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Seismic stratigraphy of the fault-controlled submarine canyon/valley system on the shelf and upper slope of Anamur Bay, Northeastern Mediterranean Sea

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ABSTRACT

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High-resolution shallow seismic reflection (Uniboom) and echosounding profiles obtained on the shelf and upper slope areas of Anamur Bay (Turkey, northeastern Mediterranean) were studied together with previous data on the onshore geology of the area to investigate the origin and related seismic stratigraphy of the submarine Anamur Canyon. It was found that the main axial trend of the submarine Anamur Canyon is aligned with the offshore projection of the N–S orientated, onshore Anamur thrust fault of Late Cretaceous (Senonian) to Early Tertiary age.

Interpretation of the distinct reflection configurations observed on the seismic profiles reveals the presence of various seismic facies comparable with the depositional sequences resulting from the relative sea-level changes during the Late Quaternary. The acoustic basement (probably Miocene in age) is overlain by a sedimentary column (mainly Plio-Quaternary) which, in turn, can be divided into two major seismic sequences and 12 seismic facies that show considerable variations in both their lateral and horizontal extent. A palaeo-deltaic environment (Sequence I), with its typical topset and foreset facies, was recognized and the corresponding deposits are interpreted to be indications of coastal–deltaic progradation during Late Pleistocene sea-level highstands, or during the early phases of the last major eustatic lowering. Reflections of Sequence II, which includes nine distinct facies, are marked by onlap configuration and are believed to be marine deposits of the Flandrian transgression. At least four transgressive cycles are evident from the seismic profiles, at 70–90, 60, 45 and 40 m water depths. The two sequences (I and II) are now covered with the most recent facies.

Introduction

Submarine canyons and other valley-type topographic features and their associated depositional environments have become areas of increased interest to marine geologists as they can provide valuable information on the history of erosional and depositional processes on continental slope (Brown and Fisher, 1977; Bouma, 1982; Schlee and Hinz, 1987; Bugge et al., 1988; Soh et al., 1990; Ergin et al., 1991). In particular, canyons may represent sources of eroded sediment and/or pathways of sediment mass or fluid transport as well as sites of distinctive deposits (e.g. Shepard and Dill, 1966; Kelling and Stanley, 1976; Middleton and Hampton, 1976; Morris and Busby-Spera, 1988; Sanford et al., 1990; Satterfield and Behrens, 1990).

However, only a few canyons or associated valley/channel systems have been investigated from the eastern Mediterranean Sea with respect to their origin and textural sediment characteristics (Goedicke, 1972; Ediger et al., 1988; Ferentinos et al., 1988). Previous studies in Anamur Bay provide a significant framework for the distribution of surface sediments (Ediger, 1987; Alavi et al., 1989; Ediger and Ergin, 1990); however, the structure and origin of the submarine valley system in this bay have not been addressed in detail (Ediger et al., 1988). In this paper we discuss the

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origin and morphological development of the fault-controlled Anamur submarine canyon/valley system and the seismic stratigraphy over the acoustic basement in the shelf and upper slope of Anamur Bay, based on seismic reflection profiles and data from the onshore geology.

Geological and environmental setting

Like many other land valleys around the world (Shepard, 1973; Kenyon et al, 1978; Gnibidenko and Svarichevskaya, 1983/1984; Nagel et al., 1986), the Anamur land valleys were probably formed by a combination of faulting and erosion.

The Anamur submarine canyon/valley system is located on the northern continental margin of the Adana–Cilician Basin, a forearc area where the Anatolian microplate has been deformed as a result of collision in the Middle Miocene with the African plate (e.g. Jackson and McKenzie, 1984). The Adana–Cilician Basin (Fig. 1), a large basin consisting of two basins, the Adana and Cilician (Şengör et al., 1985; Görür, 1992), is bordered by the Iskenderun Basin to the east, the Antalya Basin to the west and the Kyrenian Mountains of Cyprus to the south. Between the Antalya and Cilician Basins, NW–SE trending faults occur, which are probably associated in the north with the onshore thrust fault (called the "Anamur Fault") of Late Cretaceous (Senonian) to Early Tertiary age (Özgül, 1984; Tekeli and Göncüoğlu, 1984). This thrust fault extends along the course of the Sultançay River Valley and separates the flanks of the two major units in the area, the Alanya Massif, a Palaeozoic metamorphic complex in the east, and the Antalya Nappes, Palaeozoic and Mesozoic rocks in the west (Figs. 1 and 2) (Brunn et al., 1971; Yılmaz, 1981; Özgül, 1984). The offshore extent of the Anamur Thrust Fault is associated with the Anamur–Kormakiti Ridge in the south, which reaches the Cyprus Block (Anastasakis and Kelling, 1991).

In the north, the narrow coastal plain of Anamur separates the Adana–Cilician Basin from the high Taurus Mountains. The submarine geology of the Cilician Basin with a pre-Neogene basement is mainly controlled by subparallel block-faulting and halokinetics affecting the youngest sedimentary units (Evans et al., 1978), whereby vertical movements and basin subsidence appear to have begun in the area some time during the Eocene–Miocene collision of Arabia–Africa with Anatolia (e.g. Woodside, 1977; Stanley, 1977; Hempton, 1985; Şengör et al., 1985; Görür, 1992; Yılmaz, 1992). Although no satisfactory model has yet been proposed for their origin, it seems that the Adana–Cilician Basin complex is associated with the kinematics of neotectonics between the East Anatolian Fault and the oblique extensional Cyprus subduction zone (Şengör et al., 1985). In the Cilician Basin Plio-Quaternary sediments of various thicknesses lie with marked unconformity on Messinian evaporites and associated sediments (Evans et al., 1978). Unfortunately, no subsurface information on the nature and thickness of the sedimentary fill of the submarine areas of the Cilician Basin was available.

