LATE QUATERNARY EVOLUTION OF THE ALKYONIDES GULF BASIN, CENTRAL GREECE

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Abstract

Swath bathymetry, seismic profiling, coring and down-core radiometric analyses in the Gulf of Alkyonides basin provided new data on the evolution of the basin. According to them initiation of the basin took place 350-400kyr BP. Acceleration of slip rate on the south-bounding faults since 120-150kyr BP resulted to the present asymmetric character of the basin. The formation of the basin coincides with the onset of the third phase of the Gulf of Corinth evolution.

Keywords: Alkyonides, asymmetric graben, subsidence rate, sedimentation rate

Introduction

The Gulf of Alkyonides is a semi-enclosed marine basin located to the east of the Central Gulf of Corinth. Detailed structural investigation of the 1981 reactivated fault segments revealed extension in N-S direction accompanied by dextral component (1). The extension rate at the western part of the Gulf is 5 ± 3 mm/yr and becomes illegible at the eastern edge (2). Paleo-seismological investigation on the N-dipping Skinos fault (3) revealed a periodicity of 330 yr for 1981-type earthquakes.

Faulting

Two E-W trending fault segments form the active southern margin of the Alkyonides basin. They dip with 40°-45° northwards and are separated by a relay zone. The western, Strava fault segment is 14-15 km long and forms the southern bounding fault of the narrow Strava graben. The eastern segment constitutes the offshore, westward prolongation of the Psatha fault (4,5). The north-dipping fault segments form a 30km long fault zone, which controls the evolution and the structure of the basin.

Several E-W running, S-dipping fault-segments run along the northern margin of the Alkyonides basin parallel to the rocky northern coast of the Gulf. Intra-basinal faults are responsible for the formation of the shallow ridge between the main Alkyonides basin and the Central Gulf of Corinth.

Sequence stratigraphy

Single channel seismic profiling enabled the detailed investigation of the sedimentary infill of the basin. Swath bathymetric survey of the area provided excellent information on the seafloor morphology (6). Gravity and box coring, sedimentological description of the cores and ^{210}Pb down-core radiochemical analyses provided information on the nature of the recent sediments and the actual sedimentation rates.

The sediment strata dip gently southwards, forming a monocline in the hanging wall of the main, N-dipping faults. The dip gradient increases with depth below the sea floor indicating the direct control of the southern fault zone on the tectonic subsidence of the basin. The maximum thickness was observed close to the trace of the south-bounding fault and coincides with the maximum depth of the basin. A total thickness of 400m has accumulated in the depocenter. The sediment thickness decreases gradually towards the northern margin of the basin.

Basin-wide seismic packages, characterized by strong, continuous reflectors, alternate with transparent packages and represent the bulk basin infill. Lens-like bodies of chaotic seismic character intercalate between the basin-wide reflector packages. In accordance to the nature of the sedimentary infill of the adjacent central Gulf of Corinth basin (7), we interpret the above seismic-stratigraphic sequence as accumulation of silt-sand turbidites alternating with mud turbidites and hemi-pelagic mud. Correlation of the basin-wide reflector packages with major high- and low-sea level stands of Late Pleistocene indicates that, the entire, 400m thick sediment pile of the Alkyonides basin may have accumulated within the last 350-400 kyr under a mean sedimentation rate of 1-1,2m/kyr.

Nevertheless, detailed interpretation of the basin-wide reflector packages indicates that subsidence rate was not uniform throughout the basin and for the entire time since its formation. The thickness of the seismic packages in the lower part of the basin infill is more or less constant between the southern and the northern margin of the basin. This observation point out that slip rate on the southern main fault zone was compensated by the regional subsidence of the northern margin. On the contrary, seismic packages of the upper part of the basin infill thicken significantly southwards, indicating increased vertical slip rate on the southern faults. Acceleration of the slip rate on the southern faults should have taken place about 120-150 kyr BP.

^{210}Pb radiometric analyses on two cores yielded actual mean sedimentation rates of 16mm/yr for the depocenter and 12mm/yr between the depocenter and the northern margin. These rates are slightly higher than the ones observed for the mean sedimentation rate during the last 350-400 kyr and support the two-stage evolution of the basin. Similar relationship between radiometrically estimated actual sedimentation rates and geologically observed mean sedimentation rates over long periods was also found for the central Gulf of Corinth and was verified by long piston coring (7).

Conclusion - discussion

The Gulf of Alkyonides basin is an active asymmetric graben developed at the eastern prolongation of the Gulf of Corinth basin. Correlation of basin-wide reflector packages with low and high sea-level stands on Late Pleistocene indicate that subsidence and basin formation initiated 350-400 kyr BP. Tectonic subsidence was uniform throughout the basin during the early period of its formation. Acceleration of the slip rate occurred on the main, southern faults about 120-150 kyr BP and is responsible for the present asymmetric character of the basin. Actual mean sedimentation rate of 16mm/yr was found for the depocenter of the basin, close to the southern margin and becomes lower toward the northern margin. The age of the basin formation coincides with the onset of the third phase of the Gulf of Corinth evolution, as proposed recently (7,8).

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