The sediments of the Gulf of Antalya (Southern Turkey)

CATANI G.°, LENARDON G.°, TUNIS G.°, BONAZZI A.* , VINCI A. +

° Institute of Geology - University of TRIESTE **(Italy)**
*Institute of Mineralogy - University of PARMA **(Italy)**
+ Institute of Petrography - University of PARMA **(Italy)**

This paper reports the results of a study carried out on 4 cores collected in the northern part of the Antalya Basin, on the slope-margin of the basin, during the MAC-GAN cruise (Groupe MAC GAN, 1986; ROSSI *et al.*, 1988) and on 7 beach samples gathered near to the main rivers of the Turkish coasts from Kemer to Anamur (Fig. 1). In order to characterize these sediments and to point out their source area and depositional mechanism, grain size and mineralogy analyses of the sediments were performed on all the cores; heavy mineral identification was carried out both on the beach samples and sandy levels within the cores. In the Antalya Gulf a narrow platform develops with a steep continental slope. Many submarine canyons, acting as pathways of turbiditic flows, cut the slope; the main one is going away in front of Antalya Harbour, in a North-South direction. The Antalya basin reaches a maximum depth of 2600 m and is limited in the southern part by seamounts of the Cyprus Arc.

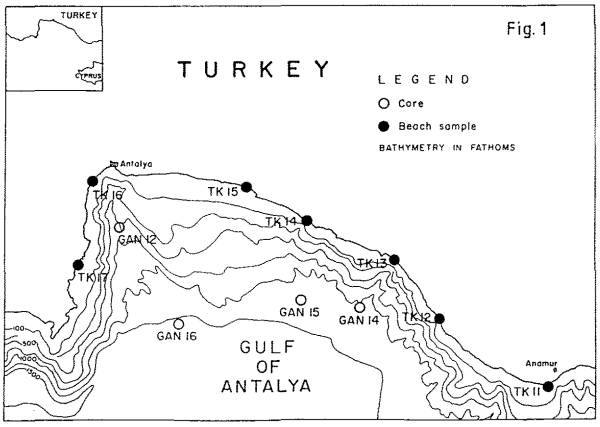
A previous study by CATANI *et al.* (1986) of the central part of the basin showed that it is characterized by two zones with different morphological and sedimentological features: coarser sediments and several turbiditic flows occur in the northern part, mainly in the north-eastern zone near Antalya canyon; conversely, clay rich sediments and several thick sapropelitic levels mark the southern part of the basin.

The stratigraphy of the cores shows a noticeable difference between the sediments located along the axis of the Antalya Canyon and those sampled in the eastern sector of the area : in fact, the former are coarser, with frequent occurrences of sands and even gravels. GAN 14 and GAN 15 cores often show alternated sandy turbiditic layers, with silty-clayey levels. In particular, in the GAN 12 core the top of a debris flow, with rounded elements of 2-6 cm size, supported by scarce coarse sand matrix has been collected. Moreover, these coarse deposits prove that frequent mass flow episodes, identified also by 3,5 kHz survey, took place.

Only one tephra layer was recognized in core GAN 15; the source area was identified after chemical analyses on the vitreous fraction and on the basis of refractive index and mineral content. This ash layer (Y5) has trachytic composition and mineralogical association characterized by augite, aegirine-augite, horneblende, biotite, apatite; this layer is correlated with the ignimbrite campana eruption dated at about 34000 years B.P. The remaining cores are free of pyroclastic material.

The mineral composition of clay fraction, determined by conventional X-ray diffraction methods, shows that there is remarkable little difference in the bulk composition of the sediments of the Antalya Gulf. With respect to the cores collected in the Antalya Basin (CATANI *et al.*, 1986), these sediments are richer in smectite and montmorillonite, as a proof of a marked influence of terrigenous inputs from the mainland. Mineralogical analyses, performed on sands collected from cores and beach samples, point out that the clinopyroxene-amphibole- orthopyroxene association is typical of both the Antalya canyon and the coast West of the town, while the garnet-chloritoid-amphibole association is typical of the Alanya coast and of the facing continental slope. Some minerals, e.g. tourmaline and olivine, mark out a convergence of the coastal transport towards Antalya.

Lastly, on the basis of the only one ash layer found in the GAN 15 core the sedimentation rate results of 9,3 cm/1000 yrs in the last 34.000 yrs; a remarkable decrease of sediment grain size in the core occurred approximatively 13.000 yrs B.P., the finer sediments being probably related to the sea level highstand still persisting.



REFERENCES

ANASTASAKIS G. and KELLING G., 1991. - Tectonic connection of the Hellenic and Cyprus arcs and related geotectonic elements. *Mar. Geol.*, 97: 261-277.

CATANI G., LENARDON G., TUNIS G., BONAZZI A. and VINCI A., 1986. - Aspetti sedimentologici e mineralogici dei sedimenti del Bacino di Antalya (Ovest di Cipro). *VII Congresso AIOL, Trieste* : 205-216.

GROUPE MAC-GAN 1986. -. La Mer de Crète et le Bassin d'Antalya, deux bassins d'arriere-arc? Comparaison structurale et sédimentaire. (Abs.) *XXX° Congrès-Assemblée Plénière C.I.E.S.M., Palma de Majorca* : 81.

ROSSI S. *et al.* 1986. - Mare di Creta e il Bacino di Antalya : entrambe sono zone di retroarco? Obiettivi e risultati preliminari della crociera MAC-GAN '86. *Rend. Soc. Geol. It.*, 9 : 11-14.

