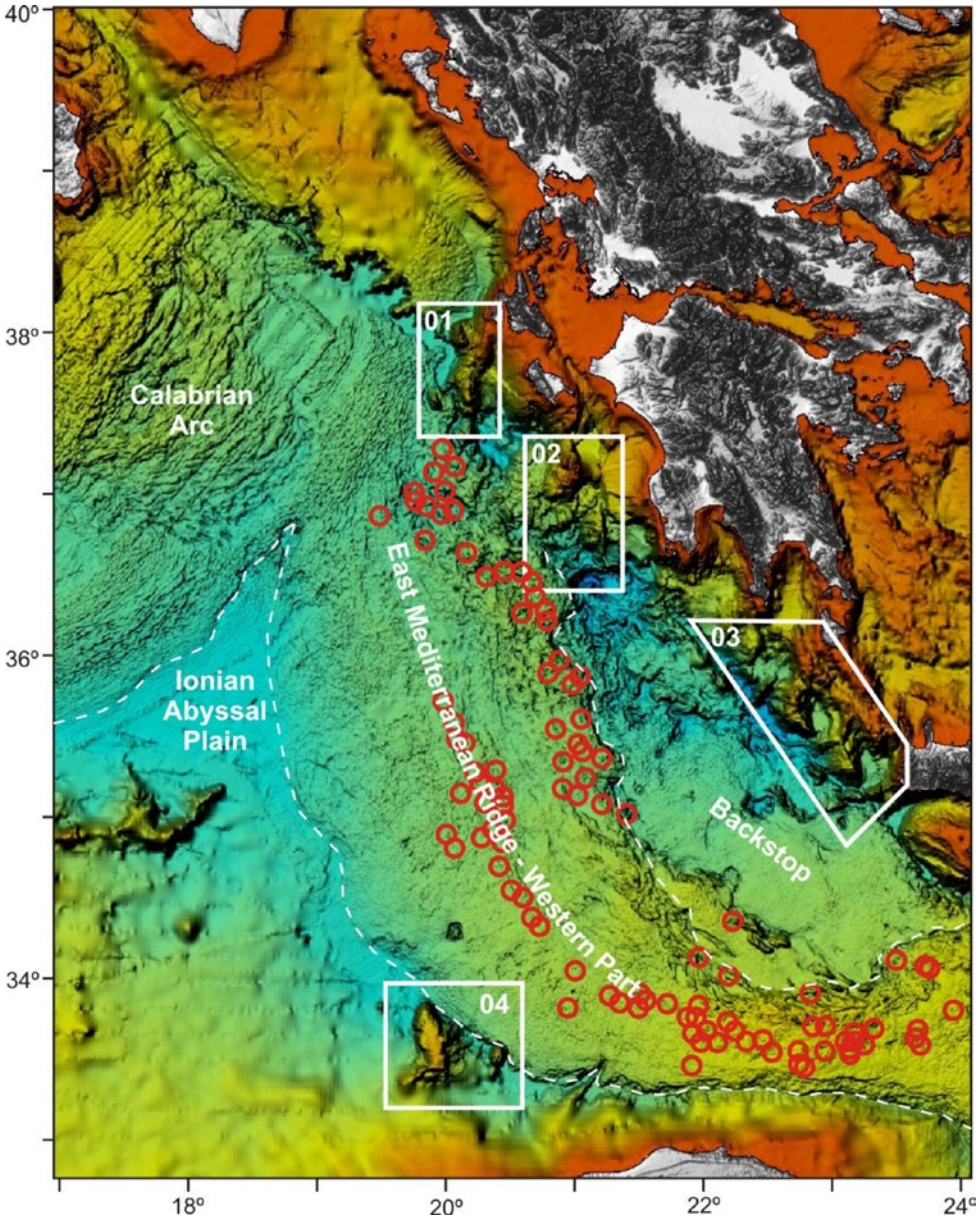


Fig. 2.2. Updated bathymetry of the Eastern Ionian Sea. Derived from GEBCO and swath bathymetry data processed at 250 m grid in the framework of EMODNET Bathymetry project (https://emodnet.eu/bathymetry;[10] and location of the seamount areas in the Eastern Ionian Sea discussed in this chapter. Red circles: mud volcanoes[11]. Boundaries between the main geodynamic and morphological elements[2].

The first area extends SSW of Kephallinia Island and includes the **Argostoli Ridge** and the **Lixouri seamount**. Their formation is controlled by the tectonic processes associated with the Kephallinia Fault. The second area extends south of Zakynthos Island and encompasses the **Strofades seamount** and the **Nestor Ridge.** The area displays complex deformation with strike-slip faults and westward thrust faults within the crust of the Peloponnese. The third area encompasses the outer (south-western) slope of the Hellenic Arc between the Southern Peloponnese and Western Crete. It is characterized by a highly complex morphology and

includes a series of tectonically controlled seamounts and ridges, e.g. **Tainaron mount, Kythera mount, Avlemonas mount, Antikythera mount, Elafonissi mount and Lissos Ridge.**

The fourth area is located off the Libyan slope, southwest of the outer edge of the East Mediterranean Ridge. It includes two major seamounts, **the Herodotus** (or Cyrene) **and the Battos seamounts**. Unlike the previous ones, these seamounts belong to the crust of the African plate and have not been involved yet in the convergent tectonics which have formed the East Mediterranean Ridge.

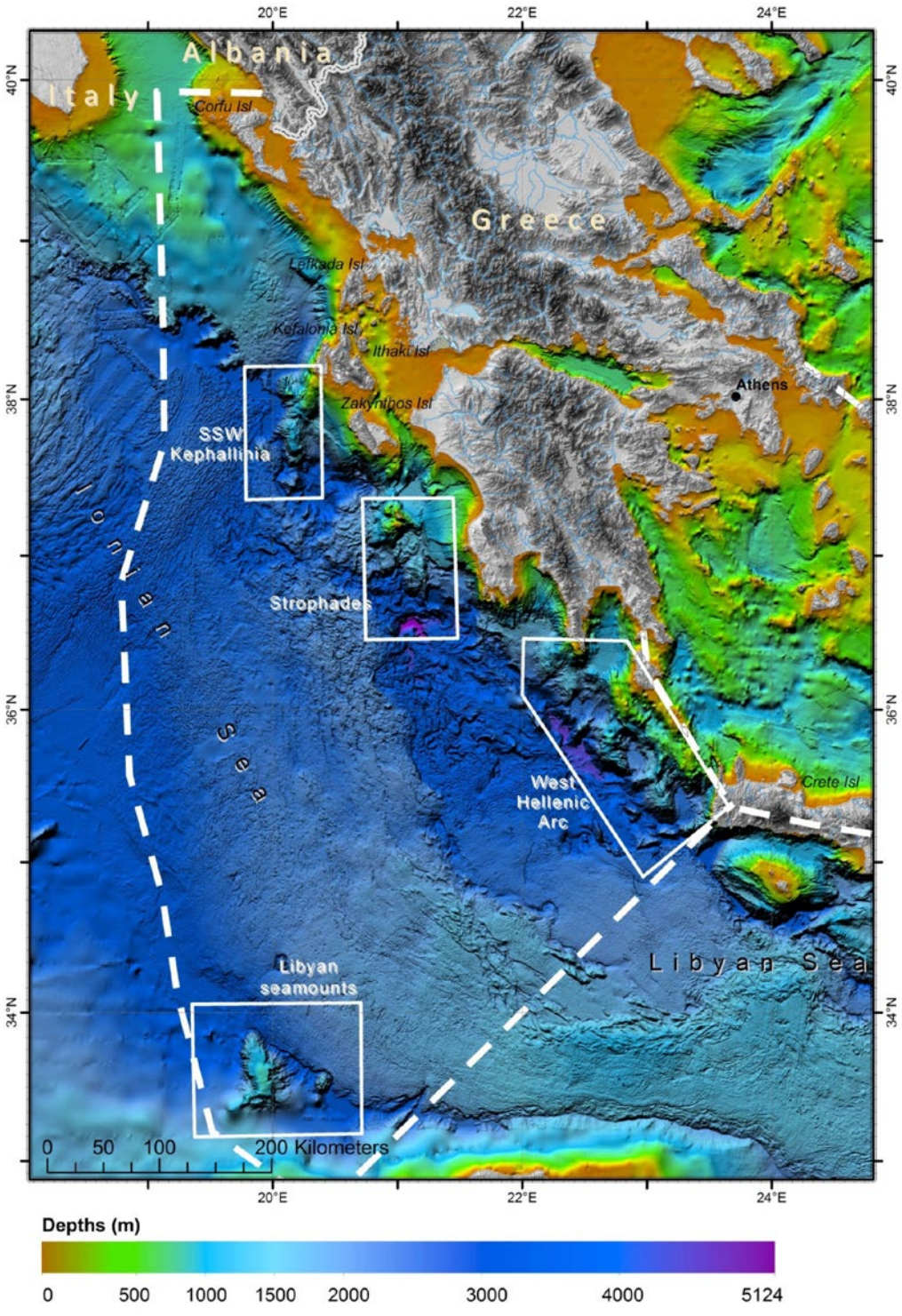


Fig. 2.3. Location of the seamount areas in the Eastern Ionian Sea.

Table 2.1. Eastern Ionian Sea Seamounts and Seamount-like structures.

			Minimum Depth / Location			Maximum Depth / Location				
Group name	Seamount	Area (km²)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Depth Range (m)	Mean Slope (deg)
SSW KEPHALLINIA SEAMOUNTS	Lixouri	443.89	38.030897	20.129387	790	38.031932	20.129387	3749	2959	13.31
	Argostoli Ridge	2434.39	38.129634	20.358007	189	37.421660	20.251946	4200	4011	8.15
			38.032761	339	339					
			37.913355	1075	1075					
			37.748851	1178	1178					
			37.748851	2473	2473					
STROFADES SEAMOUNTS	Strofades West	132.37	37.271126	20.918949	293	37.335140	20.895380	1860	1567	9.99
	Strofades South	620.60	37.197630	21.008511	43	37.112738	21.027366	2210	2167	8.01
	Nestor Ridge	1122.87	36.921852	21.128713	1800	36.588065	21.331406	4527	2727	8.15
			36.894304	1865	1865					
			36.651607	3170	3170					
WEST HELLENIC ARC SEAMOUNTS	Tainaron	923.86	36.317694	22.422650	1237	36.032974	22.278880	3529	2292	5.62
			36.144779	1858	1858					
	Kythera mount	1005.53	36.034888	22.839822	116	36.258543	22.696051	1642	1526	6.00
	Avlemonas mount	1767.06	35.824028	22.705478	980	35.822963	22.698408	4661	3681	9.73
	Lissos Ridge	2666.74	35.777947	23.127363	435	35.396751	22.870461	4459	4024	7.15
			35.751909	1003	1003					
			35.465125	1570	1570					
	Antikythera mounts	1439.78	35.751909	23.294703	217	35.493185	23.282919	3392	3175	7.09
	Elafonissi mount	253.75	35.222875	23.365410	994	35.151284	23.355983	3729	2735	15.28
LIBYAN SEAMOUNTS	Herodotus	3387.18	33.546465	19.940835	1003	33.877374	19.797065	4032	3029	7.57
	Battos	267.93	33.534623	20.412215	1802	33.581981	20.334438	3765	1963	14.75

SSW KEPHALLINIA SEAMOUNTS (FIG. 2.4)

Feature	Total Area (km²)	▲ Peak Depth (m)	⍓ Base Depth (m)
Lixouri Seamount	443.89	790	3749
Argostoli Ridge	2434.39	189	4200

The area includes the **Argostoli Ridge** and the **Lixouri seamount**. The **Argostoli Ridge** is a 60 km long morphological feature at the prolongation of the Paliki Peninsula of the Western Kephallinia Island. It has developed on the footwall (eastern block) of the Kephallinia Fault and its shallowest summits occur at depths of 1200 m. The base of the western slope of the ridge reaches a depth of 3800 m while the eastern flank reaches a maximum depth of 2800 m.

The **Lixouri seamount** displays a semi-circular shape and occurs west of the Argostoli Ridge, about 23 km southwest of the nearest coast of Kephallinia Island. It is separated from the Argostoli Ridge by a 1500-1600 m deep valley which hosts the trace of the Kephallinia Fault. The summit of the Lixouri seamount is located < 800 m deep and is surrounded by the 3400-3800 m deep Kephallinia Fault Valley.

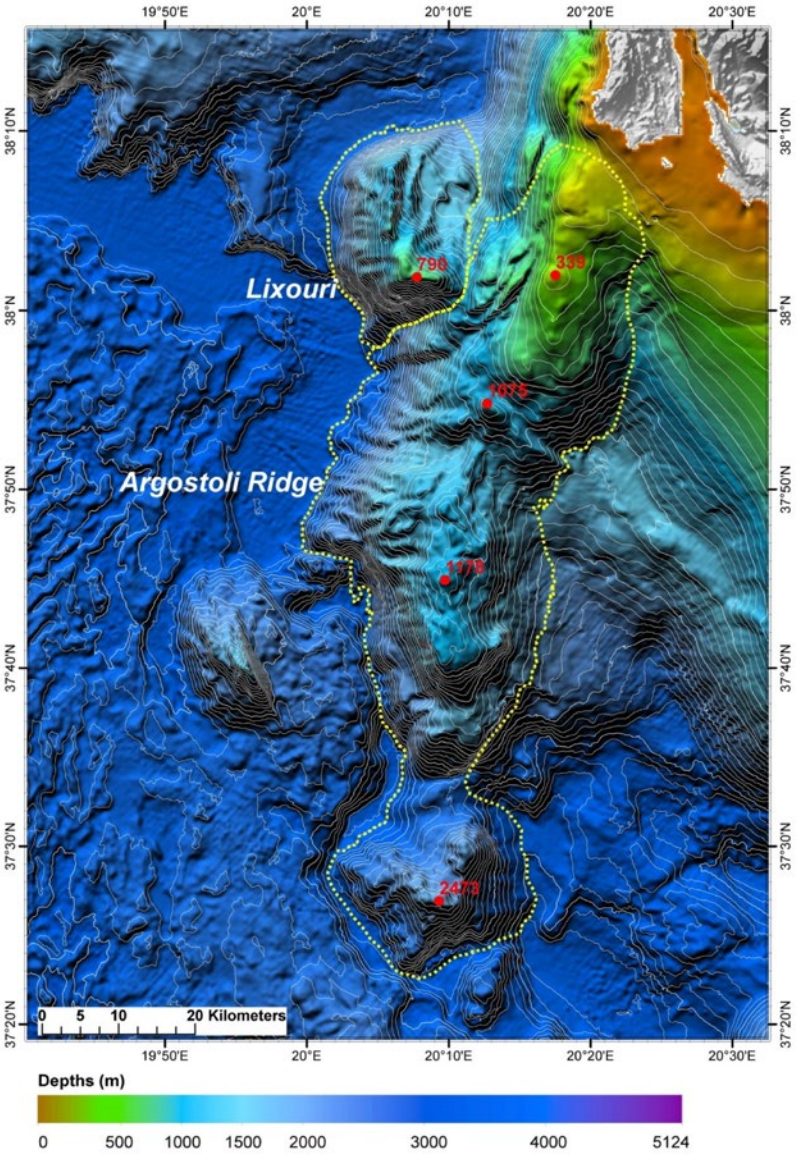


Fig. 2.4. Shaded relief map of the SSW Kephallinia seamounts area. The outline and the tops of the observed features are indicated on the map.

STROFADES SEAMOUNTS (FIG. 2.5)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Strofades West	132.37	293	1860
Strofades South	620.60	43	2210
Nestor Ridge	1122.87	1800	4527

The two islets of Strofades, south of Zakynthos Island, mark the exposed summits of the 30 x 30 km wide, irregularly shaped seamount. It is surrounded by steep, faulted slopes with their bases lying at depths exceeding 2000 m. Next to the Strofades islets, two more shallow banks, the **Strofades South** and the **Strofades West**, with their shallowest points at 43 m and 293 m respectively, occur at about 6-7 km south and west of the islets.

Further south, the **Nestor Ridge** is a 30 km long feature which run in a N-S direction, parallel to the coastline of the SW Peloponnese. Its eastern slope is steep and linear and reaches maximum depths between 2700 m in the north and 3400 m in the south. The shallowest points of the ridge occur at the upper edge of the eastern slope and the minimum depth is roughly 1800 m. The western slope of the ridge dips more gently at depths of 3500 m. The southern tip of Nestor Ridge coincides with the NE margin of the 5200 m Oinousses Deep (North Matapan).

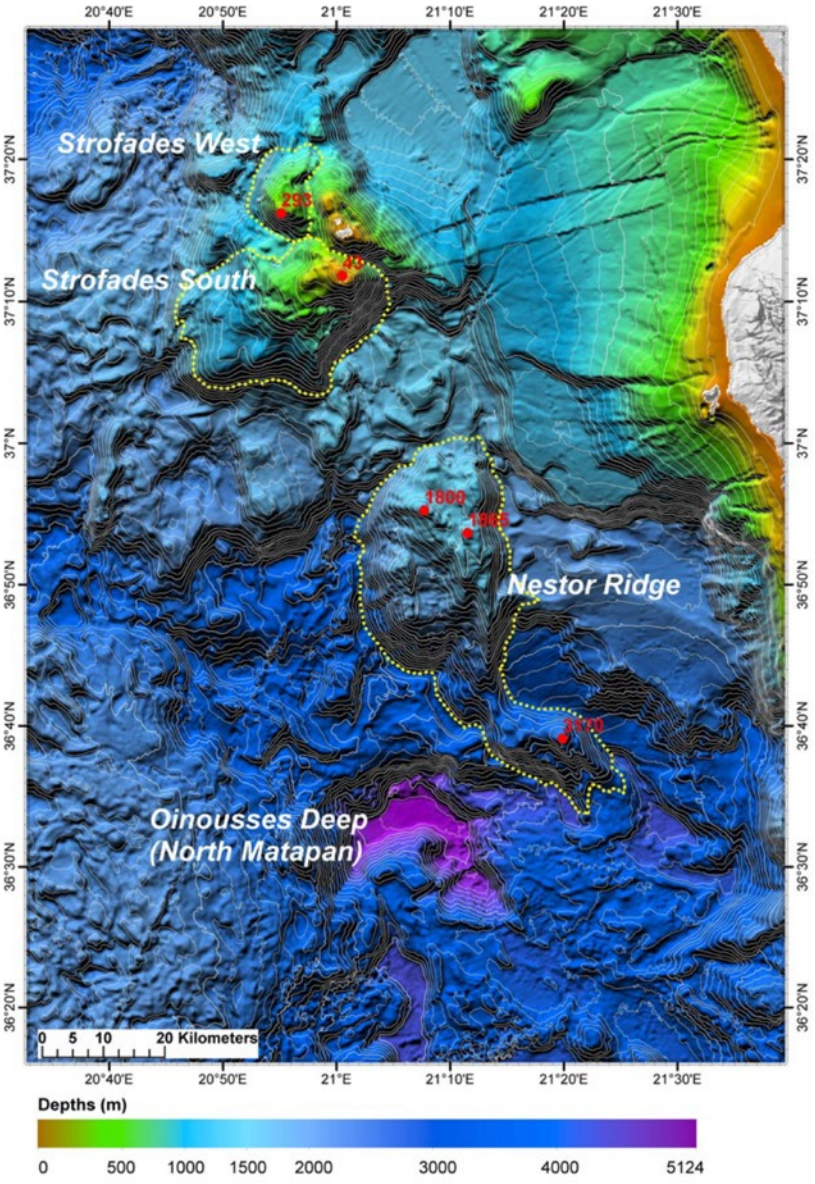


Fig. 2.5. Shaded relief map of the Strofades seamount area.
The outline and the tops of the observed features are indicated on the map.

WEST HELLENIC ARC SEAMOUNTS (FIG. 2.6)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Tainaron	923.86	1237	3529
Kythera mount	1005.53	116	1642
Avlemonas mount	1767.06	980	4661
Lissos Ridge	2666.74	435	4459
Antikythera mounts	1439.78	217	3392
Elafonissi mount	253.75	994	3729

This area encompasses the outer (south-western) slope of the Hellenic Arc between the Southern Peloponnese and Western Crete. It is characterized by highly complex morphology and includes a series of tectonically controlled seamounts and ridges, e.g. **Tainaron, Kythera, Avlemonas, Antikythera, Elafonissi seamounts** and **Lissos Ridge.**

The **Tainaron seamount** is located 27 km south of Tainaron cape, the southernmost tip of the Mani Peninsula of the Peloponnese. Its summit rises to a 1858 m depth. The mount reaches maximum depths at the bases of the western and eastern slopes exceeding 2500 m. A 4700 m deep trough, belonging to the deep basins of the Hellenic Trench, is located some 30 km south of the summit of Tainaron mount.

The **Kythera seamount** is located 16 km southwest of Kythera Island. It is a 22 km long, elongated mount with its highest summit at about a 116 m depth. It is separated from Kythera Island by a 400 m deep morphological neck. The south-western flank of the mount dips down to a small basin > 3000 m deep.

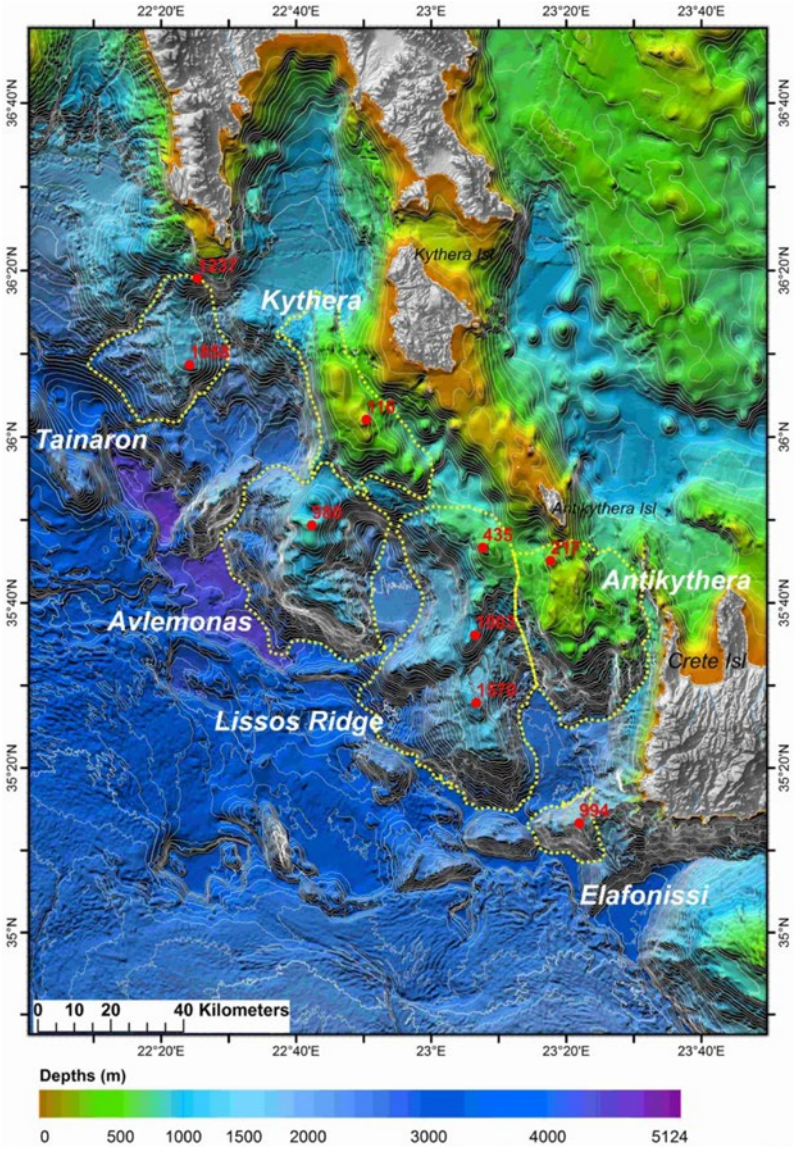


Fig. 2.6. Shaded relief map of the West Hellenic Arc seamount area. The outline and the tops of the observed features are indicated on the map.

The **Avlemonas seamount** is separated from Kythera mount to the North by a 1500 m deep neck. The shallowest summit rises at a depth of 980 m. The NW and SE flanks of the mount dip down to > 3000 m. The south-western slope faces a 4600 m deep elongate to the basin of the Hellenic Trench.

The **Antikythera seamount** marks the underwater prolongation towards the southeast of the Kythera-Antikythera morphological ridge. It is located between Antikythera Island and the western coast of Crete. The shallow part of the mount displays very irregular, rough topography with several summits, the shallowest of which is found at a depth of 217 m.

The **Elafonissi seamount** marks the underwater prolongation of the mountainous morphology of the south-western corner of Crete. The shallowest point is found at a 994 m depth and is surrounded by steep slopes which plunge to depths of up to 3500 m or more.

Lissos Ridge is located between the Avlemonas and Antikythera mounts and has a N-S orientation. The depth of its crest increases gradually from N to S with the most prominent summits at depths of 435 m, 1003 m and 1570 m. The western, eastern and southern slopes of the ridge display high dip values.

LIBYAN SEAMOUNTS (FIG. 2.7)

Feature	Total Area (km²)	▲ Peak Depth (m)	⍓ Base Depth (m)
Herodotus	3387.18	1003	4032
Battos	267.93	1802	3765

Two prominent seamounts occur between the south-western edge of the East Mediterranean Ridge and the continental slope of the Libyan margin. The **Herodotus** seamount is a rather irregularly shaped seamount of about 70 km. The summit displays a smooth morphology with the shallowest point at a depth of 1003 m. **Battos** seamount is a smaller, semi-circular seamount east of Herodotus with its highest point at a depth of 1802 m.

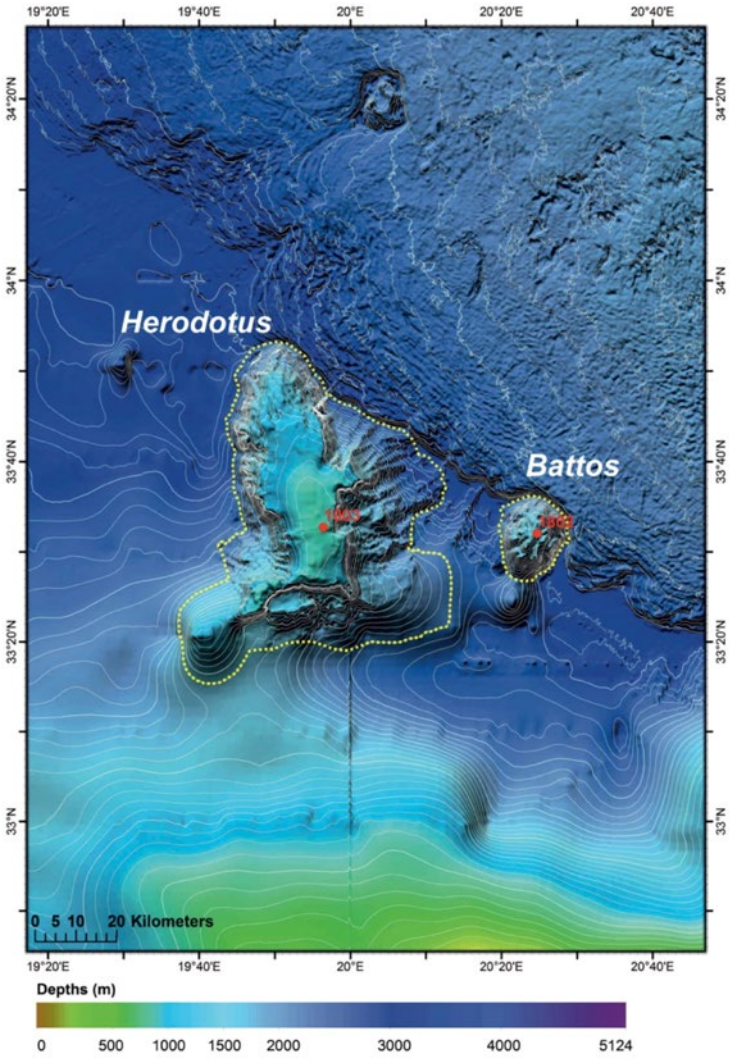


Fig. 2.7. Shaded relief map of the Libyan seamount area.
The outline and the tops of the observed features are indicated on the map.

2 NORTH AEGEAN SEA

The North Aegean Sea includes the marine area between Northern Greece (Macedonia and Thrace) to the north, Turkey (Anatolia) to the east, Central Greece (Thessaly) to the west and the Cyclades Plateau to the south[3]. It is characterized by two **troughs**, the North Aegean Trough (NAT) and the North Skyros - Edremit Trough (NSET), as well as a series of basins and shallow banks and ridges between the latter, the Cyclades Plateau, the eastern coast of Evia and the western coast of NW Anatolia (Fig. 1.8).

The majority of the morphological basins in the **Aegean Sea** are shallower than 1000 m. The North Aegean Trough, with a depth of 1600 m, is the deepest among them. It has developed along the prolongation of the major North Anatolian Fault in the Aegean Sea and it is a 300 km long morphological feature composed of two parts with distinct morphological and structural characteristics. The western North Aegean Trough (Sporades Basin), between Pelion Peninsula and Lemnos Island, consists of a series of variably shaped basins, including the 1600 m deep Sporades Basin, separated by several high and shallower ridges, including the seamounts in the area of **NW Limnos**. The eastern North Aegean Trough (Saros Trough) extends between the north of Lemnos Island and the Saros Gulf. It consists of the 1500 m Lemnos Deep (LB), the narrow, up to a 1000 m deep basin between Samothraki and Gokceada Islands (Imbros Depression) and the 600 m deep Saros Trough which continues eastward into the Saros Gulf (SG).

The North Skyros - Edremit Trough has developed along the southern branch of the North Anatolian Fault. It is a 200 km long feature consisting of the North Skyros Basin (NSB) in the west and the Edremit Trough (EdT) and Edremit Gulf (EdG) in the east. The 1200 m deep North Skyros Basin has a base parallel to the eastern coastline of Skyros Island and its peak at 70 km[12], where it continues in the narrower and shallower Edremit Trough.

The area between the North Aegean Trough and the North Skyros - Edremit Trough constitutes a relatively flat plateau extending between a depth of 100 m and 300 m below sea-level. It includes the North Sporades Archipelago, Agios Efstratios, Limnos, Gokceada and Bokceada islands. The **North-Sporades** area is located between the North Sporades Archipelago and the Agios Efstratios Island where there are several seamounts.

Small deep basins, down to 1100 m, occur between the eastern coast of Evia, the Sporades Archipelago and Skyros Island. Skopelos Basins (SB), South Skyros Basin (SSB) and other smaller basins close to the north-eastern coast of Evia create a morphological puzzle with local depressions separated from each other by shallow ridges and mounts. The **South-Sporades** and **West-Skyros** (Fig. 2.8) areas include the most pronounced seamounts of this particular region.

The available morphology of the area, extending between the North Skyros - Edremit Trough to the north and the Cyclades Archipelago to the south[14], is made by alternating uplifted basement blocks (islands and shallow banks) and subsiding extensional depressions. The Psara Ridge separates the 700 m deep Lesvos Basin to the east from Psara Basin to the west. The **North-Skyros-Edremit-Ridge** area encompasses the seamounts on the SW-NE trending ridge along the southern margin of North Skyros - Edremit Trough, while **North-Psara** includes the seamounts north of Psara Island.

Further south, the 800 m deep Cavo Doro Basin (SE Evia Basin), north of Andros Island, is a wide depression bounded by a trending ridge which separates it from South Skyros Basin. This ridge constitutes the **Cavo-Doro-North-Ridge** area, with several shallow summits on the top. To the east, the 900 m deep North Mykonos Basin is separated from the Cavo Doro Basin by two groups of shallow banks and ridges which are included in the **South Psara** and **Andros-Tinos-North** areas.

The seamounts of the **North-Ikaria** area separate the North Mykonos Basin from the North Ikaria Basin (NIB) to the east. The latter is a 1400 m deep and wide basin bounded to the south by steep faulted slopes.

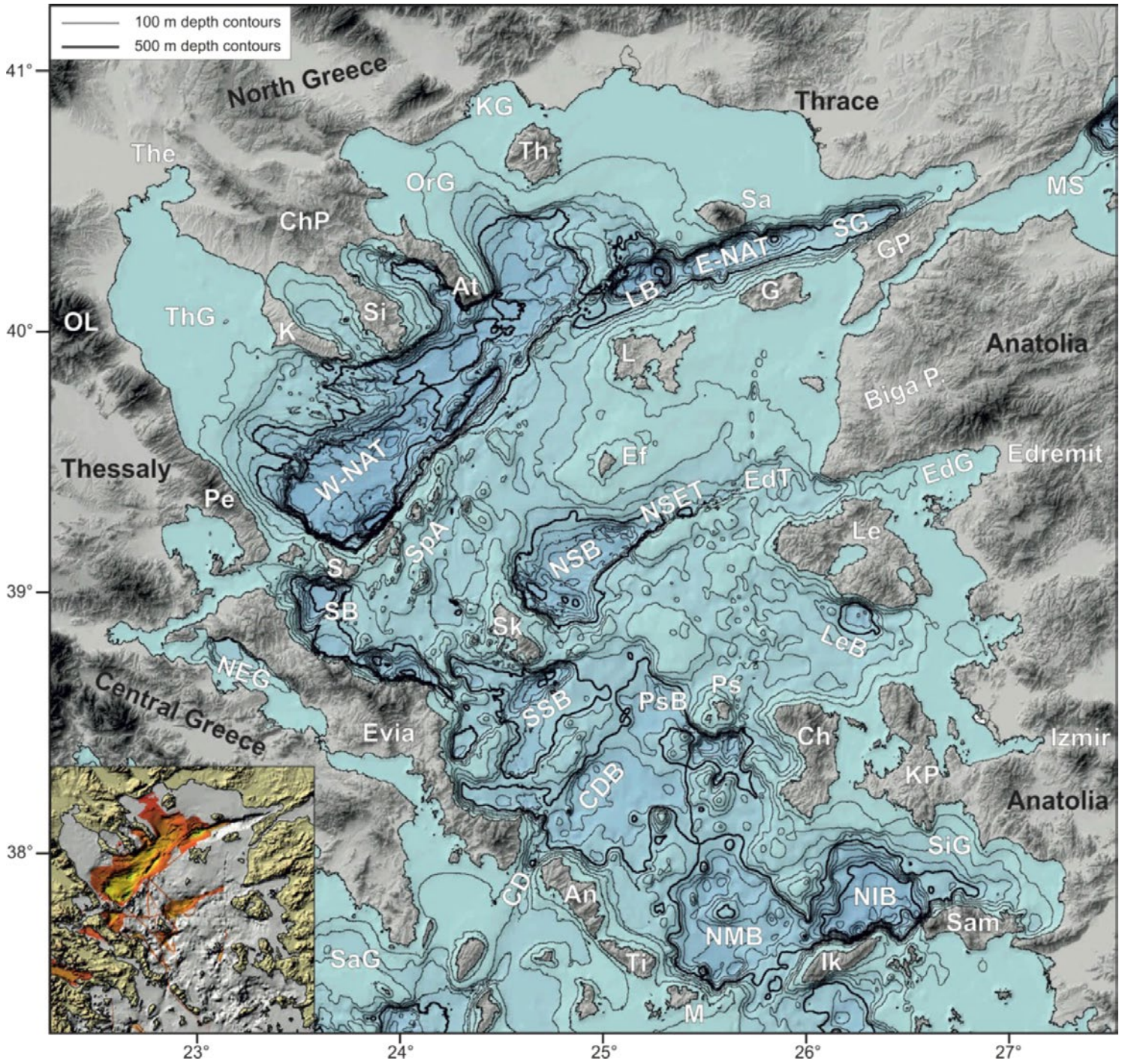


Fig. 2.8. Updated bathymetry of the North Aegean Sea.

Derived from GEBCO and swath bathymetry data processed at 250 m grid in the framework of EMODNET Bathymetry project (https://emodnet.eu/bathymetry;10,13,3). Inset map: Swath bathymetry coverage in the North Aegean. Terminology after 3. An: Andros, At: Athos, Ch: Chios, CD: Cavo Doro strait, CDB: Cavo Doro Basin, ChP: Chalkidiki Peninsula, CG: Corinth Gulf, EdG: Edremit Gulf, EdT: Edremit Trough, Ef: Agios Efstratios, E-NAT: Eastern North Aegean Trough, G: Gokceada, GP: Gelibolu Peninsula, Ik: Ikaria, K: Kassandra, KG: Kavala Gulf, L: Lemnos, LB: Lemnos Basin, Le: Lesvos, LeB: Lesvos Basin, MS: Marmara Sea, NEG: North Evia Gulf, NIB: North Ikaria Basin, NMB: North Mykonos Basin, NSB: North Skyros Basin, NSET: North Skyros-Edremit Basin, OL: Olympos, OrG: Orfanou Gulf, Pe: Pelion, Ps: Psarra, PsB: Psarra Basin, S: Skopelos, SB: Skopelos Basin, Sa: Samothrace, SaG: Saronic Gulf, Sam: Samos, SG: Saros Gulf, Si: Sithonia, SpA: Sporades Archipelago, Sk: Skyros, SSB: South Skyros Basin, Th: Thassos, The: Thessaloniki, ThG: Thermaikos Gulf, Ti: Tinos, W-NAT: Western North Aegean Trough.

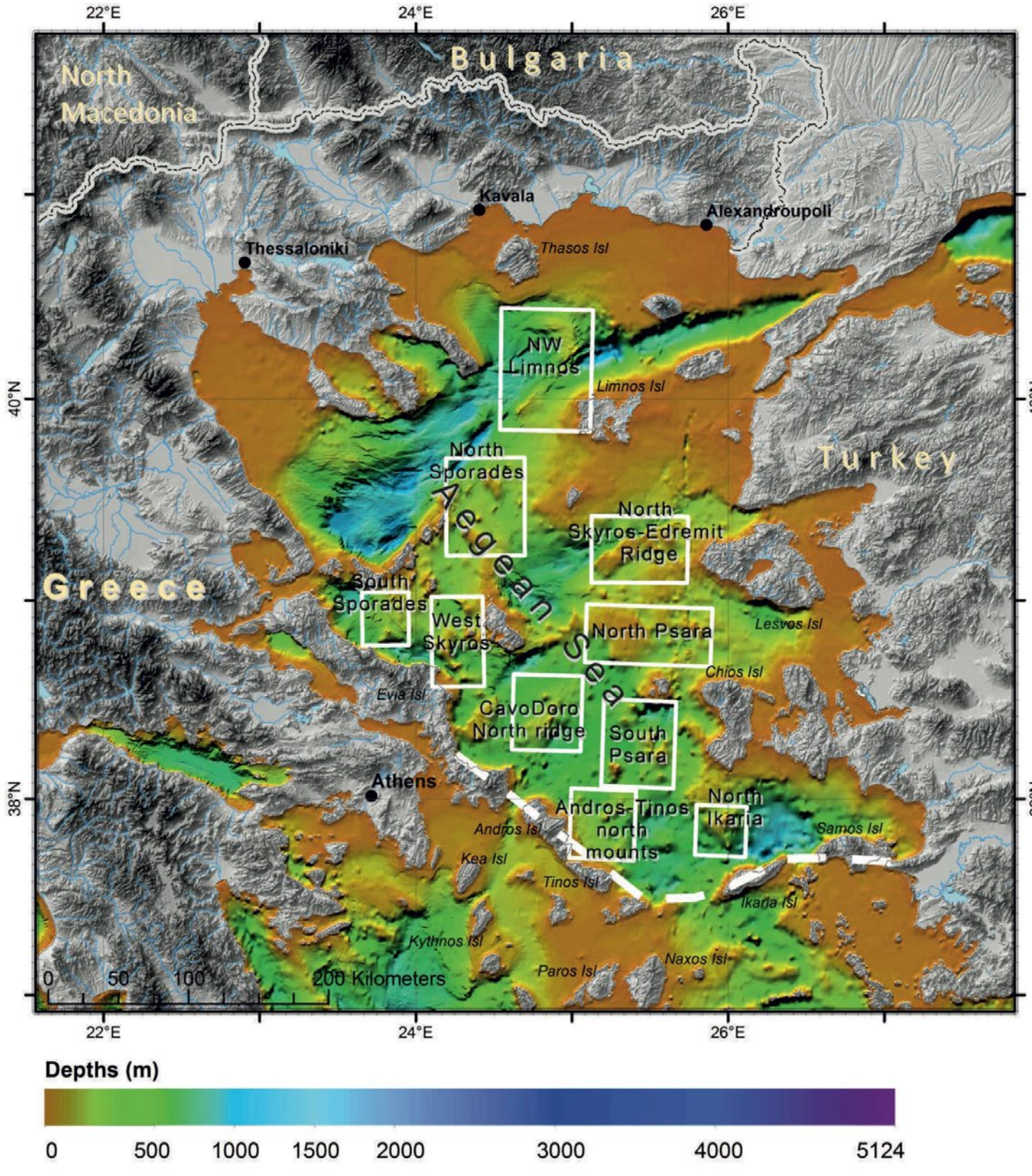


Fig. 2.9.
Location of the seamounts area in the North Aegean Sea.

Table 2.2. North Aegean Sea Seamounts and Seamount-like structures.

			Minimum Depth / Location			Maximum Depth / Location				
Group name	Seamount	Area (km²)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Depth Range (m)	Mean Slope (deg)
NW LIMNOS	Lemnos Ridge (Venus Bank)	1042.07	40.241580	25.031738	152	40.209061	24.664062	978	826	2.27
	Mourtzeflos Bank	442.84	40.138550	24.939819	258	40.225322	25.175509	1357	1099	3.41
	Myrina Bank (Aphrodite Bank)	622.04	39.946532	24.671132	160	40.009995	24.638136	922	762	2.72
NORTH SPORADES	Agios Efstratios West	295.39	39.622862	24.442513	124	39.644731	24.418944	399	275	1.89
	Psathoura East	34.49	39.549916	24.329382	221	39.529842	24.315241	373	152	2.66
	Piperi NorthEast	55.16	39.403792	24.402446	124	39.418418	24.369449	333	209	2.36
	Piperi SouthEast	221.20	39.295827	24.397732	60	39.295827	24.324668	308	248	1.74
SOUTH SPORADES	Staphylos	13.05	38.976445	23.709517	177	38.981964	23.693019	518	341	10.01
	Sarakiniko	100.69	38.842016	23.827362	172	38.799609	23.751942	508	336	2.76
	Patitiri	12.83	39.011391	23.850931	84	38.996679	23.850931	259	175	4.60
WEST SKYROS	Aloni Bank (Amfitrite)	145.96	38.958045	24.341166	117	38.994840	24.239820	505	388	2.49
	Chiliadou Bank (Ira)	480.69	38.747948	24.180897	112	38.736873	24.100763	805	693	2.75
	Kimi-1	20.27	38.611235	24.220965	57	38.620481	24.242177	462	405	5.74
	Kimi-2	177.64	38.609386	24.305813	195	38.587191	24.310527	513	318	2.47
NORTH SKYROS-EDREMIT RIDGE	Eressos Ridge	1229.70	39.308645	25.387630	83	39.196865	25.116586	895	812	2.49
	Sigri-1	108.86	39.297659	25.630390	89	39.304983	25.675171	266	177	1.51
	Sigri-2	41.53	39.253694	25.536114	58	39.240866	25.512545	281	223	2.81
	Sigri-3	27.50	39.202366	25.519616	121	39.217035	25.503118	253	132	2.28
NORTH PSARA	Psara Bank	1871.79	38.886240	25.399414	79	38.698097	25.210862	629	550	1.10
	Kalloni Bank	274.54	38.865974	25.783589	79	38.818050	25.807158	306	227	1.82
CAVO DORO NORTH RIDGE	Cavo Doro North Ridge	1736.93	38.464994	24.871469	153	38.314739	24.887967	843	690	1.68
			38.403817	24.862041	177					
			38.518712	24.826688	239					
			38.368570	24.727698	263					
SOUTH PSARA	Antipsara Bank	340.04	38.468700	25.397057	152	38.429777	25.467764	903	751	3.02
			38.401963	25.335778	239					
	Mesta Bank	802.29	38.218114	25.562040	64	38.409381	25.559683	796	732	2.67
			38.311026	25.517259	145					
			38.285022	25.595037	174					
ANDROS-TINOS NORTH	Sariza Bank	143.97	37.994638	25.043522	270	38.076659	25.060021	693	423	2.36
	Kalogeros South Ridge	451.62	37.906922	25.222647	220	37.968521	25.175509	589	369	1.62
			37.938661	25.269785	271					
			37.946127	25.307495	280					
	Panormos Bank	280.88	37.738661	25.290997	237	37.832187	25.380559	736	499	2.39
IKARIA NORTH	Pyrgi Bank	485.20	37.901320	25.995710	44	37.832187	25.866080	612	568	2.49
	Evdilos Bank	31.12	37.759247	26.002780	248	37.742404	25.995710	718	470	7.43

NORTH AEGEAN SEA SEAMOUNTS

NW LIMNOS SEAMOUNTS (FIG. 2.10)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Lemnos Ridge (Venus Bank)	1042.07	152	978
Mourtzeflos Bank	442.84	258	1357
Myrina Bank (Aphrodite Bank)	622.04	160	922

The NW Limnos seamounts occur at the junction of the two main segments of the North Anatolian Fault Zone in the Aegean: the western segment, which runs N40°E along the southern margin of the western North Aegean Trough and terminates towards NE at the Limnos Basin; similarly, the eastern segment, which runs N70°E along the eastern North Aegean Trough and dies out towards the west at the Limnos Basin. The overlapping tectonic movements at the junction of the two strike-slip fault segments creates a complicated deformation pattern with local transtension and subsidence (e.g. Limnos Basin) and local transpression and uplift (e.g. seamounts)[14,13]. The three main seamounts in this area have been formed as pressure ridges where the basement has been squeezed between faults and uplifted.

