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Gondwana (Africa) from top to base in space and time

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Gondwana with Africa at its core is reviewed from the unification of its several cratons in the Late Neoproterozoic, through its combination with Laurussia in the Carboniferous to form Pangea and up to its progressive fragmentation in the Mesozoic. For much of that time it was the largest continental unit on Earth and its remnants constitute 64% of all land areas today. New palaeogeographical reconstructions are presented, ranging from the Early Cambrian (540 Ma) through to just before the final Pangea breakup at 200 Ma.

In Late Palaeozoic and Early Mesozoic times, Gondwana lay over the African large low shear-wave velocity province (LLSVP), one of two major thermochemical piles covering ca. 10% of the core-mantle boundary. The edges of the LLSVPs (Africa and its Pacific antipode) are the plume generation zones (PGZs) and the source regions of kimberlite intrusions and large igneous provinces (LIPs). Our palaeomagnetic reconstructions constrain the configuration of Gondwana and adjacent continents relative to the spin axis, but in order to relate deep mantle processes to surface processes in a palaeomagnetic reference frame, we have also rotated the PGZs to account for true polar wander. In this way, we visualize how the surface distribution of LIPs and kimberlites relate to Gondwana's passage over the PGZs. There are only two LIPs in the Palaeozoic (510 and 289 Ma) that directly affected Gondwanan continental crust, and kimberlites are rare (83 in total). This is because Gondwana was mostly located between the two LLSVPs. The majority of Palaeozoic kimberlites are Cambrian in age and most were derived from the African PGZ. Sixty-six Early Mesozoic kimberlites are also linked to the African LLSVP. All known LIPs (Kalkarindji, Panjal Traps, Central Atlantic Magmatic Province and Karoo) from 510 to 183 Ma (the lifetime of Gondwana) were derived from plumes associated with the African LLSVP, and three of them probably assisted the breakup of Gondwana and Pangea.