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African and global event synchroneity: lithosphere-core coupling

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Abstract

African intra-plate igneous activity is pre-eminently in the form of numerous (~1000), small volume, alkali and carbonate rich eruptive centres. Activity was episodic, with ages spanning the range 2.5 Ga to present, typically repeated in the same areas, and located on earlier lithosphere lesions. Most of Africa has been non-orogenic for > 500 Ma, but many igneous episodes are synchronous across the plate, and correlate with distant, major tectonic events, such as orogenic periods. There are no generally accepted hot spot tracks. None of the numerous and divergent models proposed for different single provinces can accommodate all the relationships observed, through time, and across the plate.

Over the period 150-0 Ma, correlations with oceanic events and geomagnetic polarity changes are evident, showing that African magmatism holds a sensitive record of global events. Important episodes are linked to geomagnetic reversal frequency changes, most notably with the Cretaceous Normal Superchron (CN, 125-80 Ma) which is marked by a surge in activity in Africa, and major changes world wide. This magnetic quiet period set in just after Africa became a completely separate plate and started to collide with Europe, it ended with another major change in plate motion patterns, and with collision coming to a halt.

As data accrue more details emerge in the event timing record, in the distributions of magma types in time and space. These relationships impose immense constraints on the driving mechanisms of African intra-plate activity.

Fragmentation of Gondwanaland was a first order change in lithosphere distribution, completed shortly before the major change in the core dynamo, marked by the CN Superchron, and both must be connected with a massive re-ordering of the thermal and stress distributions in the mantle.