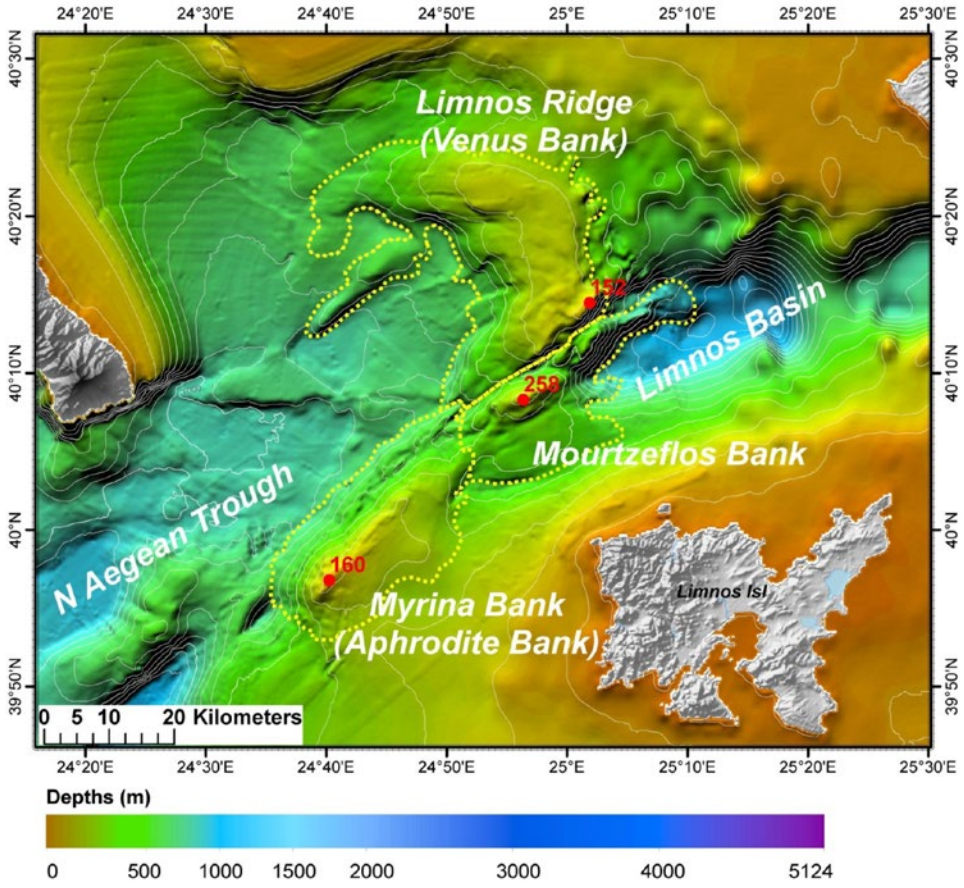


Fig. 2.10. Shaded relief map of the NW Limnos Seamount area.

The outline and the tops of the observed features are indicated on the map.

The term **Limnos Ridge** previously named as “Venus Bank”[1], refers to the larger seamount in this area. The Limnos Ridge is a concave, 23 km long and 9 km wide ridge. It rises from a base depth of 600-700 m to a flat plateau at about 300-250 m depth. The shallowest summit, 152 m deep, occurs at the southernmost part of the ridge and is separated from the 1500 m deep Limnos Basin by a 1300 m high morphological escarpment. Despite the absence of high-resolution seismic profiles and sediment sampling data, it is believed that the rocky basement is exposed on the highest summit, while the rest of the ridge is draped by mud.

The **Mourtzeflos Bank,** proposed here, has been named after the north-western cape of Limnos island. It is a < 300 m shallow, 9 km long by 3.5 km wide, elongated bank, aligned parallel to the western segment of the North Anatolian Fault Zone. The eastern flanks dip down to the 1600 m deep Lemnos Deep, while the base of the bank in the west is at a depth of 700-800 m. The rocky basement is believed to form the shallowest parts of the bank.

The term **Myrina Bank,** previously named “Aphrodite Bank” has been renamed after the main port of Limnos Island, it occurs at the south-western prolongation of Mourtzeflos Bank. It is a < 200 m shallow, 20 km wide by 75 km long, elongated positive feature, aligned parallel to the North Anatolian Fault Zone. It rises from the 300-400 m deep neck which separates off to the south from Limnos Island. The northern flanks of Myrina Bank dip down to a depth of 900-1000 m in the North Aegean Trough. The rocky basement is believed to form the summit of the bank, while the rest of it may be covered by mud.

1 http://www.geomapapp.org/database/GEBCO/GEBCO_gazetteer.htm.
IOC-IHO GEBCO SCUFN (Sub-Committee on Undersea Feature Names) Gazetteer database.

NORTH SPORADES SEAMOUNTS (FIG. 2.11)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Agios Efstratios West	295.39	124	399
Psathoura East	34.49	221	373
Piperi NorthEast	55.16	124	333
Piperi SouthEast	221.20	60	308

A series of several mounts occurs between Psathoura-Gioura and Agios Efstratios islands. The mounts are located on a flat, 300-400 m deep plateau separating two major basins of tectonic origin: the western part of the North Aegean Trough to the north from the North Skyros Basin to the south. The four mounts described here (Fig. 2.11) are the most pronounced ones in this area. Several other smaller mount-like features can be recognized on the Sporades plateau.

The summit of **Piperi Southeast** mount rises to a depth of 60 m, while the one of the smaller **Piperi Northeast** to 124 m deep. The **Psathoura East** and the **Agios Efstratios mounts** are located on the uplifting block of the North Anatolian fault-zone. The latter is elongated in a NW-SE direction and includes the Glavki Bank. All four features are named after the nearby islands and islets Piperi, Psathoura and Agios Efstratios.

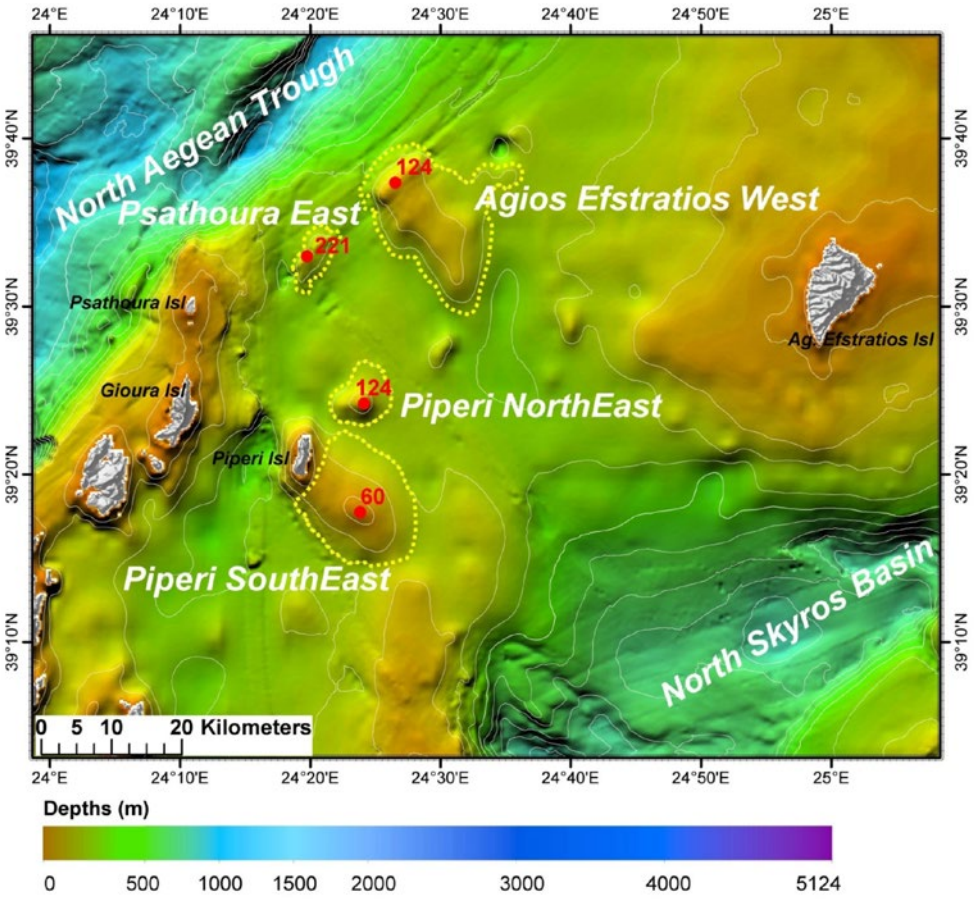


Fig. 2.11. Shaded relief map of the North Sporades area.

The outline and the tops of the observed features are indicated on the map.

SOUTH SPORADES MOUNTS (FIG. 2.12)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Staphylos	13.05	177	518
Sarakiniko	100.69	172	508
Patitiri	12.83	84	259

Further south-westwards on the Sporades plateau, a series of small and larger seamounts occurs on the seafloor between Skopelos Island and the north-eastern coast of North Evia.

Staphylos bank, with a depth of 177 m at its summit, named after a popular sandy beach on Skopelos Island. Staphylos bank marks the shallowest point on the south-eastern, steep, faulted margin of the 1000 m deep Skopelos Basin. The high relief and the steep slopes of the bank indicate that the rocky substrate outcrops on the seafloor.

Patitiri bank rises at a depth of 84 m while the depth of the surrounding seafloor varies between 150 m and 200 m. The bank is named after the main port of Alonissos Island.

Sarakiniko mount is the largest one among the mounts in this area. The depth at its summit is 172 m and is named after the nearby cape of North Evia. It has a pear-like shape, with its long axis oriented in a NE-SW direction. The base of the mount lies at roughly 300 m, however its south-eastern slope dips down to about 1000 m.

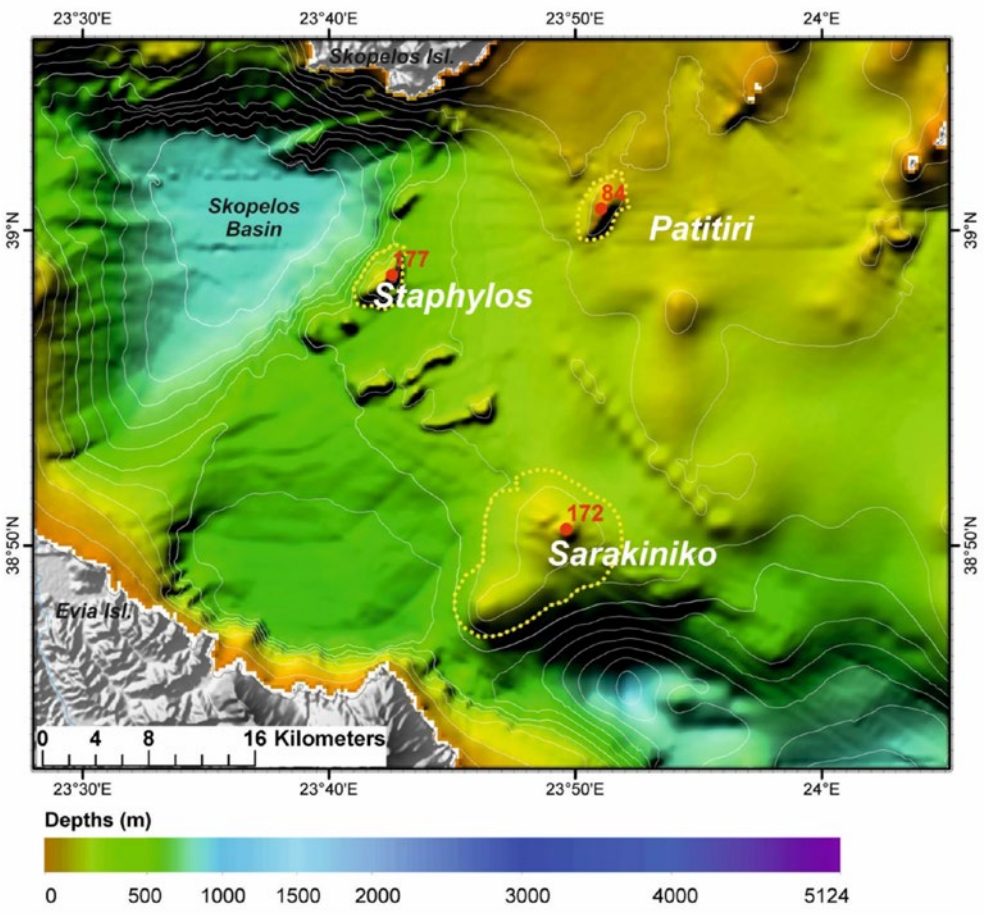


Fig. 2.12. Shaded relief map of the South Sporades mount area.

The outline and the tops of the observed features are indicated on the map.

WEST SKYROS MOUNTS (FIG. 2.13)

Feature	Total Area (km²)	▲ Peak Depth (m)	⍓ Base Depth (m)
Aloni Bank (Amfitrite)	145.96	117	505
Chiliadou Bank (Ira)	480.69	112	805
Kimi-1	20.27	57	462
Kimi-2	177.64	195	513

The morphology of the seafloor between Skyros Island and the coasts of Evia displays a complicated character with many shallow banks, steep slopes and NW-SE trending narrow basins and valleys.

The term **Aloni bank** is proposed here for the mound located west of the Cape Aloni, the northern tip of Skyros Island. Aloni Bank contains the "Amfitrite Bank". Its shallowest point occurs at a depth of 117 m, while the depth of its base varies between 300 m and 500 m.

Chiliadou bank is an irregularly shaped mound with three main summits, the shallowest of which rises to a depth of 112 m and it is known as "Ira bank". The northern flanks of the mound rise from a depth of 300-400 m. The south-western and south-eastern steep slopes dip down to > 1000 m and > 700 m respectively.

Kimi-1 and **Kimi-2** banks, with depths of 57 m and 195 m at their summits, respectively, are two mounds located east of the port of Kimi. Kimi-1 mound sits on the edge of the shelf of Evia, while Kimi-2 is separated from the latter by a 350-400 m deep morphological neck. The depth of the base of Kimi-2 is roughly 400 m.

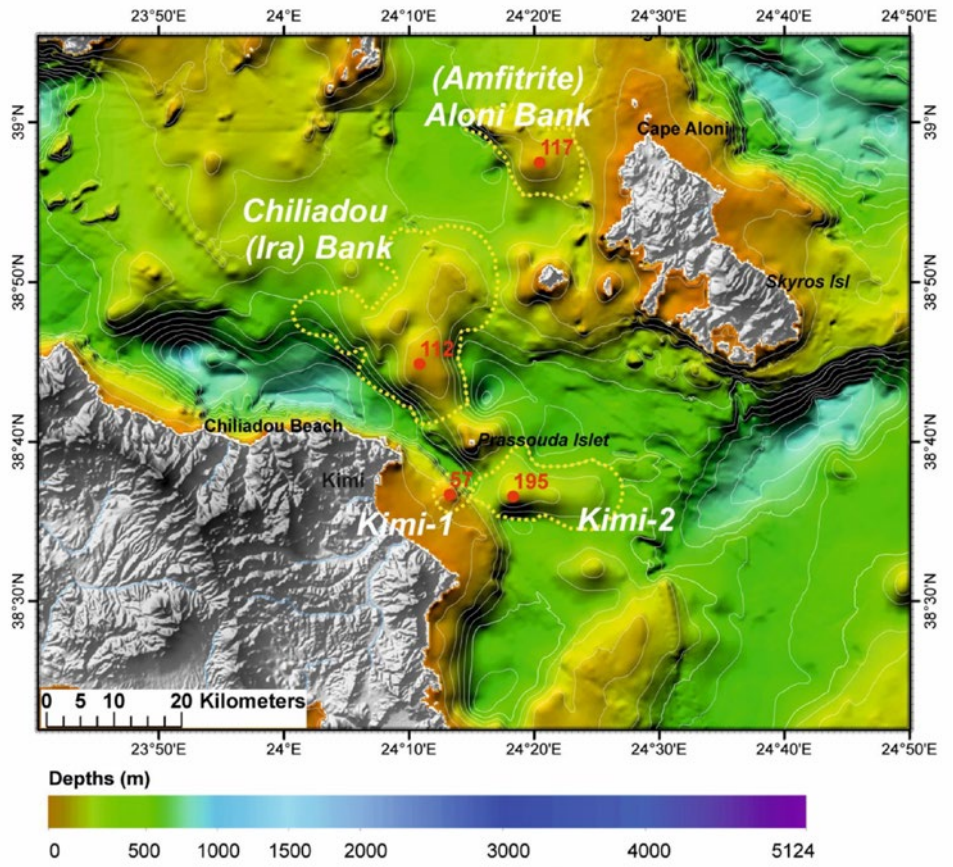


Fig. 2.13. Shaded relief map of the West Skyros mount area.

The outline and the tops of the observed features are indicated on the map.

NORTH SKYROS-EDREMIT RIDGE (FIG. 2.14)

Feature	Total Area (km²)	▲ Peak Depth (m)	⍓ Base Depth (m)
Eressos Ridge	1229.70	83	895
Sigri-1	108.86	89	266
Sigri-2	41.53	58	281
Sigri-3	27.50	121	253

The North Skyros-Edremit Ridge is a morphological feature running along the south-eastern margin of the North Skyros-Edremit Trough. The geological and geomorphological evolution of this area is directly associated with the tectonic activity along the southern branch of the North Anatolian Fault, which runs within the trough.

Eressos Ridge, named after the historic village of Lesvos Island, is a < 200 m deep, NE-SW elongate ridge running along the southern margin of the North-Skyros-Edremit Trough. The difference in depth between the shallow plateau of the ridge and the trough varies between 200 m at the east edge of the slope and > 700 m at the western edge. The difference in depth along the south-eastern side of the ridge does not exceed 200 m.

Three prominent mounds should be mentioned along the south-eastern side of Eressos Ridge. They are named **Sigri-1, Sigri-2** and **Sigri-3** and their tops rise below sea-level at 89m, 58 m and 121 m depth respectively. The mounts are named after Sigri, a small village on the western coast of Lesvos Island. The Sigri-1 and Sigri-2 mounds are also known as Mansell and Johnston Banks.

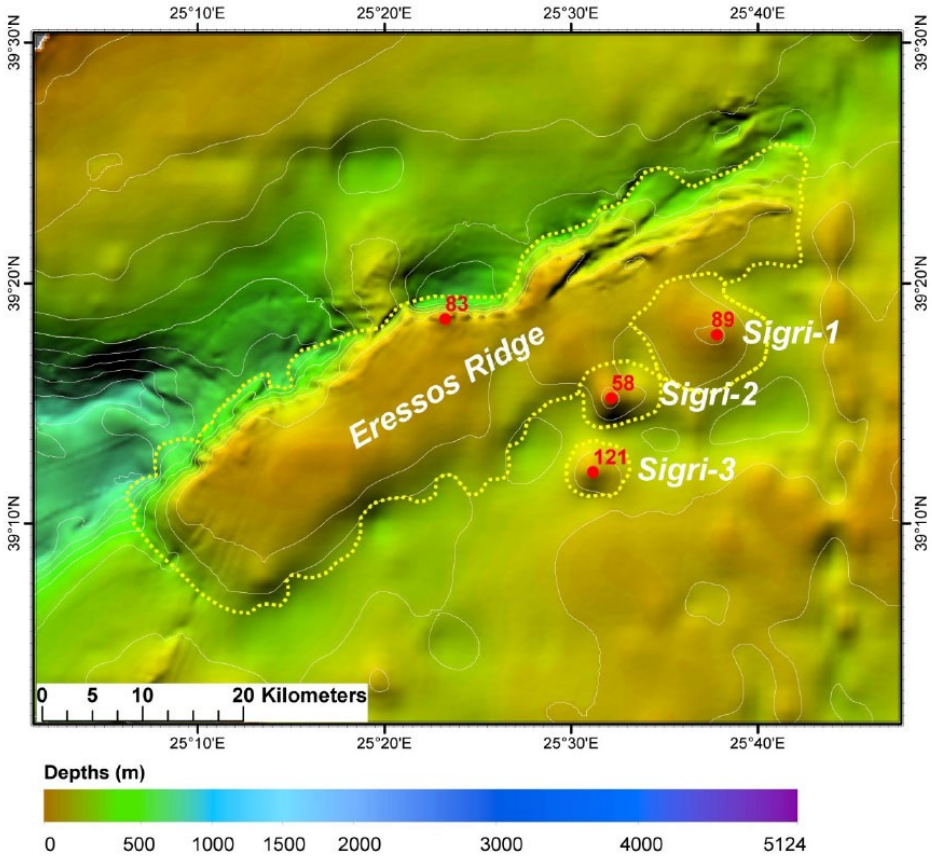


Fig. 2.14. Shaded relief map of the North Skyros-Edremit area.

The outline and the tops of the observed features are indicated on the map.

NORTH PSARA MOUNTS (FIG. 2.15)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Psara Bank	1871.79	79	629
Kalloni Bank	274.54	79	306

Despite the lack of accurate, swath bathymetry data in the area between Lesvos Island to the North and Psara and Chios Islands to the south, the available low-resolution bathymetry indicates a very irregular and complicated seafloor relief here with many small and larger mounts (including the Brooker, Stokes and Sinaia Banks) and valley-like basins in between. The two most prominent are mounts, **Psara** and **Kalloni** Banks.

Psara Bank is named after the homonymous island and is a wide, shallow plateau with its top at 150-200 m depth and its highest summit at a depth of 79 m. The north-eastern flanks of the mount dip to roughly 300 m, while towards the south the maximum depth at the base of the slope reaches a depth of 700 m. With the exception of its highest summit, the shallow plateau displays smooth relief and is believed to be draped by sedimentary deposits.

Kalloni Bank is located opposite to the entrance of the Kalloni Gulf/Lagoon of Lesvos Island and is named after it. The summit of the mount reaches a depth of 79 m while the depth of the surrounding seafloor is 250-300 m.

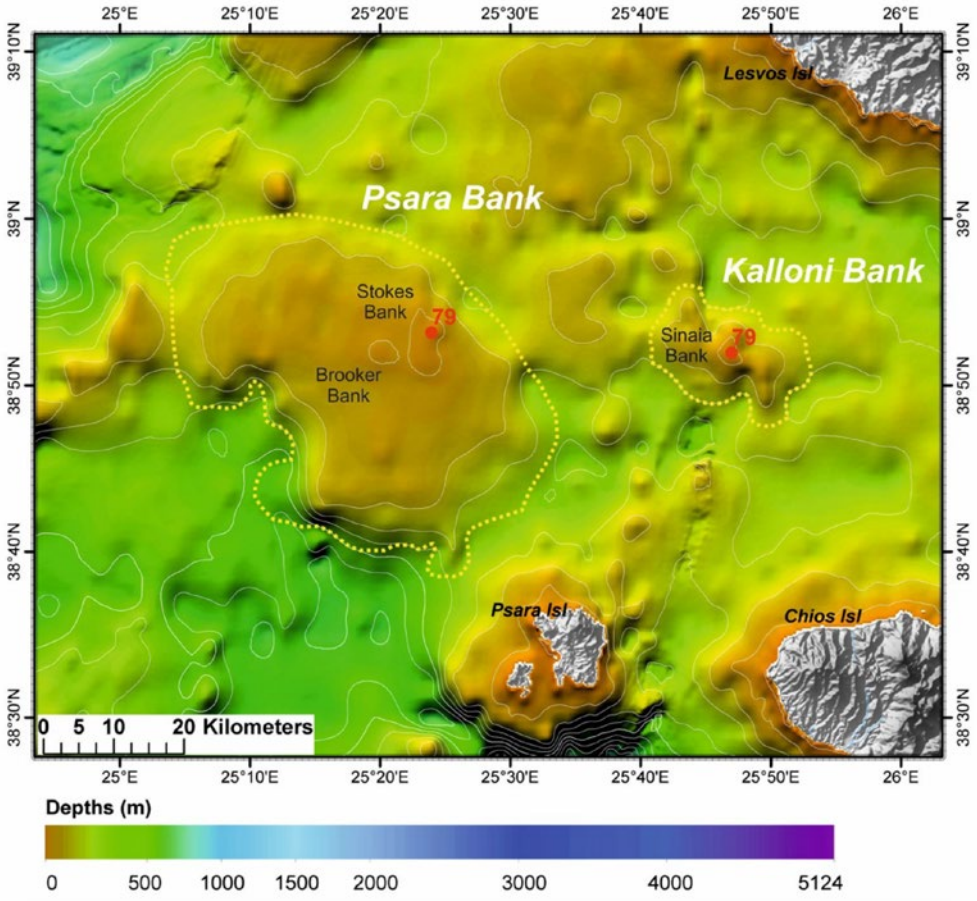


Fig. 2.15. Shaded relief map of the North Psara mounts area.

The outline and the tops of the observed features are indicated on the map.

CAVO DORO NORTH RIDGE (FIG. 2.16)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Cavo Doro North Ridge	1736.93	153	843

It is a 40 km long, NE-SW oriented, elongated shallow ridge located to the northeast of Cavo Doro Strait. The shallow plateau of the ridge is outlined by the 300 m depth contour and the most prominent summits rise at various depths with the shallowest one at 153 m. The base of the ridge is at a depth of 600-700 m. The origin of the ridge is believed to be associated with vertical movements along a NE-SW trending fault-zone, which runs along the south-eastern flank of the ridge and continues south-westwards to the Cavo Doro strait. With the exception of the highest points (summits), the shallow ridge is believed to be covered by marine sediments of the Upper Quaternary.

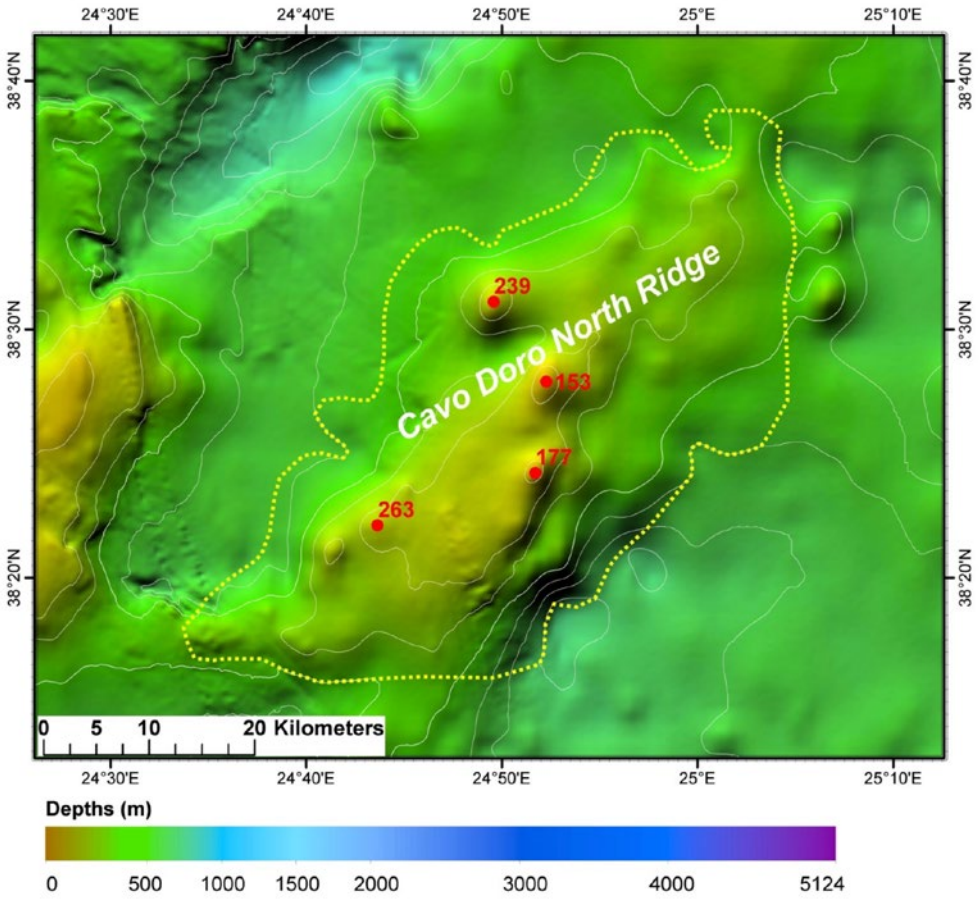


Fig. 2.16. Shaded relief map of the Cavo Doro North Ridge area.

The outline and the tops of the observed features are indicated on the map.

SOUTH PSARA MOUNTS (FIG. 2.17)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Antipsara Bank	340.04	152	903
Mesta Bank	802.29	64	796

The 600-700 m deep basin between the Cavo Doro Ridge to the West and Chios Island to the east hosts three main morphological highs. One rises above the sea-surface where the Kalogeros Islet is located. The other two mounds, the Antipsara Bank and the Mesta Bank, constitute two seamounts.

The **Antipsara Bank** displays two summits at depths of 239 m and 152 m and is named after the small island of Antipsara, southwest of Psara.

The **Mesta Bank**, is characterized by three prominent summits at depths of 64 m, 145 m and 174 m. It is named after the Medieval castle-village of Mesta on Chios Island.

Swath bathymetry and seismic profiling data are not available for the Antipsara and Mesta mounts. However, based on the sharp morphology, it is predicted that rocky substrate may be exposed on the seafloor of the shallowest points.

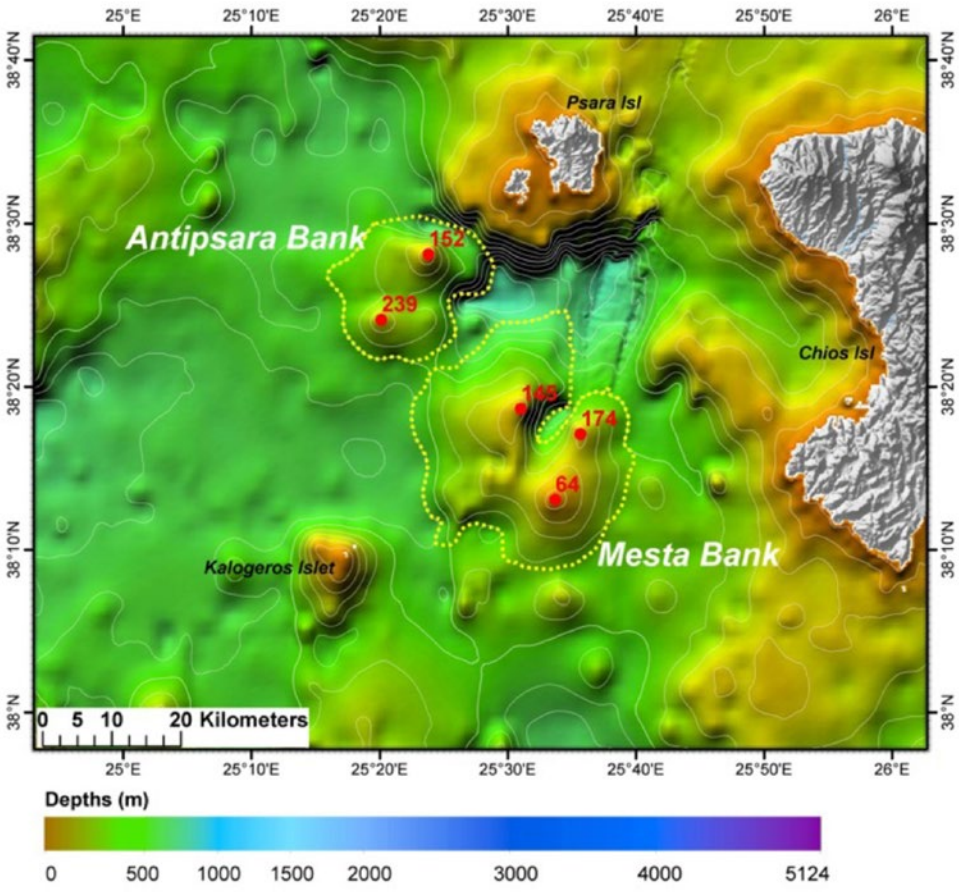


Fig. 2.17. Shaded relief map of the South Psara mounts area.

The outline and the tops of the observed features are indicated on the map.

ANDROS-TINOS NORTH MOUNTS (FIG. 2.18)

Feature	Total Area (km²)	▲ Peak Depth (m)	⛫ Base Depth (m)
Sariza Bank	143.97	270	693
Kalogeros South Ridge	451.62	220	589
Panormos Bank	280.88	237	736

The irregular topography of the area north of the islands of Andros and Tinos displays many morphological highs rising higher than the surrounding 500-800 m deep seafloor. The most prominent and shallow seamounts highlighted here are the Sariza Bank, the Kalogeros South Ridge and the Panormos Bank.

Sariza Bank is a rather circular to elongated mound with its summit at a depth of 270 m. It is named after a water-spring on Andros Island, which has been famous since Antiquity for its quality.

Panormos Bank is a fairly circular mound with its summit rising at a depth of 237 m while the base of its eastern flank is at 800 m. It is named after the picturesque bay and village located on Tinos Island.

The **Kalogeros South Ridge** is an irregularly shaped mound with its crest running in a NE-SW direction and is outlined by the 300 m depth contour. The three shallowest points on the crest are located at depths of 220 m, 271 m and 280 m.

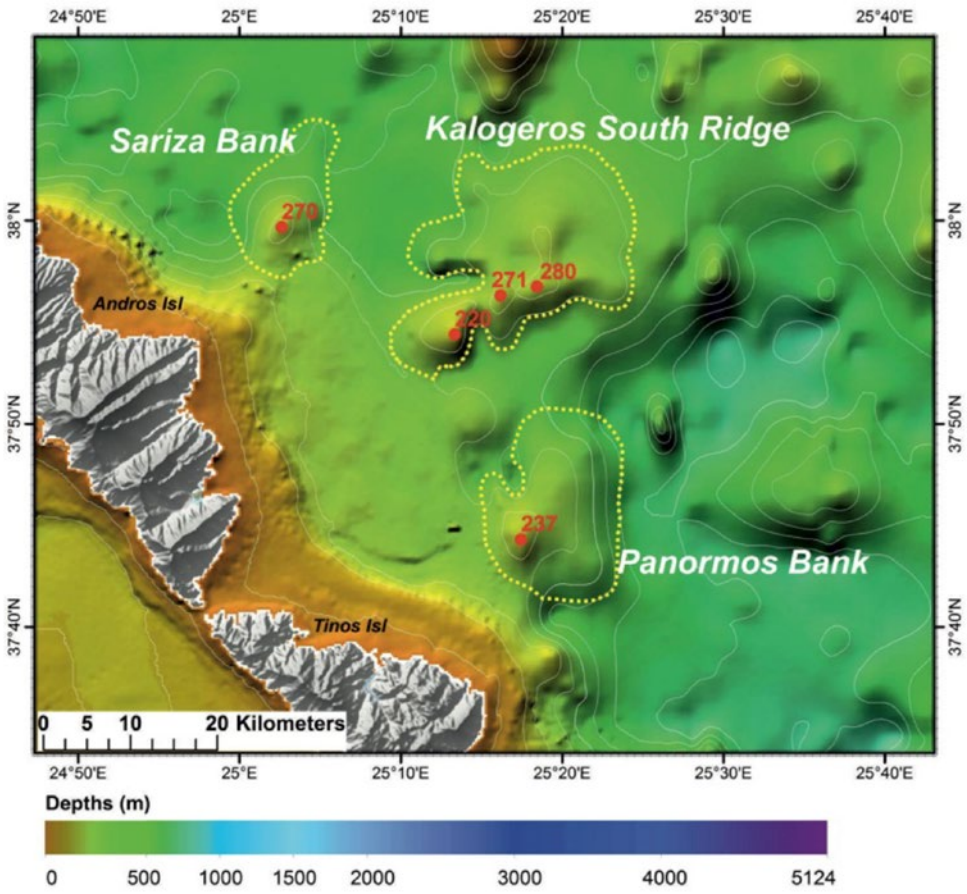


Fig. 2.18. Shaded relief map of the Andros-Tinos North mounts area.

The outline and the tops of the observed features are indicated on the map.

IKARIA NORTH SEAMOUNT (FIG. 2.19)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Pyrgi Bank	485.20	44	612
Evdilos Bank	31.12	248	718

The western margin of the 1100 m deep North Ikaria Basin, between Ikaria Island to the South and Chios Island to the North, is marked by the presence of an irregularly shaped seamount with the shallowest summit rising at a 44 m water depth. Its name, **Pyrgi Bank**, is derived from PIRGY village on Chios Island, which is known as the "painted village" because of the unique decoration of the houses with black and white motifs in different shapes.

Evdilos Bank marks the southernmost tip of the seamount with a narrow summit at a depth of 248 m facing towards the South of the village of Evdilos on the northern coast of Ikaria Island.

The eastern flanks of the Ikaria North seamount form the > 1000 m high margin of the North Ikarian Basin. The western slopes dip down to a depth of 600-700 m.

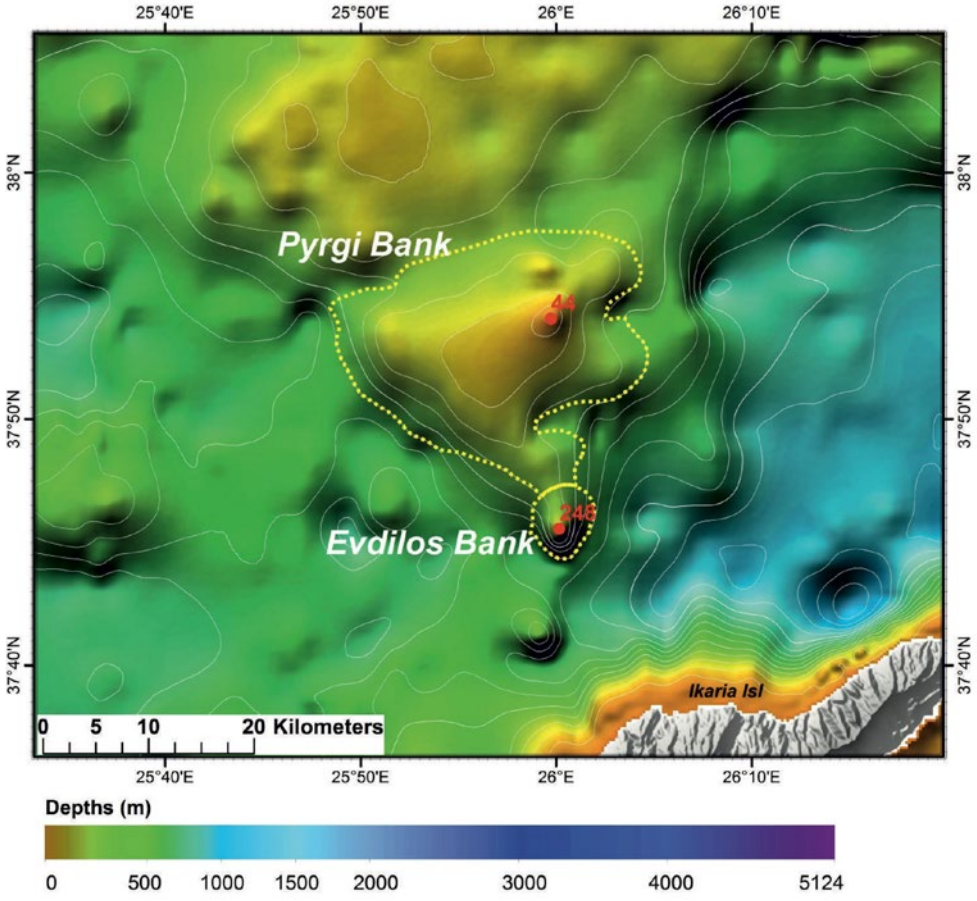


Fig. 2.19. Shaded relief map of the Ikaria North seamount area.

The outline and the tops of the observed features are indicated on the map.


© MICHELLE MARIA, PIXABAY

3 SOUTH AEGEAN SEA

The South Aegean Sea, as described here, includes the Cyclades Plateau to the north and extends between the western coast of Anatolia to the east, the eastern coast of the Peloponnese to the west and the Hellenic Arc (Crete, Rhodes) to the south (Fig. 2.20). Maximum depths in the South Aegean Sea, between 2000 m and 2500 m, occur only at the south-eastern edge of the Aegean. The rest of the South Aegean is characterized by variably shaped basins with bottom depths ranging between 1000 m and 2000 m, and separated from each other by shallow ridges[3].

For decades the shallow marine Cyclades Plateau (CP) has been considered as a tectonically inactive area extending from Central Greece to the west until the western coast of Anatolia to the east. Therefore, very few data are available from this area and very little is known about its offshore structure. However, a more thorough look at the updated bathymetry of the Plateau reveals some interesting geomorphological observations (Fig. 2.20). Its northern edge is marked by (i) a NW-SE running ridge consisting of the South Evia, Andros (An), Tinos (Ti) and Mykonos (M) Islands, and (ii) an ENE-WSW running ridge delineated by the Ikaria (Ik) and Samos (Sam) Islands. Both directions coincide with the major tectonic trends recognized in the Aegean Sea. The **Central Cyclades** area includes two small mounts rising from the 200-300 m deep flat seafloor between Paros, Tinos, Serifos and Sifnos Islands (Fig. 2.21).

The 500 m deep Cavo Doro strait (CD) separates South Evia from the Andros Island and extends further as a narrow, deep depression, between Kea (Ke) and the Kythnos (Ky) Islands. A similar, narrow and deep, strait separates the Serifos and Sifnos Islands and terminates in the Myrtoon Basin (MB). The **Hydra East** area highlights two mounts occurring at the western margin of the Myrtoon Basin.

The 700 m deep, South Ikaria Basin (SIB) separates the wide shelf of Anatolia from the central part of the Cyclades Plateau. Here the main morphological elements of the seafloor and of the non-volcanic islands are aligned along the two main trends of the major tectonic elements. The **South Ikaria** area includes several small and larger mounts occurring in the South Ikaria Basin.

The southern margin of the Cyclades Plateau hosts the Hellenic Volcanic Arc (Fig. 2.20). Its outward outline displays a complex morphology and coincides with the tectonically controlled margins of important basins (Myrtoon, Christiana, Heraklion and Amorgos Basins). The western sector of the South Aegean seafloor is marked by the Argolic Gulf (ArB) and Maleas (MaB) Basins, two elongated 1000-1200 m deep basins that developed along the eastern flanks of the Peloponnese and Kythera-Antikythera Ridge. A narrow ridge separates the Argolic Gulf from the composite 1100 m deep Myrtoon Basin and the Maleas from a morphologically “chaotic” area extending southwest of Milos Island (Mi). Three areas, namely **Maleas**, **Myrtoon** and **South Milos** (Fig. 2.21) highlight the complex topography and the presence of numerous shallow banks. A fourth area, namely **Antikythera-Gramvousa**, encompasses the irregular ridges and shallow summits southeast of Antikythera Island and north of the NW edge of Crete.

