Evidence for Holocene bottom-currents erosion in the Western Gulf of Corinth, Greece

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Abstract: *The Gulf of Corinth, Greece, is connected to the Ionian Sea through a 62m deep sill. Strong tidal currents have been measured above this sill, what could potentially induce bottom-current erosion in the Gulf. Seismic reflection data allowed us to identify this present-day expected seafloor erosion in a wide area, as well as erosional unconformities and a wide channel between 100 and 300m below sea level. These features highlight the possible occurrence of strong bottom-currents since the last sea level rise.*

Key words: *bottom-currents, seafloor erosion, Holocene transgression.*

INTRODUCTION

The Gulf of Corinth is a 860 m deep basin in central Greece, connected to the Ionian Sea to the west through the 62 m deep Rio sill. Because of the presence of the sill, the Gulf was disconnected from the World Ocean during Quaternary lowstands (Collier et al., 2000). Consequently, hydrodynamic circulation should have changed dramatically between lowstand and highstand conditions, and these changes could have been recorded in the offshore sedimentation. Periodic changes in the sediments properties in relation with the eustatic level have been highlighted in the deep Gulf by seismic data, but the processes responsible for these changes are still unknown (Bell et al., 2009; Taylor et al., 2011). Measurements of present-day sea currents are scarce. Strong, up to 2m.s^{-1}, tidal currents occur at the Rio Strait (Hadjitheodorou et al., 1992), but the influence of these currents on the deep gulf water circulation is unknown.

Here we investigated the western extremity of the Gulf of Corinth, i.e. the Nafpaktos Basin. In this area located just East of the sill, we look for evidence for bottom-currents morphologies associated with the known tidal currents. Because of the disconnection of the Gulf during Quaternary lowstands, occurrence of bottom-current-related morphologies could be a reliable stratigraphic marker for highstand or transgressive conditions.

METHODS

To test this hypothesis, seismic reflexion lines have been acquired with RCMG's "Centipede" multi-electrode sparker. They allowed us to image at least 130ka of sedimentation according to a previously developed chronostratigraphic model (Bell et al., 2009). Isopach map for the Holocene has been built and morphological features and deposits associated with bottom-currents have been mapped.

RESULTS AND DISCUSSION

Present-day seafloor erosion is observed in the whole Nafpaktos Basin, between 40 and 100 m water depth, indicating widespread action of bottom-currents coming from the Rion sill. In the center of this basin, a 10 m deep, 400 m wide channel is eroded into what we interpreted as early Holocene deposits. This feature is reminiscent, at a smaller scale, to mega-flood channels described in the English Channel (Gupta et al., 2007) and could indicate that a similar flood event occurred in the Gulf of Corinth during the Holocene transgression, 11.5ka ago. However, improving the Nafpaktos Basin stratigraphy is needed to better date this erosional event.

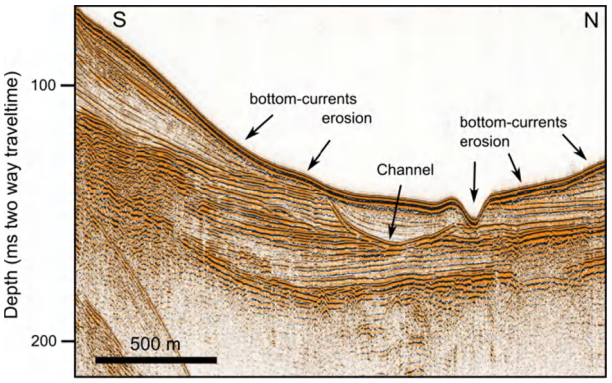

FIGURE 1. Seismic profile showing present seafloor erosion and Holocene mega-flood (?) channel in the centre of the Nafpaktos Basin, Gulf of Corinth, Greece.

More to the east, no seafloor erosion is observed, indicating that today, bottom-currents erosion stops around 12km east of the sill. Instead, depositional reliefs develop on the flanks of the basin floor. These morphologies could be formed by bottom-currents ("contourites") or could result from the cloud settling of turbidity currents originating from the surrounding deltas.

In the northern depositional relief, 200 to 300 m below sea level, an erosional unconformity is observed below 30m of Holocene sediments. It may indicate in this area the occurrence of erosive bottom-currents occurring only during the post-glacial rapid sea level rise in this gulf. Identification of erosional unconformities associated with older Quaternary highstands and associated transgressions, e.g. the marine isotopic stage 5, is in progress.

CONCLUSION

As expected by the strong tidal currents measured at the outlet of the Gulf of Corinth, seafloor erosion is highlighted in a wide area at the western tip of the Gulf. This erosion stops around 12km east of the sill where large depositional relief develop. Two older phases of bottom-currents erosion are observed. The first one is associated to the post-glacial sea level rise, and the second one occurred during the early Holocene.

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