Methods

A total of about 110 km of 37 track lines were surveyed to collect echosounding data and shallow seismic (300 J) reflection profiles (analogue format) in Anamur Bay during the cruises of *R/V Bilim* and *R/V Lamas* in 1985 (Fig. 3). An EG&G Uniboom high-resolution shallow seismic system was used with a resolution of about 30 cm; the effective acoustic frequency range was 400 Hz to 14 kHz and the average vertical exaggeration of profiles was twelve. An assumed seismic velocity of 1500 m/s was used to derive the water depths. The seismic velocity for consolidated and unconsolidated sediments was about 1700 m/s (cf. Ediger, 1987). Bathymetric data were collected with an ATLAS DESO-10 precision depth recorder (40 and 210 kHz) and a RAYTHEON portable echosounder (208 kHz). Position-fixing was achieved by using a Del Norte trisponder system. The recognition of seismic sequences and their interpretation are based on the seismic stratigraphic analysis methods outlined by Mitchum and Vail (1977), Vail et al. (1977a,b), Sangree and Widmier (1979) and Brown and Fisher (1980).

Results of the surface sediment analysis within the scope of this work are presented in detail in

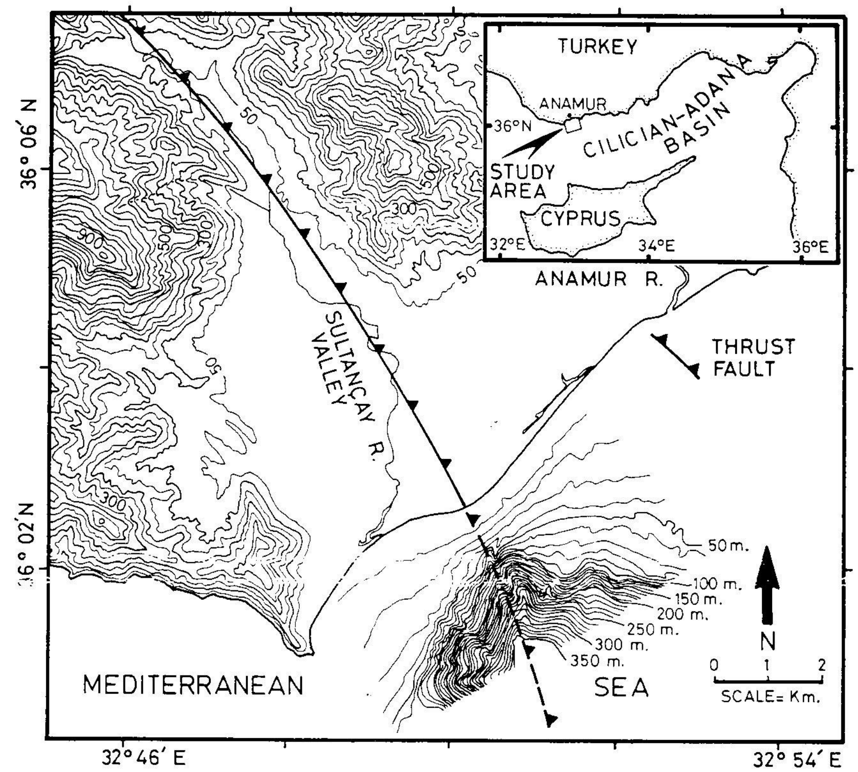

Fig. 1. Location and bathymetry of the studied marine region and topography of the coastal region (adapted from Alavi et al., 1989; Ediger, 1987). Note the Anamur thrust fault (Özgül, 1984) coinciding with the onshore valley and offshore Anamur Canyon (Ediger et al., 1988).

IMS-METU (1985), Ediger (1987) and Alavi et al. (1989).

Results and interpretations

Origin and topography of the Anamur Canyon

The offshore projection of the Anamur thrust fault aligns with the main trend of the Anamur Canyon, which is V-shaped in cross-section and is probably a submarine expression of the thrust fault onshore (Figs. 1 and 2). The onshore continuation of the Sultançay River along this thrust fault, its alignment with the canyon and the steep-sided wall of the canyon support this interpretation (Ediger et al., 1988). Their fault origin is also confirmed by fault scarps observed on most of the seismic profiles. However, these profiles do not show the rock outcrops on the walls of the canyon. Seismic profiles show that the lateral extent of the walls of the canyon and valleys are partly related to the parallel faulting and warping that has taken place in the valleys of the continental margin (Figs. 1 and 2).

Bathymetric surveys have shown the presence of a seaward-convex topography of the continental shelf and upper slope of Anamur Bay (Fig. 1). The continental shelf is very narrow and breaks at about the 50 m (in the southwest) and 100 m (in the northeast) depth contours. It is about 1 km wide in the central part of the study area, where the Anamur canyon/valley system appears, and tends to broaden towards both the west (about 2 km) and east (about 4 km). The gradient of the shelf varies between 1° and 3°. In contrast with the smoothly seaward-dipping shelf, the gradients of the slope increase to 10° and 14° down to the canyon and valleys. Most parts of the continental slope are extensively dissected by minor submarine canyons/valleys with straight or winding courses

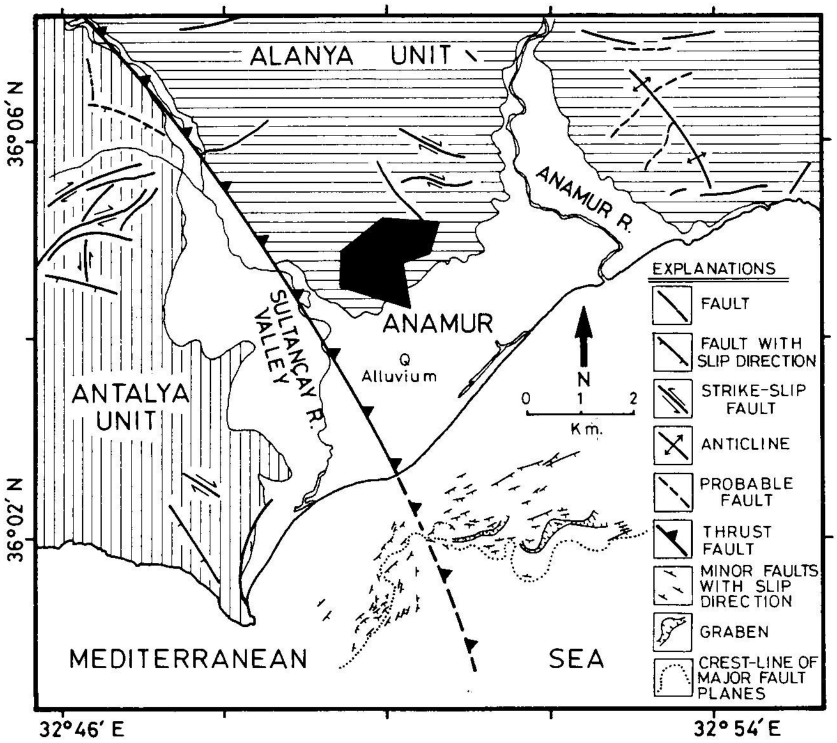

Fig. 2. Map of the geological and structural framework of the coastal region (Ilbal, 1978) and the structural framework of the acoustic basement in the study area. Note the Anamur thrust fault (Özgül, 1984) coinciding with the onshore valley and offshore Anamur Canyon (Ediger et al., 1988).