The south and south-eastern part of the South Aegean displays an even more complex morphology (Fig. 2.20). The entire area, encompassing the 500 m deep flat Christiana Basin (ChB) in the west and the 400-500 m deep Anydhros (AnB) and the 700 m deep Amorgos (AmB) elongated Basins in the east, hosts the volcanic group of Thera Island (Santorini). Further south, it is the almost 2000 m deep Heraklion Basin (HB). The area **Santorini** includes the submarine cones and domes associated with the Santorini volcanic province along with morphological highs of tectonic origin. The **Anafi East** and **Astypalea Ridge** areas (Fig. 2.21) include mounts and ridges developed along or within the complex Santorini-Amorgos Fault Zone.

A series of shallow ridges and narrow depressions separate the Heraklion Basin (HB) from the > 2000 m deep Kamilonissi Basin (KaB). The southeast corner of the South Aegean is marked by two deep South and North Karpathos Basins (SK and NK) more than 2500 m deep, which constitutes a negative, mirror-image, of the Karpathos and Kassos Islands landscape (Fig. 2.20). The **Syrna**, **Tilos East**, **Avgo**, **Saria East** and **East Cretan Strait** (Fig. 2.21) areas represent the individual or groups of shallow mounts developed due to tectonic processes along the margins of the major basins of the SE Aegean Sea.

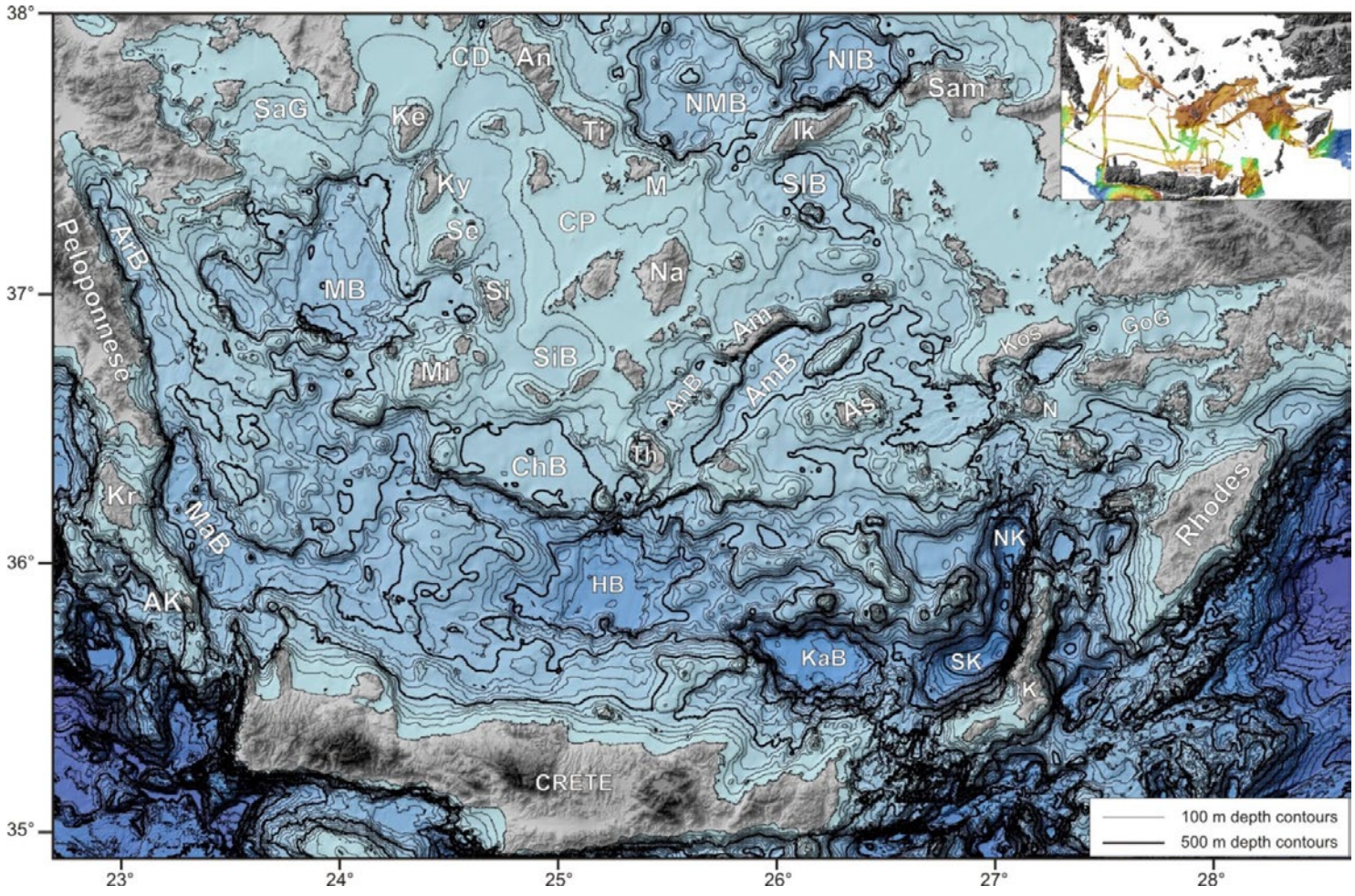


Fig. 2.20. Updated bathymetry of the South Aegean Sea.

Derived from GEBCO and swath bathymetry data processed at 250 m grid10, 3 https://emodnet.eu/bathymetry). Inset map: Swath bathymetry coverage in the South Aegean. AK: Antikythera, Am: Amorgos, AmB: Amorgos Basin, An: Andros, AnB: Anydhros Basin, ArB: Argolikos Basin, As: Astypalaea, CD: Cavo Doro Strait, ChB: Christiana Basin, CP: Cyclades Plateau, GoG: Gulf of Gokova, HB: Heraklion Basin, Ik: Ikaria, K: Karpathos, KaB: Kamilonisi Basin, Ke: Kea, Kr: Kythera, Ky: Kythnos, M: Mykonos, MaB: maleas Basin, MB: Myrtoon Basin, Mi: Milos, N: Nisyros, Na:Naxos, NIB: North Ikaria Basin, NK: North Karpathos Basin, NMB: North Mykonos Basin, SaG: Saronic Gulf, Sam: Samos, Se: Serifos, Si: Sifnos, SiB: Sikinos Basin, SIB: South Ikaria Basin, SK: South Karpathos Basin, Th: Thera, Ti: Tinos.

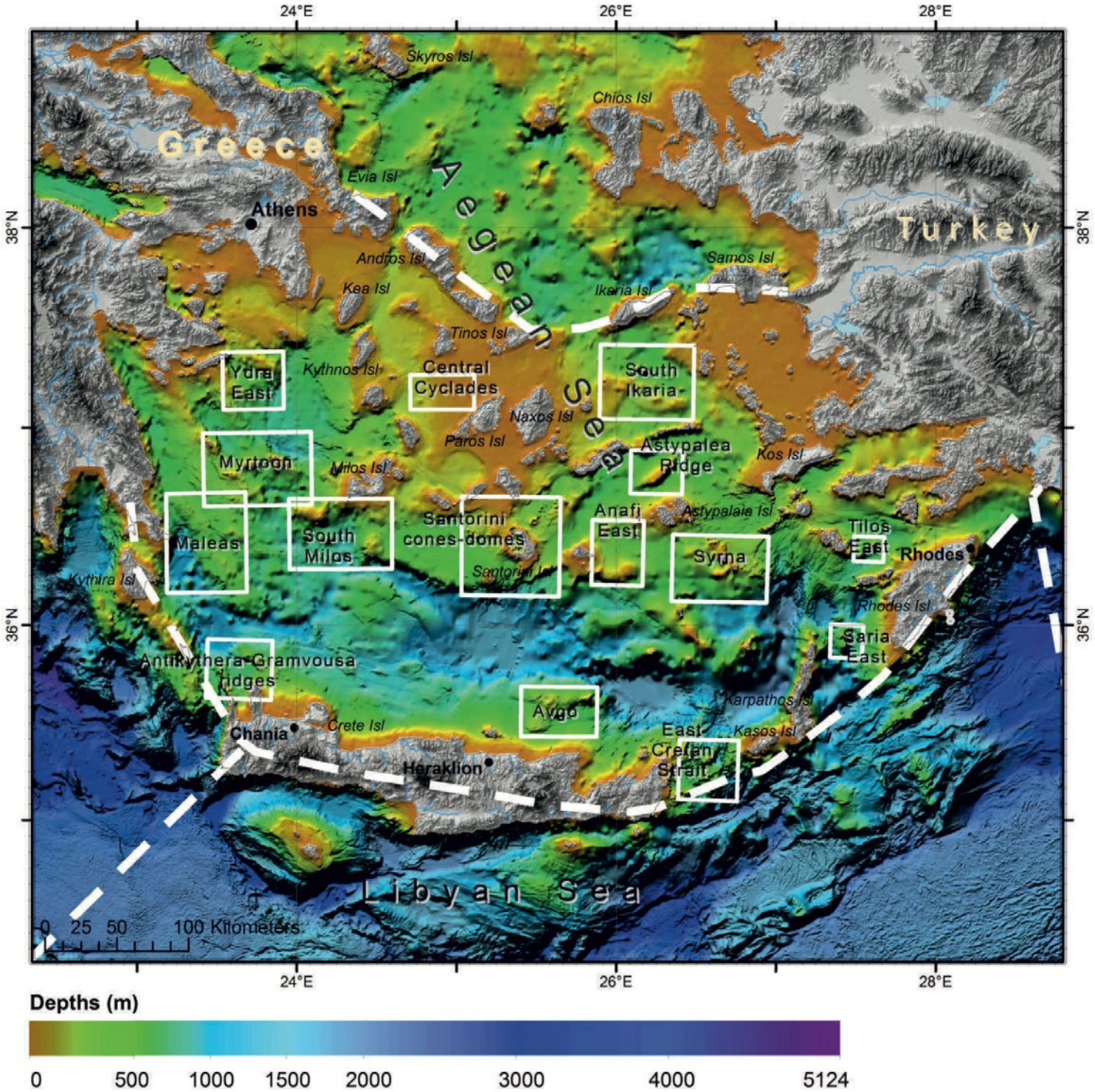


Fig. 2.21. Location of the seamount areas in the South Aegean Sea discussed in this chapter.

Table 2.3. South Aegean Sea Seamounts and Seamount-like structures.

			Minimum Depth / Location			Maximum Depth / Location				
GROUP NAME	Seamount	Area (km^2)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Depth Range (m)	Mean Slope (deg)
HYDRA EAST	Hydra East	581.73	37.342668	23.751942	127	37.333258	23.942850	813	686	2.72
	Agios Nikolaos	50.58	37.165571	23.716588	346	37.176888	23.754298	711	365	3.48
CENTRAL CYCLADES	Herronissos	40.40	37.135385	24.777193	181	37.152366	24.753624	275	94	1.13
SOUTH IKARIA	Donoussa	496.85	37.195745	26.009851	63	37.274893	26.054632	406	343	1.50
			37.210827	25.920289	89					
	Ikaria twins	100.53	37.286193	26.184262	145	37.271126	26.153622	629	484	5.66
			37.303140	26.139481	218					
	Apocalypse	39.81	37.193859	26.408167	304	37.212712	26.386955	548	244	2.82
	Kinaros	253.92	37.144820	26.266753	112	37.182545	26.287965	452	340	1.67
	Levitha	224.49	37.114626	26.361029	138	37.180660	26.342174	438	300	2.24
MYRTOON SEA	Velopoula South East	80.83	36.836648	23.565747	315	36.872635	23.575174	791	476	3.33
	Karavi West	202.41	36.768416	23.563390	139	36.783584	23.499753	498	359	2.37
	Karavi South	312.46	36.645064	23.601100	299	36.711510	23.799080	691	392	2.08
			36.694429	23.766083	320					
			36.662156	23.707161	331					
	Falkonera West	246.87	36.823386	23.723659	167	36.882102	23.730730	667	500	3.16
	Ananes North	52.18	36.703919	24.034770	297	36.684938	24.020628	730	433	4.23
	Ananes West	138.07	36.652661	23.869787	370	36.681142	23.862716	931	561	3.84
MALEAS	Monemvasia Ridge	325.98	36.586165	23.346555	364	36.523415	23.297060	792	428	1.88
	Velanidia	357.86	36.477747	23.596386	308	36.593767	23.561033	633	325	1.60
	Diakofti	218.63	36.216537	23.327700	759	36.258543	23.308845	1310	551	4.45
			36.203167	23.252279	917					
			36.273812	23.337127	922					
	Cavo Malea	550.28	36.315787	23.553962	347	36.262360	23.398407	1113	766	2.38
SOUTH MILOS	Ananes	460.03	36.512001	24.126689	0.5	36.610870	23.961706	887	886.5	4.06
	Fyriplaka	540.34	36.420623	24.449584	198	36.281445	24.395375	1036	838	3.18
SANTORINI	Sikinos South	124.35	36.458710	25.111872	183	36.491070	25.010526	546	363	3.03
	Kolumbo volcanic chain	169.82	36.521513	25.472478	84	36.527220	25.488976	507	423	3.18
	Christiana East	13.85	36.252816	25.319280	336	36.243271	25.331064	683	347	7.49
	Perissa Ridge	136.34	36.273812	25.538471	178	36.210807	25.411199	1017	839	7.53
ANAPHI EAST	Anaphi East	82.58	36.487263	25.941501	176	36.500584	25.899077	400	224	2.08
	Makra East	281.38	36.268086	26.064060	78	36.224176	25.948572	413	335	2.44
ASTYPALEA RIDGE	Astypalea Ridge	412.97	36.760831	26.283251	32	36.686837	26.108841	587	555	3.93

			Minimum Depth / Location			Maximum Depth / Location				
GROUP NAME	Seamount	Area (km^2)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Depth Range (m)	Mean Slope (deg)
SYRNA MOUNDS	Sofrana West	81.70	36.159220	26.419952	278	36.201257	26.422308	699	421	5.74
	Syrna West	29.37	36.355832	26.610860	176	36.352019	26.582578	374	198	2.85
	Plakida west	95.94	36.254725	26.629716	18	36.239452	26.596719	609	591	4.72
TILOS EAST MOUNDS	Antitilos	57.92	36.348206	27.520624	374	36.321509	27.506482	898	524	4.68
	Livadia	42.87	36.411099	27.619613	256	36.386329	27.621970	511	255	4.20
GRAMVOUSA	Kissamos	308.23	35.816350	23.751942	227	35.852815	23.594029	1114	887	4.67
			35.845140	23.693019	331					
	Balos Ridge	208.05	35.664550	23.570460	78	35.833625	23.485612	1000	922	6.73
SARIA EAST	Saria East	238.22	35.983184	27.454630	164	35.868164	27.454630	1096	932	6.10
EAST CRETAN STRAIT	Sidero	59.43	35.321451	26.514228	252	35.400610	26.509514	1098	846	8.76
	Fry	151.34	35.315656	26.568436	203	35.344628	26.641500	1196	993	9.53
	Palaikaston	31.99	35.232545	26.592005	253	35.201598	26.530726	646	393	8.50
	Zakros	181.92	35.178380	26.627359	105	35.149348	26.690995	1501	1396	9.46
AVGO MOUND	Avgo East	70.30	35.627997	25.828370	129	35.602978	25.771804	622	493	5.99

HYDRA EAST MOUNTS (FIG. 2.22)

Feature	Total Area (km²)	▲ Peak Depth (m)	⍓ Base Depth (m)
Hydra East	581.73	127	813
Agios Nikolaos	50.58	346	711

The western margin of the 800-1000 m deep Myrtoon basin is dominated by morphological highs which mark the eastward, underwater prolongation of the Argolid Peninsula east of Hydra Island.

Hydra East ridge is a 20 km long, E-W oriented, irregular ridge located east of Hydra Island. The eastern flank of the ridge faces the 800 m deep seafloor of the northern Myrtoon Basin. The shallowest summit of the ridge is found at a depth of 127 m.

The small, circular **Agios Nikolaos mound** is located to the south of the Hydra East ridge. The depth of its summit is 345 m and it marks the south-eastern tip of the morphological ridge, which extends from the southern coast of Hydra Island towards the SE.

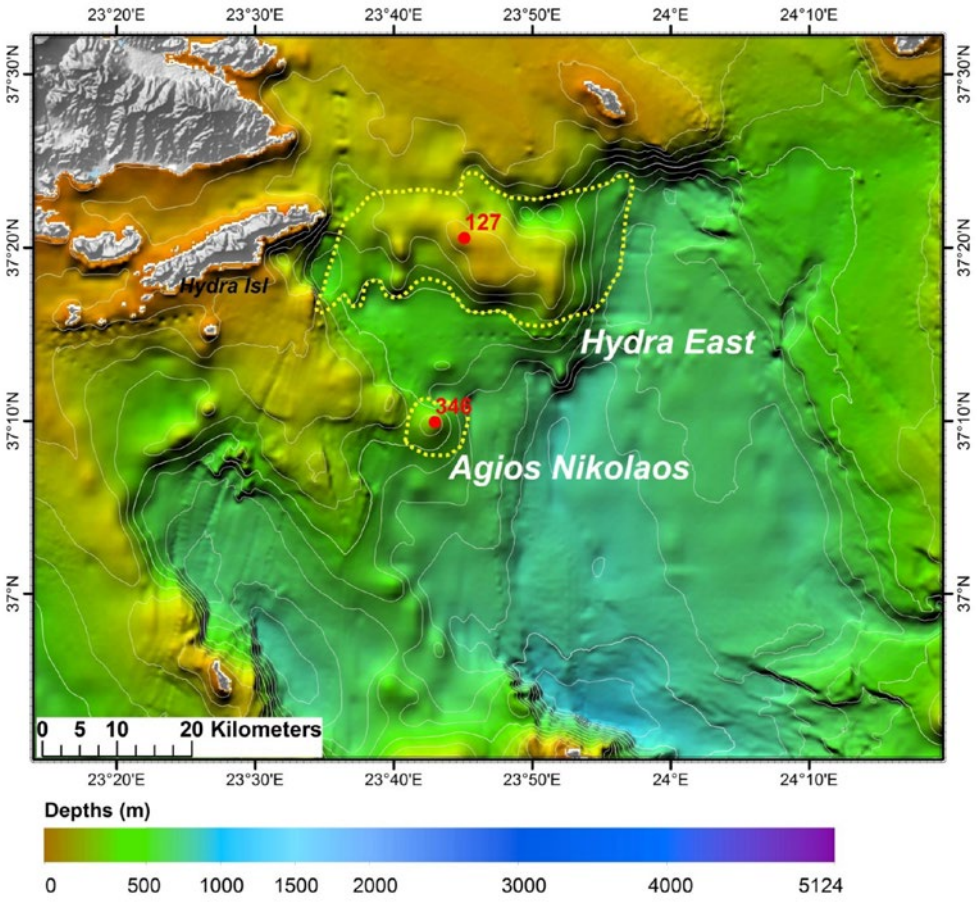


Fig. 2.22. Shaded relief map of the Hydra East mounts area.

The outline and the tops of the observed features are indicated on the map.

CENTRAL CYCLADES MOUNTS (FIG. 2.23)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩘ Base Depth (m)
Central Cyclades Mounts	40.40	181	275

The circular **Herronissos mound** with its summit at a depth of 181 m has been named after the Herronissos village and bay at the northern tip of Sifnos Island. The area of the mount has not been surveyed by means of systematic bathymetry, thus the exact shape and depth of its summit may differ from those observed.

The second, small mount shown east of Herronissos rises above the sea level forming the rocky Mermigkas Islet.

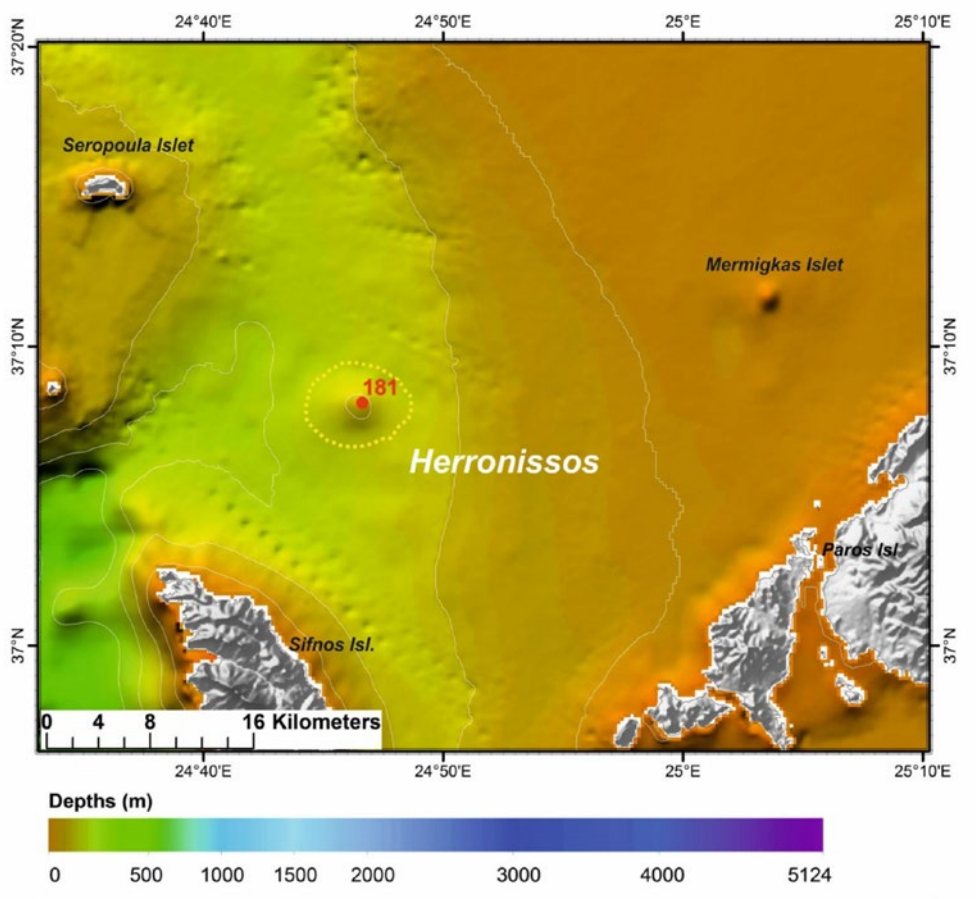


Fig. 2.23. Shaded relief map of the Central Cyclades area.

The outline and the tops of the observed features are indicated on the map.

SOUTH IKARIA MOUNDS (FIG. 2.24)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Donoussa	496.85	63	406
Ikaria twins	100.53	145/218	629
Apocalypse	39.81	304	548
Kinaros	253.92	112	452
Levitha	224.49	138	438

The South Ikaria basin, has developed in a NW-SE direction between the Central Cyclades plateau to the west, the shelf of Patmos Island to the east, the Ikaria Island to the North and the islets of Kinaros and Levitha to the South. The floor of the basin displays complicated morphology with many morphological and structural highs. The most prominent highs in this area are highlighted here.

The **Ikaria Twins** is a semi-circular mound with two summits at depths of 145 m and 218 m which rise from the surrounding, 500-600 m deep seafloor of the basin.

Apocalypse mount rises at a depth of 304 m and is named after the homonymous monastery on Patmos Island.

The **Kinaros** and **Levitha mounds** mark the two summits at depths of 112 m and 138 m of an E-W direction morphological ridge in the southern part of the South Ikaria basin.

The **Donoussa mounds** mark the shallow feature at the eastern edge of the Central Cyclades plateau, at the western margin of the South Ikaria basin. The two highest summits are located at depths of 63 m and 89 m rising from the 150-200 m deep rather flat plateau.

The entire area of the South Ikaria mounts has not been surveyed by means of systematic bathymetry, therefore the morphological characteristics described here are subject to improvement in the future.

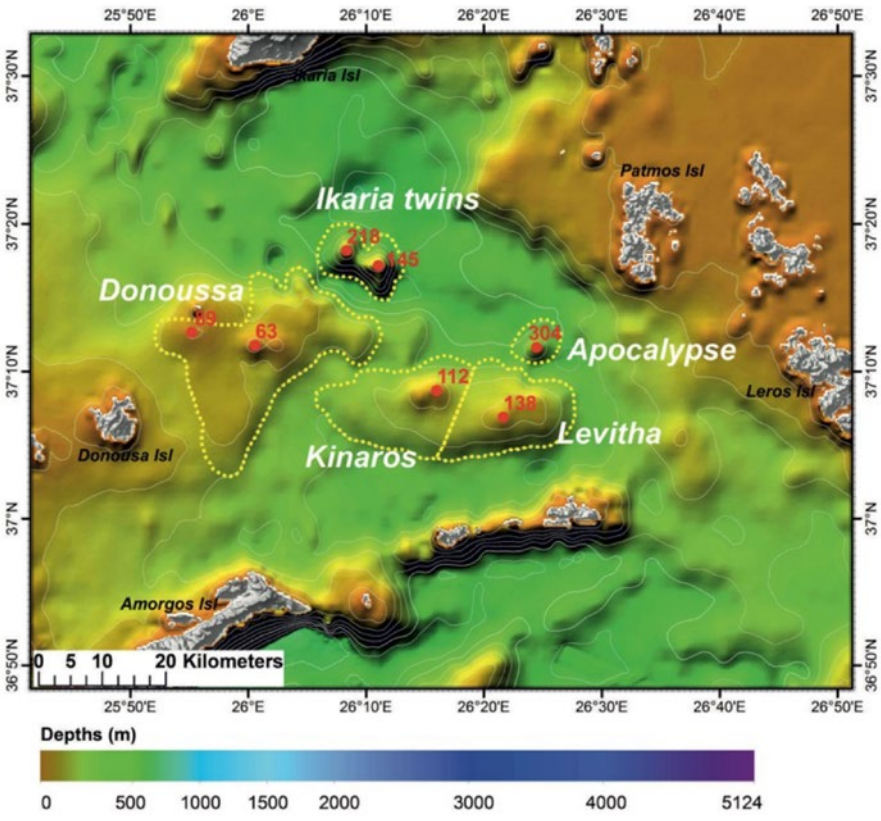


Fig. 2.24. Shaded relief map of the South Ikaria mounds area.

The outline and the tops of the observed features are indicated on the map.

MYRTOON MOUNDS (FIG. 2.25)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Velopoula South East	80.83	315	791
Karavi West	202.41	139	498
Karavi South	312.46	299	691
Falkonera West	246.87	167	667
Ananes North	52.18	297	730
Ananes West	138.07	370	931

The southern, fault controlled, steep margin of the Myrtoon Basin displays a complicated morphological structure with numerous highs and mounds, some of which rise above the sea level (Falkonera, Velopoula, Karavi islets), and are separated from each other by deeper valleys.

Falkonera West is a rather circular mound rising from a depth of 600-700 m to 167 m. It is separated from the Falkonera Islet by a 450 m deep morphological neck.

Velopoula South East is located southeast of Velopoula Islet and its summit is found at a depth of 315 m.

Karavi West is a 139 m shallow bank located west of the Karavi Islet.

Karavi South is a group of small mounds with their summits at depths of 299 m, 320 m and 331 m, located to the South and Southeast of Karavi Islet.

Ananes West and **Ananes North** are two circular mounds named after the volcanic Ananes Islets, with their shallowest points at 370 m and 297 m respectively.

The entire area of Myrtoon mounds has not been surveyed be means of systematic bathymetry, therefore the morphological characteristics described here are subject to improvement in the future.

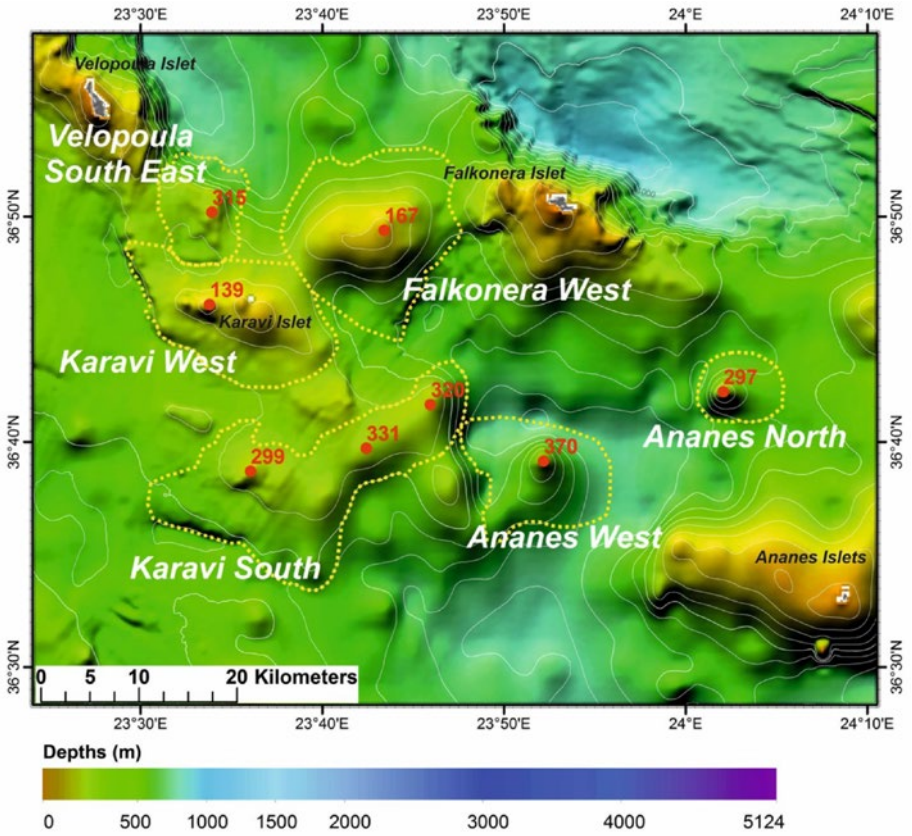


Fig. 2.25. Shaded relief map of the Myrtoon mounts area.

The outline and the tops of the observed features are indicated on the map.

MALEAS SEAMOUNTS (FIG. 2.26)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Monemvasia Ridge	325.98	364	792
Velanidia	357.86	308	633
Diakofti	218.63	759	1310
Cavo Malea	550.28	347	1113

The Maleas Basin is a NNW-SSE oriented, elongated, more than 1100 m deep basin, developed in line with and south of the Argolid Basin, along the eastern margin of the Peloponnese. The evolution of the basin is controlled by a NNW-SSE trending, predominantly extensional faults which run along both the western and the eastern margins of the basin. Towards the East, the Maleas Basin is bounded by an oriented shallow, composite ridge with the shallowest parts rising up to 200-300 m higher from the shallow plateau.

Monemvasia Ridge is a 15-20 km long elongated feature located opposite the historical castle and village of Monemvasia. The shallowest summit of the narrow crest of the ridge is found at a depth of 364 m.

Velanidia mount is located east of Monemvasia Ridge. It displays an irregular shape and rises at a depth of 308 m, roughly 200 m higher from its base. The ridge is named after the picturesque village overlooking the South Aegean Sea from the eastern flank of the mountainous Maleas Peninsula of the Peloponnese.

The **Cavo Malea ridge** is located on the southwestward prolongation of the Monemvasia ridge, with its summit rising at a depth of 347 m. It is named after Cape Maleas, the southeasternmost tip of the Peloponnese.

Diakofti mounts is a group of small mounts that rise from the more than 1200 m deep floor of the Maleas Basin, east of Kythera Island. The summits of the most prominent mounts are found at depths of 759 m, 917 m and 922 m. However, due to the lack of accurate bathymetric surveys, the precise depth of the mounts is subject to revision.

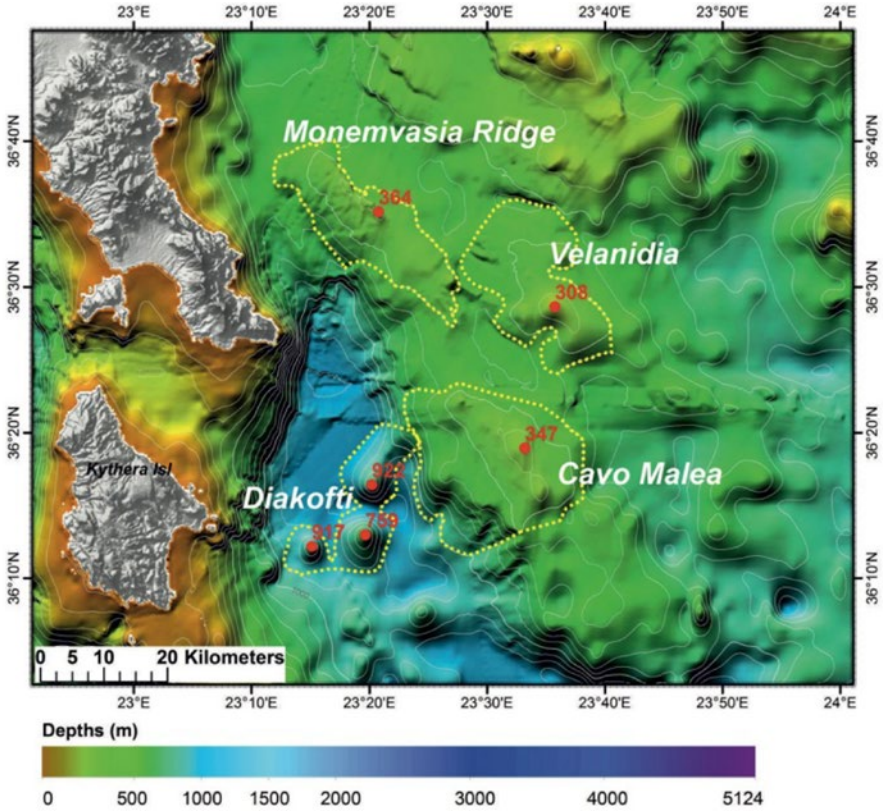


Fig. 2.26. Shaded relief map of the Maleas mounts area.

The outline and the tops of the observed features are indicated on the map.

SOUTH MILOS SEAMOUNTS (FIG. 2.27)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Ananes	460.03	0.5	887
Fyriplaka	540.34	198	1036

The **Ananes seamount** is located southwest of the volcanic Milos Island. The seamount displays several summits at depths shallower than 100 m. The highest summit rises above sea-level forming the group of small, rocky islets called Ananes, while the second highest summit is slightly submerged. Ananes Islets are formed of volcanic rocks. Thus, it is assumed that a large part of the Ananes seamount may be of volcanic origin too. The base of the seamount displays a circular shape and varies between a depth of 600 m and 800 m.

Fyriplaka seamount is located south of Milos Island. It is a circular mount with the base of the slopes located at a depth of roughly 1000 m in the West and South and at 500 m in the East. The summit of the mount rises at a depth of 198 m and is named after the spectacular volcano in Fyriplaka on Milos Island. However, marine geological surveys conducted in the area suggest a non-volcanic origin for the Fyriplaka seamount.

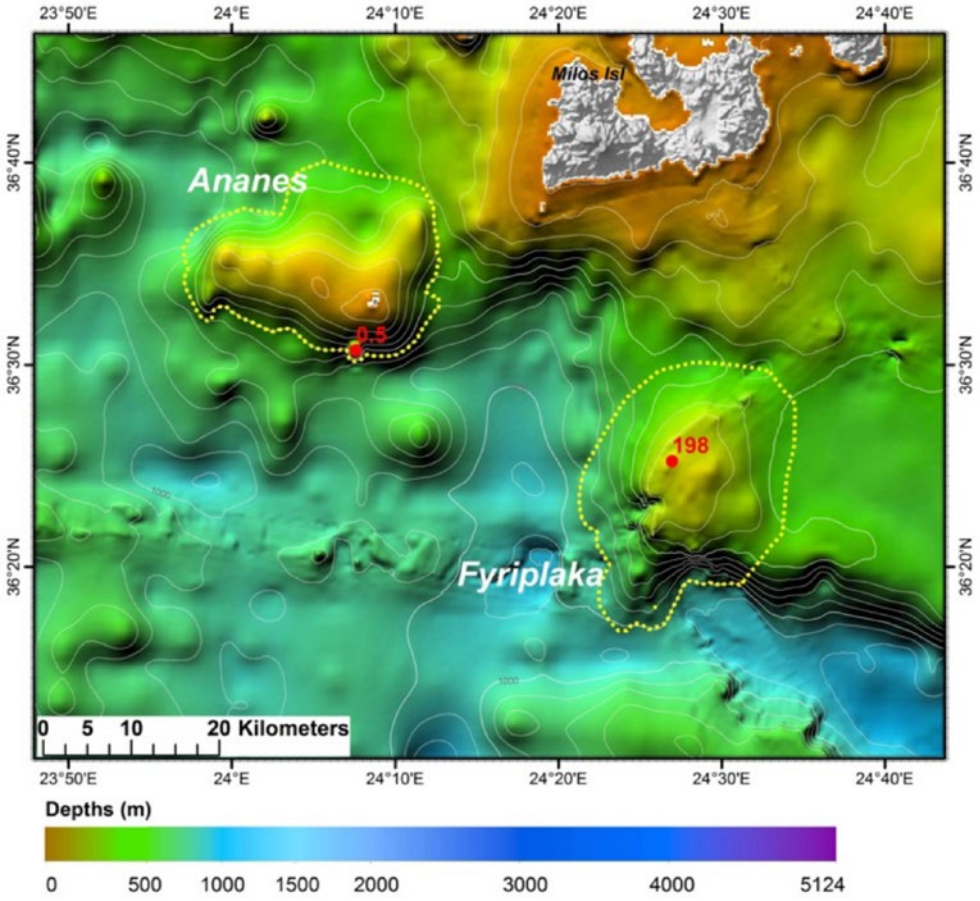


Fig. 2.27. Shaded relief map of the South Milos mounts area.

The outline and the tops of the observed features are indicated on the map.

SANTORINI MOUNTS (FIG. 2.28)

Feature	Total Area (km²)	▲ Peak Depth (m)	⬆ Base Depth (m)
Sikinos South	124.35	183	546
Kolumbo volcanic chain	169.82	84	507
Christiana East	13.85	336	683
Perissa Ridge	136.34	178	1017

Santorini Island is world famous for its volcanic landscape and offers some of the most spectacular geomorphological and geological features of volcanic origin, including the large caldera and the steep walls surrounding it, composed of successive lava flows.

The volcanic province of Santorini includes the Christiana Islets and a large number of submarine volcanic domes. The latter are grouped here into two groups: Christiana East and the Kolumbo volcanic chain.

Christiana East is a group of small mounds, volcanic domes, located east of the Christiana Islets, with the highest summit rising at a depth of 336 m while the surrounding seafloor is at 600-700 m.

The **Kolumbo volcanic chain** is a group of more than 20 volcanic cones and domes arranged in a NE-SW direction within the 300-350 m deep, flat Anydros Basin. The most prominent feature among them is the Kolumbo submarine volcano, which erupted in 1650 and trig-

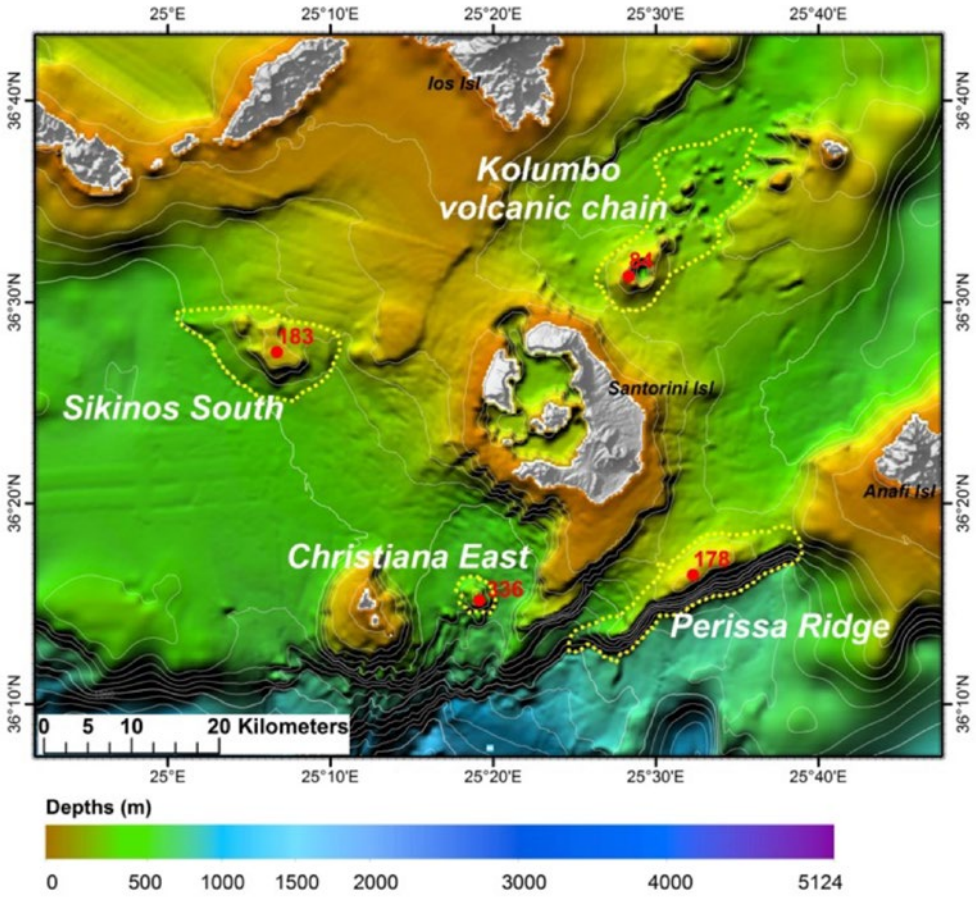


Fig. 2.28. Shaded relief map of the Santorini mounts area.

The outline and the tops of the observed features are indicated on the map.

gered a large tsunami with catastrophic impact on the nearby islands. Kolumbo displays a circular shape with a 500 m deep caldera in the centre. The rim of the submarine caldera rises at a depth of less than 100 m. The majority of the other volcanic domes of the Kolumbo chain rise several tens of metres higher than the surrounding basin's floor.

The **Sikinos South mount** is a shallow plateau (< 200 m) rising from a 300-500 m deep surrounding seafloor. Unlike the volcanic Christiana and Kolumbo domes, Sikinos South mount represents a structural high of the non-volcanic basement.

Perissa ridge is a 20 km long, NE-SW oriented narrow ridge located south of Santorini and southwest of Anafi Island. The shallowest point of the ridge rises at a depth of 178 m and is bounded both to the North and South by fault controlled steep slopes. The Perissa ridge marks a tectonically uplifted block of the non-volcanic basement of the area. It is named after Perissa beach on Santorini, which is famous for the dark coloured (black) sand and pebbles.

ANAFI EAST MOUNTS (FIG. 2.29)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Anaphi East	82.58	176	400
Makra East	281.38	78	413

Two shallow mounts are located on the seafloor between the islands of Anafi and Astypalaea.

Anafi East is an elongated mount in a NE-SW direction which rises at a depth of 176 m. Seismic profiles acquired close to the mount suggest that the rocky basement is exposed on the seafloor at the summit of the mount.

Makra East is named after the small islet south of Anafi Island. It is an ENE-WSW elongated mount with its summit rising at a depth of 78 m. Towards the west, the mount faces an 800 m deep basin while the eastern, southern and northern bases of the mount are 300-400 m deep.

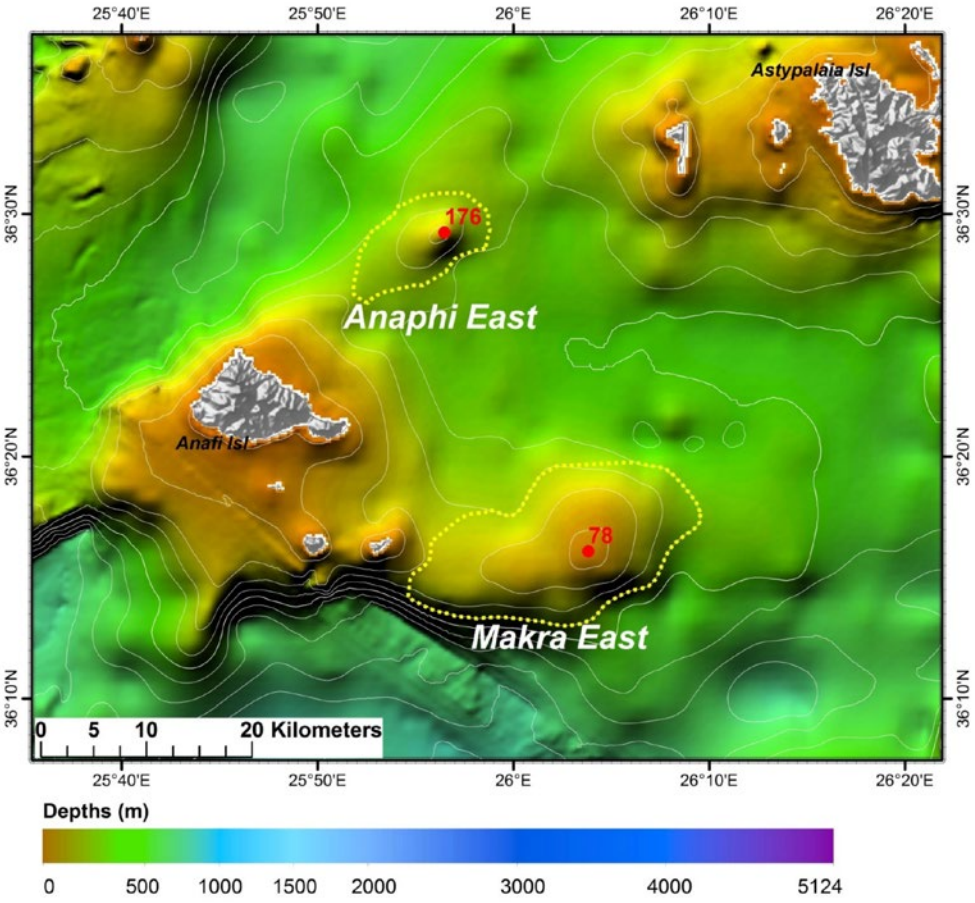


Fig. 2.29. Shaded relief map of the Anafi East mounts area.