Chemical composition and X-Ray mineralogy of beach sands, Corfou Island, Greece

N.K. CONISPOLIATIS

Section of Geological Sciences, National Technical University of ATHENS **(Greece)**

Sands from 3 beaches of the Corfou island, namely Arila, Glyfada and Ag. Georgios, were analysed for a number of major, trace elements and main minerals. In particular SiO_2, Al_2O_3, Fe_2O_3, MgO, CaO, Na_2O, K_2O, TiO_2, P_2O_5, MnO, Ba, Co, Cr, Cu, Li, Ni, Pb, U, V and Zn were analysed with I.C.P., Corg with LECO carbon analyser, and the main minerals with X-ray diffraction analysis. The highest levels of SiO_2, Al_2O_3, Fe_2O_3, K_2O, TiO_2 Ba, Cr, Ni, V and Zn are in general found in the sands of Arila and Ag. Georgios beaches while the Glyfada beach sands contain relatively high values of CaO and MgO. Cu, Co, Pb, U and Corg appeared to be uniformly distributed. Quartz, and calcite mainly of terrigenous origin, are the main minerals.

Introduction

The beaches of Arila, Glyfada and Ag. Georgios at the western coast of the Corfou island (Fig.1), consist of well to very well sorted sands and in some cases sands and gravels, materials of second cucle or erosion, which are supplied by streams and coastal erosion (CONISPOLIATIS, 1989). The principal rock types supplying coarse sediments to the beaches are Tertiary sandstones, breccias, conglomerates marls and conglomerate limestones (MARAGOUDAKIS, 1967, GEOL.MAP OF GREECE, 1962).

The aim of this research is to evaluate the main minerals present in the beach sands, to the levels of SiO_2, Al_2O_3, Fe_2O_3, MgO, CaO, Na_2O, K_2O, TiO_2, P_2O_5, Corg ,Ba ,Co, Cr, Cu, Li, Ni, Pb, U, V, Zn and to delimit areas of anomalous composition.

Materials and Methods

60 sediment samples were collected from beaches of the western coast of the Corfou island, for sedimentological, mineralogical and geochemical analyses. The results of the sedimentological analyses have been given in a previous investigation (CONISPOLIATIS, 1989).

The samples were examined under the binocular microscope and the bulk mineralogy of the powdered samples was studied by X-ray Phillips diffractometer. The main minerals were determined semi-quantitatively according to the method of NORRISH and TAYLOR (1962). The samples were analysed chemically with Inductively Conpled Plasma (ICP) after a total digestion by a HF-$HClO_4$-HCl mixtute. Corg was analysed with a LECO carbon analyser.

Results

The most abundant minerals are quartz and calcite. Quartz ranges from 13% to 37% and calcite from 17,8% to 46,2%. Major and trace elements levels, fall in the ranges : SiO_2, 25.36-66.12%; CaO, 15.36-33.81%; Al_2O_3, 0.70-2.40%; MgO, 0.58-5.33%; Fe_2O_3, 0.03-1.59%; Na_2O, 0.27-1.62%; K_2O, 0.22-0.66% ; TiO_2, 0.03-0.57%; P_2O_5, 0.12-0.23%; MnO, 0.02-0.11%; Corg, 0.07-1.11%; Ba, 41-514 ppm; Co, 8-27%; Cr, 43-383%; CU, 43-383 ppm; Cu, 2-23%; Li, 11-26 ppm; Ni, 7-59 ppm; Pb, 2-7 ppm; U, 2-5 ppm; V, 15-39 ppm; Zn, 6-24 ppm.

Discussion and Conclussions

The microscopie examination revealed very low contents of biogenic material (shells and shell fragments) (<4%) and heavy minerals (<3%). Therefore, the abundant calcite seems to be of terrigenous origin. The main minerals of various size fractions were also examined : calcite and dolomite tend to be concentrated in the coarser sand fractions, quartz in the medium sands and feldspars tend to be concentrated in the fine and very fine sand fractions.

The concentrations of CaO and MgO in the Corfou beach sands, in general, are high compared with the average values of CaO and MgO in sandstones and shales given by PETTIJOHN (1957) and AHRENS (1965), respectively.

The highest values of SiO_2, Al_2O_3, Fe_2O_3, K_2O, TiO_2, Ba, Cr, Ni, V and Zn are found in the sands of Arila and Ag. Georgios beaches while the sands of the Glyfada beach are characterized by relatively high values of CaO and MgO. Cu, Co, Pb, U and Corg appeared to be uniformly distributed, their levels are generally low and did not indicate any significant input. The mineralogical and chemical composition of the beach sands seems directly correlatable to the rock lithologies of the adjacent land. The extremely low levels of Corg could be due to the sandy nature of the sediments. Two samples from the Glyfada beach, being relatively enriched in Corg and Cu, are considered to have been contaminated to some degree with domestic sewage.

Fig.1. The Corfou island and the beaches mentioned in the text
1: Arila, 2: Glyfada, 3: Ag.Georgios

REFERENCES

AHRENS L.H., 1965. - Distribution of the elements in our planet. McGraw-Hill.

CONISPOLIATIS N., 1989. - Contribution to the study of coastal marine processes along the western coasts of the Corfou island. *Bull. Geol. Soc. Greece*, Vol. XXIII/1, pp. 409-422.

GEOLOGICAL MAP OF GREECE, I.G.M.E., 1962.

MARAGOUDAKIS N., 1967. - Geology and micropalaeontology of southern Corfou. *Inst. for Geol. and subsurface Research.* Vol. XII/1, pp. 5-133.

NORISH K. and TAYLOR R., 1962. - Quantitative analysis by X-ray diffraction. *Clay Min. Bull.* V.8, pp. 98-109.

PETTIJOHN F.J. 1975. - Sedimentary rocks. Harper and Row Publ., New York.