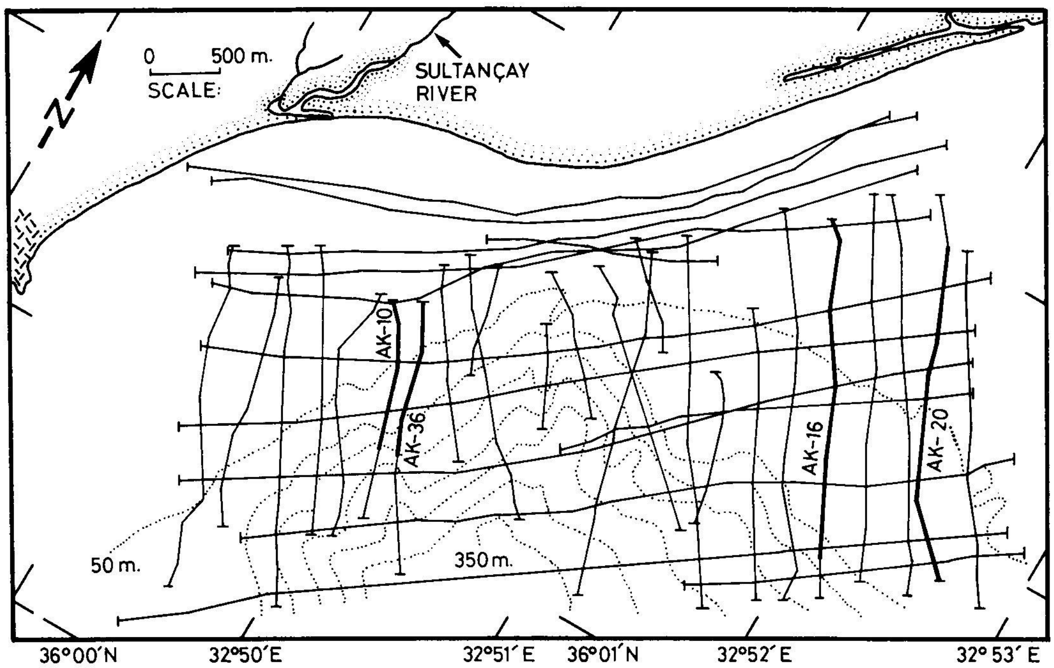

Fig. 3. Trackline map of the Uniboom seismic reflection and echosounding profiles used in this study.

and V- to U-shaped transverse profiles at their lower ends.

These submarine canyon and valleys extend parallel to the major thrust fault system on the adjacent land (Figs. 1 and 2). Occurrences of steep, possibly fault, scarps of the studied canyon/valleys are in line with the major fault patterns of these features.

Seismic stratigraphy

Based on the delineation and interpretation of geometry, continuity, amplitude, frequency and the external form of the reflection configurations observed on the seismic profiles, the following depositional settings and corresponding seismic facies and sequences are recognized.

Acoustic basement

The acoustic basement (Miocene in age) is characterized by a chaotic internal reflection configuration and usually appears in the lower parts of seismic profiles (Figs. 4–7). Its upper surface seems to be eroded and shows a fault-controlled depositional basement in the study area (Fig. 2). The lateral extent of the acoustic basement strongly suggests a tectonic connection with the northerly, onshore Anamur thrust fault (Late Cretaceous to Early Tertiary in age), and the southerly, submarine Anamur–Kormakiti Ridge (Late Tertiary in age). Some of these faults, coinciding with the present day steep canyon/valley walls, were easily recognized on the seismic records over the acoustic basement (e.g. Figs. 2 and 4–7). Seismic records and the bathymetric contours also indicate that the southwest side of the canyon walls are more steeply faulted than the northeastern sides (Figs. 4–7).

Seismic facies

The seismic reflection configuration is the most obvious and directly analysed seismic parameter and shows the gross stratification patterns from which the depositional processes, erosion and palaeotopography can be determined (Mitchum et al., 1977).

Twelve distinctive seismic facies (A, B, C, D, E, TS, FS, TD, L, CD, SS and channel deposit) above the Miocene acoustic basement have been identified on the seismic profiles of the Anamur continental and canyon margin (Figs. 4–7).

Facies TS and FS

Facies TS (topset) shows oblique to chaotic internal reflection configurations with a wedge-shaped external form. It pinches out at the edge of the slope and has a thickness of about 5 m. Palaeo-deltaic foreset (FS) deposits are well developed and can be clearly identified by their sigmoid to chaotic reflection configurations on the seismic records and fan-shaped external form. The thickness of the palaeo-deltaic FS is about 11 m on the northeastern and 17 m on the southwestern sides of the canyon. Unfortunately, the boundary of the bottomset deposit is not clearly identified from the seismic records (Figs. 4–7). The upper edge of the palaeo-deltaic deposits corresponds to about 40 m (50 ms) depth of water on the northeastern side and to 22–30 m (30–40 ms) depth of water on the southwestern side (Figs. 4–7). The total thickness of the palaeo-delta (Facies TS and FS) reaches up to about 12 m in the northeast and 23 m in the southwest of Anamur Canyon (Fig. 8). The differences in thickness between the two sides of the delta indicate that the sedimentation rate at the southwestern side was twice that of the northeastern side of the delta. The horizontal alignment of the topset and foreset deposits are conformable with the present day bathymetric contours (Fig. 9B).

Deposits of Facies TS and FS are well developed until the beginning of the last major eustatic lowering during the Late Pleistocene. Topset facies of these deltaic deposits probably partially crop out on the southwestern shelf due to erosion by currents (Fig. 9A). Similar observations were made by Alavi et al. (1989).