The outline and the tops of the observed features are indicated on the map.

ASTYPALEA RIDGE (FIG. 2.30)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Astypalea Ridge	412.97	32	587

Astypalea ridge, between Amorgos Island to the North and Astypalea Island to the South, is an asymmetric morphological feature characterized by a steep south-eastern slope and a gently sloping north-western slope. The length of the ridge is roughly 30 km and its shallowest summit is found at a depth of 32 m. The depth at the base of the slopes on both sides of the ridge is roughly 600 m. Seismic profiling data indicate that the tectonically uplifted ridge is built by Plio-Quaternary sediments.

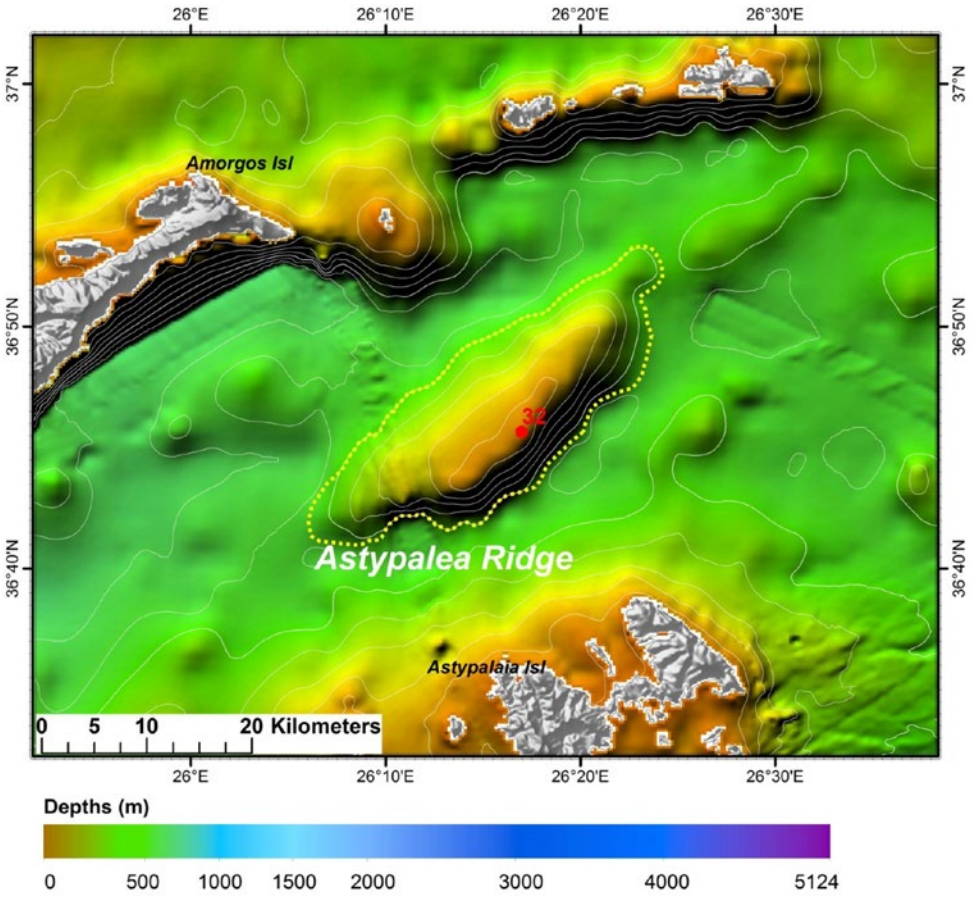


Fig. 2.30. Shaded relief map of the Astypalea ridge.

The outline and the tops of the observed features are indicated on the map.

SYRNA MOUNDS (FIG. 2.31)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Sofrana West	81.70	278	699
Syrna West	29.37	176	374
Plakida west	95.94	18	609

The seafloor of the area around the Syrna, Plakida and Sofrana islets is characterized by complicated topography with numerous morphological highs and lows and steep slopes.

Next to Syrna and Plakida islets, the **Syrna West** and **Plakida West** banks are the two shallowest summits of a composite seamount which rises from the surrounding 400-500 m deep seafloor. They rise at depths of 176 m and 18 m respectively and are composed of the rocky basement of the area.

Sofrana West is a semi-circular mound with two summits, the shallowest of which rises at a depth of 278 m.

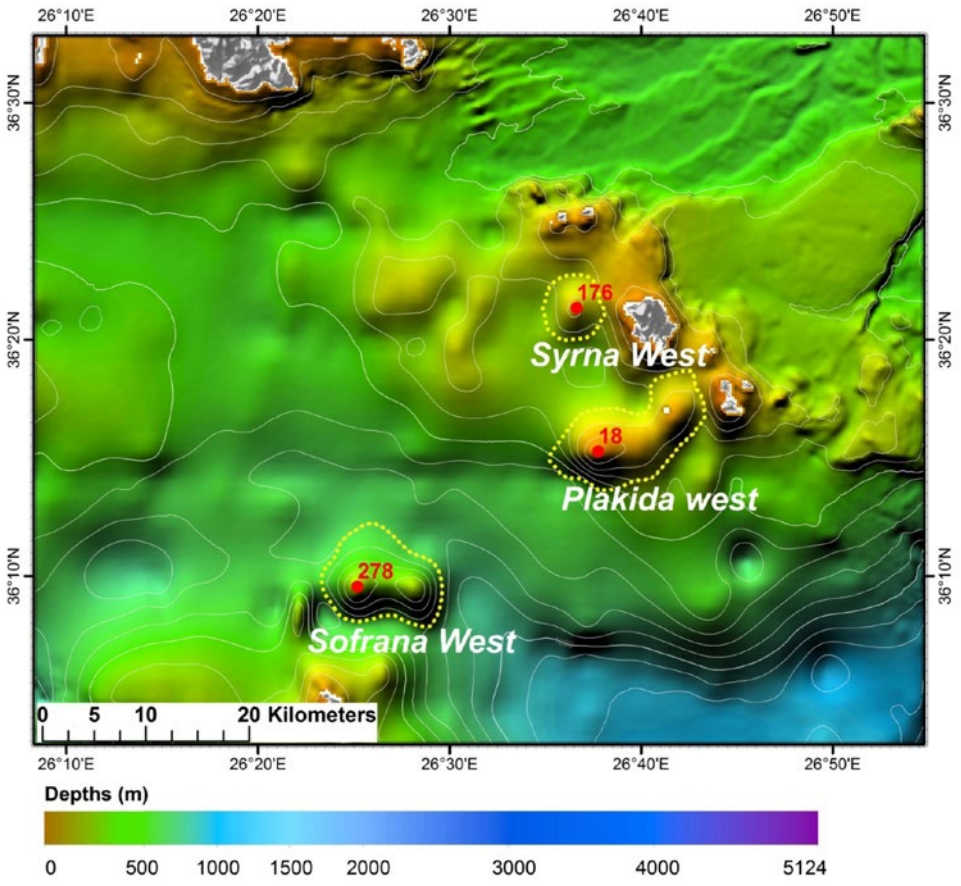


Fig. 2.31. Shaded relief map of the Syrna mounds area.

The outline and the tops of the observed features are indicated on the map.

TILOS EAST MOUNDS (FIG. 2.32)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩚ Base Depth (m)
Antitilos	57.92	374	898
Livadia	42.87	256	511

Two small mounds rise from the 600-700 m depth sea-floor east of Tilos Island.

Antitilos mound has its summit at a depth of 374 m and is located east of Antitilos Islet.

Livadia mound is a circular mount with its summit at a depth of 256 m. It is named after the main village and harbour of Tilos Island.

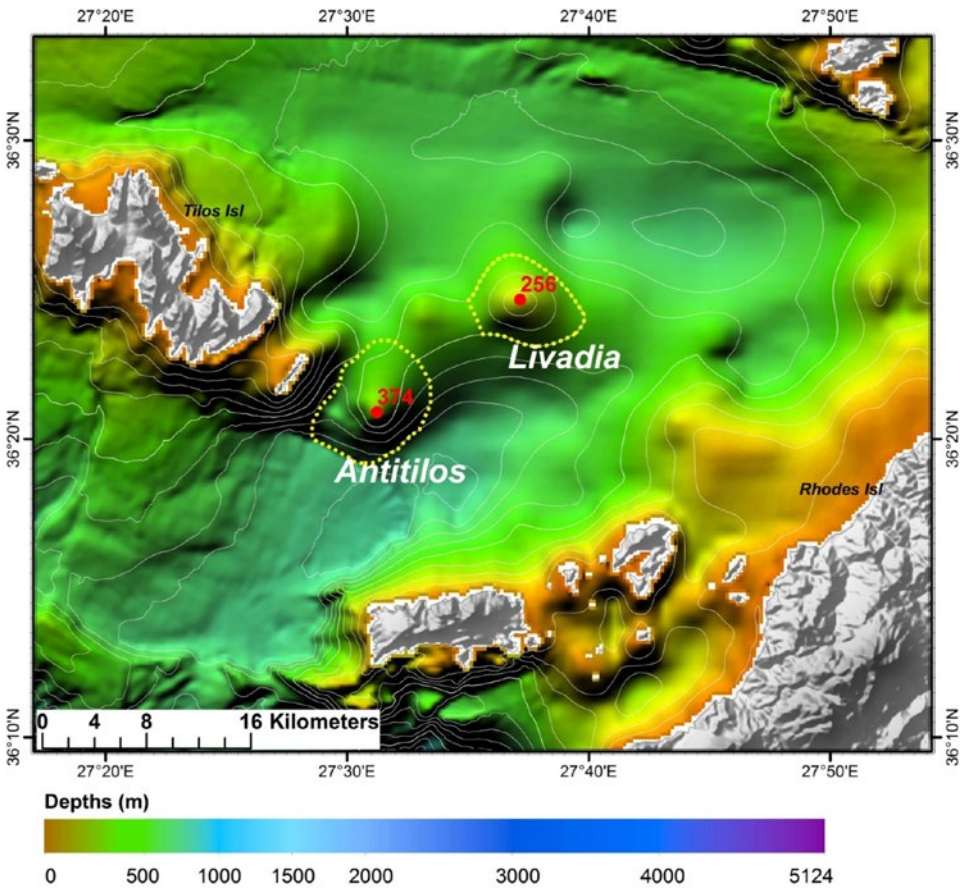


Fig. 2.32. Shaded relief map of the Tilos East mounds area.

The outline and the tops of the observed features are indicated on the map.

GRAMVOUSA RIDGES (FIG. 2.33)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Kissamos	308.23	227	1114
Balos Ridge	208.05	78	1000

The two elongated, N-S oriented, mountainous peninsulas at the north-western edge of Crete, Balos and Gramvousa, prolong northwards below the sea level forming two pronounced ridges.

Balos Ridge is located at the northward prolongation of the Balos Peninsula. It is a 20 km long ridge with steep slopes dipping down to > 1000 m. The shallowest summit of the crest of the ridge is 78 m deep and located at a short distance from the northern tip of the Balos Peninsula. Several other summits along the crest further north, rise at depths shallower than 200 m.

Kissamos Ridge is located north of the Gramvousa Peninsula and is NW-SE oriented. It is characterized by two summits, 227 m and 331 m deep, while the surrounding seafloor is > 1000 m deep.

Both ridges described here are composed of the geological basement formations occurring on nearby NW Crete.

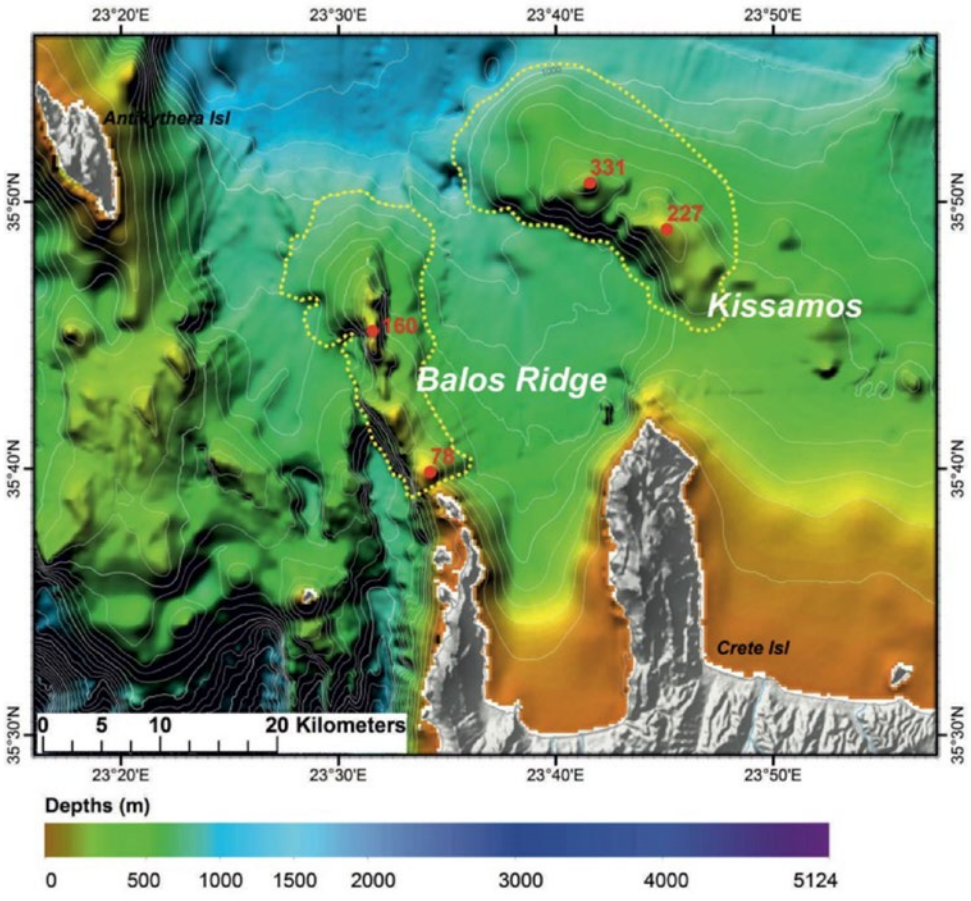


Fig. 2.33. Shaded relief map of the Gramvousa ridges area.

The outline and the tops of the observed features are indicated on the map.

AVGO EAST MOUND (FIG. 2.34)

Feature	Total Area (km²)	▲ Peak Depth (m)	⍓ Base Depth (m)
Avgo East Mound	70.30	129	622

Avgo Islet marks the summit of an irregularly shaped morphological feature to the north of Central Crete. **Avgo East** marks the shallowest of a group of summits located at the eastern part of that feature overlooking the > 2000 m deep Kamilonissi Basin. The summit of Avgo East is at a depth of 120 m and is surrounded by steep slopes plunging to 700 m to the south and > 1500 m to the north.

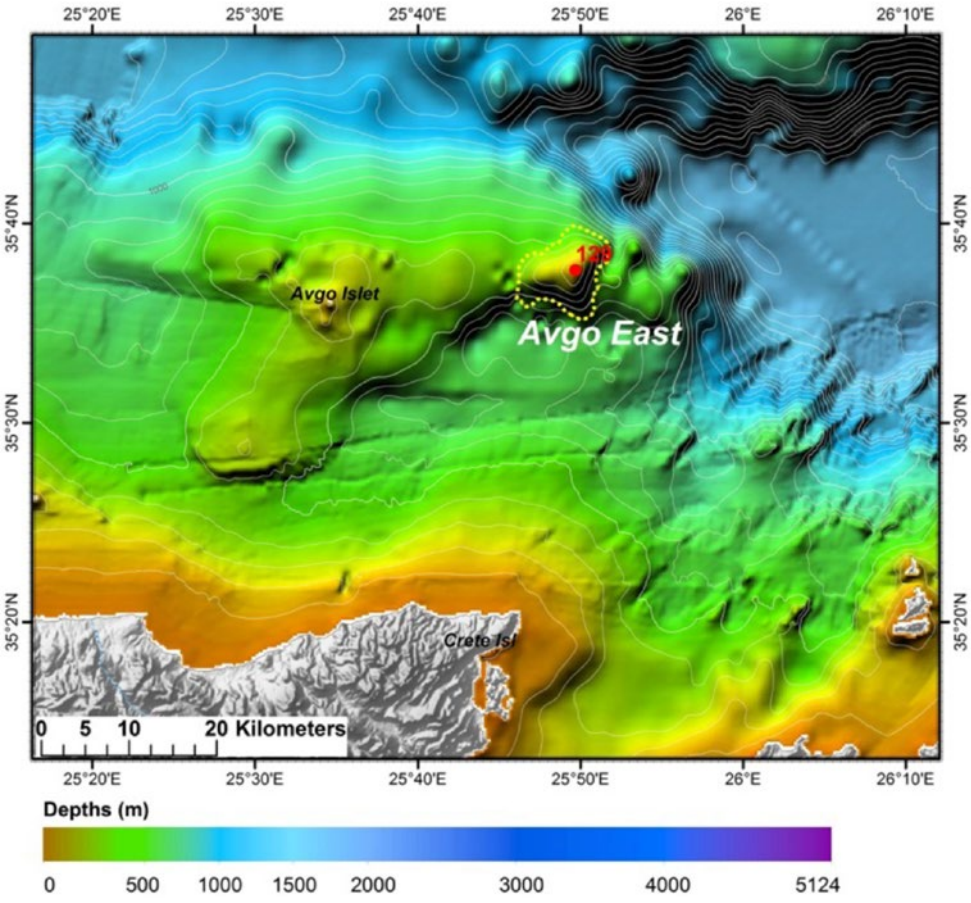


Fig. 2.34. Shaded relief map of the Avgo East mounts area.

The outline and the tops of the observed features are indicated on the map.

SARIA EAST SEAMOUNT (FIG. 2.35)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Saria East Seamount	238.22	164	1096

The seafloor between Karpathos and Rhodes displays a very complicated morphology, with local depressions and shallows, which are the result of the ongoing tectonic activity along the eastern sector of the Hellenic Arc.

Saria East is the most pronounced seamount in this area. It is located east of Saria Island and its shallowest summit rises at a depth of 164 m. Saria East mount is separated from Karpathos Island (West) and Rhodes Island (East) by two, 600-800 m deep, N-S oriented valleys.

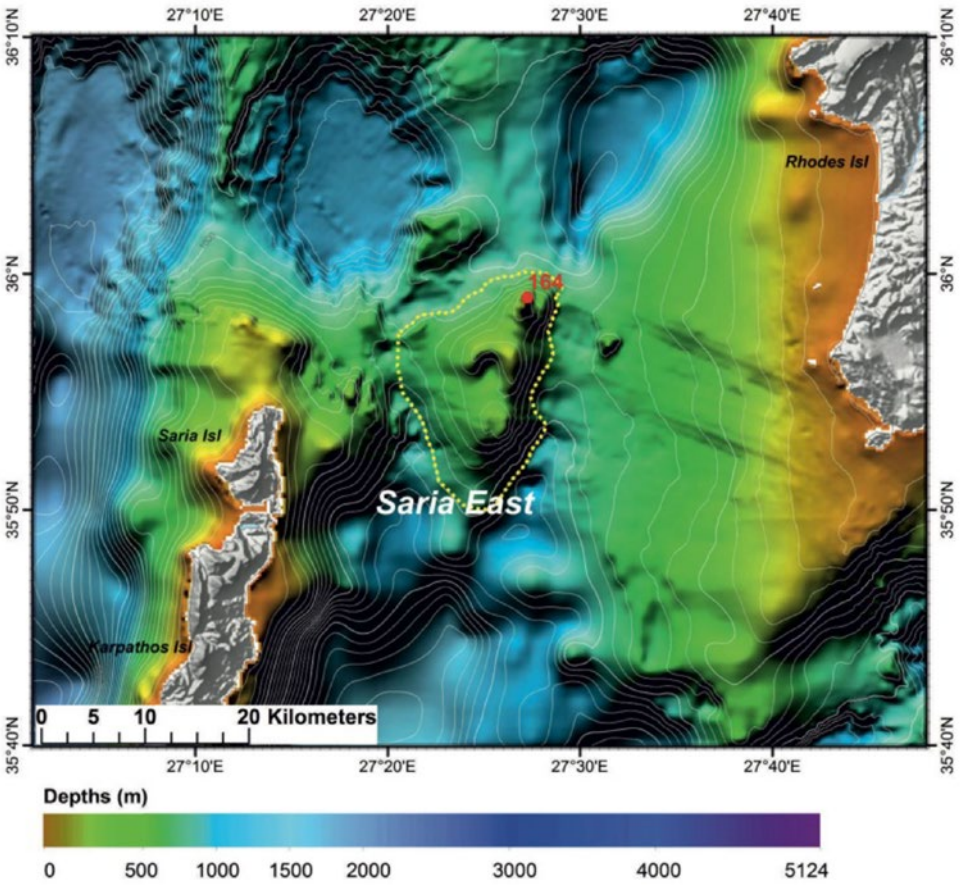


Fig. 2.35. Shaded relief map of the Saria East Seamount area.

The outline and the tops of the observed features are indicated on the map.

EAST CRETAN STRAIT MOUNTS (FIG. 2.36)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Sidero	59.43	252	1098
Fry	151.34	203	1196
Palaikaston	31.99	253	646
Zakros	181.92	105	1501

The seafloor of the East Cretan Strait, between Crete and Kassos Island is spectacular in its morphological complexity and is a result of the ongoing tectonic activity along the Hellenic Arc. It is carved and ruptured by numerous, cross-cutting faults, which create deep and narrow valleys and gorges separating small and larger mounts and ridges and creating a complex morphological pattern.

The most prominent positive morphological features of the East Cretan Strait are highlighted here. The rocky basement outcropping on Crete and Kassos Islands is believed to be exposed on the seafloor of all mounts.

Sidero and **Fry** mounts are located in the northern part of the strait. They are oriented in a NE-SW direction and overlook the > 2000 m deep South Karpathos Basin towards the NE. Their summits rise at 252 m and 203 m, respectively. Sidero mount is named after the homonymous cape at the north-eastern tip of Crete, while Fry has taken its name from the main village and port of Kassos Island.

Palaikastron mount has a central location in the strait and is oriented in a ENE-WSW direction. It rises at a depth of 253 m and is outlined by very steep slopes dipping down to a > 900 m depth. Palaikastron mount is named after the historical site on the eastern coast of Crete.

Zakros mount is the largest and shallowest one in the East Cretan Strait and is located in its southern part. Its summit is located at a depth of 105 m while its southern slopes dip down to a depth of > 3000 m, in the Pliny Trench.

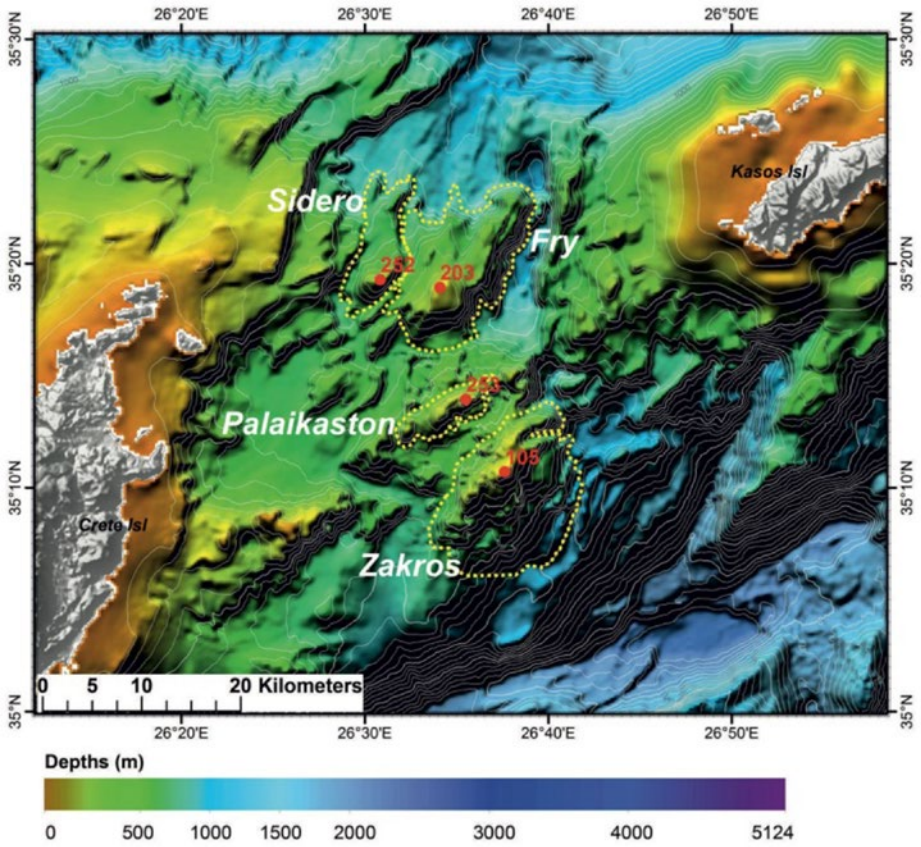


Fig. 2.36. Shaded relief map of the East Cretan Strait mounts area.

The outline and the tops of the observed features are indicated on the map.

4 LIBYAN SEA

The most pronounced geomorphological elements of the Libyan Sea are the following two (Fig. 2.37):

a) the central and eastern sectors of the Hellenic Arc and Trench, extending from off the south-western edge of Crete to the Rhodes Basin and

b) the central and eastern parts of the Mediterranean Ridge

The Hellenic Trench surrounds the outward side of the Hellenic Arc and displays two distinct sectors: The western sector, known as the Ionian Trench (IT) or Matapan Trench[15] that trends NW-SE and extends from the Ionian Islands to the south of Gavdos Island. It is a composite morphological feature characterized by small, discontinuous, NW-SE elongated or spindle-shaped basins with depths exceeding 4000-5000 m and separated by shallower ridges. The NW slopes of the Trench are steep and irregular, with N-S trending ridges advancing towards the south. The SW slopes of the Trench toward the Mediterranean Ridge are less steep. The eastern sector is delineated by three striking features: the WSW-ENE trending Ptolemy Trench south of central Crete, and the WSW-ENE to SW-NE trending Pliny and Strabo Trenches. Complex seafloor topography with shallow ridges and NW-SE trending linear deeps prevails in the areas between the Ptolemy and Pliny Trenches and between the Pliny and Strabo Trenches. The Ptolemy Trench terminates eastward at the NNE-SSW trending Ierapetra graben (depression bounded by normal faults) while the Pliny and Strabo Trenches extend up to the 4000 m deep Rhodes Basin (Fig. 2.37).

The Ptolemy (2500-3700 m) and Pliny (3700-4500 m) Trenches have developed along major transcurrent or strike-slip fault zones on the outer edge of the Aegean crust while the Strabo Trench (3000-3500 m) marks the boundary between the Aegean crust and the Mediterranean Ridge. The rugged topography of the seafloor between the three trenches is the result of the deformation of the crust due to the active tectonic processes in the area.

The majority of the observed seamounts in the Libyan Sea occur between the Ptolemy, Pliny and Strabo Trenches. The **Ptolemy Mountains** and **Chryssi** Seamounts (Fig. 2.38) are located between the Ptolemy and Pliny Trenches. The **Vai, Faistos** and **Olympos** seamounts occur between the Hellenic Arc and the Pliny Trench. The **Strabo Mountains, Knossos** and **Colossus** seamounts occur on the north-western margin of the Strabo Trench (Fig. 2.38).

The shallowest part of the Mediterranean Ridge is known as **Herodotus Rise** or Antaeus High, and is located north of Cyrenaica (Fig. 2.37). Minimum depths of the individual summits on Herodotus Rise are between 1100 and 1200 m below sea-level and increase to > 3200 m and > 2200 m towards the west and east respectively[1].

Numerous mud volcanoes occur on the Mediterranean Ridge (Fig. 2.37) and tend to cluster in groups or mud fields: The main fields of mud volcano occurrence are Pan di Zucchero, Prometheus II, Olimpi, Southern Belt and United Nations. The relationship between their occurrence and the active tectonic elements has been documented in the eastern Mediterranean Sea[2,1].

The morphological characteristics of the 9 main seamounts or groups of seamounts in the Libyan Sea are described below and in (Table 2.4).

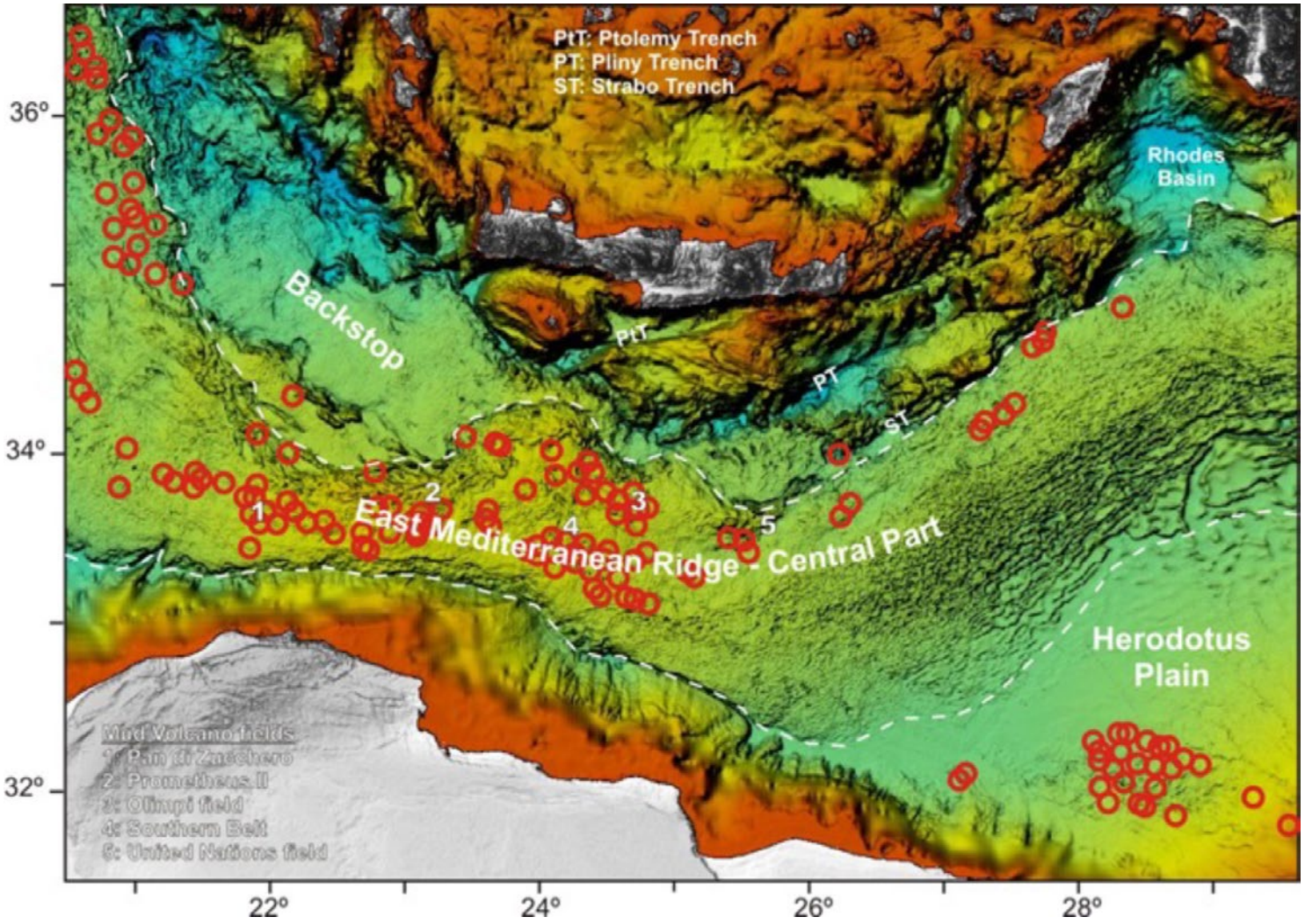


Fig. 2.37. Updated bathymetry of the Libyan Sea. Derived from GEBCO and swath bathymetry data processed at 250 m grid in the framework of EMODNET Bathymetry project (https://emodnet.eu/bathymetry). Red circles: mud volcanoes 11. GT: Gortys Trench, ST: Strabo Trench, PT: Pliny Trench, PtT: Ptolemy Trench. Mud volcano main fields: 1: Pan di Zucchero, 2: Prometheus II, 3: Olimpi, 4: Southern Belt, 5:United Nations.

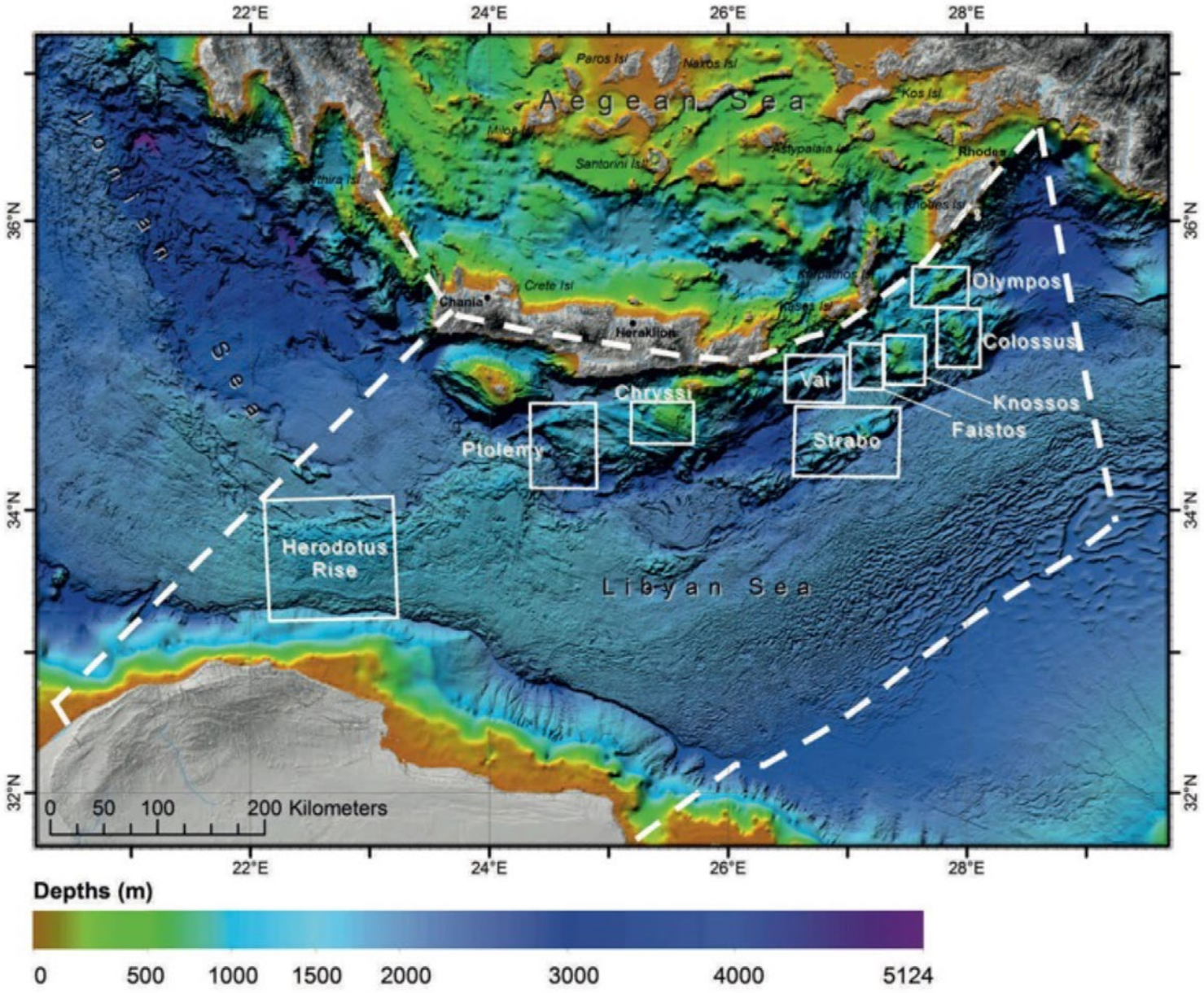


Fig. 2.38. Location of the seamount areas in the Libyan Sea discussed in this chapter.

Table 2.4. Libyan Sea Seamounts and Seamount-like structures.

			Minimum Depth / Location			Maximum Depth / Location				
Group name	Seamount	Area (km²)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Depth Range (m)	Mean Slope (deg)
HERODOTUS RISE	Herodotus Rise	10531.58	33.771151	22.714906	22.714906	33.265767	23.221639	2618	1481	3.17
			33.745559	22.917599	22.917599					
			33.773119	22.601775	22.601775					
PTOLEMY SEAMOUNTS	Ptolemy	1911.01	34.628885	24.562715	24.562715	34.673682	24.421301	3398	2352	7.63
			34.531416	24.534432	24.534432					
CHRYSSI SEAMOUNTS	Chryssi	899.35	34.665893	25.543185	25.543185	34.519712	25.455980	1310	861	3.30
			34.601605	25.302781	25.302781					
VAI SEAMOUNT	Vai	1232.07	34.934187	26.728705	26.728705	34.663946	26.535440	4036	3322	8.20
FAISTOS SEAMOUNT	Faistos	644.27	35.071878	27.143520	27.143520	35.027299	27.039816	3124	2455	10.93
			34.941950	27.178873	27.178873					
KNOSSOS SEAMOUNT	Knossos	1148.29	35.083503	27.412206	27.412206	35.013727	27.275506	2532	2144	6.14
			34.961356	27.475842	27.475842					
COLOSSUS SEAMOUNT	Colossus	1500.41	35.209336	27.944865	27.944865	35.023422	27.831734	2960	2415	6.80
			35.079628	27.966077	717					
OLYMPOS SEAMOUNT	Olympus	872.56	35.524020	27.838805	229	35.658780	28.048569	2483	2254	8.32
			35.514385	27.751600	321					
			35.616451	27.916583	894					
STRABO MOUNTAINS	Strabo	3410.42	34.504104	27.152947	729	34.183492	26.719278	3467	2738	7.47
			34.554819	27.251937	1219					
			34.525564	26.933756	1342					
			34.488493	26.789985	1467					

HERODOTUS RISE (FIG. 2.39)

Feature	Total Area (km²)	▲ Peak Depth (m)	⍓ Base Depth (m)
Herodotus Rise	10531.58	1137, 1262, 1269	2618

Herodotus Rise or Antaeus High is the part of the Mediterranean Ridge with the shallowest depths. It is located north of Cyrenaica and close to the contact to the so-called "backstop", a crustal slice with weak or no deformation which is believed to belong to the overriding Aegean crust.

The minimum depths of the individual summits on Herodotus Rise are between 1100 and 1200 m below the sea-level and increase to > 3200 m and > 2200 m towards the west and east respectively[1].

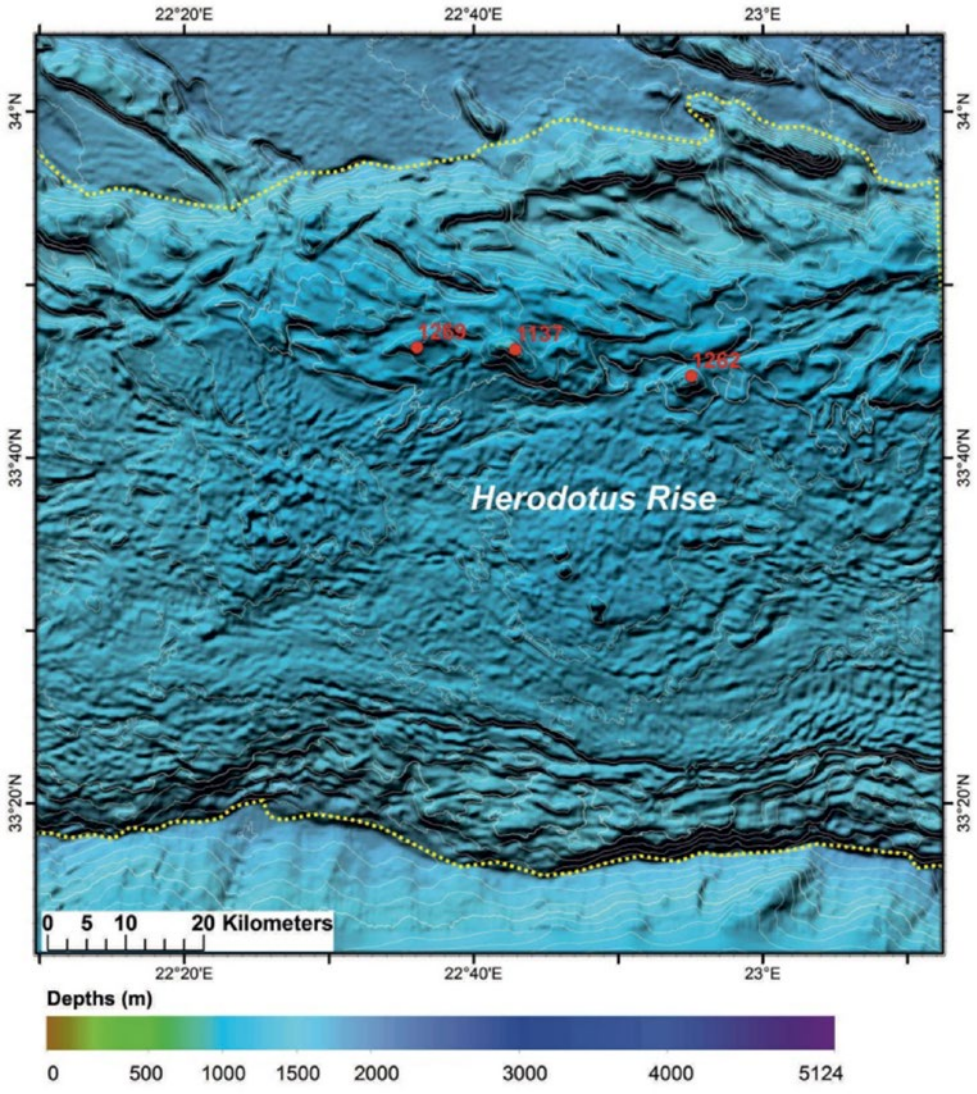


Fig. 2.39. Shaded relief map of Herodotus rise area.

The outline and the tops of the observed features are indicated on the map.

PTOLEMY SEAMOUNT (FIG. 2.40)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Ptolemy Seamount	1911.01	1046, 1117	3398

Ptolemy seamount is located on the south-western edge of the ENE-WSW trending tectonic slice which is uplifted between the Ptolemy Trench to the North and the Pliny Trench to the South. It results from the conjunction of two ridges. The first one is oriented in a ENE-WSW direction, parallel to the tectonic direction of the Ptolemy and Pliny Trenches and its shallowest summit is located at a depth of 1046 m. The second ridge runs in a NW-SE direction, parallel to the tectonic direction of the Ionian Trench. The shallowest summit of the latter is at a depth of 1117 m.

The northern and western flanks of the seamount are very steep and dip down to the > 3500 m deep basins of the Ptolemy and Ionian Trenches. The geological basement is believed to outcrop on the seafloor of both the flanks and the highest parts of the seamount.

