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# The Protracted Development of the Continent-Ocean Transition in Afar

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Continental breakup is often associated with the production of large volumes of magma that intrude the crust and erupt to the surface as voluminous basalt flows. Much of our knowledge of this fundamental tectonic process comes from passive margins such as the north Atlantic but these regions are now tectonically inactive. Thus the mantle conditions and extensional processes that characterised the transition to sea-floor spreading are no longer observable and have to be inferred using models that speculate on process to match the incomplete geological record. The voluminous lava flows that sit atop the continent-ocean transition, often termed 'seaward-dipping reflectors', also serve to preclude our view of this part of the geological record. Once place on Earth where we can observe continent-ocean transition developing today, however, is the East African Rift in Ethiopia.

Here we draw on a wide range of geoscientific constraints, including seismic and field geological data to place spatial and temporal constraints on the state of the mantle and mechanisms of plate rupture in Ethiopia. The late stages of breakup are dominated by magma intrusion without marked crustal thinning, but it is not until a final episode of stretching thins the plate that the soon-to-be passive margin begins its descent below sea-level and vast volumes of basalts are erupted over the continent-ocean transition. Intriguingly, these processes are occurring above what appears to be the slowest seismic wavespeed mantle on Earth. The observations from Ethiopia bear striking resemblance to those seen at passive margins elsewhere, such as at the north Atlantic with the implication that more can soon be learned about continental breakup in the past.