Facies E

This facies, which is referred to as a palaeo-lagoonal deposit by Alavi et al. (1989), is marked by chaotic to hummocky internal reflection configurations and vertical infill of a boundary controlled by faulting on the northeastern side of the acoustic

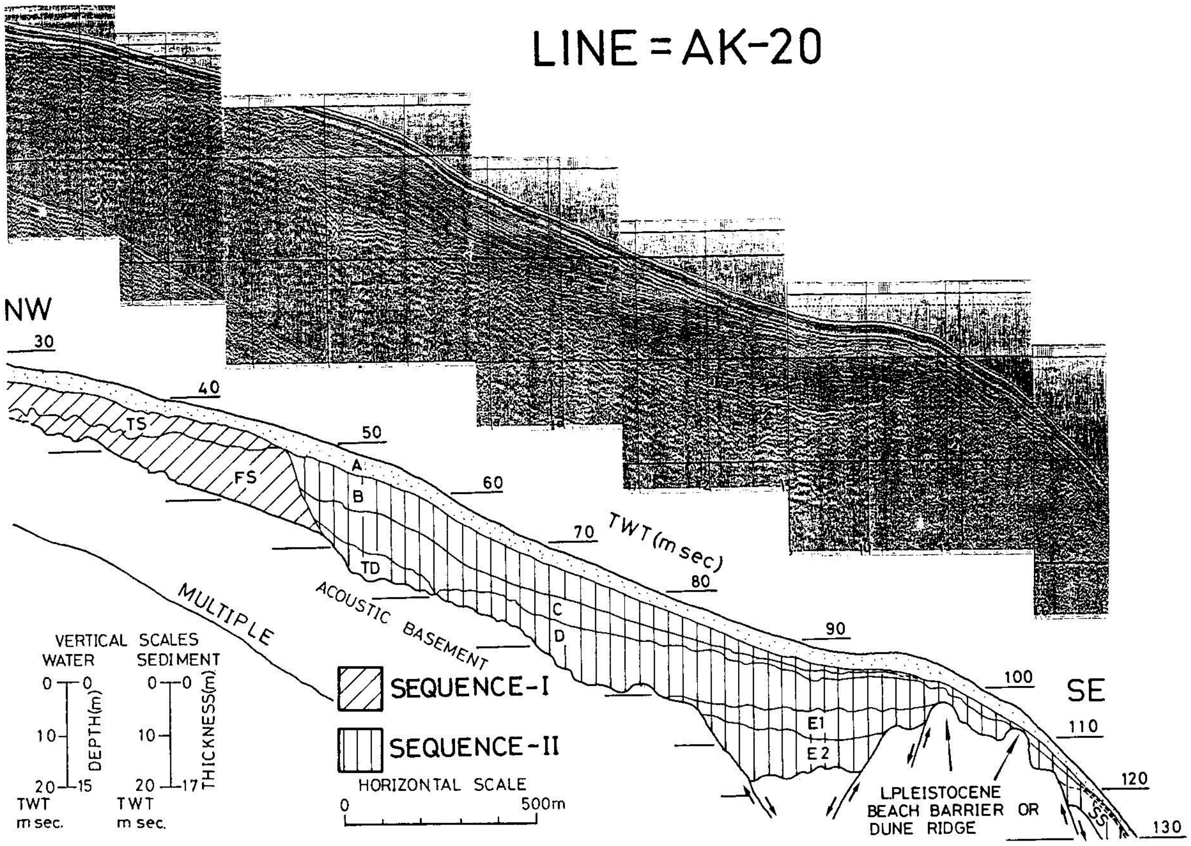

Fig. 4. High-resolution seismic profile and interpretation along line AK-20 (see Fig. 3 for location).

basement (Figs. 4 and 5). This type of facies was probably deposited during the last maximum sea-level lowstand in the fault-controlled depressions (graben; Fig. 2) over the acoustic basement. The upper boundary of this facies is located between 70 and 90 m (100 and 120 ms) depth of water. At this depth the last glaciation reached its maximum sea-level lowstand (Alavi et al., 1989). The alignment of this palaeo-coastline, which is conformable with present day depth contours, is mapped in Fig. 9C. The horizontal distribution pattern of this type of lagoonal deposit is also shown in Fig. 9C. Facies E shows partially subparallel and transparent reflection configurations. The offshore side of this lagoonal deposit was probably backed by a Late Pleistocene beach barrier or dune ridge system (Fig. 4) (Van Andel and Lianos, 1984; Alavi et al., 1989). This facies consists of two different units, E1 and E2, as shown along Line AK-20 (Fig. 4). The thickness of Unit E1, which has a chaotic internal reflection configuration, is approximately 4 m; Unit E2, which has hummocky and irregular internal reflection configurations, is about 7 m thick.

Facies D and TD

Facies D, which is characterized by a chaotic reflection configuration, is partially deposited over Facies E, as well as above the acoustic basement (Figs. 4–7). Facies D is the earliest onlap facies in this area and has a wedge-shaped external form. The deposits of Facies D have a thickness of about 6 m, and must have been deposited during the sea-level rise after the Last Glacial Maximum. Facies D pinches out at about 60 m (80 ms) water depth during the second sea-level stillstand at this depth. The horizontal alignment of this palaeo-coastline is conformable with the present day bathymetric

