GEOMORPHOLOGICAL STUDY IN THE LOKRIAN COAST OF N. EVOIKOS GULF (CENTRAL GREECE) AND EVIDENCE OF PALAEOSEISMIC DESTRUCTIONS

K. Gaki-Papanastassiou[1]*, H. Maroukian[1], D. Papanastassiou[2], N. Palyvos [2] and F. Lemeille [3]

[1] Faculty of Geology,, University of Athens, Greece
[2] Institute of Geodynamics, National Observatory of Athens, Greece
[3] IPSN/DPRE/SERGD, Fontenay-aux-Roses, France

Abstract

The broader area of Lokris (Central Greece) is one of active tectonism where large earthquakes have occurred in historical times that have significantly affected its coastal morphology. Along the eroding coastal strip south of the Kynos archaeological site, Late Holocene alluvial fan deposits are exposed in a 120 m long retreating coastal cliff, where detailed stratigraphic study revealed the existence of at least one archaeological destruction layer and a tsunami deposit. Radiocarbon ages of the tsunami deposit and the destruction layer correlate well with the earthquakes of 426 BC and 105 AD.

Keywords: Tectonics, Geomorphology, Coastal Processes, Aegean Sea

Introduction

Lokris (Fig. 1) is a tectonically active region located in the extensional province of Central Greece, which is characterised by a series of parallel WNW-ESE, north-dipping normal fault zones (1,2). The area has been affected by a number of catastrophic earthquakes since ancient times, like those of 426 BC, AD 105, 551 and 1894 (3). A detailed geomorphological study of the broader coastal area of Livanates (Fig. 2) was performed, together with stratigraphic observations in Holocene alluvial fan deposits, in order to find indications of past seismic destructions.

Geomorphological study - results

During detailed coastal geomorphological mapping, terraces, raised or submerged beachrocks, and uplifted marine notches were recognised (Fig. 2). The area is characterised by a series of parallel secondary faults extending into north Evoikos gulf, which result in vertical coastal movements (mainly uplift). The stretch of coast between Livanates and the Kynos archaeological site is characterised by shoreline retreat, and Late Holocene alluvial fan deposits are exposed in a 120m long coastal cliff, up to 3m high. In this natural section, two stratigraphic units including a large quantity of in situ archaeological sherds were identified (Fig. 3). Between these, a 20 to 30 cm thick lens of sand was observed, rich in marine shells.

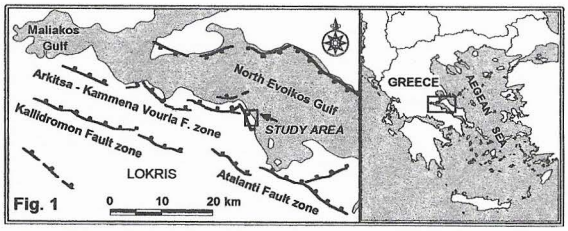

Fig. 1

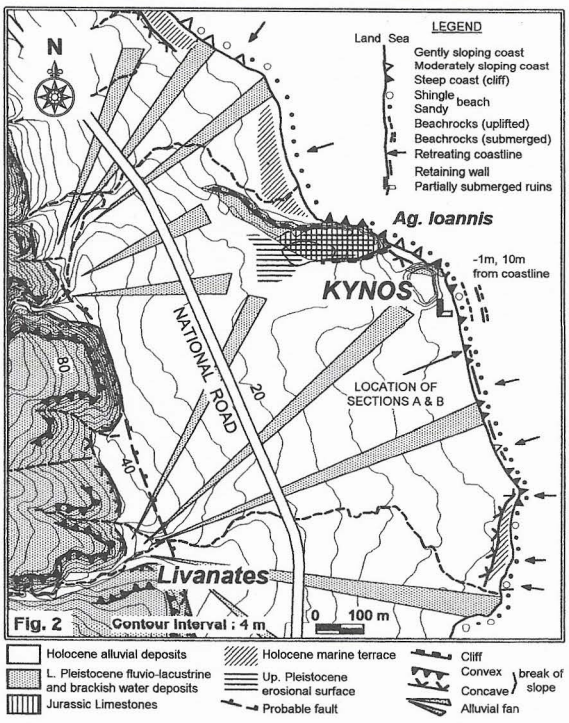

Fig. 2 Contour Interval : 4 m

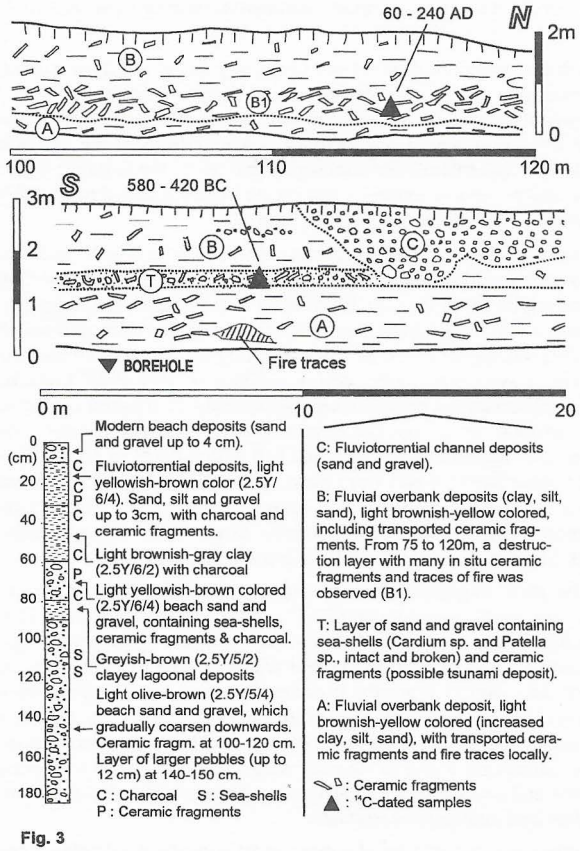

Fig. 3

Grain size analysis combined with microscopic examination suggest that this deposit is a result of a tsunami event, radiocarbon dated to 2450±80 yrs BP (13C corrected, ±1_), that correlated well with the earthquake of 426BC. The same tsunami deposits were also observed during the excavation of the coastal archaeological site of Alope, located a few km to the NW.

The unit of fine-grained overbank deposits overlying the tsunami sand contained a large amount of in situ archaeological sherds as well as remains of fire, suggesting it might be a destruction layer. Pieces of charcoal were dated to 1870±40 yrs BP (±1_, 95% probability) corresponding to a calendar age of 150±90 AD (±2_, 95%). This age suggests a possible correlation with the earthquake of 105 AD, which caused severe damage in the broader area, and especially the area of Atalanti, as reported by archaeologists. In order to gain further information about the stratigraphic sequence in depth, a shallow (2m) borehole was drilled. In the first meter alternating terrestrial and coastal deposits were encountered, followed by a continuous coastal environment (Fig. 3). These alternating deposits could be an indication of submergence due to seismic events prior to 2500 yrs BP.

References

1. Philip H. 1974. Etude neotectonique des rivages Egeens en Locride et en Eubee nord occidentale,.These Univ. de Montpellier, 86 pp.
2. Lemeille F. 1977. Etudes neotectoniques en Grèce centrale nord-orientale (Eubée centrale, Attique, Béotie, Locride) et dans les Sporades du Nord (isle de Skiros). These, Un. Paris XI, 173 pp.
3. Papazachos, B. C. and C. B. Papazachou (1997). The earthquakes of Greece. P. Ziti and Co., Thessaloniki, 304 pp.