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Paleomagnetism and paleosecular variation from the late Miocene to recent lavas of Mauritius

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We present new paleomagnetic data from the late Miocene to recent lavas of the island of Mauritius in the south-western Indian Ocean (20.3˚S, 57.6˚E). The island is a shield volcano that has formed over the Reunion hotspot and is composed of three temporally-distinct series of basaltic lavas: the Older Series (4.7-8.9 Ma), the Intermediate Series (1.7-3.5 Ma) and the Younger Series (0-1 Ma). Oriented core specimens were collected from 36 sampling sites covering all three lava series. Rock magnetic analyses indicate that the remanence carriers in these basalts are pseudo-single-domain titanomagnetites with variable degrees of high-temperature oxidation. Nearly half of the sites showed pervasive magnetic overprints imparted by lightning strikes. Nonetheless, in almost all cases (35 sites), we were able to isolate the characteristic (primary) remanence directions through detailed thermal and alternating field demagnetization experiments, using the principal component analysis of demagnetization data and the analysis of remagnetization circles. Both normal and reverse polarity directions were observed, with the mean direction of the reversely-magnetized lavas (15 sites, D = 189.2˚, I = 44˚, α_{95} = 5.3˚) being steeper than and ca. 9˚ of antiparallel from the mean direction of the normal-polarity flows (20 sites, D = 1.1˚, I = -37.3˚, α_{95} = 6.9˚). The mean normal and reverse directions yield a negative reversal test that is just significant at the 5% probability level (P = 4.5%). However, when our new data set is combined with previously published paleomagnetic results from Mauritius, the difference between the normal mean direction and the antipode of the reverse mean is not significant at the 5% level, yielding a positive reversal test. The paleomagnetic pole corresponding to the combined polarity data set excluding transitional directions (86.7˚N, 186.2˚E, A_{95} = 3.5˚, n = 32) is slightly far-sided, but the difference between its position and the geographic pole is not statistically significant. The estimates of paleosecular variation (PSV) and inclination anomaly (S_b = 11˚, ΔI = -2˚) are in good agreement with the results of PSV studies of recent lavas erupted at low latitudes. The implications of our new results for the structure of time-averaged geomagnetic field and the latitude dependence of PSV will be discussed.