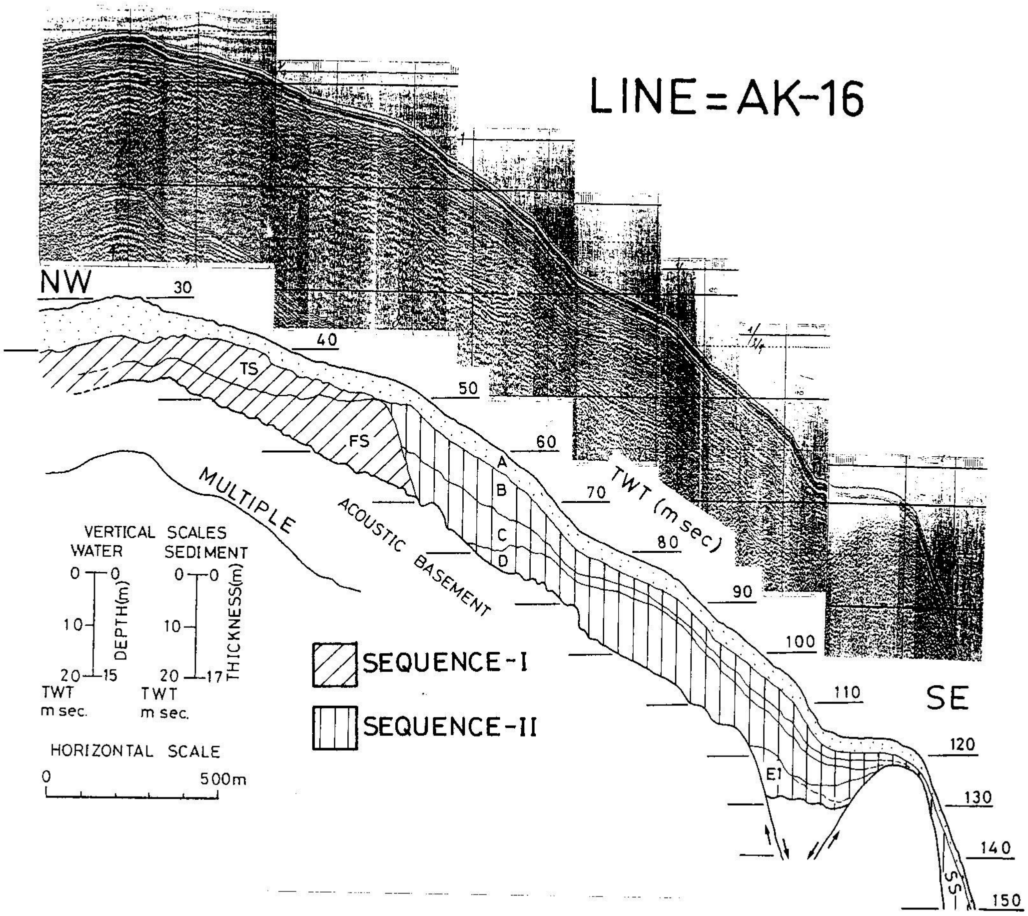

Fig. 5. High-resolution seismic profile and interpretation along line AK-16 (see Fig. 3 for location).

contours of the canyon (Fig. 9D). During the sea-level stillstand, Facies D developed in the offshore zone, whereas the lens-shaped talus deposit (Facies TD), which has a simple stratified reflection configuration (about 4 m thick), was deposited in the backshore zone (Fig. 4). The sediments of this non-marine talus deposit were probably produced by erosion of the nearby palaeo-deltaic deposits by the action of external physical weathering effects while Facies D was being deposited in the marine environment.

Facies C

This facies is marked by a simple stratified parallel reflection configuration and was deposited over Facies D during a rise in sea level, and it pinched out at nearly 45 m (60 ms) depth of water during the third sea-level stillstand (Figs. 4–7). This facies is the second onlap facies of the environment and has a wedge-shaped external form. The horizontal distribution pattern of this palaeo-coastline is also conformable with the present day bathymetric contours (Fig. 10A). The thickness of Facies C is about 10 m and it thins offshore (Figs. 4–7).

Facies B, L and CD

Facies B has a simple stratified parallel reflection configuration with wedge-shaped external form. It progressively onlaps (called the third onlap) the underlying initial surface of deposition (Facies C) during a sea-level rise. It pinches out at nearly 40 m (50 ms) depth of water during the fourth sea-level stillstand on both sides of the canyon (Figs. 4–7). The horizontal distribution of this palaeo-coastline is also conformable with the present day

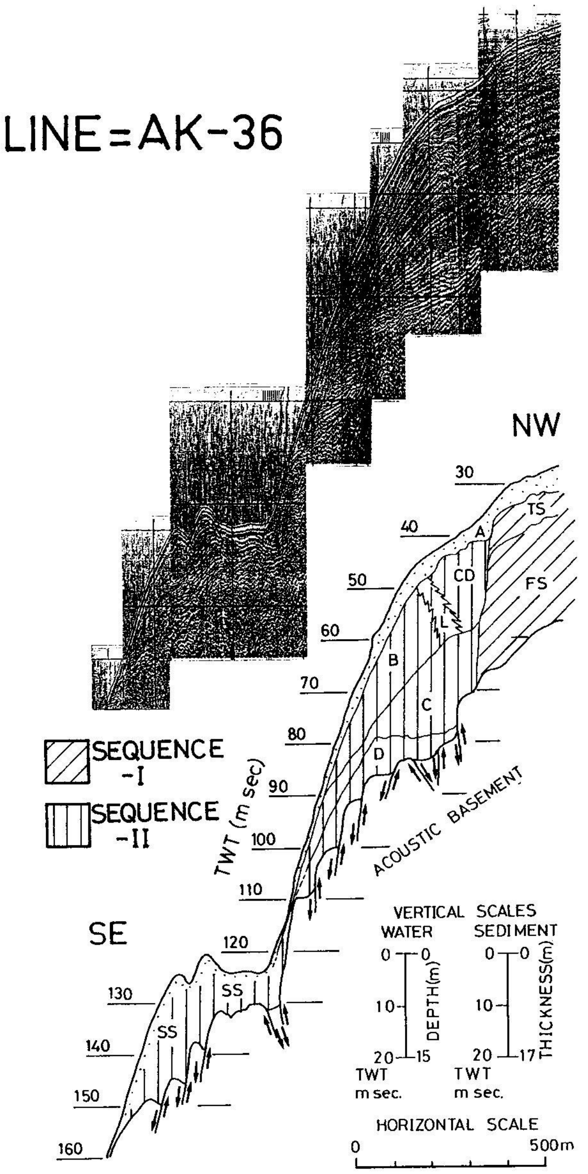

Fig. 6. High-resolution seismic profile and interpretation along line AK-36 (see Fig. 3 for location).

