

# HOLOCENE GEOMORPHOLOGICAL EVOLUTION OF THE KALAMAS RIVER DELTA (EPIRUS, GREECE)

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## Abstract

High resolution seismic profiling acquired by a boomer and a 3.5 kHz device has revealed the configuration and internal structure of the Kalamas River prodeltaic deposits. The acoustic survey shows that during the Holocene the Kalamas River mouth moved frequently as a result of the relative sea-level rise, constructing a delta with a complicated structure. In addition, the use of aerial photographs and topographic maps demonstrates that human forcing on the fluvial system during the last 50 years has modified considerably the natural evolution of the delta resulting in the retreat of the shoreline.

**Keywords:** *Shoreline Evolution, Seismics, Deltas*

**Regional setting** The Kalamas River discharges into the Ionian Sea, near the Greek-Albanian borders, and creates one of the most important hydrographic networks in Greece, in terms of freshwater and sediment influxes ( $1.8 \times 10^9 \text{ m}^3/\text{y}$  and  $1.5 \times 10^6 \text{ t/y}$ , respectively), and associated wetlands (designated as a Natura 2000 site). It is 115 km long forming numerous tributaries and drains a basin of about 1830 km<sup>2</sup>. The river plays a fundamental role in the social and economic life within the region of Epirus (NW Greece).

**Results and Discussion** The deltaic plain of the Kalamas River covers a surface area of about 80 km<sup>2</sup>. Within the plain, there are some topographic irregularities with the most significant of them being the mountains Mavro (509 m) and Maskilinitza (142 m) [1]. At an early stage of the delta evolution (from the Last Glacial Maximum to the Early Holocene), these mountains were possibly islets, whilst the river mouth was located eastwards near the village Ragio. During the Holocene, river-born deposits were settled in front the prograding Kalamas River mouth shifting the shoreline to the west and constructing, finally, the present-day deltaic plain. Since 1958, an extended reclamation project of the deltaic plain has been realized. The alignment and diversion to the north of the river lower course, the construction of a dam near Ragio and a well developed irrigation network on the deltaic plain have provided about 3200 ha for cultivation. Presently, cut off meanders and abandoned channels are still visible by the detection of aerial photographs and represent the imprints of old pathways of the river route before the human interference.

Data from seismic profiling, in the vicinity of the active northwestern river mouth, show that the subaqueous delta of the Kalamas River is extended seawards some 5-6 km, at water depths up to 30-40 m. Within the first 2-3 km away from the shoreline, the water depths are very low and do not exceed 5 m. Farther and until water depths reach 30-40 m, the seafloor slope increases abruptly and attains a value of ~4%. The prodeltaic clinofolds present an oblique tangential progradational configuration pattern, consisting probably of mud and sandy mud. In depths greater than 30 m the distal ends of these clinofolds become thinner exhibiting an apparent onlap (Fig. 1). The above lithoseismic features are similar with those appeared in the nearby Arachthos River deltaic system [2].

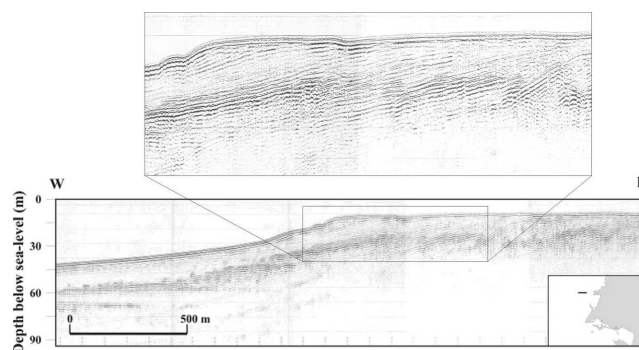


Fig. 1. High resolution seismic profile exhibiting the clinoforms pattern in front of the active Kalamas River mouth.

Seismic profiling of the area near the inactive southern river mouth (Fig. 2)

indicates a high bottom gradient (>10%) and a subaqueous delta not sufficiently developed. This evidence may imply inadequate riverine sediment influx or a strong coastal hydrodynamic regime, which causes dispersion of the fluvial material into the open sea.

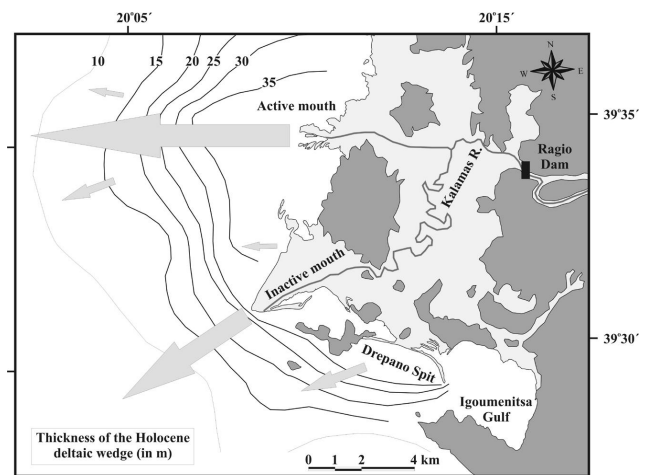


Fig. 2. Prograding directions of the Kalamas River delta. Contours (in m) indicate the thickness of the prodeltaic deposits.

In contrast, in front of the sand spit at the Drepano site (in the south part of the deltaic plain), the seismic survey displays the existence of a well built prodeltaic prism. The occurrence of this submarine lobate formation seems not to be connected with the old estuary (south) of the Kalamas River and, probably, is related to a third mouth at the Gulf of Igoumenitsa. This river mouth maybe functioned at the past as a secondary outlet without, however, ignoring the possibility to have acted as well as a primary estuary for some period of time.

## References

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