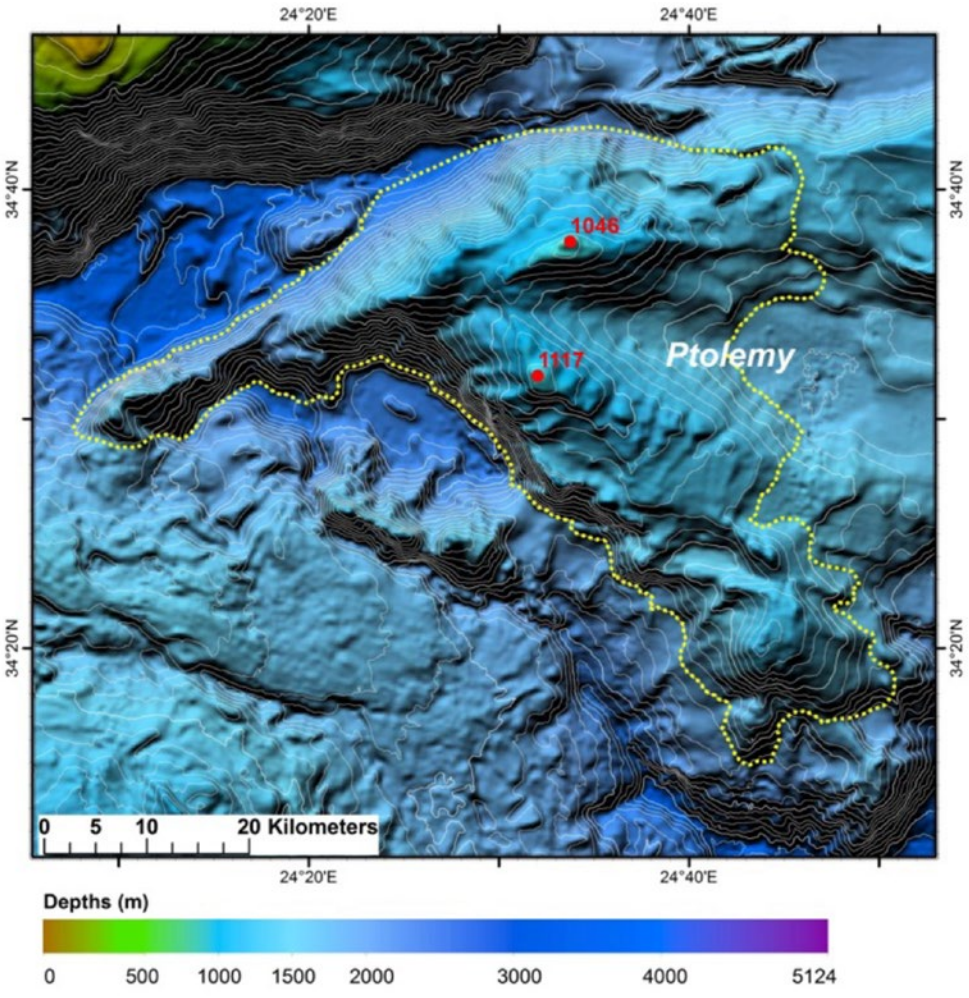


Fig. 2.40. Shaded relief map of Ptolemy Seamount area.

The outline and the tops of the observed features are indicated on the map.

CHRYSSI SEAMOUNTS (FIG. 2.41)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Chryssi Seamounts	899.35, 244.09	449, 955	1310

The Chryssi seamounts are located southwest of Chryssi Island, on the ENE-WSW trending tectonic fragment which is uplifted between the Ptolemy Trench to the North and the Pliny Trench to the South.

It is a large elliptical seamount, with its long axis trending NW-SE it is separated from Chryssi Island by an 800 m deep neck. Its shallowest summit is at a depth of 449 m while the scarps that run across the seamount in an E-W and NW-SE direction indicate enhanced tectonic activity along active faults. A high resolution seismic profiling survey in that area has shown that the gently sloping parts of the seamount are covered by Quaternary sediments.

A 25 km long, NW-SE oriented, narrow ridge is located southwest of the previous seamount and is separated from it by a 1200 m deep valley. The shallowest point of its crest rises at a depth of 955 m. Both flanks of the ridge display high dip values and are probably controlled by active faults.

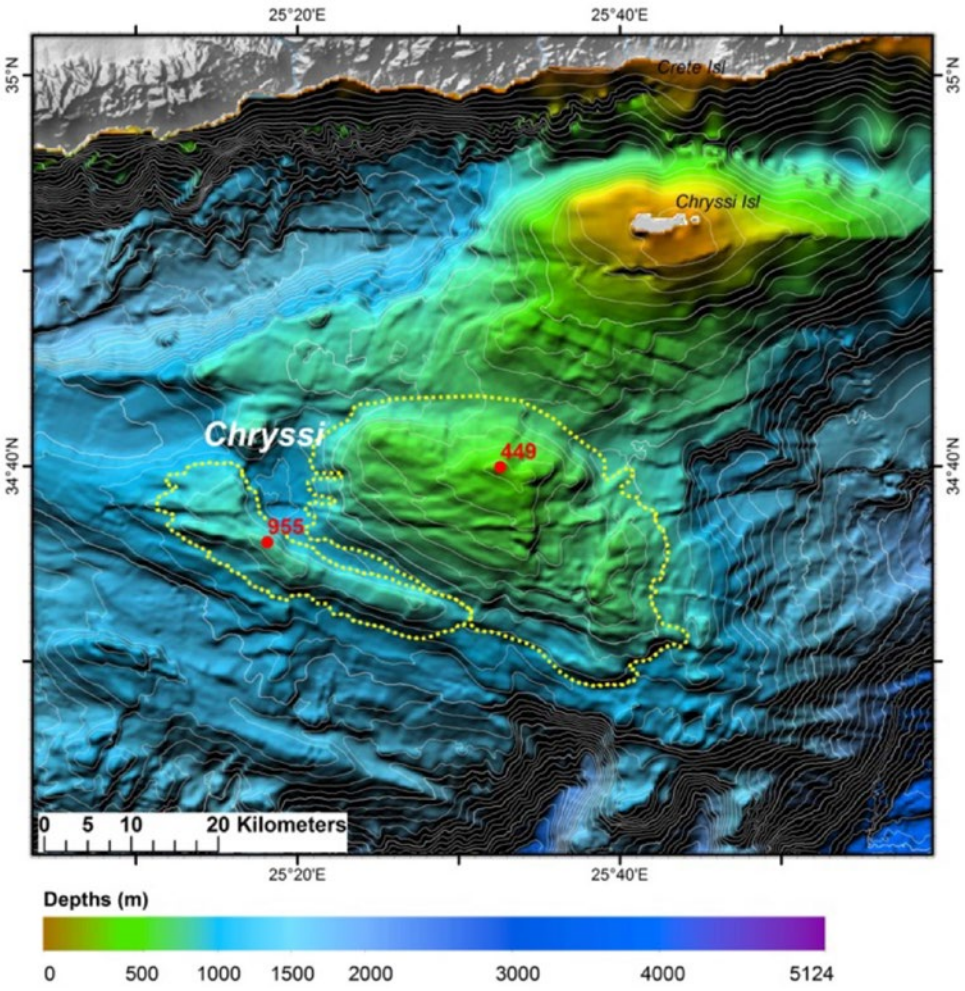


Fig. 2.41. Shaded relief map of Chryssi Seamount area.

The outline and the tops of the observed features are indicated on the map.

VAI SEAMOUNT (FIG. 2.42)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Vai Seamount	1232.07	714	4036

Vai Seamount is located between the base of the slope of the Hellenic Arc and the Pliny Trench. It displays a spindle shape with its long axis oriented in a NE-SW direction. The steep slopes of the seamount rise from a depth of > 3500 m to its summit at 714 m deep. Vai Seamount is named after the palm tree forest in Vai, a picturesque locality on the coast of Eastern Crete.

FAISTOS, KNOSSOS SEAMOUNTS (FIG. 2.42)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Faistos	644.27	669, 813	3124
Knossos	1148.29	388, 651	2532

The two seamounts, Faistos and Knossos are named after the Minoan archaeological sites of Crete. These are located between the steep slope of the Hellenic Arc and the Strabo Trench in an area where Pliny Trench fades out.

Faistos seamount rises from a depth of about 3000 m to its highest summit at 669 m. The second highest point is at a depth of 813 m.

Knossos seamount displays a dual character with two main morphological highs; the northern one rises at a depth of 388 m, and the southern one at 651 m.

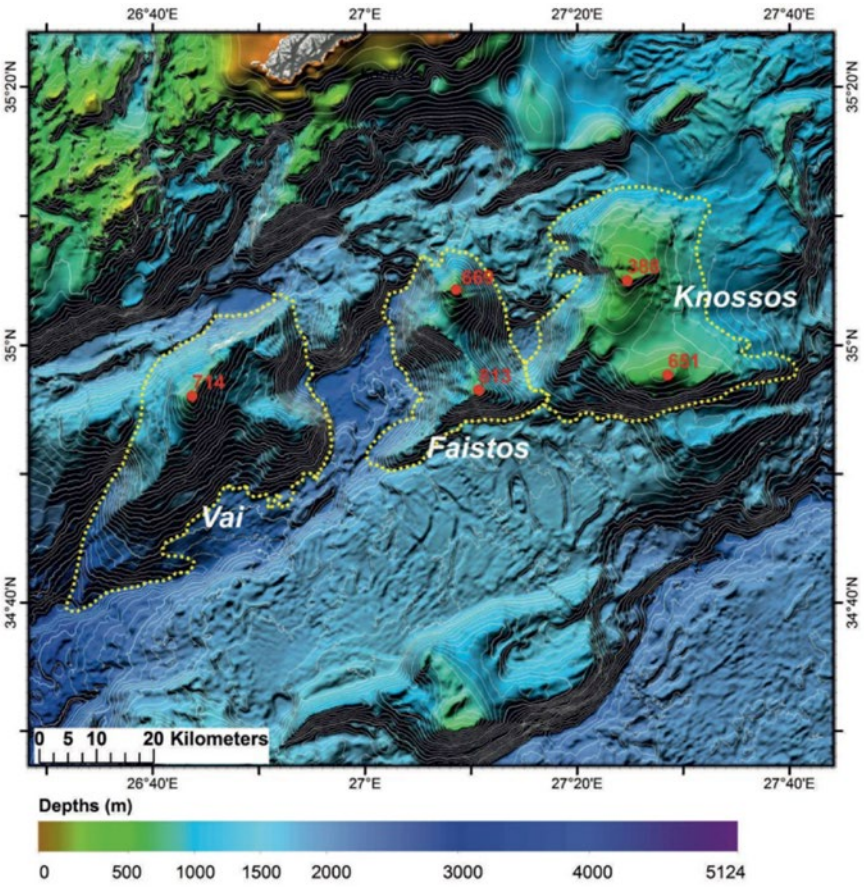


Fig. 2.42. Shaded relief map of Vai, Faistos and Knossos Seamount area.

The outline and the tops of the observed features are indicated on the map.

COLOSSUS SEAMOUNT (FIG. 2.43)

Feature	Total Area (km²)	▲ Peak Depth (m)	◩ Base Depth (m)
Colossus Seamount	1500.41	545	2960

Colossus Seamount is named after the famous statue of Colossus in the ancient city of Rhodes, which collapsed during a large earthquake in 227 BCE and has never been found. The base of the seamount displays an irregular shape and varies in depth between 1500 m and 2600 m. The main highest part of the seamount is aligned in a NNW-SSE direction. The depth of the crest ranges between 700 and 600 m and the two highest summits rise at 545 m and 717 m. The rugged topography of the seamount indicates that the rocky basement is exposed on the seafloor and has undergone extensive tectonic erosion.

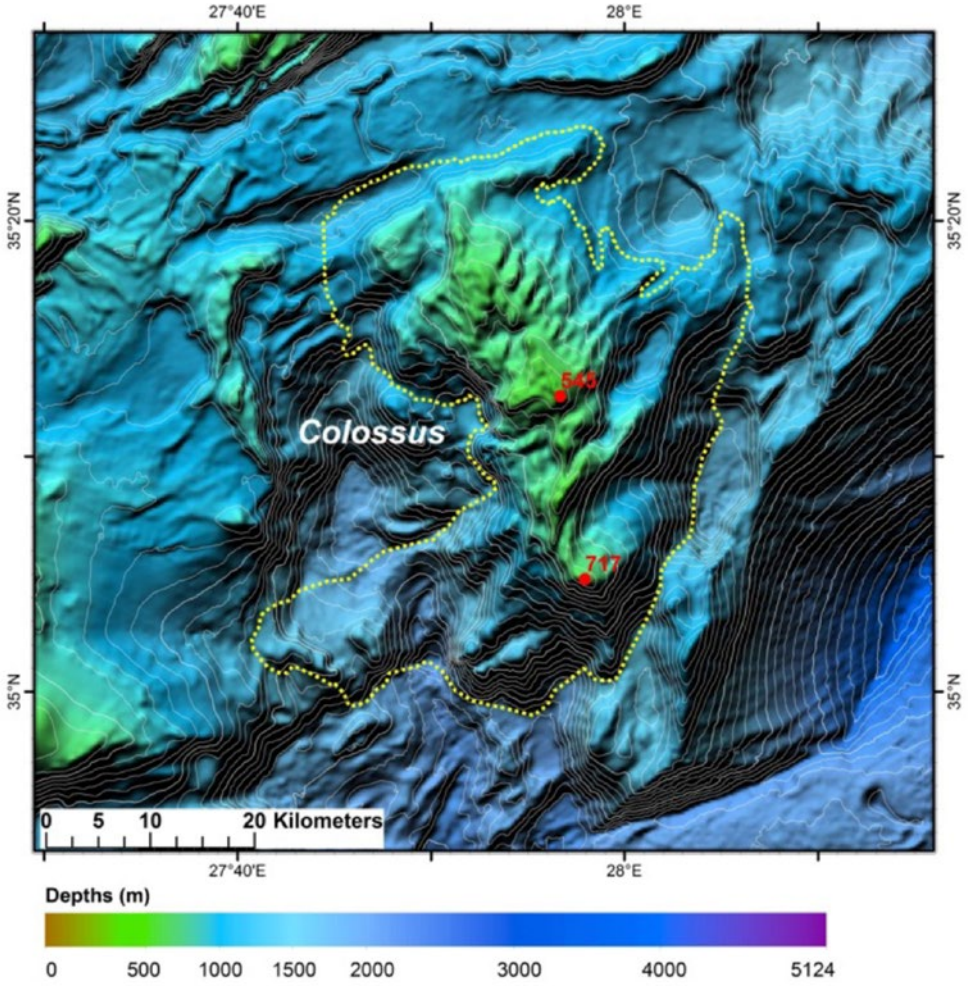


Fig. 2.43. Shaded relief map of Colossus Seamount area.

The outline and the tops of the observed features are indicated on the map.

OLYMPUS RIDGE (FIG. 2.44)

Feature	Total Area (km²)	▲ Peak Depth (m)	◩ Base Depth (m)
Olympus Ridge	872.56	229	2483

Olympus Ridge is a 40 km long, narrow ridge aligned in a NE-SW direction, parallel to the main tectonic direction of the eastern sector of the Hellenic Trench. It is located east of Karpathos Island and is named after the traditional village of Olympus in the northern part of the island. The two highest summits on the crest of the ridge rise at a depth of 229 m and 321 m. The south-eastern flanks of the ridge rise from a depth of 2000-2400 m. The base of the north-western slopes lies at a depth of roughly 1000-1300 m. The topography of the ridge indicates a rocky seafloor with restricted deposition of recent sediments.

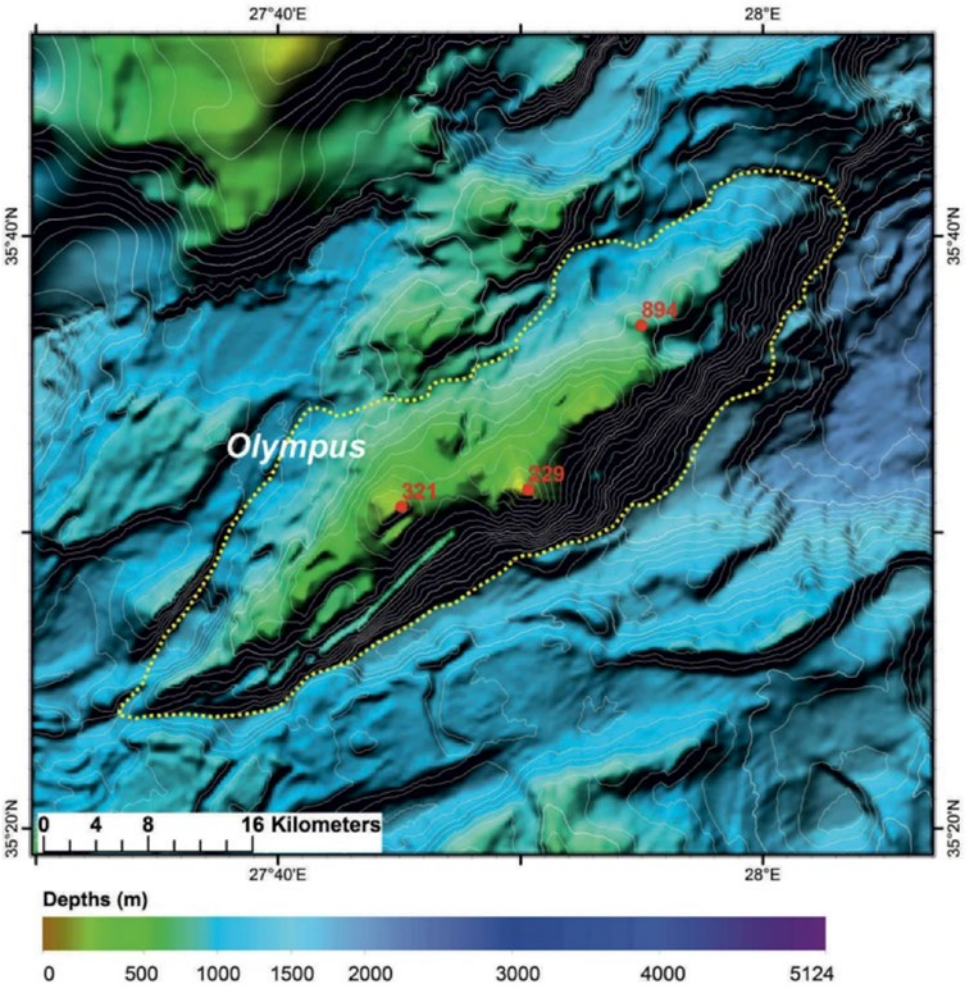


Fig. 2.44. Shaded relief map of Olympus Ridge area.

The outline and the tops of the observed features are indicated on the map.

STRABO MOUNTAINS (FIG. 2.45)

Feature	Total Area (km²)	▲ Peak Depth (m)	◩ Base Depth (m)
Strabo mountains	3410.42	729	3467

The **Strabo mountains** represent an elongated area along the Strabo Trench, which displays enhanced positive topography with numerous morphological highs and ridges. The shallowest point in the Strabo mountains is at a depth of 729 m. Many other highs are found at depths between 1400 and 1200 m. The south-eastern flanks of the mountains dip down to the Strabo Trench at a depth of 3000-4000 m. The north-western flanks rise from a wide, relatively smooth plateau at a depth of 2000-2200 m. It is assumed that the rocky basement is exposed at the highest points of the Strabo mountains in areas with rugged or steep topography.

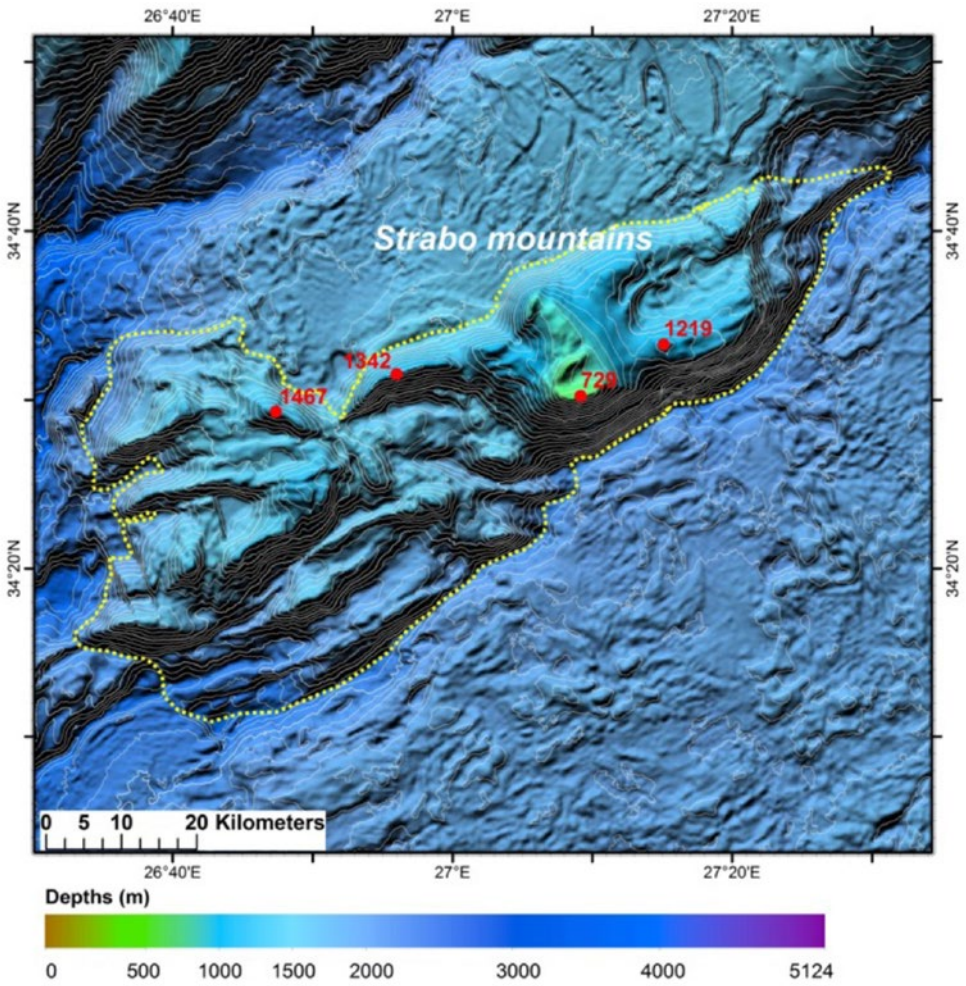
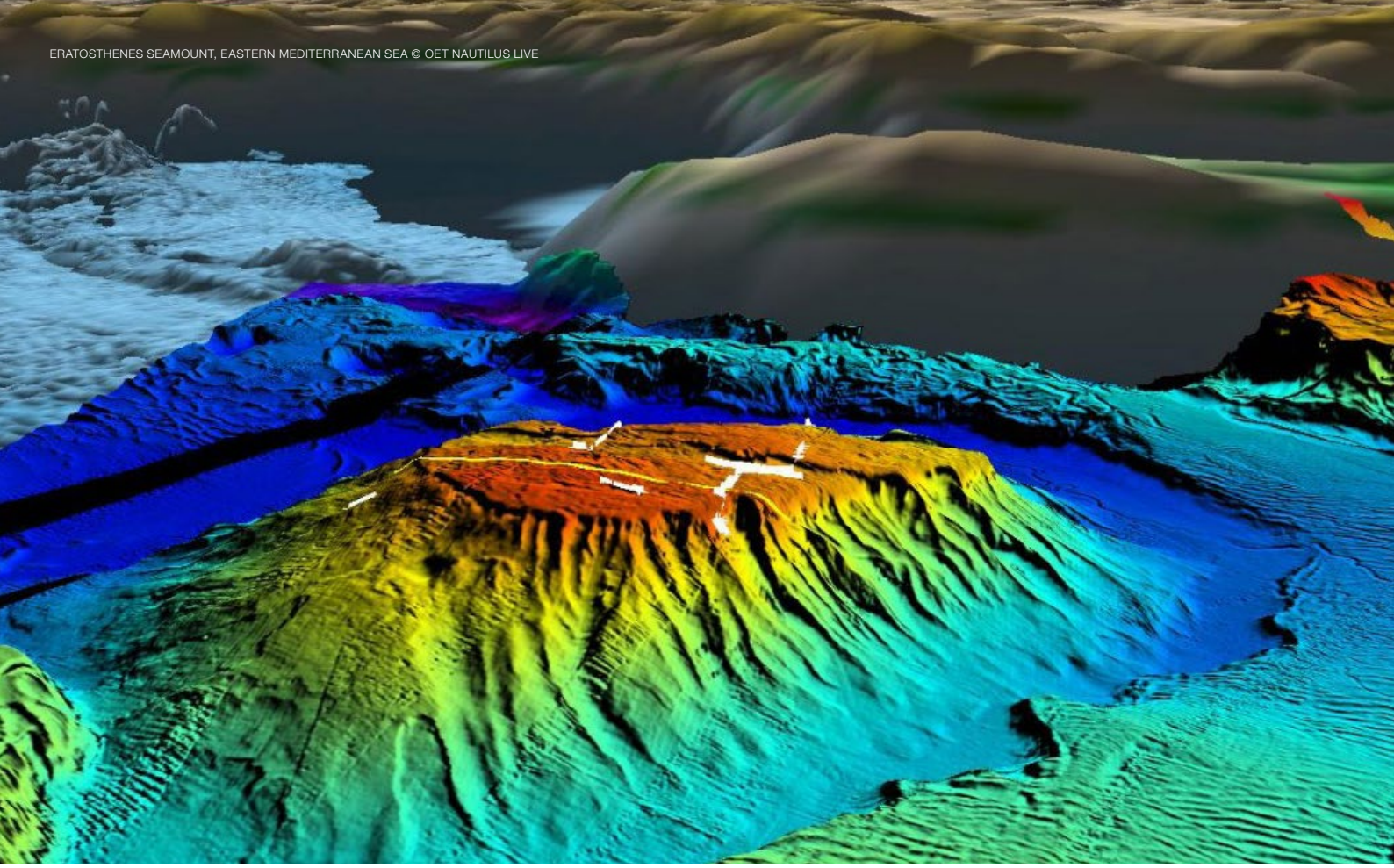


Fig. 2.45. Shaded relief map of Strabo Mountains area.

The outline and the tops of the observed features are indicated on the map.



ERATOSTHENES SEAMOUNT, EASTERN MEDITERRANEAN SEA © OET NAUTILUS LIVE

5 LEVANTINE SEA

The Eastern Mediterranean is divided by the Cyprus Arc in two, geologically and morphologically distinct areas (Fig. 2.46). The northern part includes the area between the southern coast of Turkey and the Cyprus Arc. The latter delineates the active deformation front between the African and Anatolian Plates in the Eastern Mediterranean. It extends from the Anaximander Mountains in the West over the Florence Rise and the southern margin of Cyprus to the coast of Syria near Latakia in the East. The southern part of the Eastern Mediterranean, which from the Neogene is involved in northward subduction below the Cyprus Arc, comprises two major basins, the Herodotus and Levant-Phoenician basins, with the Eratosthenes seamount located in between them.

The southern margin of the east Mediterranean is dominated by the impressive deep-sea fan of the Nile. The eastern coast of the Levantine Sea follows the trace of the N-S trending Dead Sea Fault, a major strike-slip fault which facilitates the northward motion of the Arabian plate compared to the African plate. The rate of convergence between the Eastern Mediterranean lithosphere and the Cyprus margin is **about 1 cm/yr**. Between Cyprus and the Nile Deep-sea Fan, the **Eratosthenes seamount**, the largest seamount in the Mediterranean Sea, constitutes a major, positive morphological feature rising above the seafloor of the Herodotus and Levant basins. The involvement of the continental block of the Eratosthenes seamount into the subduction zone and its incipient collision with the Cyprus margin may have also played a role in the deformation of the Cyprus Arc[16,17,18].

The majority of the seamounts described here (Fig. 2.47) are associated with the Cyprus Arc and the complex tectonic deformation along it, which is associated with the convergence of the northward moving African plate and the Anatolian continental block. **Anaximander Mountains** and **Florence Rise** are located on the western sector of the arc, while **Hecataeus** and **Cavo Greco** mounts along with the **Latakia Ridge** are located along the eastern sector of the arc. The Kas and Bilim mounts and the Rizokarpasso or Karpass Ridge are located behind the Cyprus Arc, on the overriding plate.

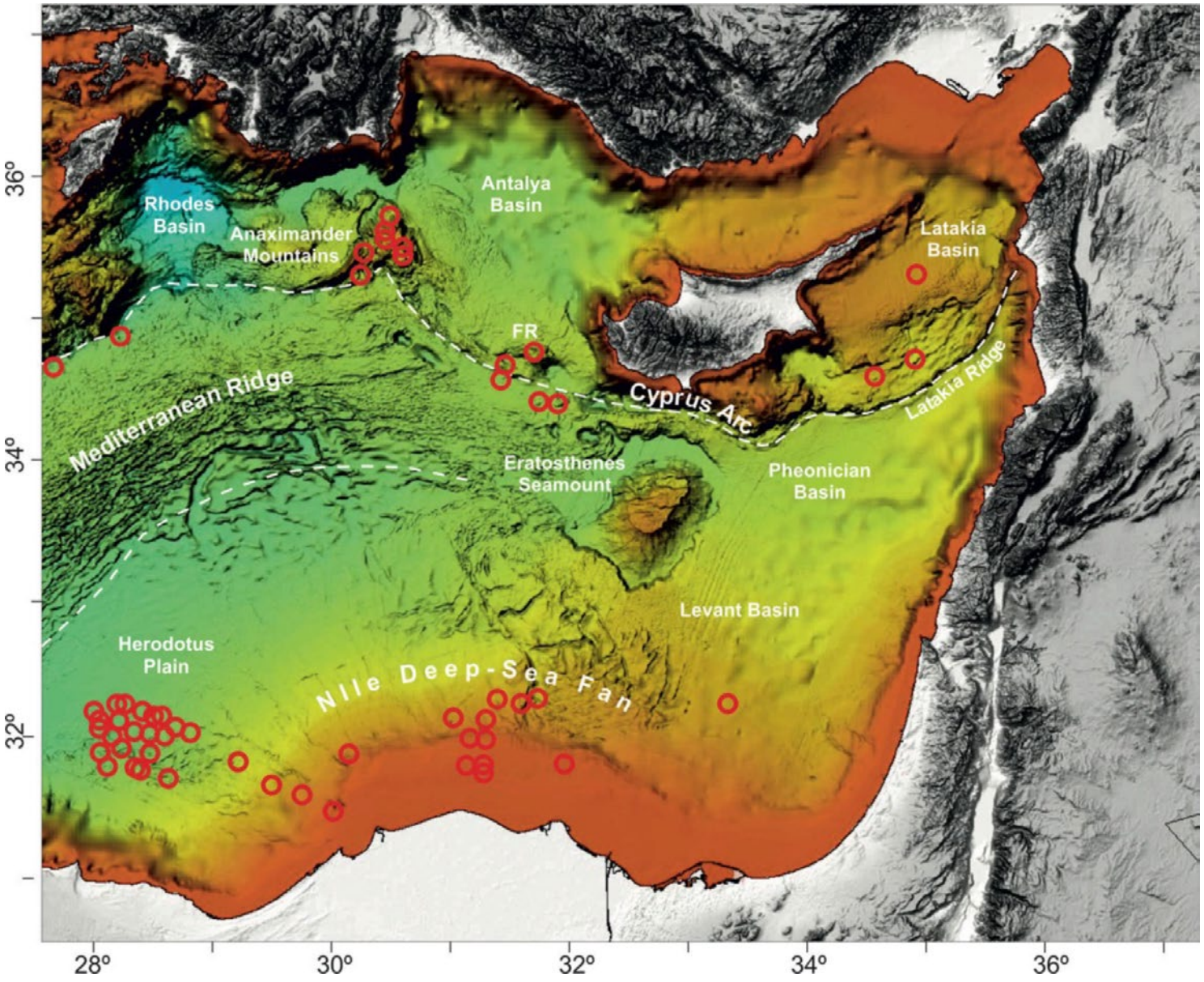


Fig. 2.46. Bathymetry of the Levantine Sea. Derived from GEBCO and swath bathymetry data processed at 250 m grid in the framework of EMODNET Bathymetry project. Red circles: mud volcanoes[11].

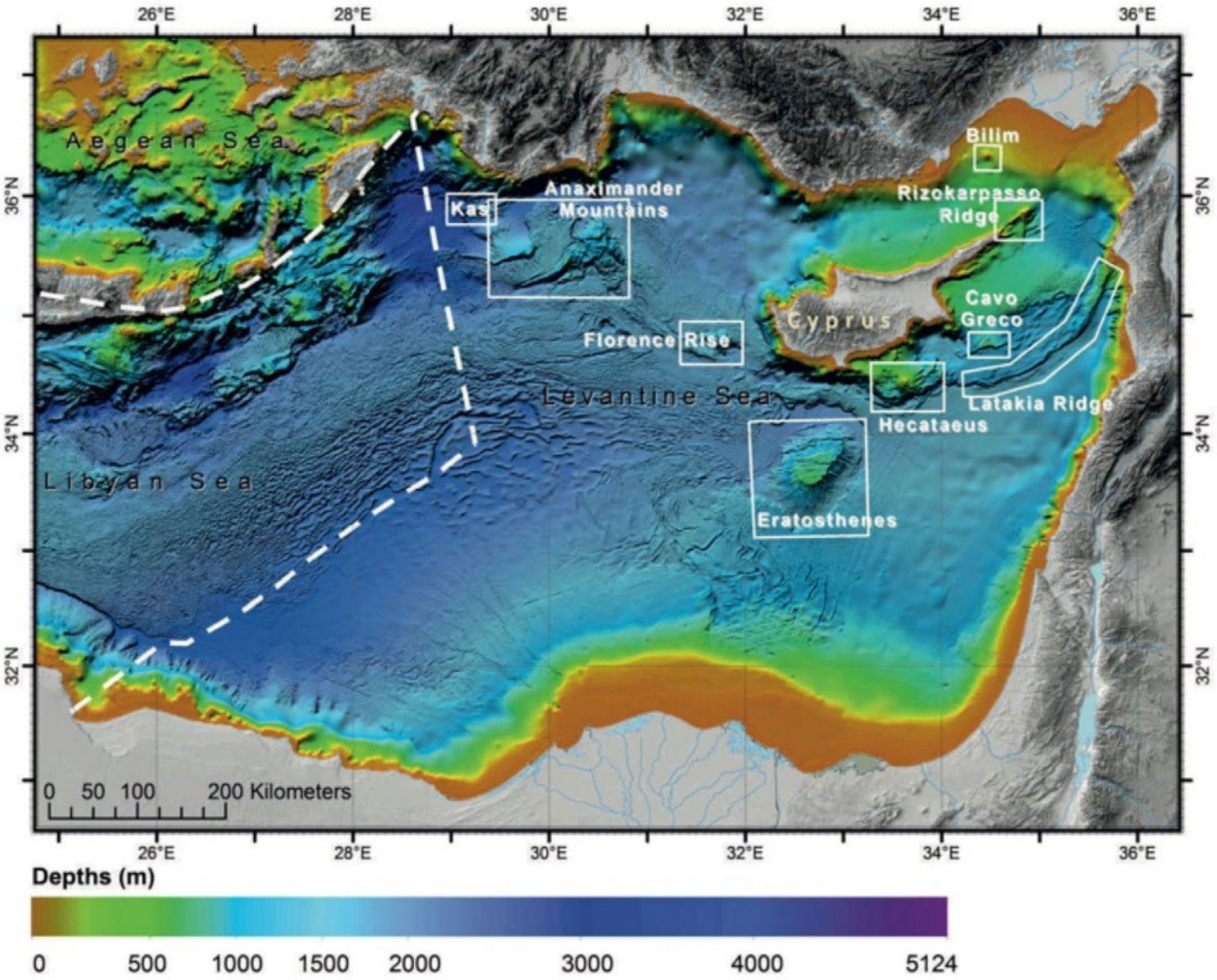


Fig. 2.47. Location of the seamounts areas in the Levantine Sea discussed in this chapter.

Table 2.5. Levantine Sea Seamounts and Seamount-like structures.

			Minimum Depth / Location			Maximum Depth / Location				
GROUP NAME	Seamount	Area (km^2)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Latitude (Dec. Deg)	Longitude (Dec. Deg)	Depth (m)	Depth Range (m)	Mean Slope (deg)
KAS SEAMOUNT	Kas	932.73	35.883510	29.295369	1950	35.977437	28.838130	4474	2524	6.42
ANAXIMANDER MOUNTAINS	Anaxagoras Mountain	1867.90	35.670320	30.518599	919	35.824028	30.377185	2610	1691	5.46
	Anaximander Ridge	597.55	35.508604	29.783247	1102	35.512458	29.111531	3123	2021	9.01
	Anaximenes Ridge	1936.46	35.427622	30.160351	678	35.249947	29.842169	3124	2446	6.94
FLORENCE RISE	Florence Rise	685.76	34.813758	31.664052	1573	34.734022	31.887958	2619	1046	4.67
BILIM SEAMOUNT	Bilim	154.22	36.332951	34.473476	39	36.300526	34.447550	355	316	2.00
HECATAEUS SEAMOUNT	Hecataeus	1791.86	34.445548	33.639134	230	34.236361	33.518932	2117	1887	4.20
CAVO GRECO SEAMOUNT	Cavo Greco	323.25	34.749586	34.442837	791	34.673682	34.324992	1554	763	4.81
RIZOKARPASSO (KARPAS) RIDGE	Rizokarpasso Ridge	522.72	35.800991	34.735092	85	35.829787	34.914217	802	717	4.53
			35.881592	34.883577	104					
LATAKIA RIDGE	Latakia Ridge	2838.92	35.412188	35.713205	153	34.396720	34.251928	2073	1920	4.10
			34.449453	34.336776	1067					
			34.665893	35.072129	1172					
ERATOSTHENES SEAMOUNT	Eratosthenes	9487.06	33.619455	32.658664	771	33.696322	32.248563	2724	1953	3.01

KAS SEAMOUNT (FIG. 2.48)

Feature	Total Area (km²)	▲ Peak Depth (m)	◩ Base Depth (m)
Kas seamount	932.73	1950	4474

Kas seamount is located at the base of the slopes off Kas village, on the eastern margin of the 4000 m deep Rhodes Basin. It is an E-W elongate mount with steep slopes towards the North and South. The highest summit of the seamount rises at a depth of 1950 m, roughly 1000-1500 m higher than the surrounding seafloor.

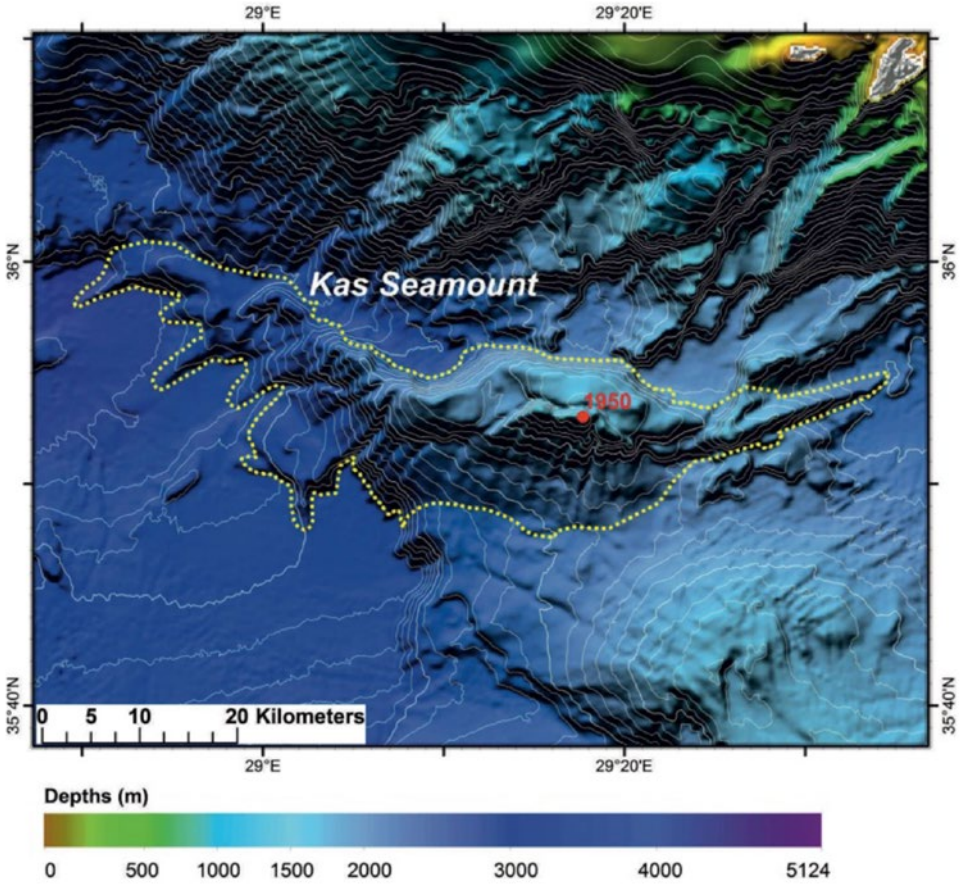


Fig. 2.48. Shaded relief map of Kas seamount area.

The outline and the tops of the observed features are indicated on the map.

ANAXIMANDER MOUNTAINS (FIG. 2.49)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩘ Base Depth (m)
Anaxagoras Mountain	1867.90	919	2610
Anaximander Ridge	597.55	1102	3123
Anaximenes Ridge	1936.46	678	3124

The **Anaximander Mountains** comprise a group of three main, positive morphological features, two ridges and one seamount, located at the junction between the Hellenic and the Cyprus Arc, east of the 4000 m Rhodes Basin. Based on their geology, they are described as large faulted and tilted continental blocks that originally were part of SW Anatolia and were detached from it and involved into complicated tectonics related to the convergence between the African plate and the Anatolian continental block[19,20,210].

Anaximander and Anaximenes Ridges can be correlated with the neritic limestone of the Bey Daglari Unit of SW Turkey[22,23], whereas the Anaxagoras SM is a continuation of the Antalya Nappes Complex[19,24,24]. The “Great Slide”, an extensive multi-lobe, north and south-westward flowing mass flow unit with impressive flow structures imprinted on the morphology of the seafloor separates Anaximander Ridge to the West from Anaximenes Ridge and Anaxagoras Seamount to the east sea mounts[20,24].

Anaximander Ridge is an 80 km long, E-W oriented, narrow ridge bounded by steep slopes which rise from a minimum depth of at least 2000 m. The highest point on the crest is at a depth of 1102 m at the easternmost part of the ridge.

Anaximenes Ridge is a concave, SW-NE oriented ridge located east of Anaximander Ridge and in contact with Anaxagoras Seamount towards the northeast. With a depth of 678 m the summit of Anaximander Ridge is the shallowest point in the entire Anaximander Mountains.

Anaxagoras Seamount rises at a depth of 919 m, more than 1500 m higher than the surrounding seafloor.

Both Anaximander Ridge and Anaxagoras Seamount are characterized by many active or dormant mud volcanoes which often occur as small mounts protruding a couple of hundred metres higher than the seafloor[20,25,26]. However, the highest parts of the Anaximander Mountains are believed to be built of the geological basement of the area.

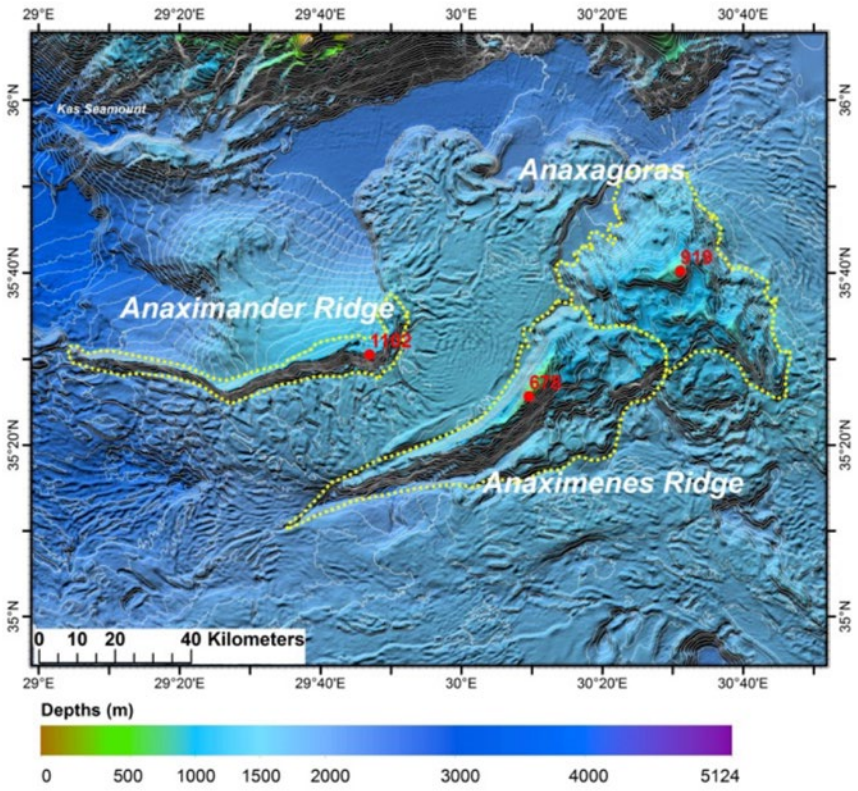


Fig. 2.49. Shaded relief map of Anaximander Mountains area.

