Preface 2025

My interest in Gondwana and its dispersal can be traced back through many years of a long career. Early highlights include the discovery from aeromagnetic survey of the Okavango dyke swarm below the Kalahari (Reeves,1978), the publication of the geological map of Gondwana (de Wit et al, 1988) and the fit of Madagascar against east Africa improved from new gravity and magnetic data (Reeves et al, 1987). Many years spent interpreting hidden geology from aeromagnetic anomaly maps of large areas of Africa, India, Australia and South America prepared me for the rich content of geological information for entire oceans evident in ocean-floor topography derived from satellite altimetry when that was first released in 1997 (Smith and Sandwell, 1997).

Not only an improved fit of the southern continents in their Gondwana configuration could be expected from this new data but also a step-by-step tectonic history of the paths by which the several Gondwana fragments separated might be developed using appropriate plate-modelling software. The tectonic record was clear in the ocean crust created in the process of dispersal. Ultimately, a model could emerge that could be checked against all available geological data – field mapping on land and hydrocarbon exploration (mostly) offshore. In the true spirit of exploration, key locations that would merit follow-up studies could be highlighted. Seeing the global context should never be overlooked when resource exploration is approached scientifically.

Returning to Delft in 1993 after a sojourn in Australia made me realise that few earth scientists have been as privileged as I had to work with the regional geophysical coverage of so many different parts of Gondwana. Thanks to contacts going back to my undergraduate days, the ‘Atlas’ plate modelling software (Alan Smith and Lawrence Rush, Cambridge Paleomap Services Limited) was acquired by my institute in 1994 and a series of MSc and PhD students worked on Gondwana-related research in the subsequent decade (see under ‘Publications’).

When I returned to professional consulting in 2005 I was once again primarily concerned with aeromagnetic surveys. I did, however, find time to pursue Gondwana-wide plate-modelling interests and even found clients who valued input of that nature. Since my final professional project concluded in 2018 I have been able to devote more time to refinement of the model.

My approach has been, as far as possible, to work from first principles. The starting point was the ‘Feb04’ global plate model of Alan Smith (unpublished) but virtually all the plate rotations there have been revised and improved using the ocean-floor topographic data. I have worked particularly with Euler interval poles since small circles about such poles reveal the growth direction of transforms and fracture zones at mid-ocean ridges and the meridians the axial direction of active rifts. I have concentrated on the paleo-mapping of mid-ocean ridges in the dispersal process since these are evidently the main location of active tectonism in continental dispersal.

I have always assumed that ocean growth has been steady and relentless except where there is credible evidence to the contrary. If two continents separate by 1000 km in 20 My, then 50 km of new ocean crust should be created every million years unless, for example, marine magnetic anomalies indicate otherwise. Velocity variation without supporting evidence constitutes a deviation from the principal of minimal hypothesis that I have pursued throughout. Certainly any model should not infer the consumption of ocean crust (i.e. ocean growth going into reverse) anywhere along the entire length of a mid-ocean ridge or anywhere else in the model where it has not been observed. Adhering to this principle across all of Gondwana at all geological times is certainly not trivial. We are observing a system that has always been in dynamic equilibrium, except where seismicity betrays abrupt local changes.

While this constraint might at first appear trivial, conscientious plate modelling has led me to rework many elements repeatedly to approach the ideal more closely. Such iterations have not always been successful. Perseverance and intolerance of inconsistency have consumed many hours (not to mention a certain scepticism of published rotation parameters) while deepening my own understanding of the detailed ways in which plate tectonics has played out in the southern oceans. Few others, I suspect, will have had the luxury of time - or the inclination - to pursue this approach to a conclusion.

I have tried to make my thoughts and conclusions as public as possible along the way: in the reviewed literature, in professional meetings and by way of this website. Recently I have noticed that my model revisions are becoming increasingly minor and hence I have resolved to change the emphasis towards publication of a definitive result of my efforts that can be released and tested more generally.

The first stage of the finalisation is reworking this website into a format more akin to a monograph explaining the methods and results while retaining the advantages of showing geodynamic processes in animated maps by way of illustration and as an aid to understanding. I have selfishly learnt a great deal about the natural history of our planet while carrying out this work but would like nothing better than to share my newfound knowledge with others. Curious minds may then take things further rather than spend time re-making many of my mistakes. Most of all, suggestions for a permanent home for the resulting datasets and models would be most welcome.

Colin Reeves

Delft, 2025 August 13

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