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A new twist on the Falkland Islands microplate

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Early stages of transform margin formation are associated with crustal fragmentation and the generation of microcontinental blocks that can undergo isolated vertical axis rotations. The limited outcrop extent of these blocks hinders the palaeogeographic reconstruction of the transform margins and the development of reliable models of their evolution. An example considered here is the Falkland Plateau, namely one of its constituent microplates: the Falkland Islands.

The islands are thought to have originated off the south-east coast of South Africa, either being part of a rigid Falkland Plateau fixed to the South American plate or undergoing a clockwise rotation of up to 180° during break-up. The scarcity of information regarding the deep structure of the basins around the Falkland Islands hampers a direct comparison between the plateau and South Africa. This study provides new insights regarding the evolution of the Falkland Plateau, by integrating seismic reflection data and open-source gravity data from the Southern North Falkland Basin (SNFB). This allows us to assess the geometry of the NW-SE faults in the SNFB and compare them to the fault network in the Outeniqua Basin, offshore South Africa.

The reactivated thrust faults bounding the half-grabens in the SNFB have shallow depth converted dips between 20° and 40°, lengths of up to 150 km, depocentres of ∼5 km and coalesce onto a north-dipping mega-décollement. On the conjugate South African margin, the faults accommodating the offshore deformation show consistent shallowing of the dip north-eastwards from 60° across the Plettenburg Fault to 24° across the St. Croix Fault and are further controlled at depth by a south-dipping decoupling plane. The architecture of the SNFB shows most similarities with the Algoa and Gamtoos Basins. We propose that the reactivated thrusts from the South African Basins and the SNFB formed along strike from each other, pointing towards a more southern pre-break-up position of the Falkland Islands than previously thought. This requires a change in trend of the Cape Fold Belt from WNW-ESE to NNW-SSE to account for this reconstruction of the islands. The trend variation is consistent with the change in strike of the St. Croix, Port Elizabeth and Gamtoos Faults thought to follow the inherited crustal fabric developed during the Cape Orogeny.

The revised position of the Falkland Islands predicts less extension affecting the Falkland Plateau Basin and yields ∼140° of rotation affecting the microplate during the break-up of Gondwana and the opening of the South Atlantic. Furthermore, our model provides more insights into the amount of rotation that can affect microcontinental blocks in transform margin settings and when in the evolution of a transform margin would these rotations occur.