PALEOMAGNETISM OF EARTH'S LONGEST CONTINENTAL HOTSPOT TRACK: THE COSGROVE TRACK IN EASTERN AUSTRALIA

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ABSTRACT: The movement or fixity of hotspots in the mantle has been a source of debate ever since early plate circuit models were unable to reconcile tracks of Pacific Hotspots with those in the Indo-Atlantic realms. Uncertainties in relative plate motions were also argued to be the cause of the discrepancy, so many early workers continued to support a fixed hotspot reference frame within their models. Constraints on plate motion have improved in resolution since, but relative motion between Indo-Atlantic and Pacific hotspots persists in recent models. Hotspot motion in the mantle is, in principle, also detectable using paleomagnetic methods, as the magnetic field of the Earth is global in extent, and sensitive to paleogeographic changes in latitude. Consequently, North-South hotspot movement should be observed as a systematic change in paleomagnetic inclination with time. Attempts have been made to measure the movement of the Hawaiian, and Kerguelen oceanic hotspots using paleomagnetism, but limitations of deep ocean drill core have fueled debate of the validity of these results. For example, the Kerguelen hotspot appears mostly stationary according to paleomagnetic data. In contrast, some southward motion of the Hawaiian-Emperor hotspot is indicated by paleomagnetic data, although this has been argued to be the result of true polar wander. We decided to evaluate the extent that predicted hotspot motion could be measured using paleomagnetic methods on land, by examining Earth's longest continental hotspot track, the Cosgrove Track in eastern Australia. It is ideal for this study as its present day position in the mantle is known, the track is aligned N-S, and the hotspot was active from at least 9 to 34 Ma during an interval of apparently minimal true polar wander. We present new paleomagnetic results for Australia from Miocene leucitite lavas in New South Wales, and several Oligocene volcanos in central Queensland (Buckland, Springsure, Peak Range, Nebo and Hillsborough Volcanos), and with these new results we reconstruct the motion of the Cosgrove hotspot, and other hotspots beneath the Australian Plate. We evaluate the extent that hotspots beneath Australia may have moved in the mantle during the past 34 Ma, present an updated apparent polar wander path for Australia during the Cenozoic incorporating our new measurements, and describe the degree of paleosecular variation of the magnetic field over this interval.

KEYWORDS: PALEOMAGNETISM, HOTSPOTS, VOLCANOS