The outline and the tops of the observed features are indicated on the map.

FLORENCE RISE (FIG. 2.50)

Feature	Total Area (km²)	▲ Peak Depth (m)	◩ Base Depth (m)
Florence Rise	685.76	1573	2619

The Florence Rise (or Ridge) is a submarine feature extending from the island of Cyprus in the southeast to the Anaximander Mountains in the northwest and forms the western sector of the Cyprus Arc[27,28]. It separates the deep Levantine basin to the south from the Antalya Basin to the north. The ridge is characterized by relatively low relief developed along a dextral, arc-parallel fault-zone which accommodates the oblique convergence between the African and Anatolian plates.

A marked topographic high, the **Florence Rise**, is located at a short distance west of the western coast of Cyprus. It displays an asymmetric rhomboid shape, elongated in an E-W direction, and rises from the 2200-2300 m deep seafloor to a minimum depth of 1573 m.

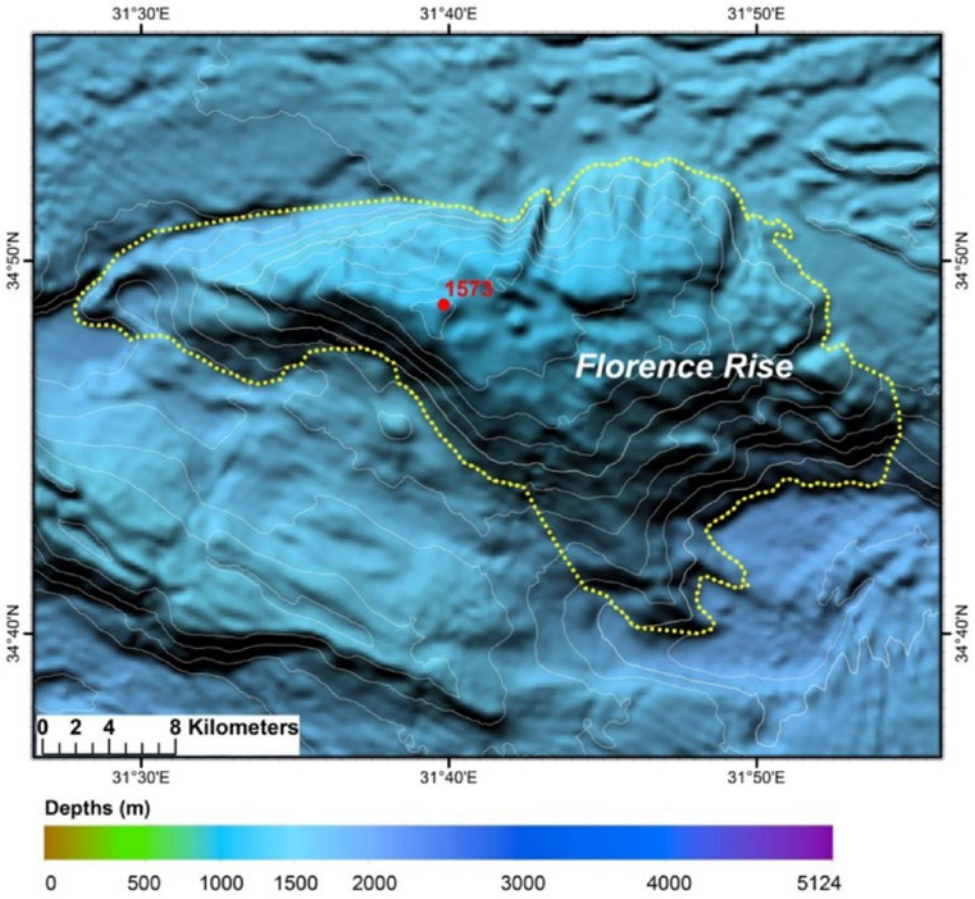


Fig. 2.50.
Shaded relief map of Florence Rise area.

The outline and the tops of the observed features are indicated on the map.

BILIM BANK (FIG. 2.51)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Bilim Bank	154.22	39	355

Bilim Bank is located on the upper slope of the Mersin Gulf off SE Turkey. It displays a rather circular shape with its base at 200 m in the north and > 400 m in the south with its summit at a depth of 39 m. Precise bathymetric data are not available from the area, thus the exact shape and depth of Bilim Bank will be better defined in the future.

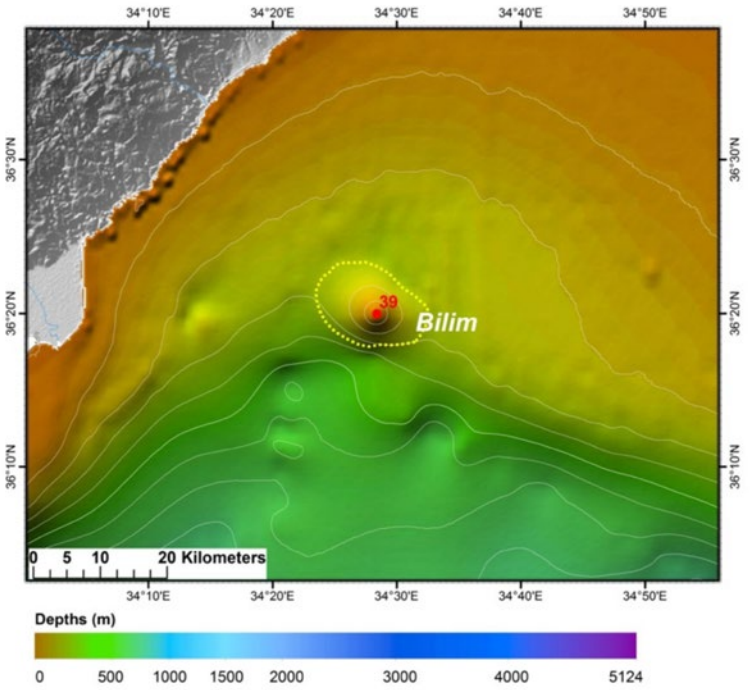


Fig. 2.51. Shaded relief map of Bilim mount area.

The outline and the tops of the observed features are indicated on the map.

HECATAEUS SEAMOUNT (FIG. 2.52)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Hecataeus Seamount	1791.86	230	2117

Hecataeus Seamount is a continental block belonging to the southern margin of Cyprus. It is located south of Larnaca and marks the shallowest underwater feature along the Cyprus Arc. It is connected with Cyprus through a 500-600 m deep, wide plateau, while its summit rises at a depth of 230 m. The southern flanks of the seamount dip steeply toward the 1800-2000 m deep Levantine Basin while the western and eastern flanks rise gently from a depth of 1000-1100 m.

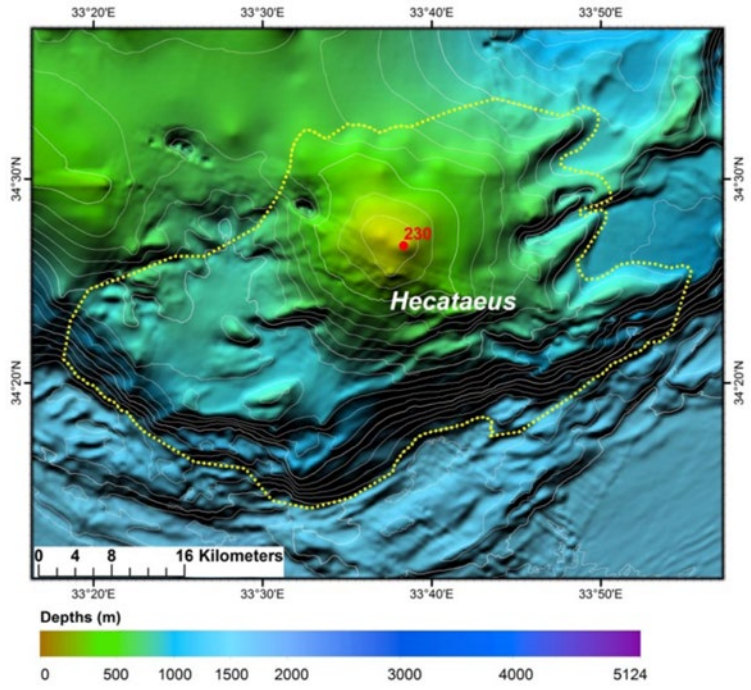


Fig. 2.52. Shaded relief map of Hecataeus seamount area.

The outline and the tops of the observed features are indicated on the map.

CAVO GRECO SEAMOUNT (FIG. 2.53)

Feature	Total Area (km²)	▲ Peak Depth (m)	⬏ Base Depth (m)
Cavo Greco Seamount	323.25	791	1554

Cavo Greco is a triangular mount located southeast of the homonymous cape at the south-eastern tip of Cyprus. It displays asymmetric relief with steep slopes rising from a depth of around 1300 m to the 791 m shallow summit. The northern flanks dip gently to a depth of 1000 m.

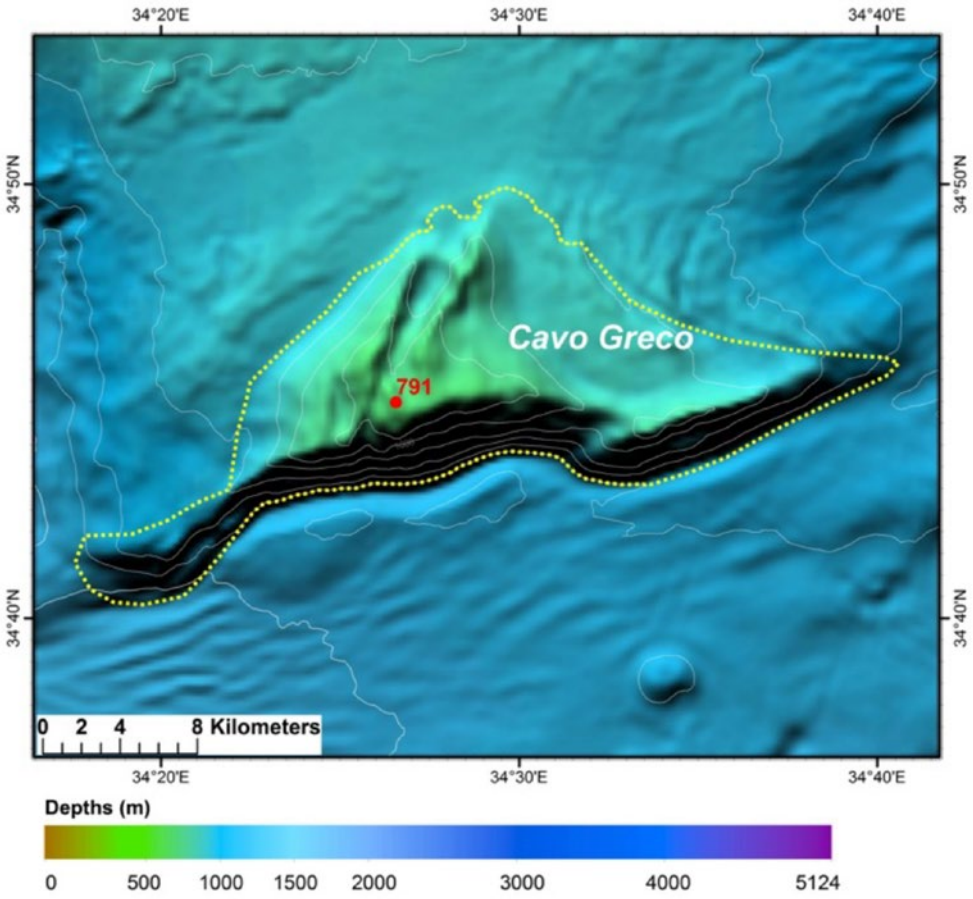


Fig. 2.53. Shaded relief map of Cavo Greco seamount area.

The outline and the tops of the observed features are indicated on the map.

RIZOKARPASSO (KARPAS) RIDGE (FIG. 2.54)

Feature	Total Area (km²)	▲ Peak Depth (m)	⩍ Base Depth (m)
Rizokarpasso (Karpas) Ridge	522.72	85	802

Rizokarpasso or Karpas Ridge is located on the north-eastern prolongation of the Rizokarpasso Peninsula in NE Cyprus. It is a > 20 km long ridge with a narrow crest occurring at a depth of 200 m. The two shallowest points of the ridge are found at depths of 85 m and 104 m. The south-eastern and eastern flanks of the ridge rise from the 1000-1100 m deep Latakia Basin. The base of the north-western flanks lies on the 500 m deep, flat seafloor.

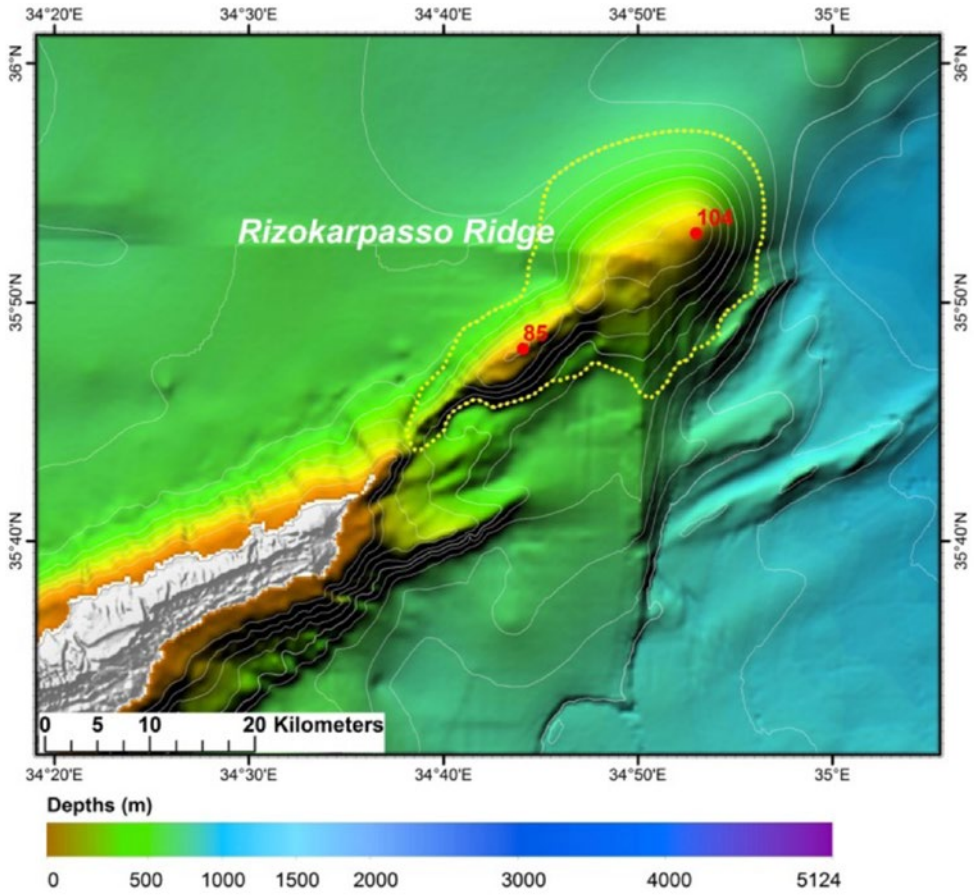


Fig. 2.54. Shaded relief map of Rizokarpasso (Karpas) ridge area.

The outline and the tops of the observed features are indicated on the map.

LATAKIA RIDGE (FIG. 2.55)

Feature	Total Area (km²)	▲ Peak Depth (m)	⍓ Base Depth (m)
Latakia Ridge	2838.92	1067, 1172	2073

Latakia Ridge marks the eastern sector of the Cyprus Arc. It displays a concave shape and extends from the Hecataeus Seamount in the southwest to Latakia in Syria in the northeast. Latakia Ridge connects the Cyprus Arc with the sinistral East Anatolian Fault towards the northeast and represents the plate boundary with the Levantine Basin[29,30]. The north-eastern part of the ridge, off Syria, deepens gradually towards the southwest from < 100 m to > 1000 m. It forms a morphological escarpment facing southwards with the shallowest point of its crest located at depths of 1172 m and 1067 m. The latter is located at the western end of the ridge and is also described as **Hecataeus Ridge**. Its southern flank is roughly 1000 m high while the base of the northern flank dips down to a depth of 1500 m.

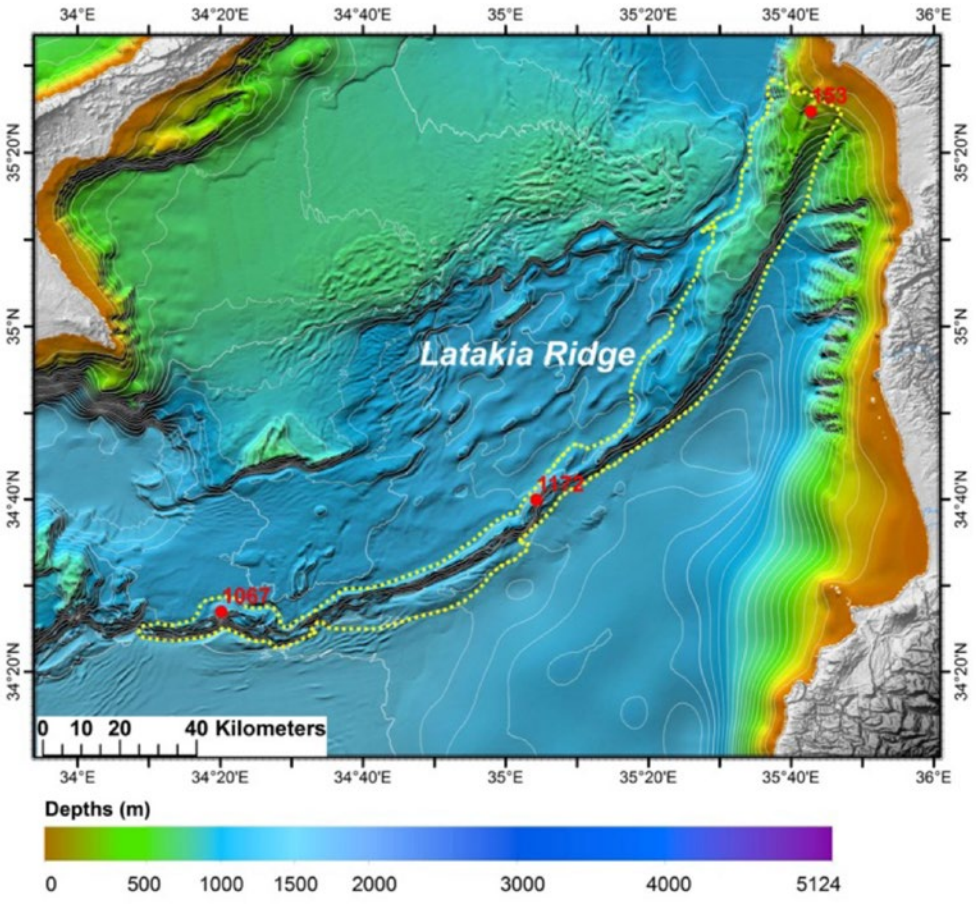


Fig. 2.55. Shaded relief map of Latakia ridge area.

The outline and the tops of the observed features are indicated on the map.

ERATOSTHENES SEAMOUNT (FIG. 2.56)

Feature	Total Area (km²)	▲ Peak Depth (m)	◩ Base Depth (m)
Eratosthenes Seamount	9487.06	1067, 771	2724

The Eratosthenes Seamount is an isolated, continental block hosting a Mesozoic carbonate platform. It belongs to the most extensively studied geological and geomorphological features in the Mediterranean Sea. The top of the seamount was exposed during the Messinian salinity crisis and has experienced several phases of emergence and submergence in older geologic times[31,32,33].

The Eratosthenes Seamount is a trapezoidal table mount (guyot). The base of the seamount is 102 km long in a NE-SW direction and 76 km wide in a NW-SE direction. The depth of the seamount's base increases from roughly 2000 m in the south to 2600 m in the west and north. The shallow plateau on the top extends over an area of 45 km long in a NE-SW direction and 28 km wide in a NW-SE direction with its depth ranging between roughly 800 m and 1100 m. The shallowest point on the shallow plateau is located at a depth of 771 m. The seamount is crosscut by several E-W running, normal faults which offset the flat top downwards toward the north. The faulting is associated with the progressive deformation induced by the involvement of Eratosthenes into the subduction below and incipient collision with the Cyprus Arc.

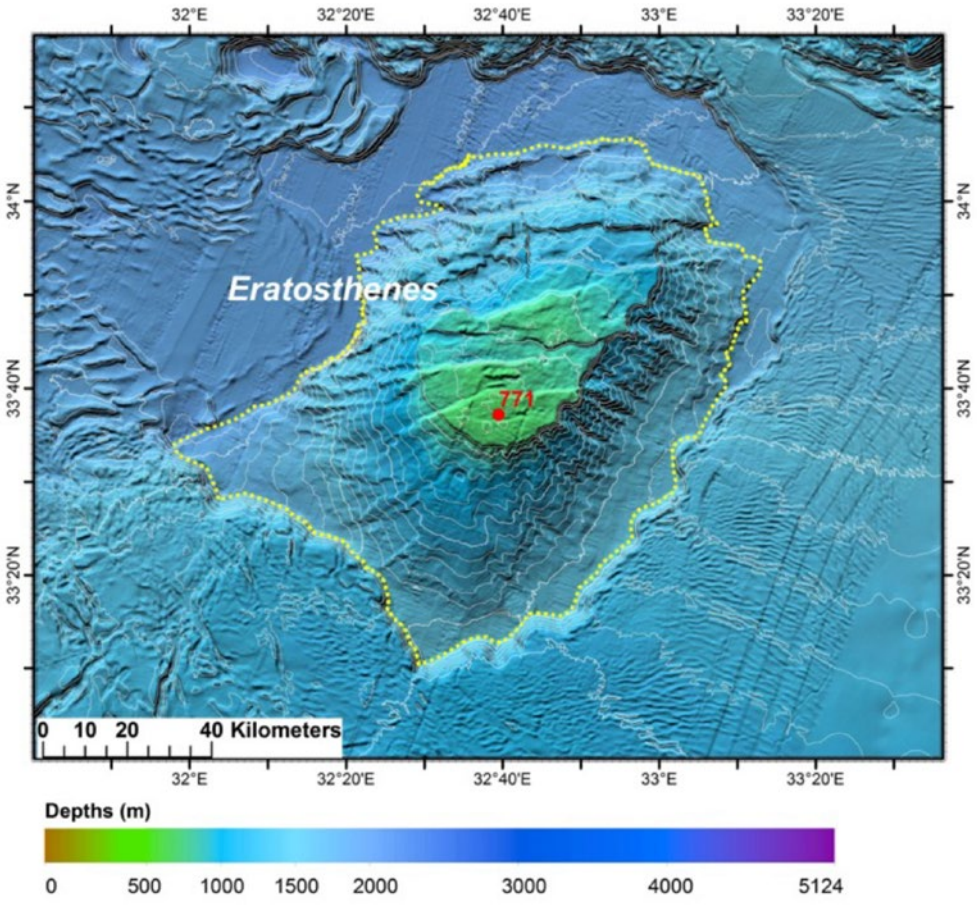
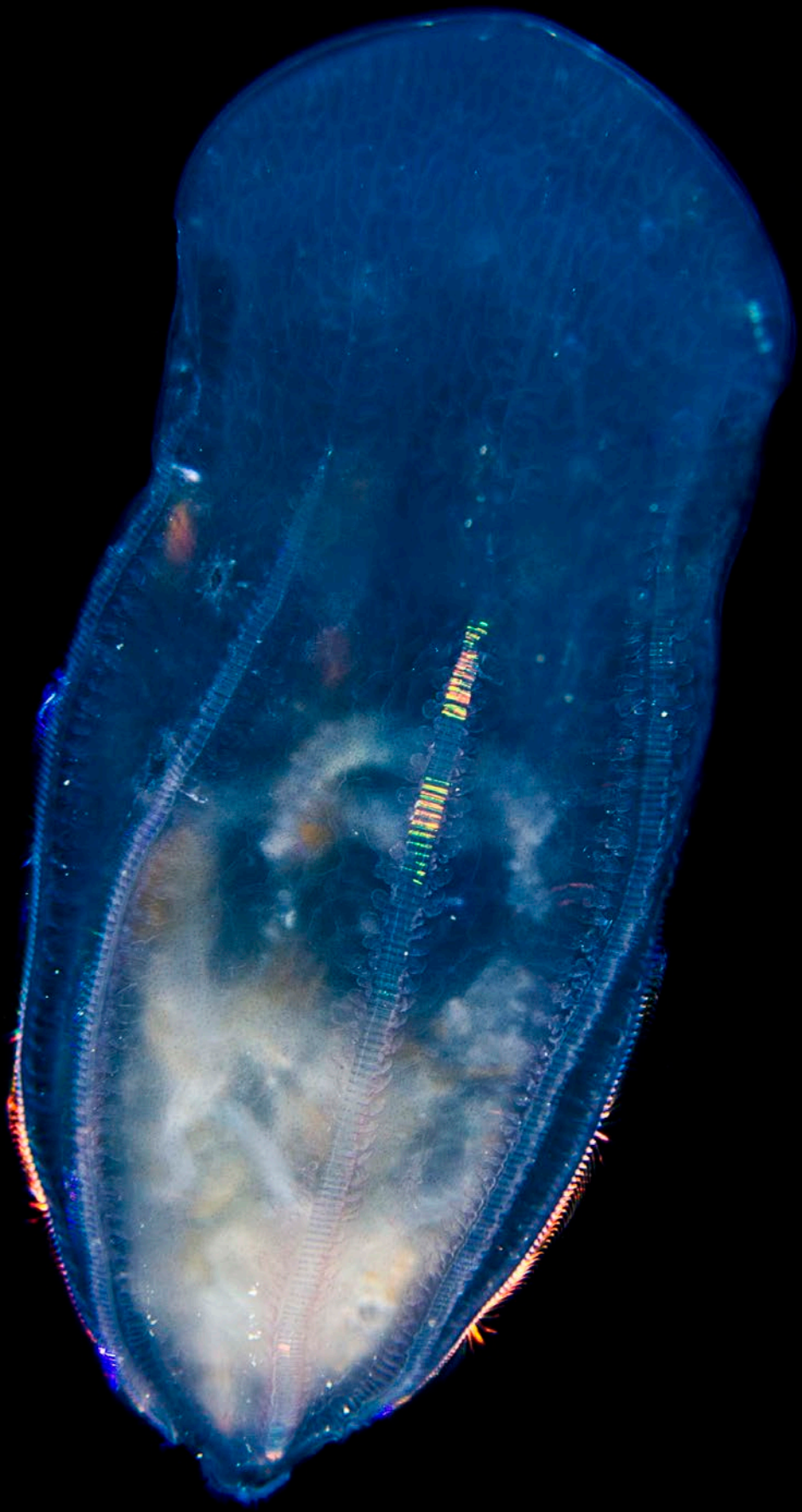


Fig. 2.56. Shaded relief map of Eratosthenes seamount area.

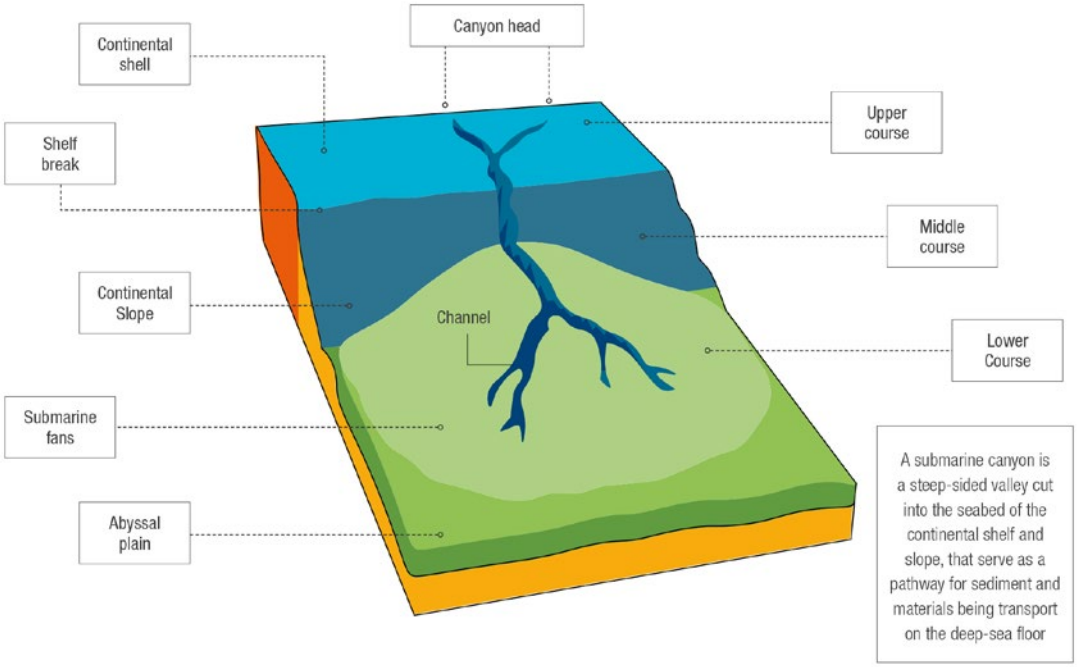
The outline and the tops of the observed features are indicated on the map.



East Mediterranean Sea Canyons

A full inventory of Mediterranean submarine canyons has not yet been developed. An initial report based on the available information obtained from scientific literature indicated at least 518 large submarine canyons in the Mediterranean[34]. While a later report from IUCN described 348 submarine canyons or canyon systems from the eastern and western Mediterranean basins, of which 237 are named in scientific literature[6].

Here, a total of roughly 400 submarine canyons and gullies were identified on the seafloor of the Eastern Mediterranean. Half of them have been identified on the outer slopes of the Hellenic Arc. The total length of the identified canyons is roughly 9,000 km.



SUBMARINE CANYONS AND GULLIES SYSTEMS

Submarine canyons, gullies and thalweg are described here following these definitions[35]:

SUBMARINE CANYONS: steep-sided, V-shaped valleys with heads at or near the continental shelf edge. They extend across the continental slope and are commonly linked to numerous tributaries, similar to unglaciated river-cut canyons on land[36,37].

THALWEG: the line connecting the deepest points along the canyon (canyon axis).

SUBMARINE GULLIES: small-scale, less than 10 km long, first-order and confined channels, generally in the order of tens of metres deep and often linear in plan-view[37].

Large submarine canyons can be subdivided into three main types, in order to study their geomorphic differences between active and passive continental margins[34]:

Type 1) shelf-incising canyons having heads with a clear bathymetric connection to a major river system

Type 2) shelf-incising canyons with no clear bathymetric connection to a major river system

Type 3) blind canyons incised onto the continental slope.

1 EASTERN IONIAN SEA CANYONS

The canyons and gullies incising the margin of the Eastern Ionian are clustered into three areas: the NE Ionian margin, the Kyparisiakos Gulf margin and the Messiniakos, Lakonikos and Kythera South margin (Fig. 2.57). The canyons identified in the Corinth Gulf are also described here.

NORTH EAST IONIAN CANYONS (FIG. 2.58)

This area extends from the margin west of the Othonioi Islands to the North until the south-western margin of Kephallinia Island to the South. The steeply sloping margin of Western Greece and Ionian Islands displays two directions. The northern part, from Othonioi to Lefkas Islands, trends NW-SE. The southern part, from Lefkas to SW Kephallinia Islands, follows the major tectonic element of the Kephallinia Transform Fault and trends NNE-SSW.

The available low-resolution bathymetric data show a major, wide valley running NW-SE along the foot of the slope from Othonioi to southwest of the Paxoi Islands. **A group of submarine gullies incise the steep, eastern slope of the valley, west of the Othonioi Islands**. They develop at depths between 100 m and 1050 m. Their mean widths range from 200 m to 800 m and their length between 3 and 6.7 km. The axes of the gullies are straight. Most of them are characterized as type 3 canyons (blind canyons incised onto the continental slope). Only a couple of them belong to type 2 (shelf-incising canyons with no clear bathymetric connection to a major river system).

From the area southwest of the Paxoi Islands towards the S and SW, the former valley displays the form of a well-shaped canyon and continues as a canyon for more than 100 km. The latter follows the base of the slope, turns towards the SSW along the Kephallinia Transform Fault controlled steep margin, continues along the western, rounded base of the Lixouri Seamount and outflows at the 3800-4000 m deep basin west of Argostoli Ridge.

The margin between the main canyon and the shelf of the Ionian Islands is incised by a few dozen smaller canyons and gullies. All of them connect downwards to the main canyon. **More than 20 submarine canyons and gullies incise the continental slope west of the Paxoi Islands from depths of 250 m up to 1700 m.** They are characterized as type 3 canyons with lengths ranging between 3 km and 35 km. Their widths are from 200 m up to 1100 m and their axes are mostly straight.

More than 12 canyons and gullies incise the western slope of Lefkas Island. They belong to type 3 and their lengths range from 7.7 km up to 17 km. Their deeper edges reach depths of up to 2800 m. Their axes are mostly straight and their widths range from 400 m to 1 km.

Four Type 3 canyons occur on the margin southwest of Kephallinia Island, between the Lixouri Seamount and the Argostoli Ridge and on the western flank of Argostoli Ridge. Their lengths range from 6.5 km up to 27 km with 300 m to 600 m width and depths ranging from 700 m to 3700 m.

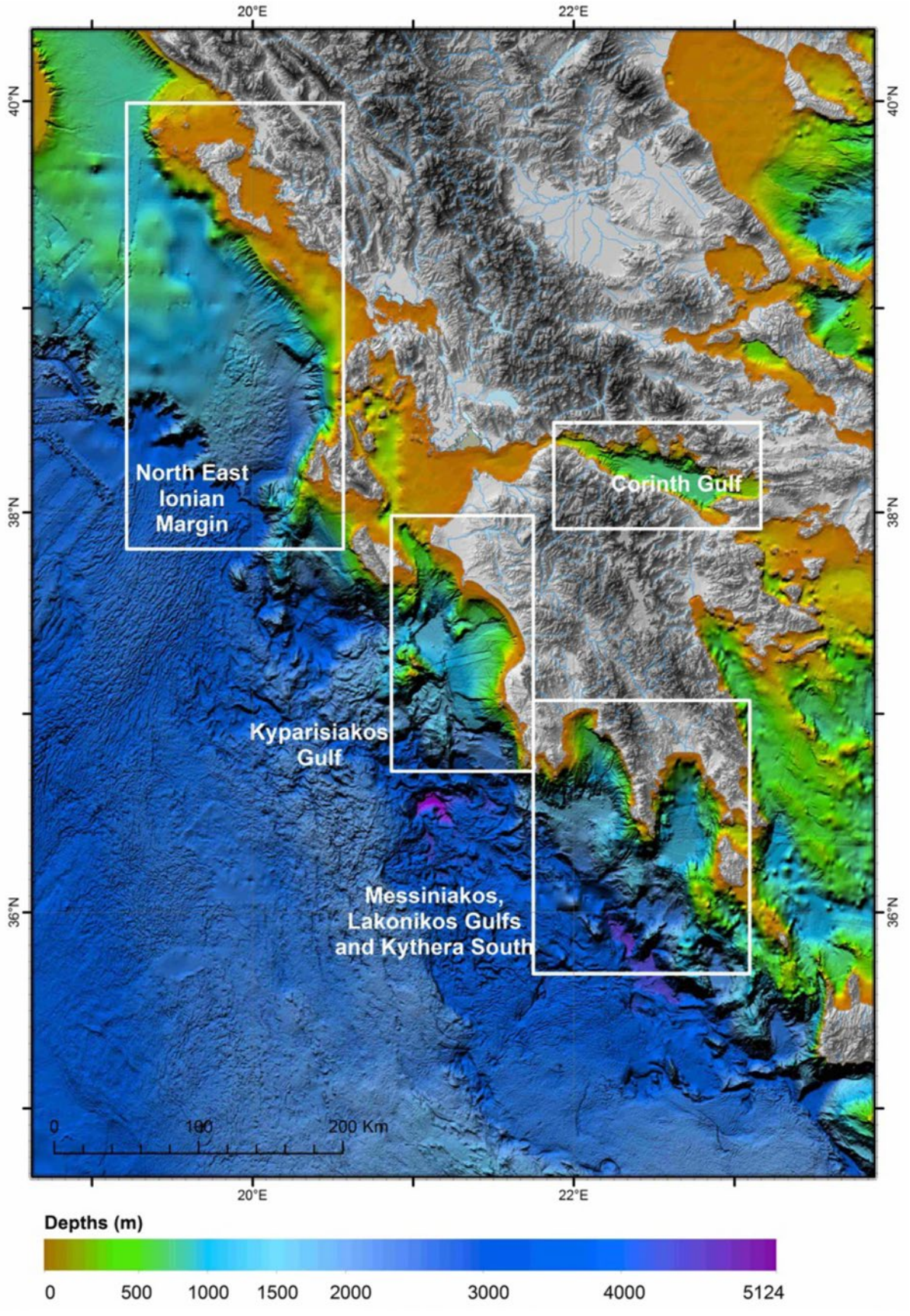


Fig. 2.57. Morphological map of the Eastern Ionian Sea with the location of the areas with submarine canyons.

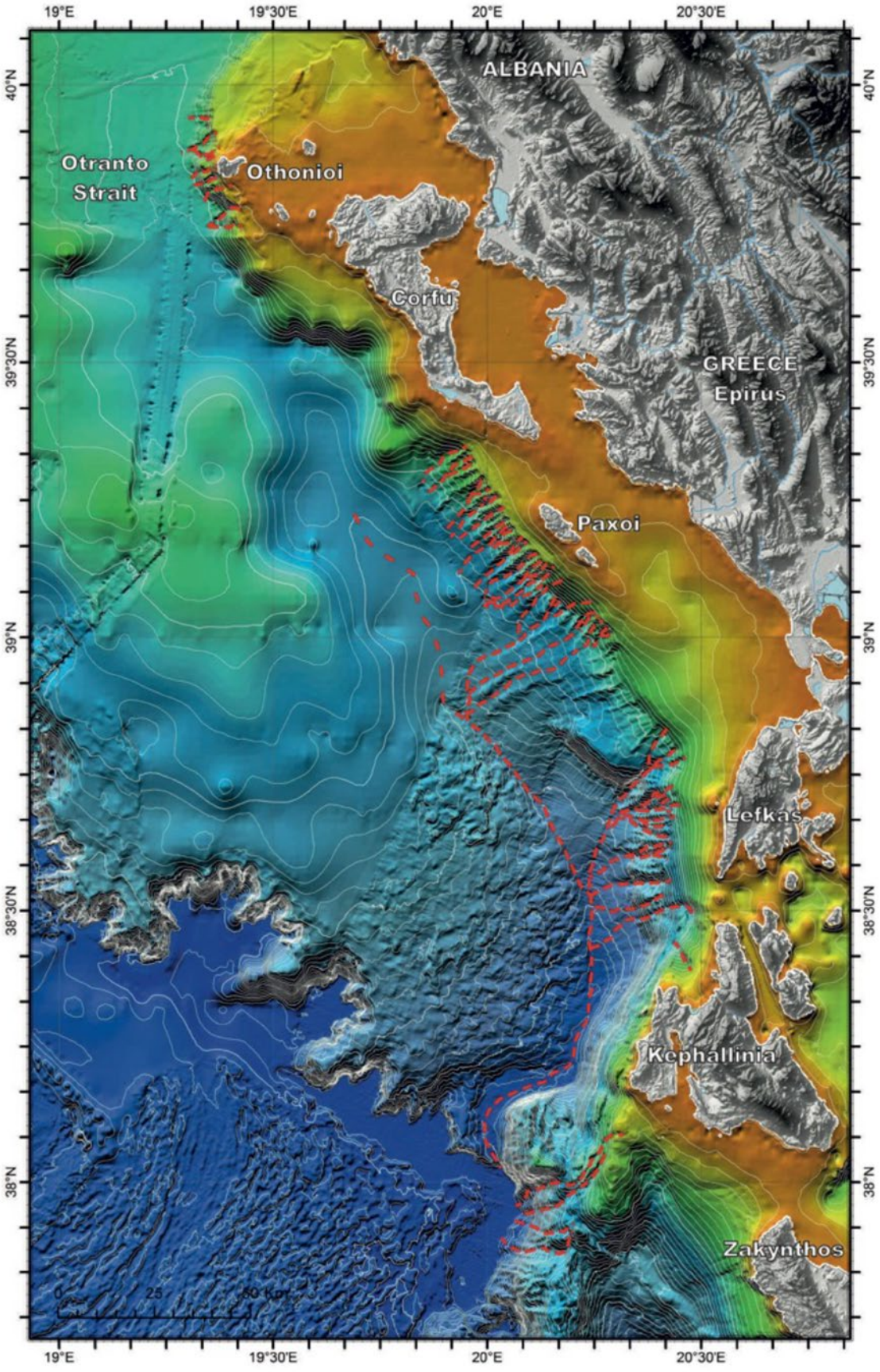


Fig. 2.58. Submarine canyons in the NE Ionian margin.

KYPARISIAKOS GULF CANYONS (FIG. 2.59)

This area extends from the strait between Zakynthos Island and Kyllene to the North all along the western Peloponnese until Pylos to the South.

The 100 km long Zakynthos Strait Canyon starts from the edge of the shelf (no connection with river – Type 2), passes through the strait of Zakynthos and outflows at a 2000 m deep plateau southwest of Katakolon. Ten smaller canyons and gullies incise the eastern wall of the canyon. Most of them start from the edge of the shelf or mid-slope, west of Katakolon, and connect at a depth with the central canyon.

Further south, **the margin of Kyparisiakos Gulf is incised by four major canyons and several gullies.** The northern canyon (**Pineios Canyon**) marks the prolongation of the **Pineios River** underwater. It is 50-55 km long and outflows at the 2000 m deep plateau mentioned above. The other three canyons start very close to the mouth of the **Neda River**. The northern one connects at a depth with the **Pineios canyon**. The other two incise the entire margin down to roughly 2000 m and merge at about 60 km southwest of the Neda mouth. From that point, one single canyon (**Neda Canyon**) continues to the south and terminates at a depth of roughly 2800-3000 m, east of Nestor Ridge.

The southern group of canyons occurs on the steep slope **west of Pylos. At least five or six canyons or gullies**, up to 15 km long, incise the steep slope starting from the edge of the shelf.

