

# AFRICAN GEODYNAMICS

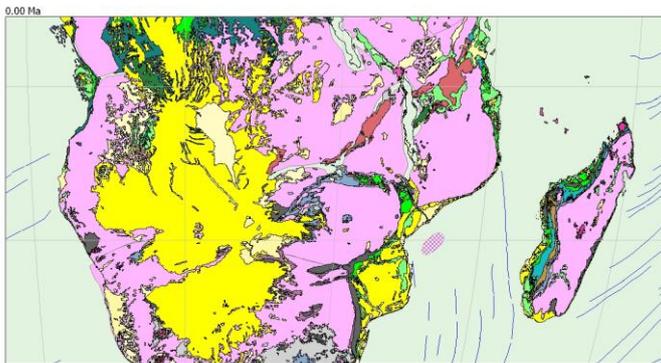
2013 Edition

## ...from the Precambrian to the Present Day

A Two-Day Course led by Colin Reeves,

Global tectonics is fundamental to understanding how geological history unfolded but is too often far from the minds of those working with exploration problems at local scale. The course aims to set the geology of Africa into its global tectonic context and demonstrate how close we are to defining the correct and unique model of Gondwana as it was at the close of Precambrian time and how, over the course of Phanerozoic time, the various southern continents of today rifted and drifted from the shores of Africa. Much new information comes from details of ocean floor topography revealed since 1998. The correct model should be valid at all scales and be testable at each geological stage.

The course instructor has spent more than 40 years with aeromagnetic and gravity surveying exploring the largely hidden geology of Africa, India, Australia and elsewhere at regional scale. This information has been exploited in over 20 years of applied plate tectonic modeling using the 'Atlas' paleogeographic software of Cambridge Paleomap Services Limited and sea floor gravity and magnetic anomaly data from the world's oceans. The course is, therefore, about the geology the oceans as well as the continents, and points clearly to remaining unknowns that

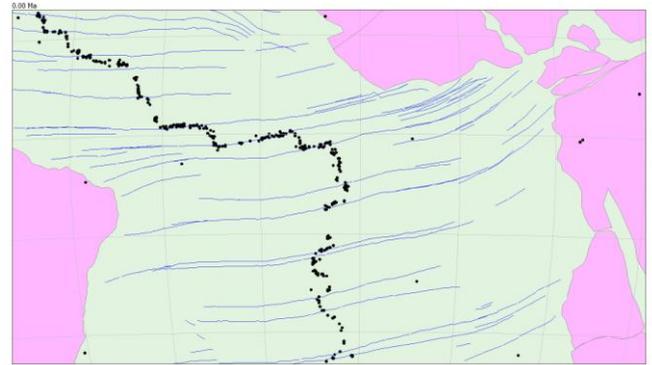


need investigation if the big picture is to be completed correctly.

The basic principles of global tectonics are introduced at the outset and most problems are addressed from first principles. A basic interest in the geology of Africa is assumed but no profound knowledge – or detailed mathematical competence – is required. The course consists of 12 lectures each of 40-60 minutes' duration, plus discussion time. Each talk is illustrated with Powerpoint slides and animations that total almost 500 slides.

A recurring theme is the construction of plate-tectonic models (animations) from incomplete data with a minimum of hypothesis. Datasets, it is argued, will always be incomplete but may already be sufficient if we take a distant view encompassing all data and avoid unnecessary invention. 'As simple as possible, but no simpler', in other words. The locations where new evidence might prove crucial to resolving remaining problems are thus highlighted.

The 12 session titles and their contents are as follows:



### 1. Africa Now – our laboratory

Topography of Africa and drainage – the geology of Africa, digital and in overlapping layers – geophysics to reveal hidden geology – the real movement of Africa from GPS – seismicity of Africa and the East African rift system.

### 2. Undoing the oceans – Africa and Antarctica

The ocean of Africa – the entire African plate – principles of plate movements and Euler rotations – Instantaneous, interval and finite poles – the ocean that separates Africa and Antarctica – a model for Africa-Antarctica in eight intervals – Principles: keep it simple!

