

Paleomagnetism of the Karoo Large Igneous Province in the Sani Pass area, South Africa-Lesotho border.



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INTRODUCTION

- The Karoo Large Igneous Province (LIP) is one of the world's largest continental flood basalt on earth (Courtilot & Renne, 2003).
- It is preserved as erosional remnant and occur prior to the breakup of Gondwana supercontinent leading to the opening of Indian Ocean (Duncan et al, 1997).
- Karoo LIP is exposed in Southern Africa (Figure 1).
- It is related to mass extinction and climate change (Moulin et al, 2016).
- The basal lava flow lie conformably on the Clarens Formation of the main Karoo Basin) and the lava flows are divided into two groups the Drakensberg and Lebombo Formation (Duncan & Mash, 2006).

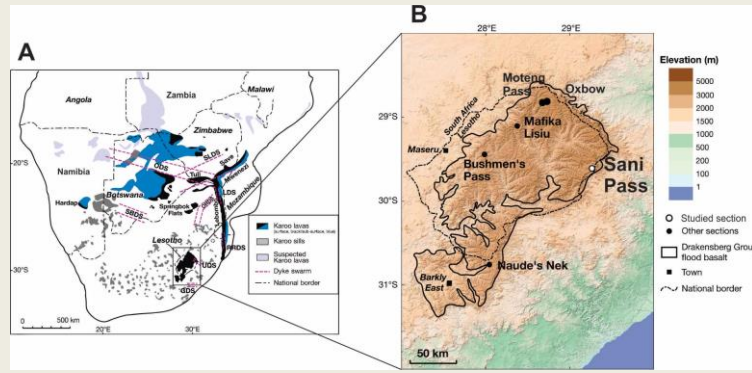


Figure 1a Showing the distribution of Karoo Large Igneous Province in Southern Africa, b Showing the locality of the study area together with previously studied localities. Modified from Moulin, 2016.

AIM AND OBJECTIVES

- Determining the Geomagnetic field behaviour, polarity reversals and palaeosecular variation during Early Jurassic period.

METHODOLOGY

- A total of 52 paleomagnetic sites were collected with typically 8 to 12 core samples per site.
- Three standard specimens were obtained from each sample and specimens were demagnetized using stepwise thermal (Th) and alternating field (AF) techniques.
- Remanence magnetization was measured with a 2G Enterprises superconducting and AGICO spinner magnetometers at the University of Texas at Dallas and the University of KwaZulu Natal, respectively.

RESULTS

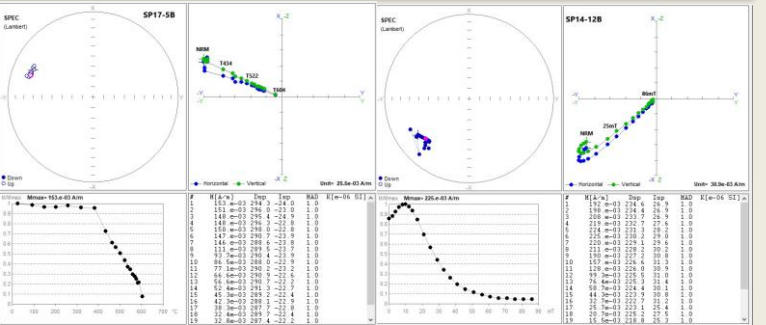


Figure 2 Demagnetization results of selected data subjected to thermal and alternating field demagnetization techniques.

- A total of 29 sites are of normal polarity, with 12 sites of reverse polarity, and 11 sites exhibit intermediate directions.
- An overall mean direction of Dec = 343.3°, Inc = -54.6°, a95 = 3.9°, k = 34.4 (N =41) is obtained. An estimated mean of Virtual Geomagnetic Poles (VGP) values is Lat = 74.6°, Lon = 270°, A95 = 4.5°, k = 25.6 (N =41).
- The normal and reverse polarity pass data the reversal test of McFadden & McElhinny, 1990.

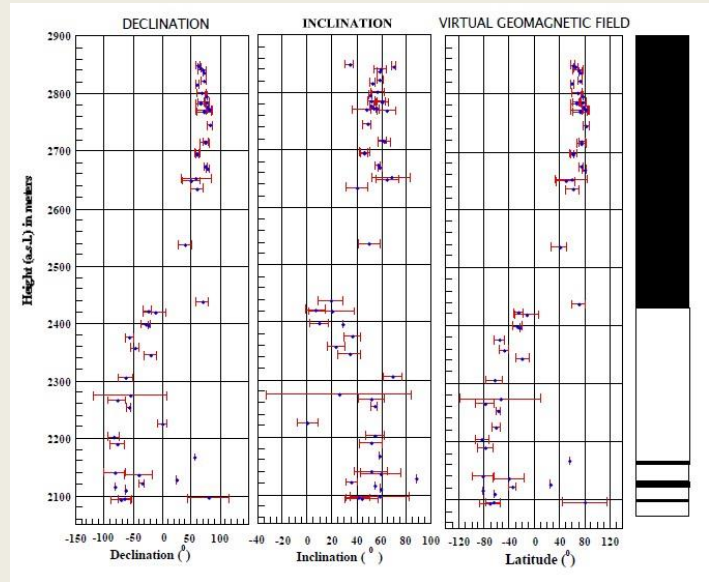


Figure3. Altitude variation of the paleomagnetic field data inclination, declination and of the Sani Pass area VGP.

Table 1 Virtual Geomagnetic pole of the Karoo LIP in the Drakensberg area. Previous data adapted from Moulin et al, 2016.

Sections	VGP Lat.					References
	N	(°N)	VGP Long. (°E)	K	A95	
Sani Pass	41b	74.6	270	25.6	4.5	This study
Oxbow-Moteng Pass	29b	65.3	267.9	27.9	5.2	Moulin, 2016
Naude's Nek	15b	76	268.8	30.8	7	Moulin, 2016
Naude's Nek ; Oxbow-Moteng Pass	44b	68.9	268.1	26.5	4.3	Moulin, 2016
Sani Pass, Bushman's Pass	74b	71	269	104	15	Van Zijl et al. 1962a,1962b
Sani Pass, Nazareth, Rhodes, Mafika Lisiu	47b	71.6	273.5	33	3.7	Kosterov & Perrin, 1996
OXB, BTW, LTW, MPLPW, MKH, LTE, MLPE, KAT, SOM, SP, ON	11c	74.4	272.8	104	4.5	Hargraves et al, 1997
OXB, BTW, LTW, MPLPW, MKH, LTE, MLPE, SOM, SP, ON	10c	72.3	273.5	427.4	2.3	Moulin et al, 2011, recalculated from data of Hargraves et al, 1997
APWP at 178.4 Ma	12	66.8	263.9	33.4	7.6	Besse & Courtillot, 2002
APWP at 182.4 Ma	9	69.8	261.4	46.5	7.6	Besse & Courtillot, 2002

CONCLUSION

- A polarity sequence of R-N-R-N is identified from bottom to top of the Sani Pass section; with the anomalous flow directions originating from the top reverse and normal polarity intervals.
- This result modifies the earlier-reported R-N polarity reversal sequence, with intervening transitional directions, by Van Zijl et al. 1962a, 1962b.

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