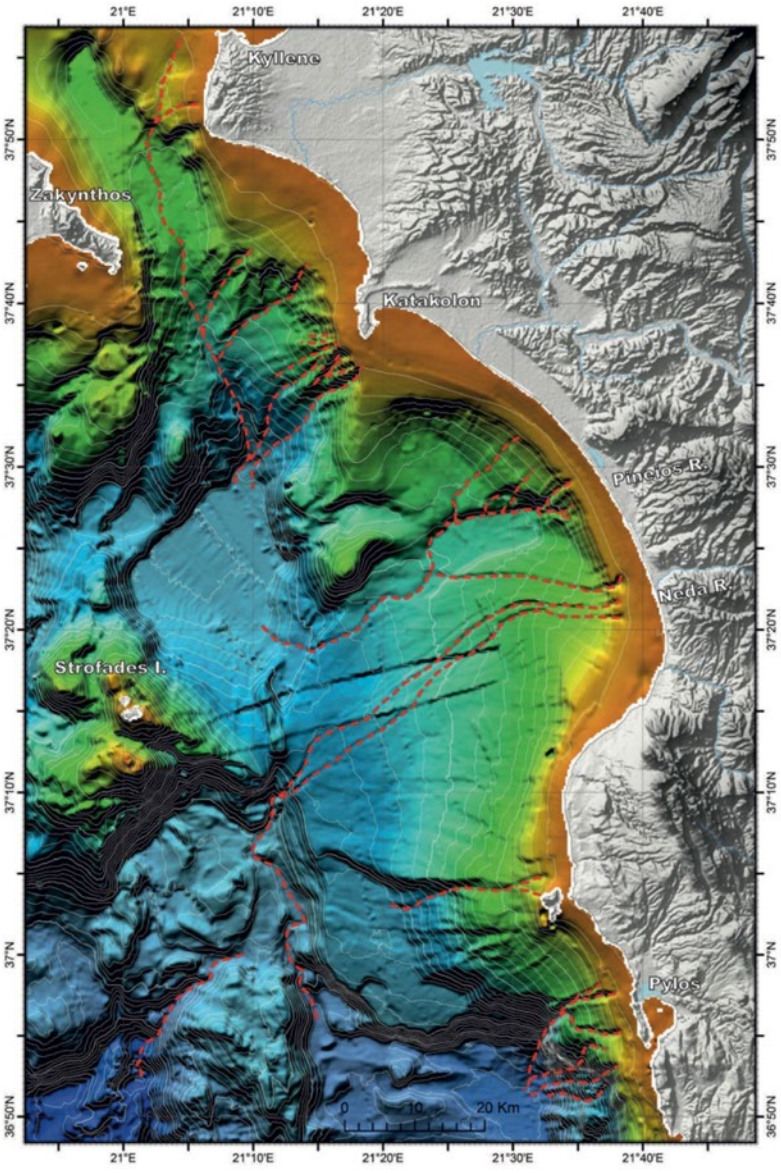


Fig. 2.59. Submarine canyons and gullies in the Kyparisiakos Gulf margin.

MESSINIAKOS-LAKONIKOS GULFS CANYONS (FIG. 2.60)

Over 40 submarine canyons and gullies incise the slope of the Messiniakos Gulf. The majority of them belong to Type 3 canyons with heads well off the shelf edge. Some of the canyons, in particular the ones which occur on the eastern slope of the Messiniakos Gulf, belong to Type 2. The length of the Messiniakos canyons ranges between 5 and 25 km and most of them terminate at a depth of around 2200-2500 m.

Two canyons begin at a depth > 200 m south of the Mani Peninsula, they merge at a depth of 2500 m and terminate at roughly 3500 m, 35-36 km away from the canyon head.

Only 2 submarine gullies have been identified in the Lakonikos Gulf. They are Type 2 canyons with lengths from 4.8 km to 10 km. Their heads are located at the shelf edge and they terminate at roughly 800 m.

One submarine canyon is recognized southwest of Kythera Island. The canyon is 12 km long and incises the eastern flank of the Avlemonas seamount. It begins at a depth of 1500 m and terminates eastwards at 3000 m.

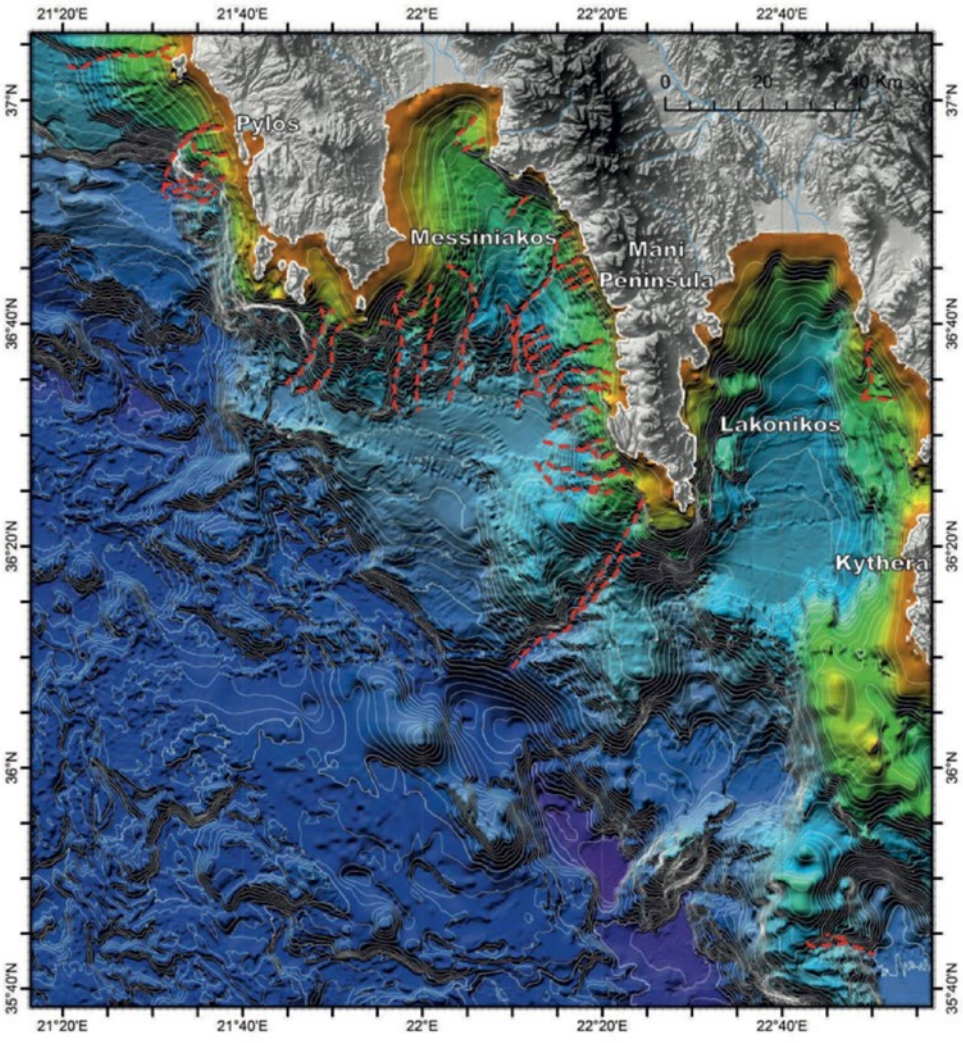


Fig. 2.60. Submarine canyons and gullies in the Messiniakos and Lakonikos Gulfs margin.

CORINTH GULF CANYONS (FIG. 2.61)

The northern and southern margins of the Gulf of Corinth are incised by numerous gullies. Only the most prominent ones have been drawn on the map (Fig. 2.61). The majority of the gullies are characterized as type 2 canyons, however some of them, in particular along the southern margin of the Gulf, do connect with rivers outflowing on the southern coast. In the western part of the Gulf they terminate at a depth of roughly 400 m. In the central part of the Gulf they terminate at the edges of the 800-850 m deep basin.

The most prominent canyon runs along the axis of the western part of the Gulf. It is 15-16 km long and connects the 400-500 m deep western basin with the 700-850 m deep basin of the central Corinth Gulf.

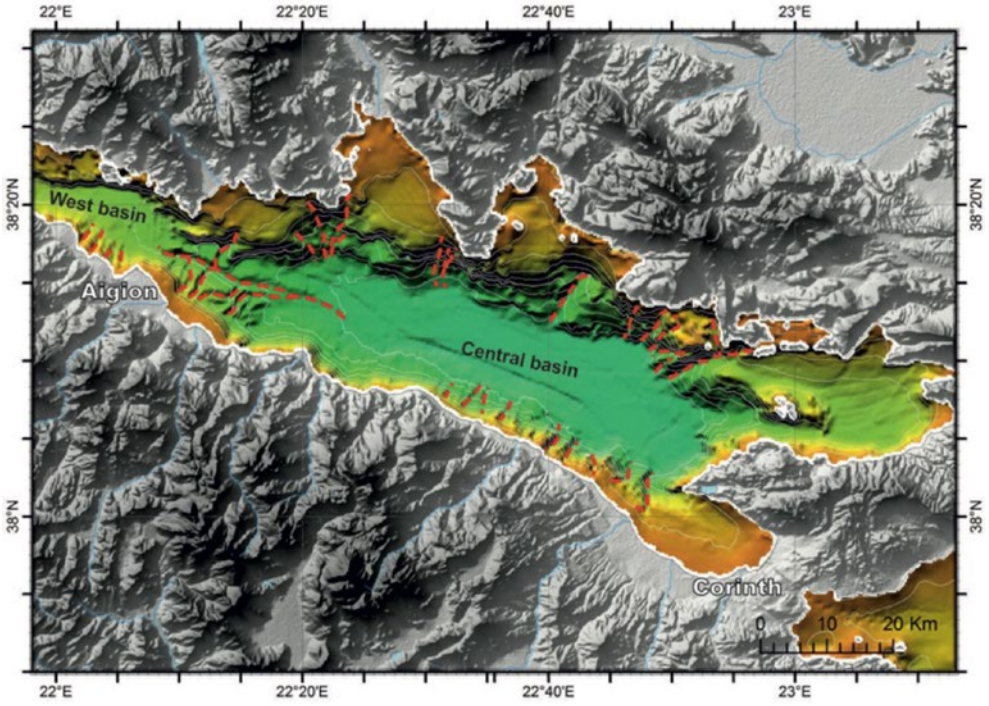


Fig. 2.61. Submarine canyons and gullies in the Corinth Gulf.

2 NORTH AEGEAN SEA CANYONS

INTRODUCTION

Submarine gullies and a few canyons have been mapped on the slopes of three basins in the North Aegean Sea: the North Aegean Trough, the Skopelos Basin and the North Evia Gulf (Fig. 2.62). With the exception of a couple of relatively long canyons on the northern slopes of the North Aegean Trough, all other canyon-like features identified in the North Aegean Sea are short gullies, which incise the steep, fault-controlled slopes.

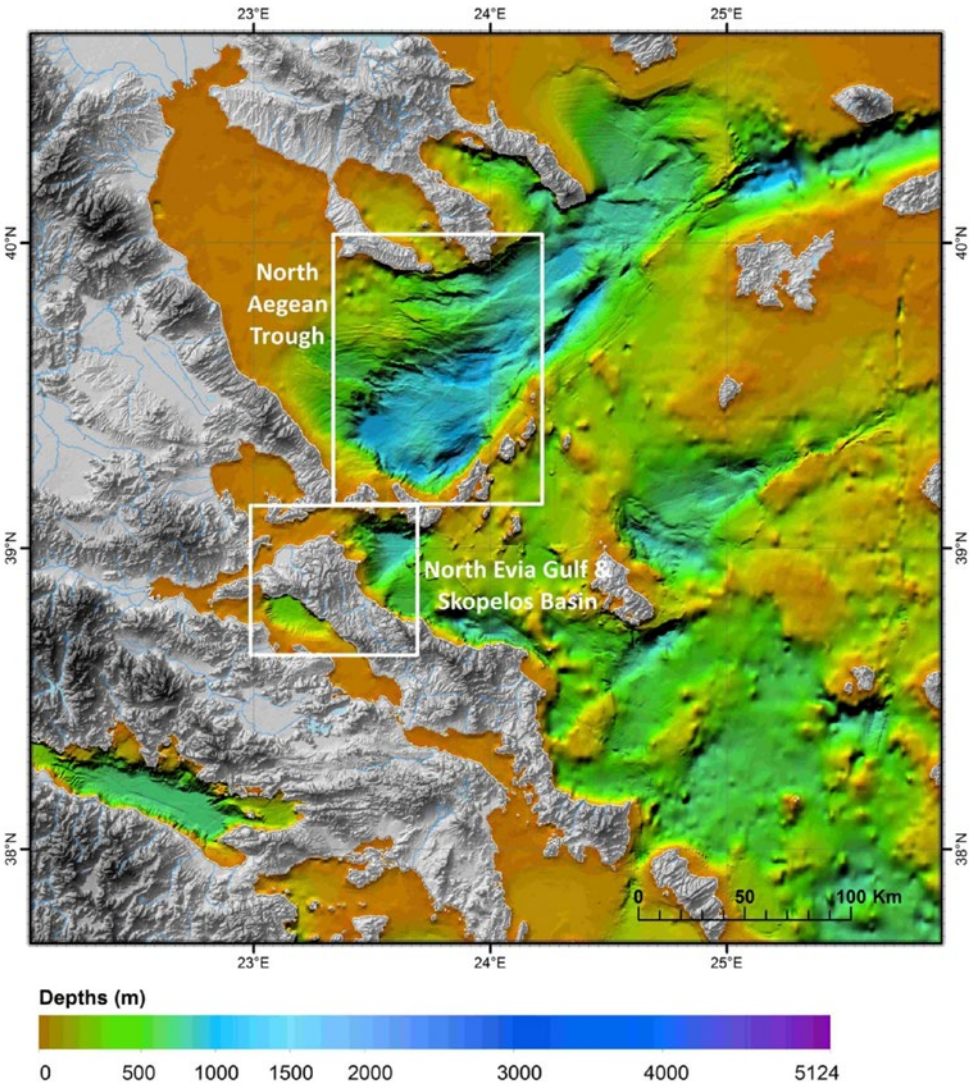


Fig. 2.62. Morphological map of the North Aegean Sea with the location of the areas with submarine canyons and gullies described here.

NORTH AEGEAN TROUGH CANYONS (FIG. 2.63)

The south-eastern margin of the North Aegean Trough displays a linear shape and is controlled by the western branch of the North Anatolian Fault. Short gullies have been identified on the westernmost part of the margin, as well as on the steep, NW-SE trending, western slope of the basin, which has developed along a major, predominantly normal to oblique fault zone.

The north-western margin of the Trough is dissected by several failure scars, associated with short gullies. **Three longer canyons occur on this margin**. They are 15-25 km long, they initiate at the upper part of the slope, at a depth of between 400-700 m and can be traced downslope and on the seafloor of the Trough, following the directions of the main tectonic lines.

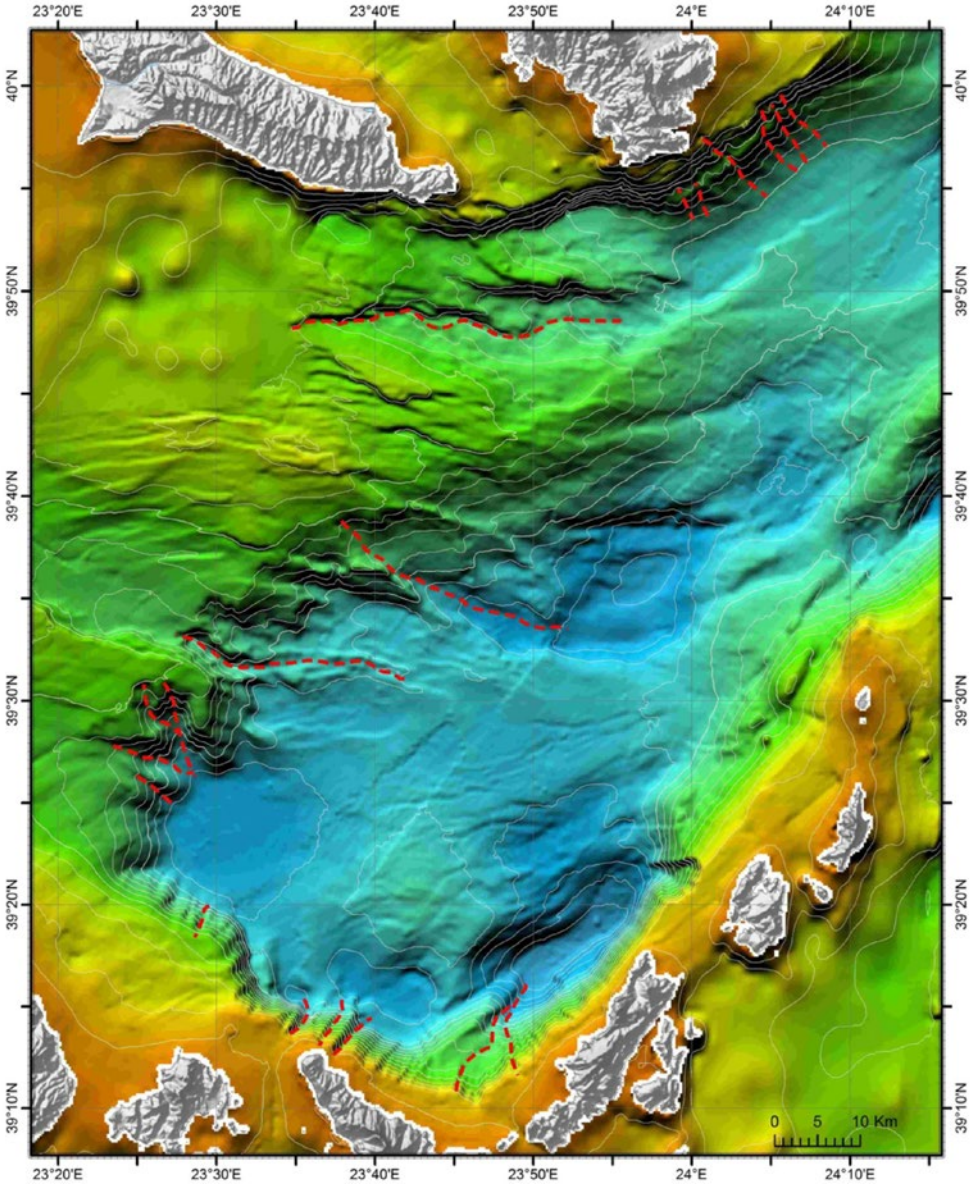


Fig. 2.63. Submarine canyons and gullies on the slopes of the North Aegean Trough.

SKOPELOS BASIN AND NORTH EVIA GULF GULLIES (FIG. 2.64)

The **Skopelos Basin** is a 1000 m deep, isolated morphological depression, surrounded by steep, fault controlled slopes. **Short gullies** incise the steep slopes of the northern margin of the basin, without any connection to any morphological feature onshore.

The 440 m deep **North Evia Gulf** basin displays an asymmetric morphological character. The north-eastern margin of the basin is very steep while the south-western one dips more gently. **Short gullies** incising the north-eastern slope probably initiate very close to the shoreline and are associated with distinct onshore valleys. The gullies which incise the south-western margin start at the edge of the shelf and show no apparent connection with any onshore river valleys.

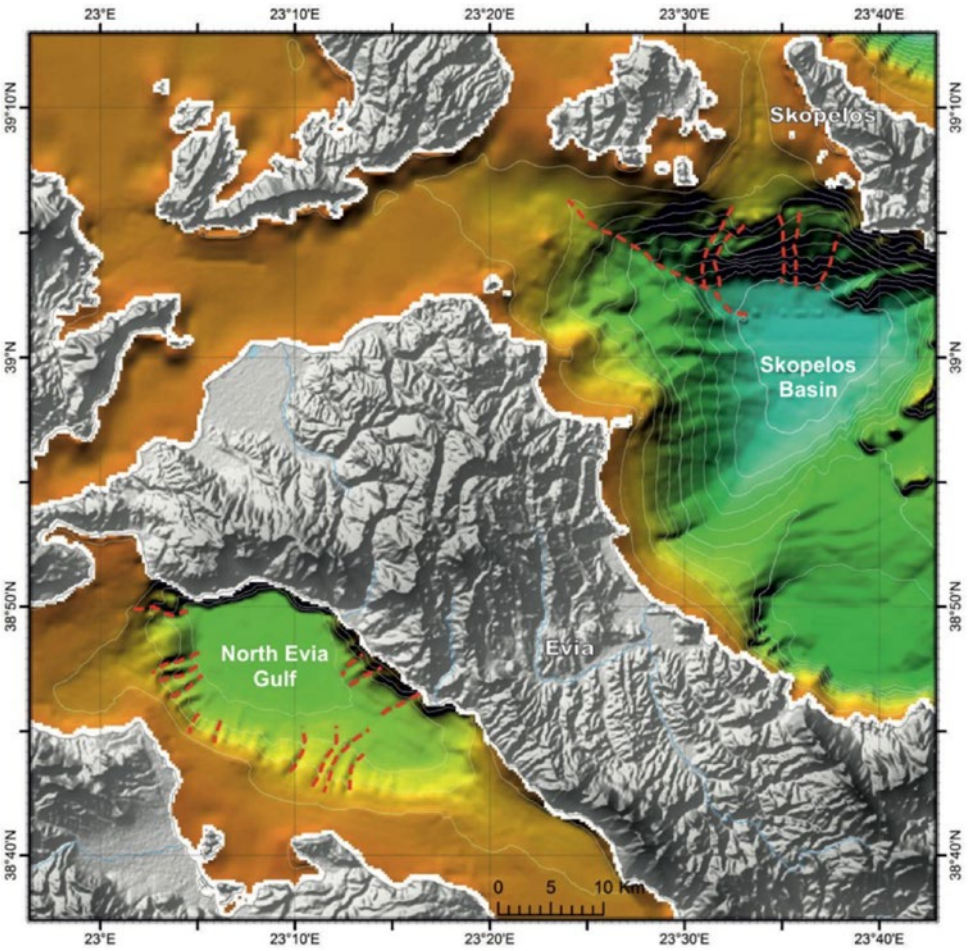


Fig. 2.64. Submarine gullies on the slopes of Skopelos Basin and the North Evia Gulf.

3 SOUTH AEGEAN SEA CANYONS

INTRODUCTION

Submarine canyons in the South Aegean Sea have been recognized in three areas: south of Serifos Island, southwest of Nisyros and Tilos Islands and south of Kassos Island. The latter is located on the Hellenic Arc (Fig. 2.65).

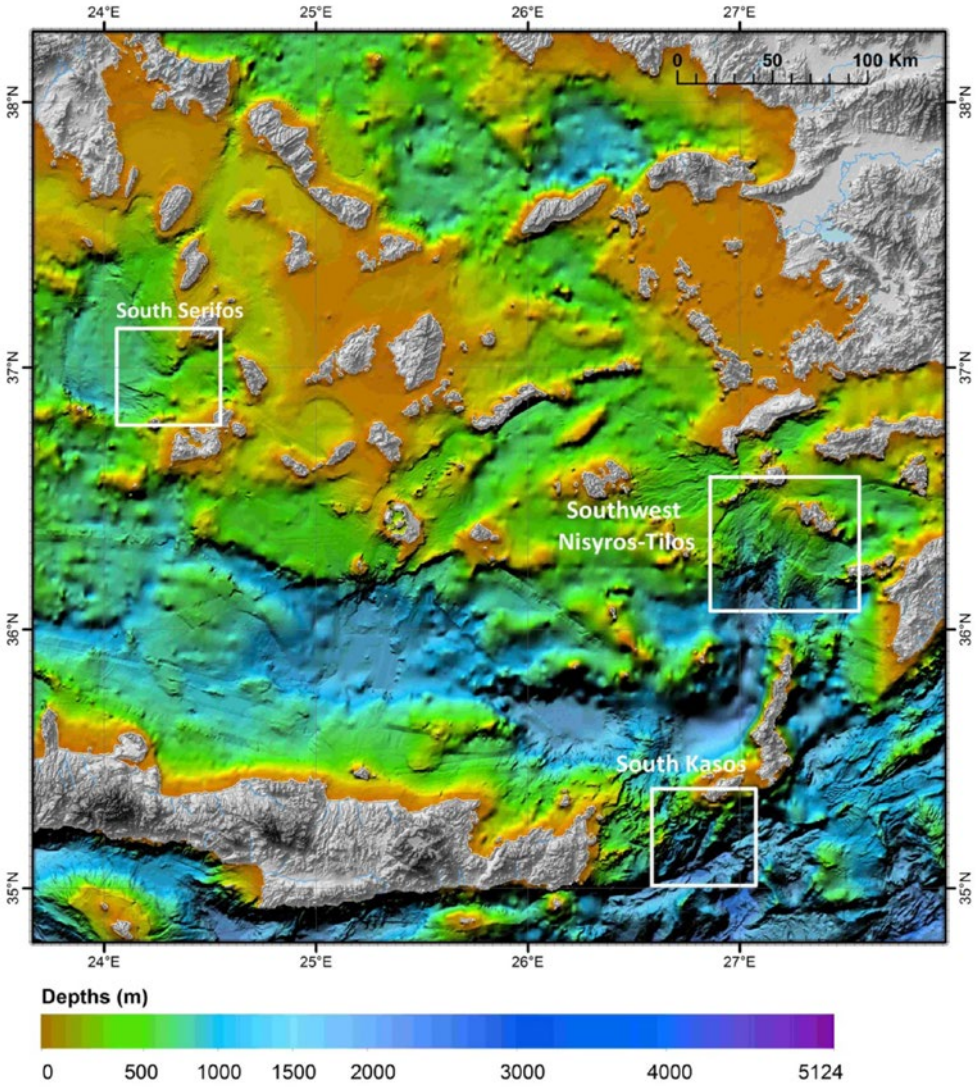


Fig. 2.65. Morphological map of the South Aegean Sea with the location of the areas with submarine canyons and gullies described here.

SOUTH SERIFOS CANYON (FIG. 2.66)

A well developed, 20-25 km long canyon has been formed along the base of the submarine slope south of Serifos Island, in the western part of the South Aegean Sea. The canyon follows the trace of a NE-SW trending fault and bends to the north before its termination in the Myrtoon Basin.

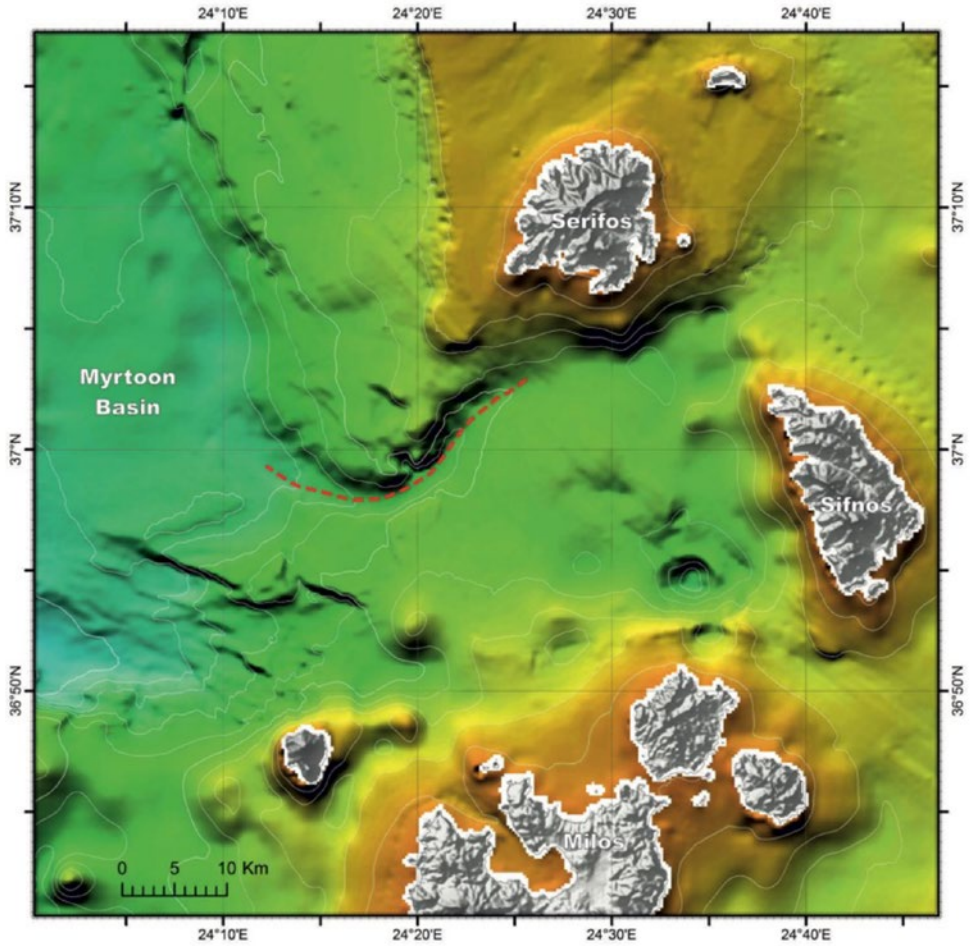


Fig. 2.66. The submarine canyon along the southern slope of Serifos Island.

SOUTHWEST NISYROS-TILOS CANYONS (FIG. 2.67)

The morphologically complex and irregular slope southwest of Nisyros and Tilos Islands, toward the > 2000 m deep North Karpathos Basin is incised by **three prominent canyons**.

The longer one, roughly 50 km long, begins south of Nisyros, at a depth of 350-400 m, runs toward the Southwest, bends to the South forming a narrow valley on the steep slope and terminates on the flat floor of the North Karpathos Basin.

Two canyons have their heads southwest of Tilos Island. They run to the southwest and merge at a depth of roughly 1000 m. The lower part of the canyon incises the steep slope and terminates in the North Karpathos Basin.

A short gully occurs south of Tilos Island and west of Chalki Island. It is < 15 km long and terminates in the flat floor of the Saria Basin.

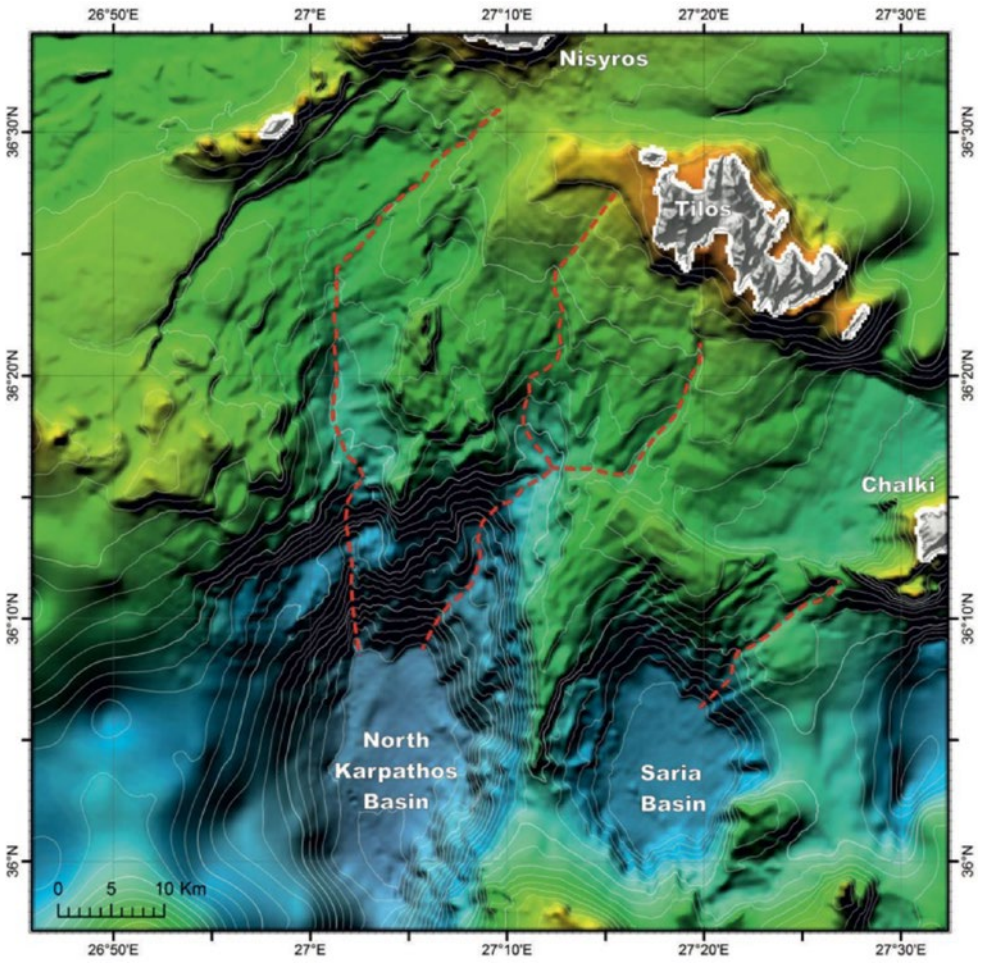


Fig. 2.67. Submarine canyons on the seafloor southwest of Nisyros and Tilos Islands.

SOUTH KASOS CANYON (FIG. 2.68)

A 30 km long canyon initiates at the upper part of the slope south of Kasos Island. It runs toward the southwest forming a V-shaped valley and terminates on the flat floor of a 3000 m deep small basin developed within the composite morphological feature of the Pliny Trough.

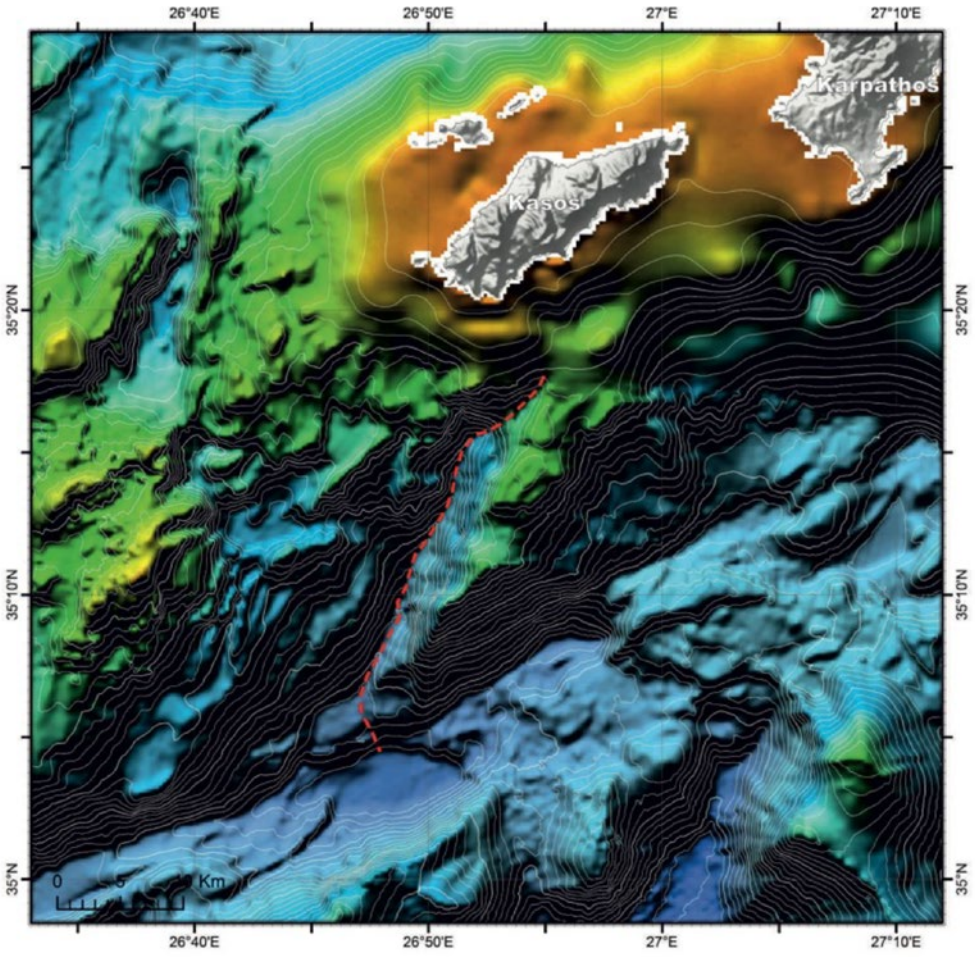


Fig. 2.68. The submarine canyon south of Kasos Island.

4 LIBYAN SEA CANYONS

The canyons and gullies incising the slopes of the Libyan Sea are clustered in two main areas (Fig. 2.69): the active margin of the Hellenic Arc and the passive margin of Libya.

The southern margin of Crete is incised by numerous gullies (Fig. 2.70). The area of the Samaria Canyon (Fig. 2.71) and east of Gavdos Island (Fig. 2.72) are described in detail. A major canyon off the south-eastern edge of Crete marks the western margin of Vai Seamount (Fig. 2.73). Long canyons and associated gullies incise the south-eastern margin of Rhodes Island (Fig. 2.74).

The canyons identified on the passive margin of Libya occur in the area of Tobruk (Fig. 2.75).

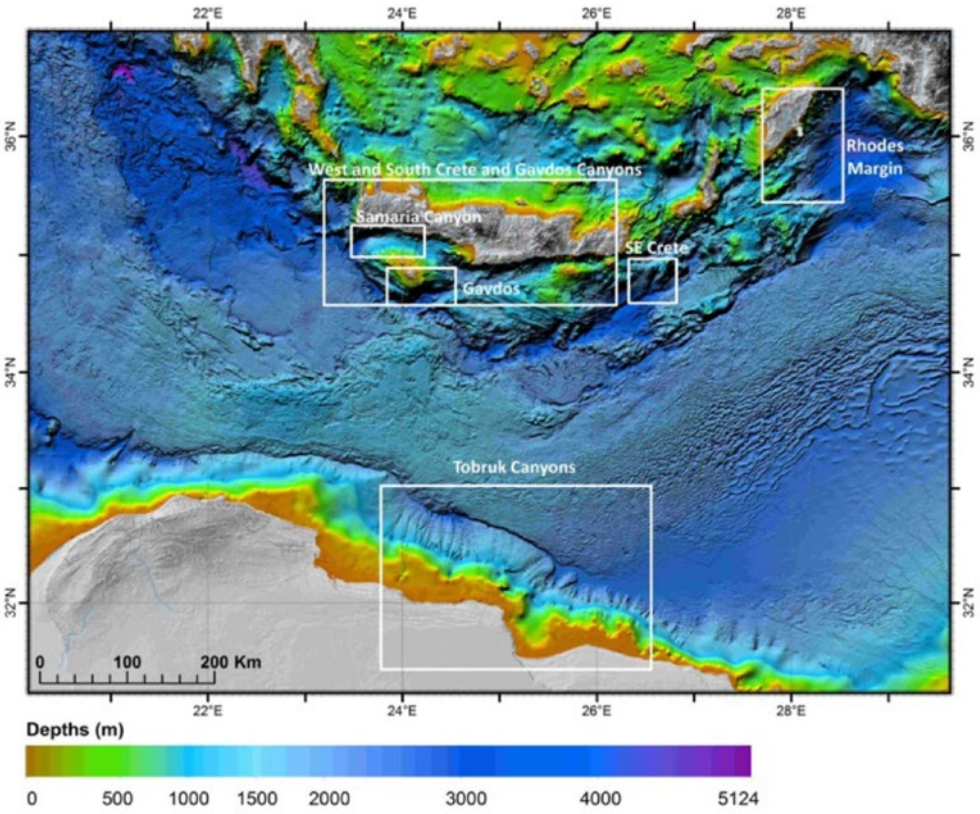


Fig. 2.69. Morphological map of the Libyan Sea with the location of the areas with submarine canyons and gullies.

SOUTH CRETE CANYONS (FIG. 2.70)

The southern, steep margin of the 250 km long Crete Island marks the spectacular morphological escarpment between the > 2000 m high mountains of the island and the > 3000 m deep marine troughs to the south. Numerous, short gullies incise the steep margin, while many of them merge with long canyons, which run along the base of the slopes.

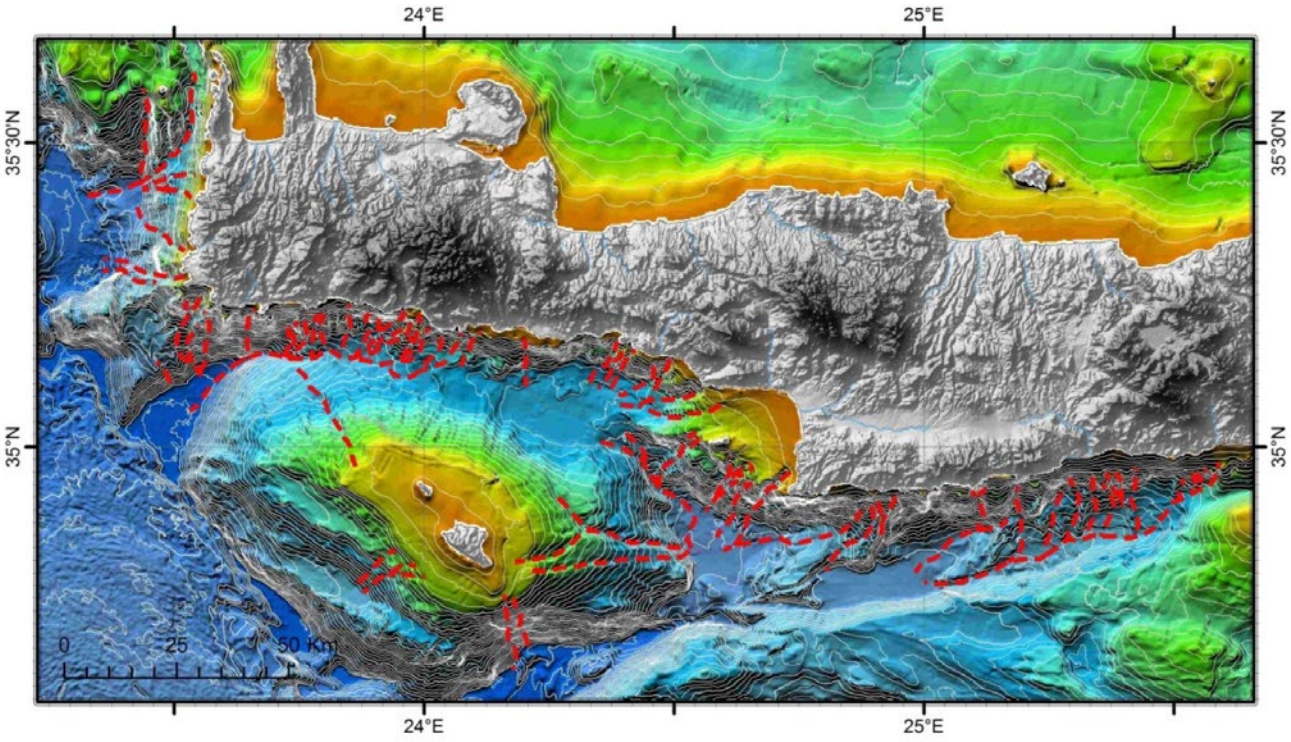


Fig. 2.70. Submarine canyons and gullies in the southern margin of Crete and on the margins of Gavdos Island.

SAMARIA CANYON (FIG. 2.71)

The Samaria Canyon is named after the Samaria Gorge, the most famous and spectacular one out of the numerous gorges which incise the southern mountainous slopes of Crete.

The total length of the **Samaria Canyon** exceeds 50 km. It originates on the steep slopes east of the Samaria Gorge, bending towards the west at the base of the slope, it runs parallel to and between the margins of West Crete and Gavdos and terminates in the Gortys Trough at a depth of roughly 3500 m. The Samaria Gorge continues offshore as one of the **dozens of gullies** which incise the steep southern margin of Crete and merge with the main Samaria Canyon.

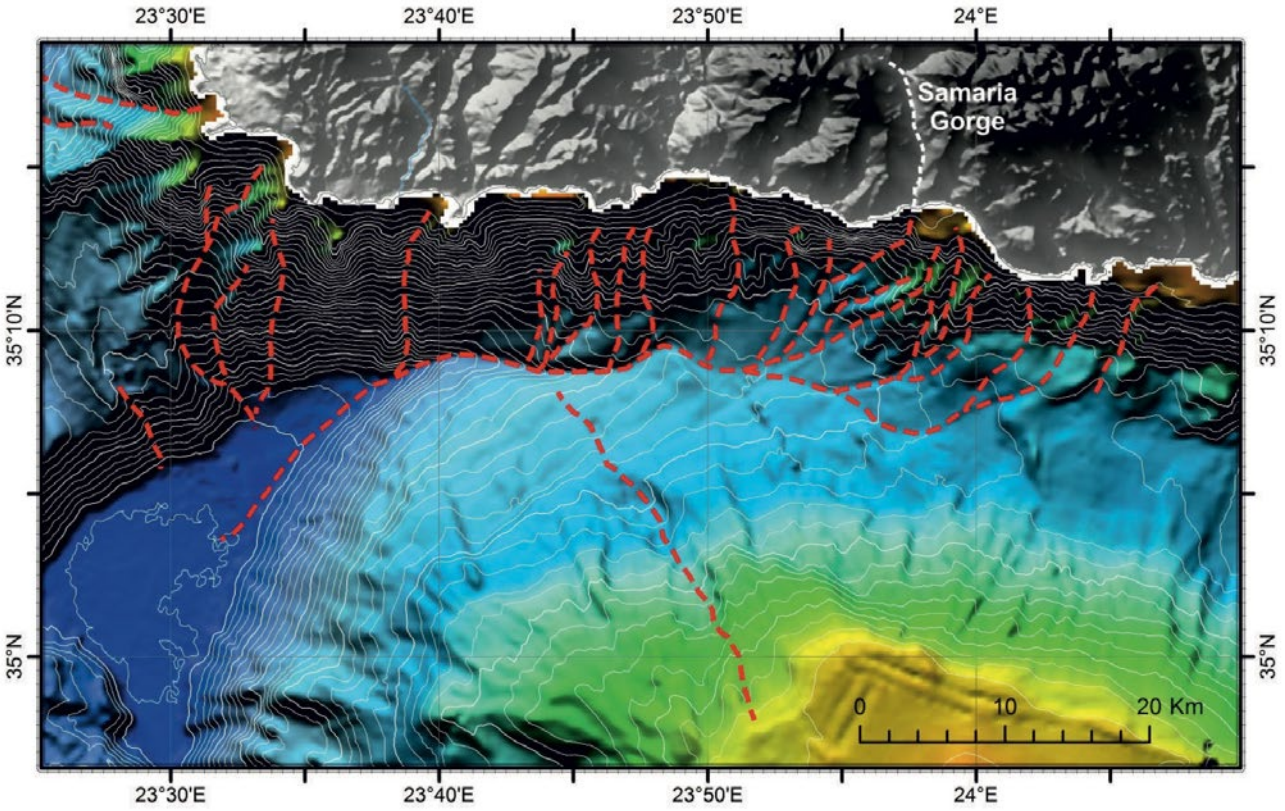


Fig. 2.71. Submarine canyons and gullies in the southern margin of Western Crete (Samaria Canyon).

