Geophysical Research Abstracts
Vol. 21, EGU2019-10915, 2019
EGU General Assembly 2019

Depocentre evolution and stain migration during juvenile rifting; a case study from the Corinth rift, central Greece, over the last 130 kyrs

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Observations from continental rifts suggest that rift zones evolve from wide zones of distributed faulting to strain localising onto large rift border faults over timescales of 10^5-10^6 years. However, what is less well known is how rifts behave over timescales of 10^4 years, which requires observations from young rifts. We investigate if sediment distribution patterns in the Gulf of Corinth, central Greece, have over the last 130 kyrs varied to better understand short-term variations in strain. We also investigate the effect of the interaction of sediment supply and tectonics has on sediment distribution patterns, as it is often an assumption that thickness increases towards faults in isopach data is a proxy for fault activity, however this may be misleading if there are high rates of sediment supply into the area.

The Gulf of Corinth, central Greece, is one of the fastest extending rifts in the world with modern geodetic rates increasing from ~5 mm/yr to 15 mm/yr from East to West. Studies that have investigated rift evolution over a 10^6-10^5 year timescale have shown that the rift has transitioned from a symmetric graben to an asymmetric half graben in the last 1 Myrs, with strain now focussed on the southern margin of the Gulf of Corinth.

We present a 0-12 ka sediment distribution map alongside the first ever Holocene active fault map for the entire Gulf of Corinth. We find that there are three major depocentres in the Gulf of Corinth during the Holocene, in the West, the centre of the Gulf of Corinth and the Alkyonides Gulf. Furthermore, the active fault network reveals numerous North- and South-dipping faults with ~270 Holocene active faults compared to ~72 faults active at 130 ka. The most significant faults are those along the southern margin. These results suggest that extension during the Holocene has been distributed throughout the Gulf, which is at odds with modern geodetic rate data that suggest strain is focussed in the western part of the Gulf. We therefore caution the use of modern geodetic extension rate data to infer longer term geological trends.

The hanging-wall of the North-dipping Lykoporia Fault has been a major sink for sediment over the last 130 kyrs, implying that strain is focussed on the southern margin. However, our high-temporal sediment distribution maps of this area over the last 130 kyrs reveal that there are localised areas of thicker sediment caused by North- and South-dipping smaller faults. This suggest that strain has not solely been focussed on the southern margin but has been more distributed in the basin over 10^4 year timescales. Furthermore, these results suggest that generalised fault evolution models do not capture the true strain variability at 10^4 year timescales.

Finally we show that high-rates of sediment supply into the basin in the Holocene has had a direct impact on sediment distribution patterns shown by the isopach. We have developed a new methodology that utilises the Getis-Ord Gi* Hot Spot analysis to help in distinguishing sediment supply from fault-controlled accommodation related sediment thicknesses.