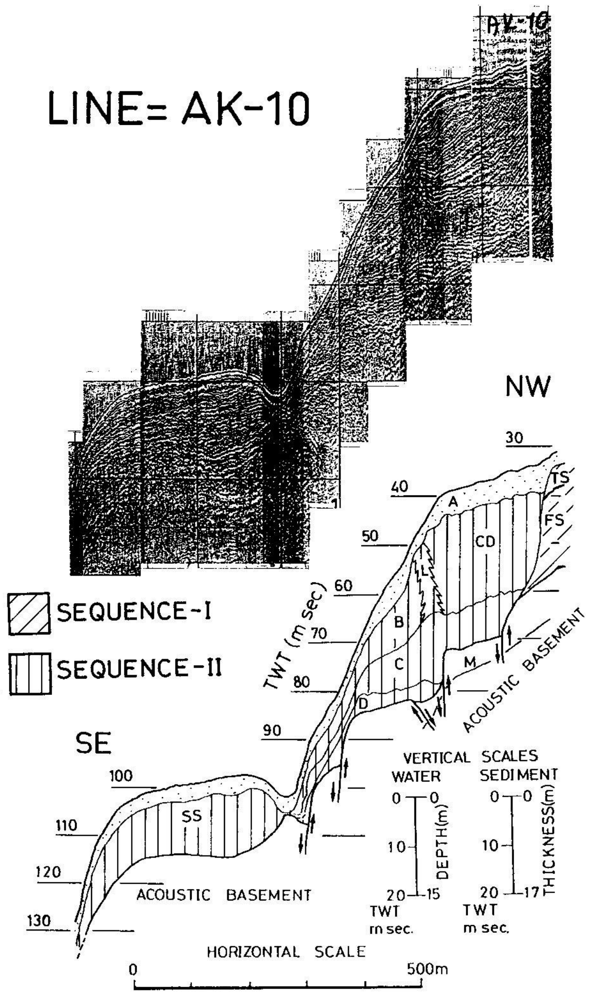

Fig. 7. High-resolution seismic profile and interpretation along line AK-10 (see Fig. 3 for location).

bathymetric contours (Figs. 10B and C). The thickness of Facies B is about 5 m on the northeastern side and 8 m on the southwestern side of the canyon. The non-marine coastal deposits (CD) in the backshore zone, the littoral (L) deposits in the transitional zone and the marine deposits (Facies B) in the marine zone can be differentiated on the seismic records collected from the southwestern side of the canyon (Figs. 6 and 7). The mean thickness of Facies CD, which has a parallel concave internal reflection configuration, is 12 m and that of Facies L, which has a parallel convex internal reflection configuration, is 11 m (Figs. 6 and 7). The vertical alignment of the littoral deposits on the southwestern side of the canyon indicates the balance between the terrigenous influx from the coastal zone and a rising sea level (Brown and Fisher, 1980). Also, the non-marine (CD), littoral (L) and marine (B) sediments are contemporaneous deposits. The horizontal distribution of facies CD, L and B are mapped in Figure 10C and the boundaries of these layers are conformable with the present day bathymetric contours.

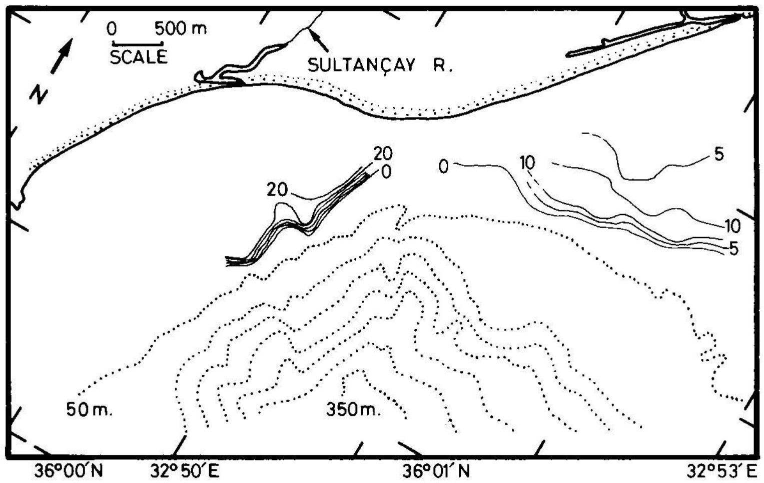

Fig. 8. Thickness contours of the paleo-deltaic deposits in the Anamur Bay (in metres).

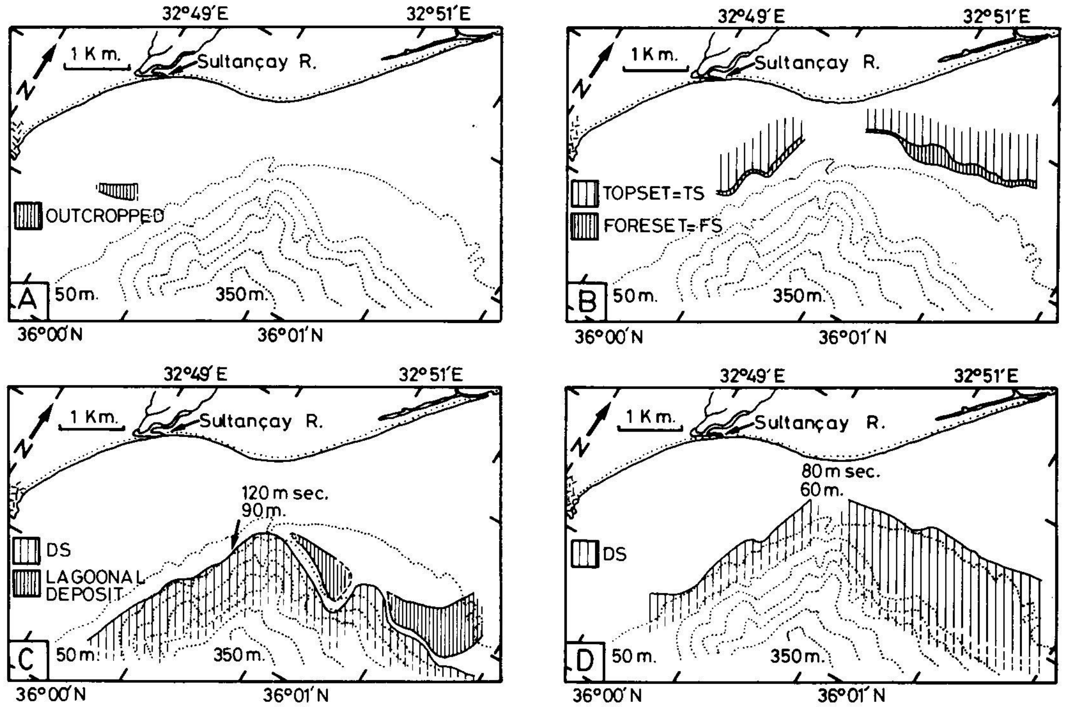

Fig. 9. (A) Outcrops of the topset of the palaeo-deltaic deposits. (B) Boundary distributions of Facies TS and FS of the palaeo-deltaic deposits. (C) Probable palaeo-coastline at 90 m (120 ms) depth during the maximum sea-level lowstand around the Anamur Canyon and the horizontal distribution of the onshore palaeo-lagoonal deposits (Facies E). *DS* shows the depositional area during maximum sea-level lowering. (D) Probable palaeo-coastline when sea level reached up to 60 m (80 ms) during the Flandrian transgression; Facies D pinches out at this depth. *DS* shows the depositional area of Facies D.