GAVDOS CANYONS (FIG. 2.72)

Four short, 10-15 km long gullies have been mapped on the south-eastern and south-western slopes of Gavdos Island. **Longer and well developed canyons** occur on the eastern submarine slope of Gavdos. One of them runs between the margin of Gavdos and the one of Central Crete and drains the 1500 m deep basin between Gavdos and Western Crete towards the 3000 m deep Ptolemy Trough to the east.

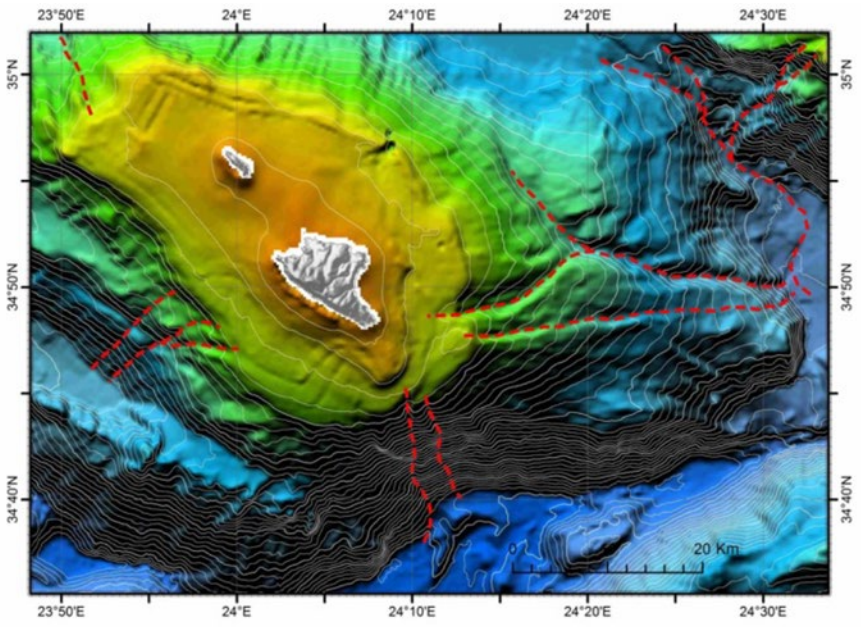


Fig. 2.72. Submarine canyons and gullies on the margins of Gavdos Island.

SE CRETE CANYON (FIG. 2.73)

A 30 km long, impressive canyon marks the western limit of Vai Seamount, located southeast of Crete. The canyon starts at a depth of 1300 m, west of the summit of Vai Seamount, and terminates at the one of the deep basins of the Pliny Trench at a depth of 3500 m.

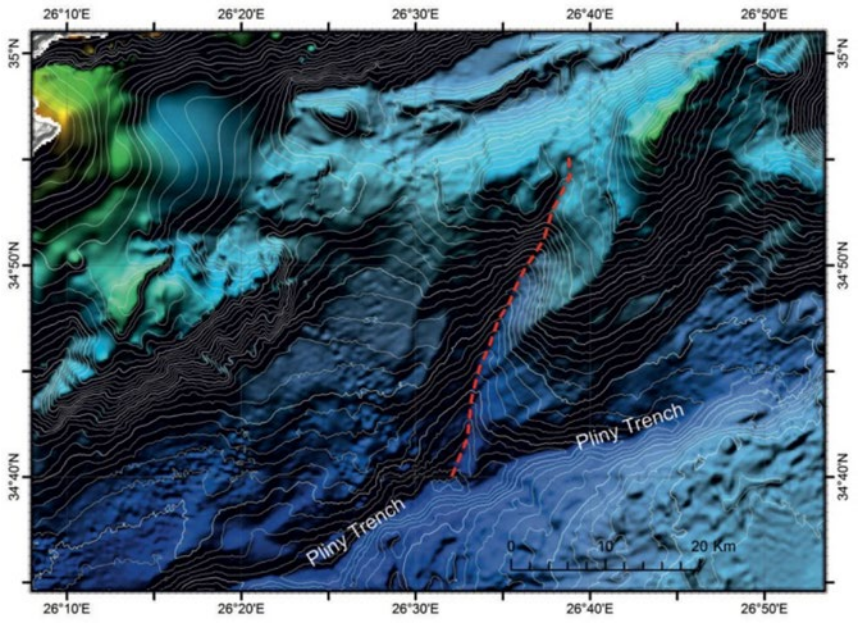


Fig. 2.73. The submarine canyon at the western limit of Vai Seamount, southeast of Crete.

RHODES MARGIN CANYONS (FIG. 2.74)

The south-eastern margin of Rhodes, toward the 4000 m deep Rhodes Basin, is incised by many canyons and gullies. Long, well developed canyons originate from the edge of the shelf or the upper slope off the northern part of the island. Short gullies occur on the slope off the southern part of Rhodes.

The longest canyon occurs south of Rhodes Island. It is a roughly 100 km long canyon, which originates from within the Pliny Trench and terminates in the Rhodes Basin towards the NE.

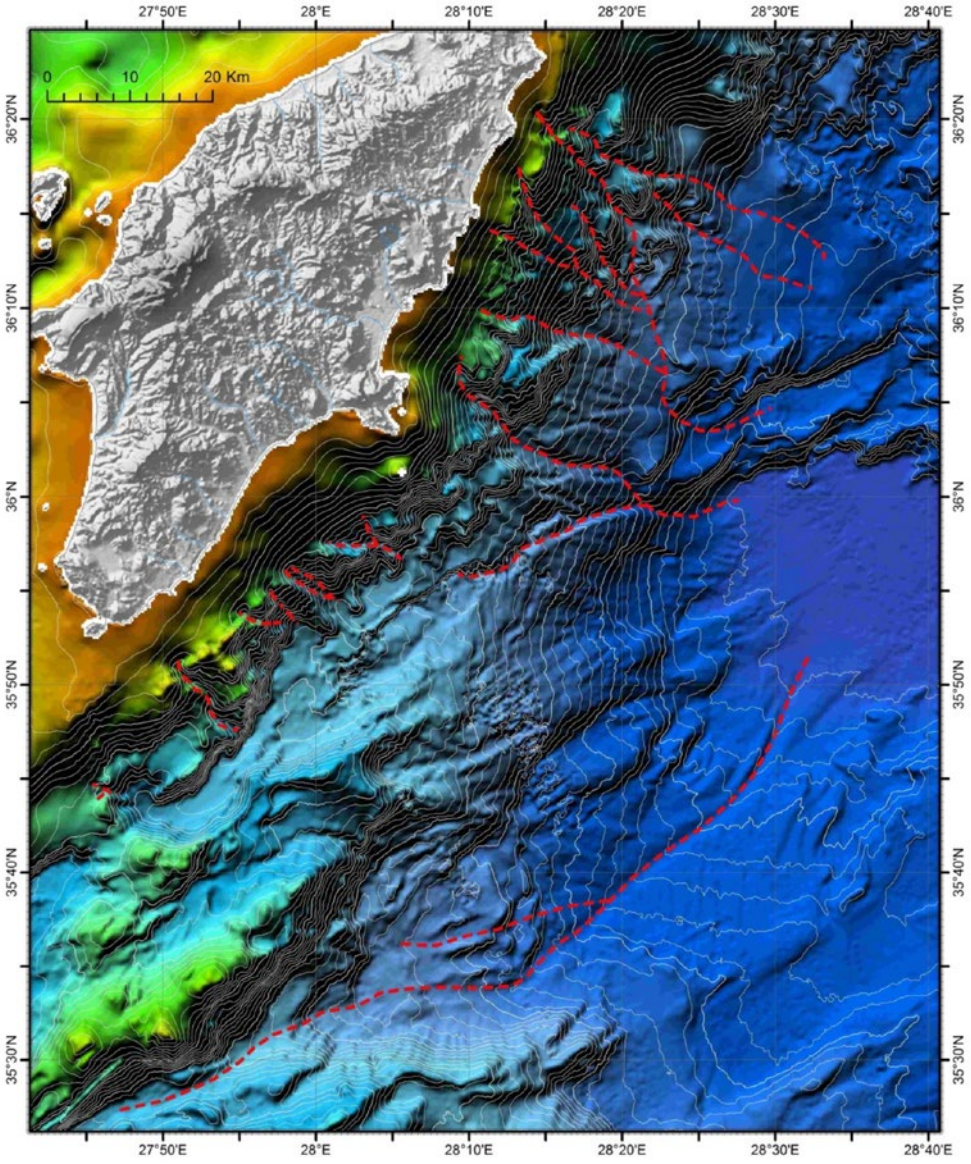


Fig. 2.74. Submarine canyons and gullies on the margins of Rhodes Island.

TOBRUK CANYONS (FIG. 2.75)

The passive margin off the coasts of Eastern Libya and Western Egypt are incised by a large number of canyons. The longest ones occur in the western part of the area, off the Libyan coast of Tobruk. Their length exceeds 30-40 km, they originate at mid-slope and terminate at the base of the passive margin, at the boundary with the deformed sediments of the Mediterranean Ridge.

The eastern canyons and gullies, off the Egyptian coast originate at the mid slope and terminate at the 3200 m deep flat Herodotus Basin.

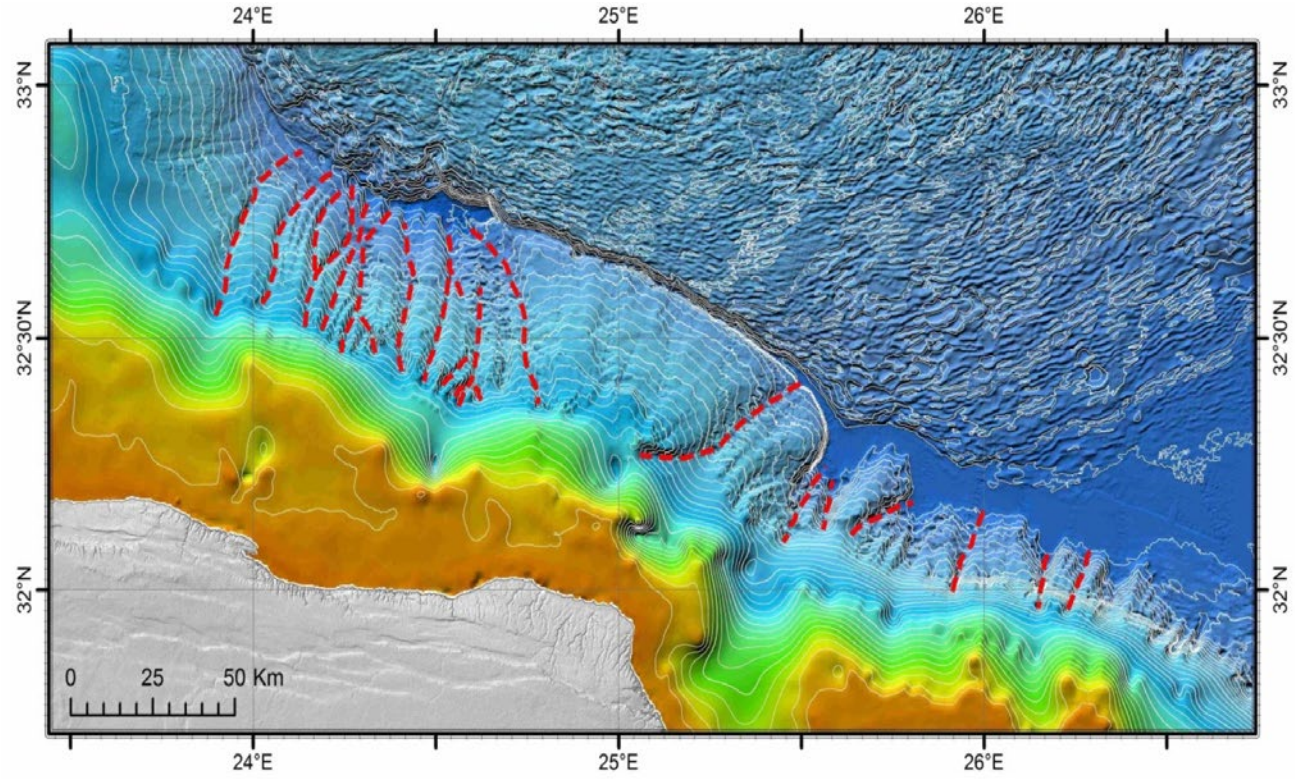


Fig. 2.75. The canyons and gullies on the margins off Tobruk (Libya).

5 LEVANTINE SEA CANYONS

Significant canyons and many gullies incise the margins and slopes of the Levantine Sea (Fig. 2.76). Five main areas are described here below: the slopes off the south-western coast of Turkey, the eastern margin of Eratosthenes Seamount, the Tartush and Haifa canyons on the eastern margin of the Levantine Sea and the western slope of the Nile deep-sea fan. Short gullies have been identified on the slopes around Cyprus, however the absence of bathymetric data with an adequate resolution does not provide enough information to describe them.

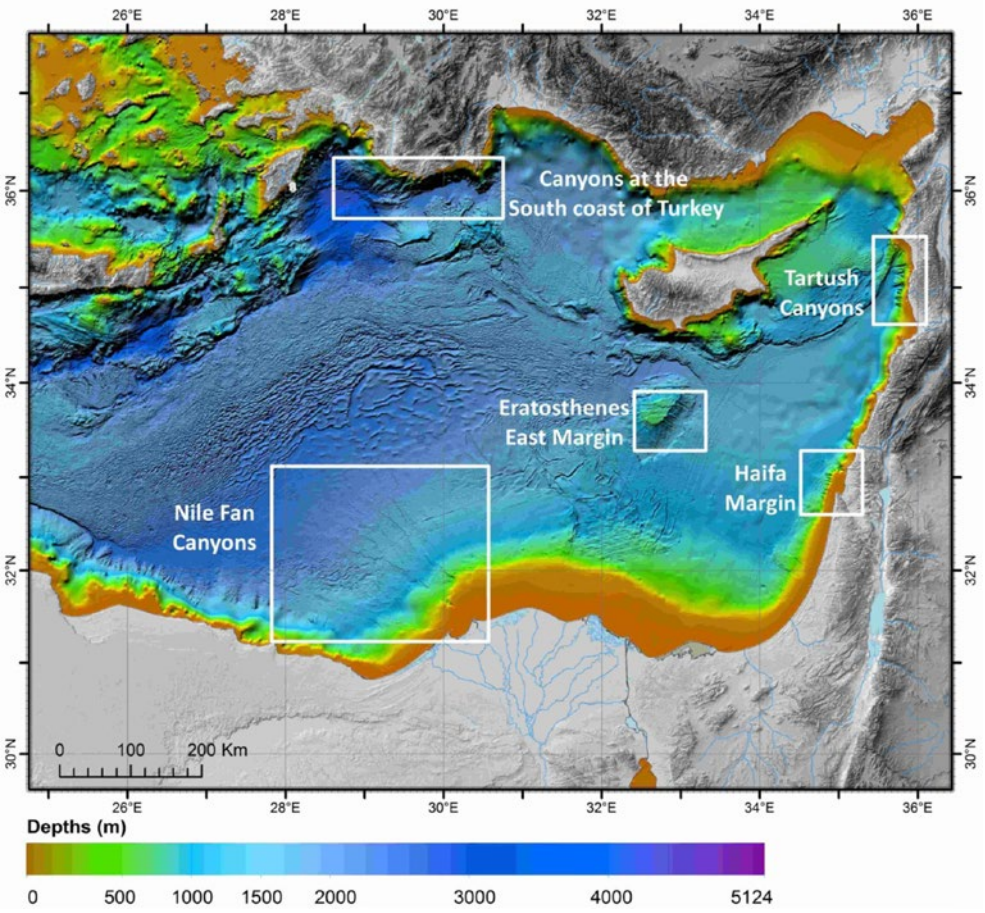


Fig. 2.76. Morphological map of the Levantine Sea with the location of the areas with submarine canyons described here.

SW TURKEY CANYONS (FIG. 2.77)

The steep slopes off South West Turkey facing the 3000 m deep Finike Basin are incised by several, short gullies, the length of which does not exceed 10-15 km. All these gullies originate either at mid slope or on the lower part of the steep slope.

Longer canyons, 30-40 km long, incise the lower parts of the slope between the coast of SW Turkey and the 4000 m deep Rhodes Basin.

All canyons and gullies in the area off the SE coast of Turkey fall into category 3 (canyons incising the continental slope).

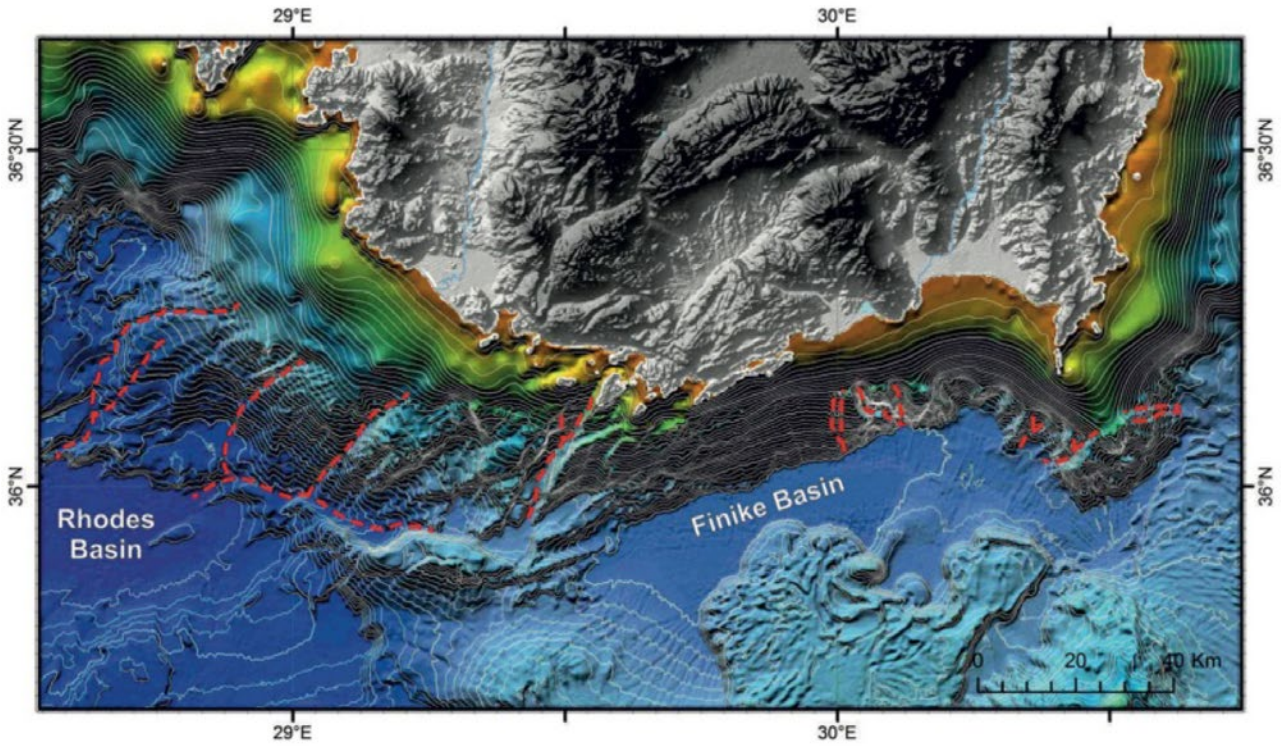


Fig. 2.77. Submarine canyons and gullies off the SE Turkey coast.

ERATOSTHENES EAST MARGIN (FIG. 2.78)

A series of 10-20 km long gullies incise the eastern margin of the Eratosthenes Seamount. They originate from the flat top of the seamount with their heads affecting the shape of its edge and they reach the 2000-2200 m deep, flat seafloor of the Levantine Basin to the East.

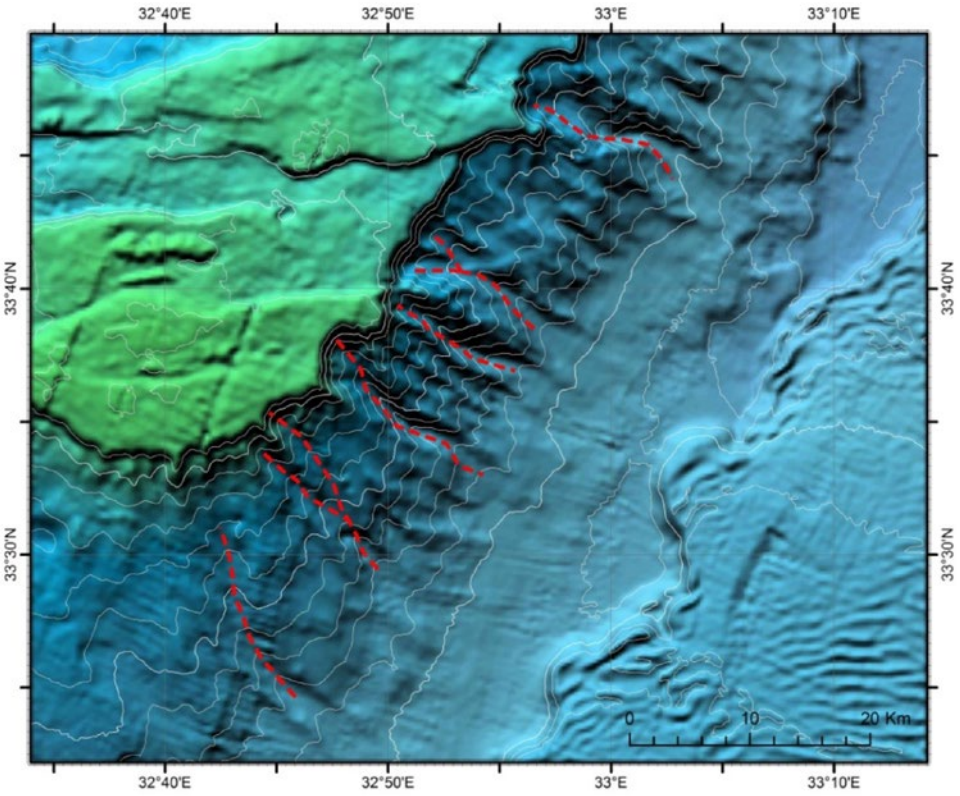


Fig. 2.78. Submarine gullies on the eastern margin of the Eratosthenes Seamount.

TARTUSH CANYONS (FIG. 2.79)

The Syrian margin, between Latakia to the North and Tartush to the South, is incised by a series of short gullies and **long canyons**. The longer canyon originates in the upper slope south of Latakia and with a SSW direction of its thalweg and a total length of roughly 55 km runs between the eastern slope of the Latakia Ridge and the Syrian margin.

Further south, the length of the canyons and gullies decreases while the steepness of the margin increases. All canyons and gullies originate from the mid slope, with no evidence of incision in the upper slope or the continental shelf.

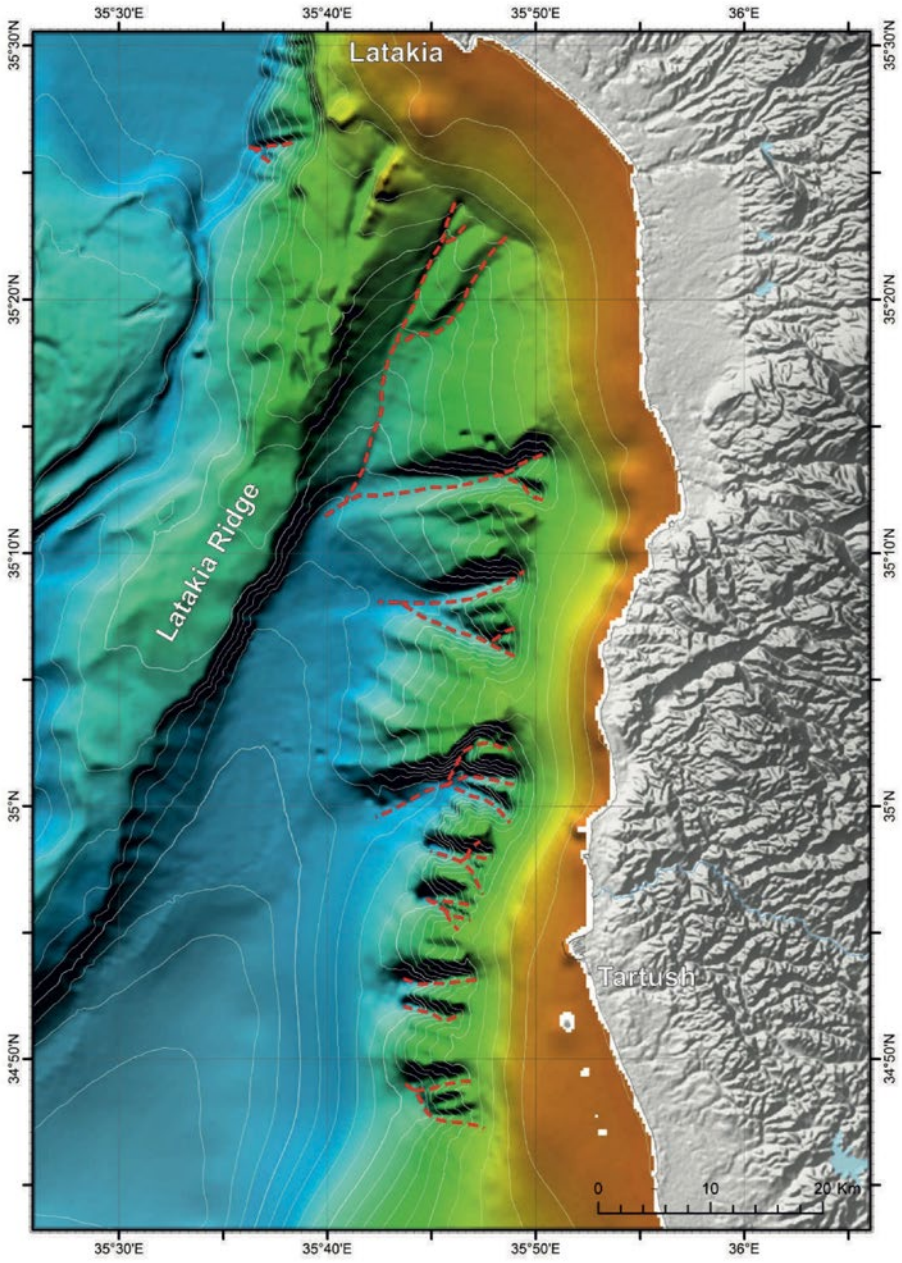


Fig. 2.79. Submarine canyons and gullies on the Syrian margin.

HAIFA CANYONS (FIG. 2.80)

The steeper part of the slope of Haifa occurs between the edge of the continental shelf and the 1000 m depth contour. This part of the slope is incised by a series of 5-10 km long gullies, which originate at the edge of the shelf and terminate at a depth of around 1000 m.

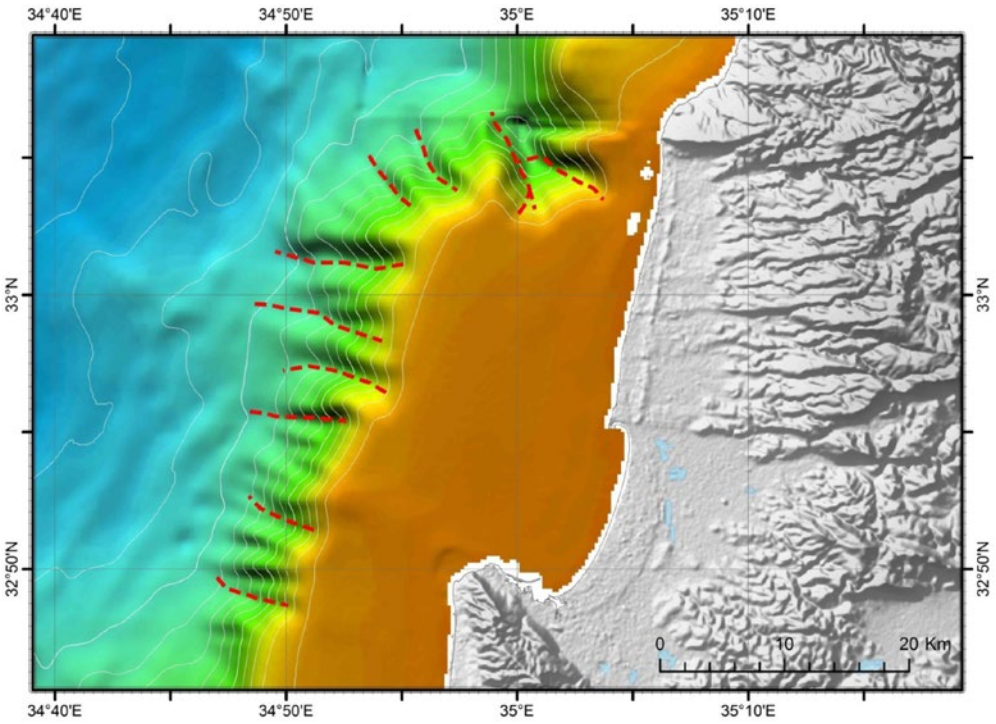


Fig. 2.80. Submarine gullies on the Haifa margin.

NILE FAN CANYONS (FIG. 2.81)

The Nile deep-sea fan is the largest deltaic body in the Mediterranean and has developed and evolved throughout the Plio-Quaternary covering the Messinian evaporate[38]. The submarine part of the delta is characterized by a 30-60 km wide continental shelf, a relatively steep upper slope between the shelf edge and the 1000-1200 m depth contour and a gentler lower slope. A detailed description of its geomorphology is provided in several references[39].

The western submarine flank of the Nile Fan is incised by **the > 100 km long Rosetta Canyon**. It begins at the shelf edge, roughly 30 km off the mouth of the Rosetta branch of the Nile River, and follows a linear path downslope toward the Northwest. At a depth of about 2000 m the Rosetta canyon branches into two meandering canyons.

Three more canyons occur on the lower slope of the western Nile deep-sea fan. They are probably relict morphological features inherited from older canyons which are no longer active[40].

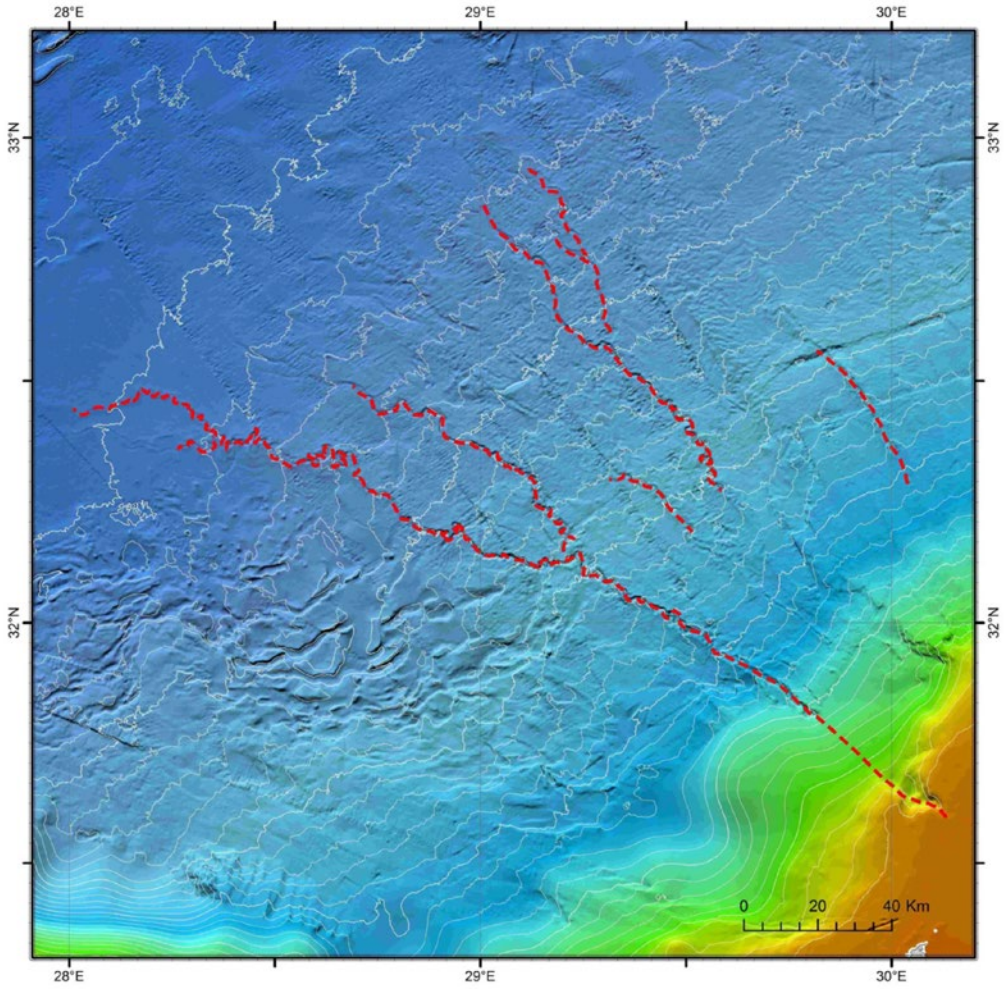


Fig. 2.81. Submarine canyons on the western Nile deep-sea fan.

CHAPTER 2 /

REFERENCES

1. Huguen C., Mascle J., Loubrieu B., Chamot-Rooke N., Loncke L., Woodside J., Zitter T., Benkhelil J., and Tahchi E. (2006). ***Regional distribution and tectonic control of mud volcanoes in the Eastern Mediterranean Sea: evidence from regional swath bathymetry, backscatter records, and seismic data***. CIESM Workshop Monographs,29: 27–34.

2. Chamot-Rooke N., Rabaute A., and Kreemer C. (2005). ***Western Mediterranean Ridge mud belt correlates with active shear strain at the prism backstop geological contact***. Geology,33: 861–864.

3. Sakellariou D. and Tsampouraki-Kraounaki, K. (2019). ***Plio-Quaternary extension and strike-slip tectonics in the Aegean***. In: J. Duarte (Ed.), Transform Plate Boundaries and Fracture Zones, 14: ELSEVIER, pp. 339–374.

4. IUCN. (2019). ***Thematic Report - Conservation Overview of Mediterranean Deep-Sea Biodiversity: A Strategic Assesment.*** Gland, Switzerland and Malaga, Spain, 122 pp.

5. Wurtz, M., and Rovere M. (eds). (2015). ***Atlas of the Mediterranean Seamounts and Seamount-like Structures***. Gland, Switzerland and Málaga, Spain: IUCN, 276 pp.

6. Würtz, M. (eds). (2012). ***Mediterranean Submarine Canyons: Ecology and Governance***. IUCN.Gland, Switzerland and Malaga, Spain, 216 pp.

7. Mitchell, N.C. (2001). ***Transition from circular to stellate forms of submarine volcanoes.*** Journal of Geophysical Research,106(B2): 1987–2003.

8. Harris, P., Macmillan-Lawer, M., Rupp, J., and Baker, E. (2014). ***Geomorphology of the oceans***. Marine Geology,352: 4–24.

9. Truffert C. (1992). ***De la compression de la Ride Mediterraneenne a` l'extension en mer Egee: Geodynamique de la Mediterranee Orientale***. PhD Thesis, Paris VI University.

10. Drakopoulou, P., and Kyriakidou, C. (2016). ***Morphological map of the Hellenic and adjacent regions.***

11. Mascle J., Mary F., Praeg D., Brosolo L., Camera L., Ceramicola S., and Dupré S. (2014). ***Distribution and geological control of mud volcanoes and other fluid/free gas seepage features in the Mediterranean Sea and nearby Gulf of Cadiz***. Geo-Marine Letters,34: 89–110.

12. Papanikolaou D., Nomikou P., Papanikolaou I., Lampridou D., Rousakis G., and Alexandri M. (2019). ***Active tectonics and seismic hazard in Skyros Basin, North Aegean Sea, Greece***. Marine Geology,407: 94–110.

13. Sakellariou D. and Tsampouraki-Kraounaki K. (2016). ***Offshore faulting in the Aegean Sea: a synthesis based on bathymetric and seismic profiling data***. Bulletin of the Geological Society of Greece,L(1): 124–133.

14. Mascle J. and Martin L. (1990). ***Shallow structure and recent evolution of the Aegean Sea: A synthesis based on continuous reflection profiles***. Marine Geology,94: 271–299.

15. Mascle J. and Le Quellec P. (1980). ***The Matapan Trench (Ionian Sea): example of trench disorganization?*** Geology,8: 77–88.

16. Robertson A.H.F. (1998). ***Tectonic significance of the Eratosthenes Seamount: a continental fragment in the process of collision with a subduction zone in the eastern Mediterranean (Ocean Drilling Program Leg 160)***. Tectonophysics,298: 63–82.

17. Robertson A.H.F. (1998). ***Formation and destruction of the Eratosthenes Seamount, Eastern Mediterranean Sea, and implications for collisional processes***. In: Proceedings of the Ocean Drilling Program, Scientific Results, 160. pp. 681–699.

18. Schattner U. (2010). ***What triggered the early-to-mid Pleistocene tectonic transition across the entire eastern Mediterranean?*** Earth and Planetary Science Letters,289: 539–548.

19. Woodside J.M., Ivanov M.K., and Limonov A.F. (1997). ***Neotectonics and fluid flow through seafloor sediments in the Eastern Mediterranean and Black Seas—***Part I, Eastern Mediterranean Sea.: 128 pp.

20. Woodside J.M., Ivanov M.K., and Limonov A.F. (1998). ***Shallow gas and gas hydrates in the Anaximander Mountains region, eastern Mediterranean Sea.*** In: Henriet J.P. and Mienert J. (Eds.), Gas Hydrates: Relevance to World Margin Stability and Climate Change. London, Geological Society, Special Publications, 137: pp. 177–193.

21. Zitter T.A.C., Woodside J.M., and Mascle J. (2003). ***The Anaximander Mountains: a clue to the tectonics of Southwest Anatolia***. Geological Journal,38: 375–394.

22. Poisson A. (1977). ***Recherches geologiques dans les Taurides occidentales (Turquie)***. Thesis: Univ. Paris-Sud, Orsay, 2 vols.

23. Gutnic M., Monod O., Poisson A., and Dumont J.-F. (1979). ***Geologie des Taurides occidentals (Turquie)***. Memoires de la Societe Geologique de France LVIII,137(112): Paris.

24. Ten Veen J., Woodside J., Zitter T., Dumon T.J., Mascle J., and Volkonskaia A. (2004). ***Neotectonic evolution of the Anaximander Mountains at the junction of the Hellenic and Cyprus arcs***. Tectonophysics,391: 35–65.

25. Zitter T.A.C., Huguen C., and Woodside J.M. (2005). ***Geology of mud volcanoes in the Eastern Mediterranean from combined sidescan and submersible surveys.*** Deep-Sea Research Part I. Oceanographic Research Papers,52(3): 457–475.

26. Lykousis V., Alexandri S., Woodside J., De Lange G., Dählmann A., Perissoratis C., Heeschen K., Ioakim C., Sakellariou D., Nomikou P., Rousakis G., Casas D., Ballas D., and Ercilla G. (2009). ***Mud volcanoes and gas hydrates in the Anaximander mountains (Eastern Mediterranean Sea)***. Marine and Petroleum Geology,26(6): 854–872.

27. Biju-Duval B., Letouzey J., Montadert L., Courrier P., Mugniot J. F. and Sancho, J. (1974). ***Geology of the Mediterranean Sea basins***. In: Burke, C.A. and Drake Ch.L. (Eds.), The Geology of Continental Margins. Springer Verlag, pp. 695–721.

28. Woodside, J.M., Mascle, J., Zitter, T.A.C., Limonov, A.F., Ergun, M., Volkonskaia, A., and Shipboard scientists of the PRISMED II expedition. (2002). ***The Florence Rise, the western bend of the Cyprus Arc.*** Marine Geology,185: 177–194.

29. Ben-Avraham Z., Tibor G., Limonov A.F., Leybov M.B., Ivanov M.K., Torkarev M.Y., and Woodside J.M. (1995). ***Structure and tectonics of the eastern Cyprean Arc***. Marine and Petroleum Geology,12: 236–271.

30. Vidal N., Klaeschen D., Kopf A., Docherty C., Von Huene R., and Krasheninnikov V.A. (2000). ***Seismic images at the convergence zone from south of Cyprus to the Syrian coast, eastern Mediterranean***. Tectonophysics,329: 157–170.

31. Mart Y. and Robertson A.H.F. (1998). ***Eratosthenes Seamount: an oceanographic yardstick recording the Late Mesozoic-Tertiary geological history of the Eastern Mediterranean***. In: Robertson A.H.F., Emeis K.-C., Richter C. and A. Camerlenghi (Eds.), Proceedings of the Ocean Drilling Program, Scientific Results, 160: pp. 701–708.

32. Feld C., Mechie J., Huebscher C.P., Gurbu C., Nicolaide S., Weber M., Hall J., and Louden K.E. (2013). ***Crustal structure of the Eratosthenes Seamount, Cyprus and S. Turkey from an amphibian wide-angle seismic profile***. In: Abstract, AGU 2013 Fall Meeting (San Francisco).

33. Papadimitriou N., Gorini C., Nader F.H., Deschamps R., Symeou V., and Lecomte J.C. (2018). ***Tectono-stratigraphic evolution of the western margin of the Levant Basin (offshore Cyprus)***. Marine and Petroleum Geology,91: 683–705.

34. Harris, P.T., and Whiteway, T. (2011). ***Global distribution of large submarine canyons: geomorphic differences between active and passive continental margins.*** Marine Geology,285: 69–86.

35. Amblas D., Ceramicola S., Gerber T.P., Canals M., Chiocci F.L., Dowdeswell J.A., Harris P.T., Huvenne V.A.I., Lai S.Y.J., Lastras G., Lo Iacono C., Micallef A., Mountjoy J.J., Paull C.K., Puig P., and Sanchez-Vidal A. (2018). ***Submarine Canyons and Gullies***. In: Micallef, A., Krastel, S., and Savini, A. (eds). Submarine Geomorphology, Springer Geology. Springer International Publishing, pp. 251–272.

36. Shepard, F.P. (1963). ***Submarine Geology***. Harper & Row.New Tork, 557 pp.

37. Neuendorf, K.K., Mehl, J.P.J., and Jackson, J.A. (2005). ***Glosarry of geology***. American Geological Institute.Alexandria, 382 pp.

38. Loncke L., Gaullier V., Bellaiche G., and Mascle J. (2002). ***Recent depositional patterns of the Nile deep-sea fan from echocharacter mapping***. AAPG Bulletin,86(7): 1165–1186.

39. Migeon S., Mascle J., Coste M., and Rouchiard P. (2012). ***Mediterranean submarine canyons and channels: Morphological and geological backgrounds***.. In: Wurtz, M. (ed). Mediterranean Submarine Canyons: Ecology and Governance. Gland, Switzerland and Malaga, Spain: IUCN, pp. 216.

40. Ducassou E., Migeon S., Mulder T., Mura A., Capotondi L., Bernasconi S.M., and Mascle J. (2009). ***Evolution of the Nile Deep-Sea Turbidite System during Late Quaternary: influence of climate change on fan sedimentation***. Sedimentology,56: 2061–2090.