

Recalibrated breakup history of SW Gondwana from the southern Cape of South Africa: New constraints from U-Pb zircon geochronology

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Syn-rift deposits often provide the only means to determine the processes for initiation and evolution of rift basins and passive margins. The structurally preserved, erosional remnants of several rift basins that formed during the Mesozoic breakup of Gondwana are located within the southern Cape region of South Africa. These onshore basins contain the Suurberg and Uitenhage Groups, which are predominantly continental, taphrogenic strata interbedded with volcanoclastics. Their significance in Gondwanan breakup is poorly understood due to a lack of radioisotopic ages. By integrating extensive field observations with U-Pb geochronology of over 4000 detrital and primary volcanic zircons from pyroclastic, mixed-origin volcanoclastic and clastic sedimentary rocks by Laser Ablation – Inductively Coupled Plasma–Mass Spectrometry (LA-ICPMS), we present the first radioisotopic ages for these rocks and provide a revised chronostratigraphic framework for the onshore Mesozoic in the southern Cape. To improve precision and accuracy, we selected 59 grains from four key stratigraphic units for single-zircon Chemical Abrasion – Thermal Ionisation Mass Spectrometry (CA-TIMS) to minimize the effects of Pb-loss and constrain depositional age uncertainties to < 1%. We thereby show that the Suurberg Group was deposited rapidly during the emplacement of the Karoo-Ferrar Large Igneous Province in the Early Jurassic (~183 Ma) and likely predates the main phase of rifting, whereas the Uitenhage Group was deposited over a prolonged period beginning in the Early to Middle Jurassic and continuing into the Early Cretaceous. These strata record an initial period of rifting that coincided with the separation of East and West Gondwana, and a subsequent period of renewed rifting during opening of the South Atlantic. This valuable chronostratigraphic framework illustrates the complexity of long-lived rift basin sedimentation and the importance of high-resolution radioisotopic age-determination of tectonic records from the final stages of a unified Gondwana.