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# IODP Expedition 381: Development of the active Corinth Rift

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International Ocean Discovery Program (IODP) Expedition 381 was operated as a Mission Specific Platform onboard the industry drilling vessel Fugro Synergy between October and December 2017 in the Gulf of Corinth, Greece. The objective of the expedition was to retrieve a record of early continental rifting and basin evolution from the Corinth rift in order to:

- obtain high spatial and temporal resolution records of the dynamics of the rifting process and its evolution,
- study the interaction of climate and tectonics on sedimentary and surface processes in a rift zone,
- generate a new high-resolution Quaternary paleoenvironment and palaeoclimate record from an active basin, and
- to improve regional hazard assessments in one of the most seismically active regions of Europe.

The Corinth Rift, one of Europe's most seismically active areas, is a region of rapid, localised extension, exhibiting today some of the highest extension rates in the world. The young rift (~5 Ma) has evolved in 3 main phases identified by integration of onshore depositional records and offshore seismic stratigraphy (e.g. Leeder *et al.*, 2002; Lykousis *et al.*, 2007; Ford *et al.*, 2013; Nixon *et al.*, 2016; Gawthorpe *et al.*, 2017). Corinth's high rates of tectonic activity, high sediment fluxes, closed drainage system and preservation of the syn-rift record make it a unique laboratory for the study of extension, sedimentation and paleoenvironment in a young rift.

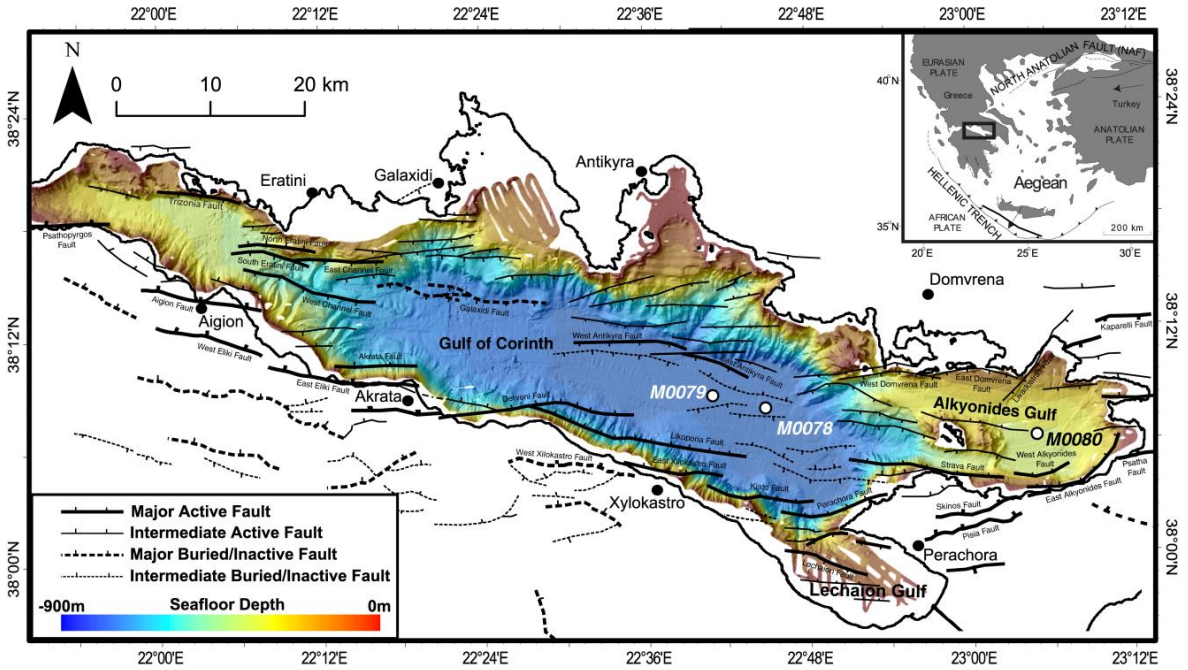


**Figure 1: Bathymetric map showing the locations of the three sites drilled during the IODP Expedition 381. Sites M0078 and M0079 are located in the central basin, while site M0080 is in the east in the Alkyonides Gulf. (Shillington *et al.*, 2019). Offshore fault traces taken from Nixon *et al.* (2016). Onshore fault traces are derived from Ford et al. (2007, 2013) and Skourtsos and Kranis (2009). Inset: tectonic setting of Corinth rift in Aegean region, Eastern Mediterranean Sea. Bathymetry data provided by the Hellenic Centre for Marine Research and collected for R/V *Aegaeo* cruises (Sakellariou *et al.*, 2007).**

During IODP Exp. 381, three sites (Figure 1) located along the Gulf of Corinth, were drilled, sampled and logged. A total of 1645 m of sediments were retrieved from 1900 m of cored section (an average recovery of 86%), sampling in high resolution the syn-rift sedimentary sequence back to ~1.5 Ma or more. During the onshore phase that took place in Bremen, Germany in February 2018, 35 scientists from 10 countries described, sampled and analyzed the recovered deposits and data (McNeill et al., 2019a). Cores recovered together provide (1) a longer rift history (Sites M0078 and

M0080), (2) a high resolution record of the most recent phase of rifting (Site M0079), and (3) the spatial variation of rift evolution (all sites; Shillington *et al.*, 2019; McNeill et al., 2019a). The deposits contain a rich and complex record of changing sedimentation, sediment and pore water geochemistry, and environmental conditions from combined micropaleontological and palynological assemblages. This is the longest and highest resolution sedimentary record from a young extensional basin at the point of connection to the global oceans, and it provides the first constraints on the age of the full rift sequence, syn-rift stratigraphy, rates and timings of rift tectonic processes, sediment fluxes and basin environmental conditions.

First results produced during the onshore phase confirmed the basin environment fluctuations between marine conditions during eustatic highstands and isolated conditions during eustatic lowstands - when the basin was cut off by basin-bounding sills. During interglacials, when the basin was connected with the Mediterranean Sea, sedimentation rates were lower, and bioturbation and organic carbon concentration higher. During glacials, the basin was isolated from the ocean, and sedimentation rates were 2 to 7 times higher than during interglacials (McNeill *et al.*, 2019b). The higher sedimentation rates during glacials may signify increased erosion and basin sediment influx driven by the decrease and change of vegetation cover during the glacial, as also recorded in other existing long Mediterranean palaeovegetation records (Sadori *et al., 2016*; Tzedakis *et al.*, 2006).

Post-cruise analysis of the IODP Exp. 381 data will allow the investigation of the relative roles of and feedbacks between tectonics, climate, and eustasy in sediment flux and basin evolution. Furthermore, the Corinth rift boreholes will provide the first long Quaternary record of Mediterranean-type climate in the region. The potential range of scientific applications for this unique data set is very large, encompassing tectonics, sedimentary processes, paleoenvironment, paleoclimate, paleoecology, geochemistry, and geohazards.

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