Facies A

Facies A shows simple stratified parallel reflection configurations which cover the underlying depositional surfaces (Figs. 4–7). It has a sheet drape to wedge-shaped external form on the seismic profiles. The mean thickness of this facies is about 4 m on both sides of the canyon. The grain size of the surface sediments of this facies

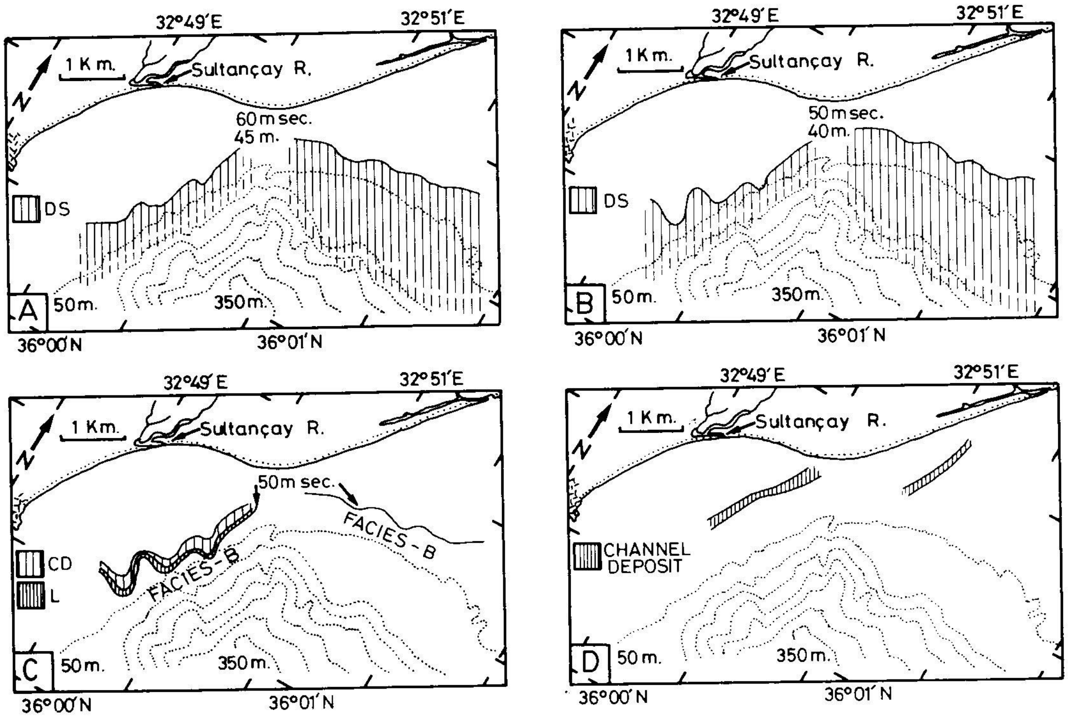

Fig. 10.(A) Probable palaeo-coastline when sea level reached up to 45 m (60 ms) during the Flandrian transgression. Facies C pinches out at this depth. *DS* shows the depositional area of Facies C. (B) Probable palaeo-coastline when the sea level reached up to 40 m (50 ms) during the Flandrian transgression. Facies B pinches out at this depth. *DS* shows the depositional area of Facies B. (C) Horizontal distribution boundaries of the marine (Facies B), littoral (*L*) and coastal non-marine (*CD*) deposits in the study area. (D) Horizontal distribution pattern and alignment of two different palaeo-channel deposits in the study area.

decreases towards the sea, as discussed by Alavi et al. (1989). The most important factors affecting the sediment thickness and the bottom boundary variations of this facies are their proximity to sources of fluviatile discharge and the palaeo-relief of the shelf. These recent sediments are partially compacted and partially saturated with sea water, thinning towards the sea. This facies reaches its minimum thickness where it meets the slope at the sides of the canyon (Figs. 4–7). The top of this facies forms the present seafloor.

Facies SS

This facies displays chaotic, hummocky and subparallel reflection configurations with a mounded external form which can be observed along seismic sections AK-36, 20, 16 and 10 (see Figs. 4–7). It is seen from the 100–120 ms depth level close to the regions of the self-break/upper slope of the surveyed area. These are most probably formed by slumping or sliding processes (Ergin et al., 1992) of sediments on the upper sides of the canyon.

Channel deposit

Buried river channels and accretionary (oblique-bedded) inter-channel sediments close to the apical part of the head of the Anamur Canyon indicate that the drainage system of the Sultançay River extended into the head of the canyon in the Late Pleistocene (Alavi et al., 1989) and/or during the early phases of the last major eustatic sea-level rise. The horizontal distribution pattern of two different buried channel deposits are distinguishable on the seismic records (Alavi et al., 1989) and mapped in Fig. 10D. The north–south alignment of these channels strongly indicates the presence of southwesterly coastal palaeo-current system.

Facies TS and FS are usually observed in the landward section of the seismic profiles and are interpreted to be palaeo-deltaic facies which are deposited over the erosional fault-controlled surface of the acoustic basement. These deltaic deposits are shaped by the regression period. During each period of the Flandrian transgression of the shoreline, Facies B, C, D, E, TD, L, CD, SS and the Channel Deposit are also deposited over the surface of the acoustic basement and the palaeo-deltaic sediments deposited earlier. Traces of the stationary shorelines are observed only on the southwestern side of the canyon during the deposition of Facies B (Figs. 6 and 7). This probably indicates the balance between the rate of sea-level rise and the rate of sediment supply. Facies CD and L were deposited during the stillstand at the time of deposition of facies B. Similarly, Facies TD is locally deposited in the palaeo-coastal zone during the deposition of Facies D in the marine environment (Fig. 4). Facies SS probably includes many of the above facies and corresponds to slope/slide deposits at the steep sides of the canyon (Figs. 4–7). River channels were probably cut and filled during the Flandrian transgression over the palaeo-deltaic Facies TS by the action of the high river inputs.

