

Palaeogeographic reconstruction of the Strymonikos Gulf (N. Aegean Sea, Greece) during the Last Glacial Maximum, based on high resolution seismic data

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Introduction

Sequence stratigraphy is the key for many studies in shallow marine environments, indirectly indicating the prevailing conditions in the recent geological past. This method, combined with the bathymetric data, can give valuable information about the geologic evolution, capturing significant sedimentary structures, also derived from the alternating interglacial and glacial periods during the Quaternary. Thus, this method based on the high resolution seismic data is a particularly useful one for the investigation of the seabed morphology and substrate sequences formed during the last transgression after the end of the Pleistocene (Last Glacial Maximum), when the sea level was roughly 120m below its present level.

Objectives

The primary aim of the present study is the palaeogeographic reconstruction of the Strymonikos Gulf at the Last Glacial Maximum (LGM), focusing on the identification of the palaeo-riverbeds of the Strymon and Nestos rivers and the palaeo-shoreline.

Methods

A hydrographic survey was conducted by the Hellenic Centre for Marine Research and the Institute of Geology and Mineral Exploration, in the frame of YPOTHER project (NSRF 2007-2013), in July 2015 (Ioakim et al. 2016), which included high resolution multibeam (SeaBeam 2120) bathymetric mapping of a submarine area extending over 1200 nm, in combination with seismic profiling of the same area, covering 250 nm (3.5 kHz system – GeoAcoustics Ltd). Data processing and imaging was achieved by using the software package SB Interpreter of Triton Imaging while the maps were created using the ArcMap of ESRI.

Results

From the analysis and interpretation of the seismic profiles from the Strymonikos Gulf two seismic Units (A and B) were identified. The seismic character of Unit A includes transparent horizons and are associated with fine-grained deposits, which chronologically are related with the transgression after the Last Glacial Maximum and during Holocene. The seismic Unit B includes chaotic horizons without continuity, possibly representing coarser material. Unit B underlies Unit A and is deposited during the LGM. The interface between the Units A and B is an unconformity.

The palaeo-riverbed of Strymon was found at water depths of approximately 110-115 m. It was 2 - 3.5 km wide and the river was flowing southwards from southeast of Loutra Eleftheron. The palaeo-riverbed of Nestos was mapped on the 60-70 m deep platform between Thassos Island and Nea Peramos. The beds of the two palaeo-rivers are located on two platforms, separated by a 40-50 m high fault-controlled southwest-facing scarp, extending from Loutra Eleftheron to the North until west of Thassos to the South. This fault scarp divides the Strymonikos plateau in two parts, the lower eastern plateau where the paleo-Strymon river flowed and the western Plateau where the paleo-Nestos river did. The path of palaeo-Nestos was found to have shifted from its present position, within a canal of 1-1.5 km wide and surprisingly, in water depths of 60-65 m. Also, during this period the position of the palaeo-shoreline was 20-30 km (locally up to 40 km) seawards from its present position.

In the study area, syn-sedimentary tectonic activity is demonstrated by the 3-5 m offset of secondary active normal faults, affecting the Upper Pleistocene-Holocene sedimentary sequences. In addition, the existence of a fault scarp in the NE-SW direction (observed in the eastern part of the Strymonikos) is most likely the subaqueous extension of the active fault zone of Kavala-Xanthi-Komotini, which is responsible for the formation of the Strymonikos Gulf.

Conclusions

The neotectonic activity and the post glacial transgression play a crucial role in the configuration of the Strymonikos Gulf since the Late Quaternary. The palaeogeographic reconstruction showed that Nestos palaeo-river was falling into Strymon palaeo-river. The bathymetric difference of 50-55 m between the two riverbeds indicates the existence of an amazing landscape with impressive waterfalls. Finally, the position of the shoreline during the LGM is observed at distances >20 km seawards from its present position and at water depths of 121-135 m.

Palaeogeographical map of Strymonikos Gulf

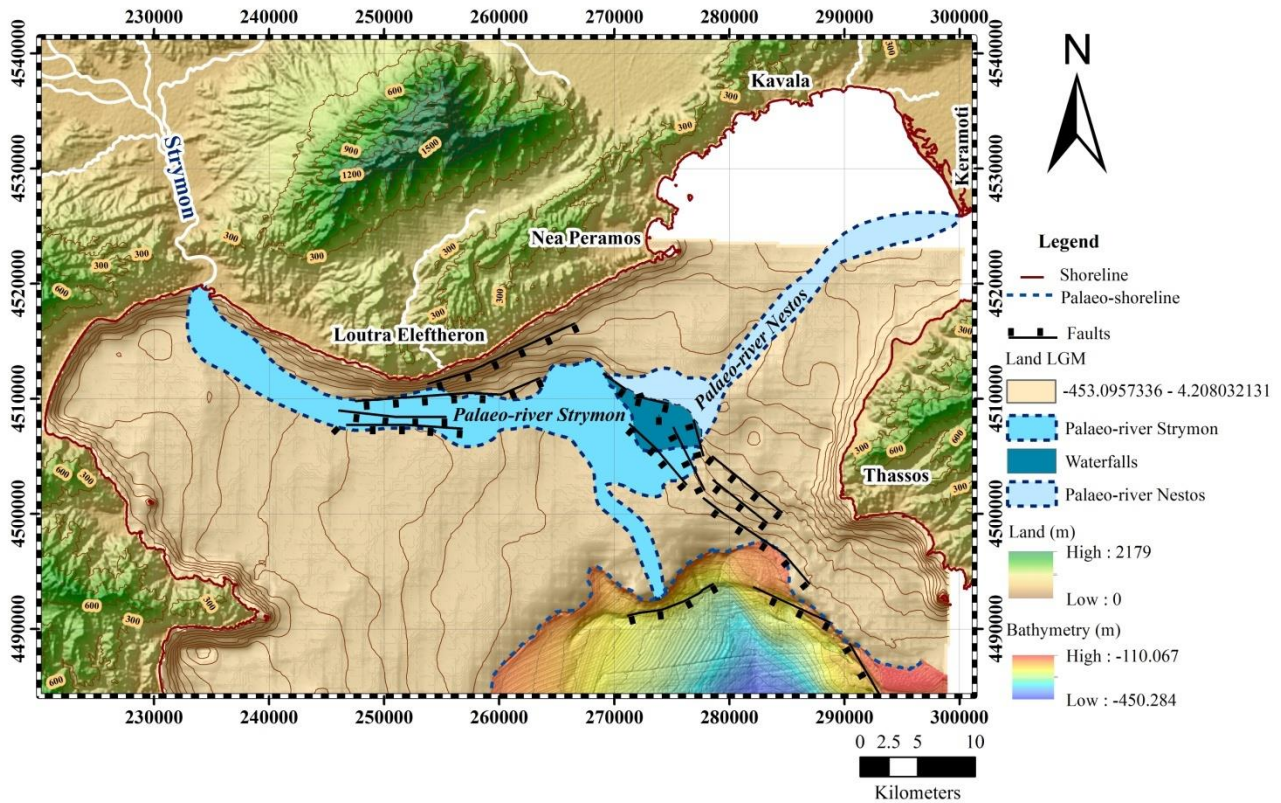


Fig. 1: Reconstruction of palaeo-shoreline and Strymon and Nestos paleo-rivers during the Last Glacial Maximum.

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