167.20 Ma :: CR12AAMM :: 2012 December 2

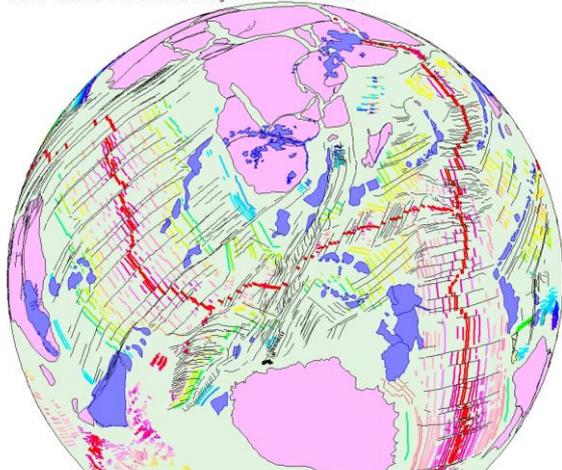


### 3. Paleozoic Africa – the centre of Gondwana

Prolonged stability, post-Precambrian – reassembling Gondwana, the questions – the Precambrian elements – how much separation between them? – a tight assembly around Madagascar.

### 4. The African Mosaic within Gondwana

Closing the Red Sea and the Gulf of Aden – the assembly with modified location for Somalia – The fracturing of north Africa – South America in place and mega-fractures in Brazil – some conclusions from the re-assembly.



### 5. East Gondwana reassembled

Not just a reassembly, a working model – putting East Gondwana back together using ocean floor topography – new precision in the 2012 model – four regimes of ocean growth.

### 6. The evolution of the Indian Ocean

In forward time: the Karoo-Ferrar igneous event – the three proto-oceans: Somali, Mozambique and Weddell – the initiation of dispersion – the rift between Madagascar and India – India goes north and the evolution of the Mascarene basin – a new ridge system as Australia finally leaves Antarctica – the Red Sea and the initiation of rifting in Africa.

### 7. The evolution of the South Atlantic Ocean

Euler poles for Africa-South America opening – issues when the fit becomes tighter in earlier phases – ocean, continent and ‘extended’ crust – the mechanics of extension – features of the early Atlantic Ocean – the Atlantic opening animation.

### 8. The evolution of the Bouvet triple junction

Implications for the evolution of the South African south coast – South Patagonia, the Falklands Islands, etc – the animation of a triple junction – the 2012 Gondwana dispersal animation – regime changes and the stratigraphic column around Africa.

### 9. Three episodes of rifting in Africa

Euler poles for the current rifting process – the mechanics of the Cretaceous rift system in a plate-tectonic context – hidden Karoo rifts? – Angola, offshore Namibia, etc

120.00 Ma



### 10. Dykes, mantle plumes and large igneous provinces

The aeromagnetic discovery of the giant Botswana dyke swarm – extent of Karoo volcanic from aeromagnetism – dykes in aeromagnetism and in the field – Earlier syn-rift injection in the Okavango – dykes in Tanzania and Uganda – when are dykes only faults? – the Bangui anomaly – Bangui and Morokweng (impacts) – Mozambique dykes and Antarctica again.

### 11. The architecture of Precambrian Africa

Magnetic anomalies and geological reconnaissance – magnetic anomalies world tour – crustal elements of Africa and Gondwana – Gondwana and Rodinia – What sort of mosaic? – tiles or lily leaves? – fault systems at all scales in Africa – many maps of Africa, little consensus.

### 12. Synthesis and summary

Geology and tectonics – information and communication technology – ‘Atlas’ demonstration.

Each session consists of an illustrated presentation followed by a discussion period to which all participants are invited to contribute. The whole of Africa is considered the area of interest, but the focus will be on sub-Saharan Africa where the course leader has had most hands-on experience.



*Colin Reeves is the principal of Earthworks BV, an independent consultancy, since retiring as professor in Exploration Geophysics at ITC in The Netherlands in 2004. He has over 40 years’ experience in the instigation, execution and interpretation of regional geophysical surveys in Africa, India, Australia and the Americas, spread across the government, commercial and educational sectors. He has been based successively in Botswana, UK, Canada, Australia and The Netherlands. His interests include the global-tectonic context of exploration geoscience and national airborne geophysical mapping programmes in Africa and elsewhere. He may be reached at reeves.earth@planet.nl*

**Earthworks BV** offers consulting services related to geophysical mapping and interpretation programmes for governments, the oil industry and the mineral industry with a specialisation in setting exploration projects in their global context. Further information and examples of plate tectonic animations may be found on the company’s website: [www.reeves.nl](http://www.reeves.nl)