Seismic sequences

Two distinctive seismic sequences (I and II) have been identified above the Miocene acoustic basement. These sequences include 11 different seismic facies (Sequence I, Facies TS and FS; Sequence II, Facies B, C, D, E, TD, L, CD, SS, and Channel Deposit) (Figs. 4–7).

Sequence I is interpreted as an indication of a palaeo-deltaic environment which can be further subdivided into two different facies (topset, TS; foreset, FS) on the basis of the alternating onlap and offlap nature of the seismic facies (e.g. Figs. 4–7). A typical arrangement is for the top of the shelf edge to form the present day seafloor. It is assumed that this palaeo-deltaic Sequence I must have been deposited during the Late Pleistocene sea-level changes or during the early phases of the last major eustatic lowering.

Sequence II is mainly marked by onlap configuration and can be subdivided into three different onlap facies (B, C and D) deposited during the Flandrian transgression (Figs. 4–7). Talus (TD), lagoonal (E), slumping and sliding (SS), coastal (CD) and littoral (L) deposits and the Cha[illegible] Deposit are also part of Sequence II and a[illegible] probably deposited during the Flandrian transgression (Figs. 4–7). The two sequences (I and II) are covered with the most recent Facies A.

The palaeo-deltaic sequence must have prograded seawards (e.g. Figs. 4–7) and, consequently, the palaeo-coastline retreated towards the sea during the last Pleistocene period. The younger sediment wedge of the second sequence (B, C and D) prograded landwards to form onlap, and this must have resulted in the landward progradation of the palaeo-coastlines during the Flandrian transgression (Figs. 4–7).

Discussion and conclusions

The depositional environments and related Late Quaternary palaeo-oceanography of the submarine Anamur Canyon and its adjacent valleys were investigated using seismic reflection profiles and echosounding records. On the basis of these, the following observations can be made.

The offshore projection of the thrust fault aligns with the main trend of the Anamur Canyon, which is V-shaped in cross-section and is probably a submarine expression of the thrust fault onshore. A gently sloping (shelf) area extending from the shoreline as far as the edge of the canyon and steep sloping walls of the canyon are two main topographic features of Anamur Bay.

Depositional trends are related to the NW–SE thrust fault system along the canyon axis and the small-scale normal parallel faulting system that developed on the margin during the Late Cretaceous (Senonian) to Early Tertiary and to the subsequent subsidence of the basement.

Twelve distinctive seismic stratigraphic facies have been identified in the subbottom of Anamur Bay. The palaeo-deltaic deposit over the acoustic basement is an older sequence in this area. The TS facies of this delta partially crops out on the southwestern shelf by the action of the bottom current. The total thickness of the palaeo-delta reaches about 12 m in the northeast and 23 m in the southwest. This difference in thickness between the sides of the palaeo-delta indicates that the sedimentation rate on the southwestern side is twice that of the northeastern side of the delta and the southwestern delta coast migrated further towards the sea than the northeastern delta during the Late Pleistocene sea-level highstand or during the early phases of the last major eustatic lowering of sea level.

Facies E (probably a palaeo-lagoonal deposit) has a vertical infill of a boundary controlled by a fault basin (graben) on the northeastern side of the canyon. The depth of the upper boundary of this facies is between 70 and 90 m (100–120 ms) water depth. This depth corresponds to the first sea-level stillstand during the last glaciation. The last glaciation reached the maximum lowering of sea level at this depth.

Facies D pinches out at 60 m (80 ms) depth of water during the second sea-level stillstand. Talus is deposited at the coastal zone during the deposition of Facies D. Facies C pinches out at nearly 45 m (60 ms) water depth during the third sea-level stillstand. Facies B progressively onlaps the underlying initial surface of deposition and this marine deposit is pinched out at nearly 40 m (50 ms) depth of water during the fourth sea-level stillstand. The vertical alignment of the littoral deposits (L) on the southwest side of the canyon indicates a balance between the terrigenous influx from the coastal zone and the sea-level rise at the time of deposition.

The horizontal distribution patterns of the first, second, third and fourth palaeo-coastlines are conformable with the present day bathymetric contours.

All facies (except Facies A) have been grouped into two distinctive seismic stratigraphic sequences (I and II) based on the stratigraphic characteristics of the facies. These seismic sequences possibly represent Plio-Quaternary deposits. However, the post-Miocene delta-building and coastal progradational processes in the eastern Mediterranean are confined mostly to Quaternary sea-level oscillations (e.g. Vita-Finzi, 1972; Evans, 1979; Aksu et al., 1992). We therefore believe, on the basis of the persistent acoustic response and the geometry of the reflector packages observed on most seismic profiles in this study, that the seismic sequences above the acoustic basement could correspond mainly to the Late Quaternary period.

The two different palaeo-deltaic facies (TS and FS) of Sequence I were probably deposited during the last Pleistocene sea-level highstand or during the early phases of the last major eustatic lowering. During the transgression and stillstand periods, three main onlap facies (D, C and B) and six different facies (E, TD, L, CD, SS and the Channel Deposit) of Sequence II were probably deposited during the Flandrian transgression by rising sea levels.

The relative sea-level change necessarily produces a shoreline regression (falling), transgression (rising) and stillstand (stationary), and is typical of the Late Quaternary. Shifts in the shoreline during a relative sea-level change is a function of sea-level fluctuations, subsidence and sediment supply (Brown and Fisher, 1977). Determining the eustatic sea-level rise using coastal onlap must involve adjustment for subsidence and sediment compaction. Three different models are available to explain the deposition of sediment over the acoustic basement in Anamur Bay: shoreline transgression, regression and stillstand.

The horizontal distribution pattern of two different buried channel deposits near the coastal zone indicates the presence of a southwesterly flowing coastal palaeo-current system. The most recent facies (A), which is partially saturated with sea water and is partially compacted, thins out towards the open sea and covers the pre-deposited sediments of Sequences I and II.

The fault-controlled depositional basin, the different sedimentation rates at the sides of the canyon and the sea-level oscillation around the canyon strongly indicate that different factors have controlled the depositional patterns of the Anamur Bay base of shelf and slope: (1) structural control; (2) sediment supply and depositional processes and (3) sea-level fluctuations.

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