IODP Expedition 398 Reveals a Major Normal Fault along the Kolumbo Volcanic Chain

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Many hazardous volcanic systems worldwide are located in extensional back-arc systems, where the crust is influenced by pervasive faulting. However, our knowledge about the spatial and temporal relationship between crustal faults and the emplacement of volcanic edifices is immature. Located on the South Aegean Volcanic Arc, the Christiana-Santorini-Kolumbo volcanic field formed in a continental rift zone and represents an ideal natural laboratory to study the structural interaction between volcanism and tectonism. From December 2022 to February 2023, IODP Expedition 398 drilled 12 sites across the volcanic rift system. We will present the results of core-seismic integration of several sites from the rift basins. Two of these drill sites lie on the hanging wall and footwall of the Kolumbo Fault, respectively. This fault strikes parallel to the Kolumbo Volcanic Chain and was previously considered a fault with little vertical offset. However, tephra and biostratigraphic markers identified in recovered cores from IODP Expedition 398 indicate a major vertical offset of >200 m (~260 ms TWT) along this fault. Seismic data reveal that this fault is a major NE-SW-directed normal fault and represents an important structural element of the rift system.
but subsequent rapid sedimentation of volcanoclastic material buried this fault. The volcanic edifices of the Kolumbo Volcanic Chain formed on the hanging wall of this fault at a distance of approx. 6 km from the surface trace. Adjacent, non-volcanic rift basins show pervasive internal fault zones at a similar distance from the respective basin-bounding faults, indicating that these faults may be the preferred pathway for magma to reach the surface. Our study implies a fundamental tectonic control of the emplacement of volcanoes at the Christiana-Santorini-Kolumbo volcanic field, a process that might be present at other back-arc systems.

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