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Comprehensive palaeomagnetic study of San Borja and Jaraguay monogenetic volcanic fields, Baja California (28–30°N): considerations on latitudinal corrections

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We report 24 palaeomagnetic directions and 10 high-quality Thellier-derived palaeointensity (PI) values, obtained from 27 sites located in Baja California Peninsula, northwestern Mexico. Sampling was done in four rock units (magnesian andesites, calc-alkaline lavas, ignimbrites, adakites) belonging to San Borja and Jaraguay monogenetic volcanic fields. These units were erupted between ~ 15 and 2.6 Ma (previous K-Ar and $^{40}Ar/^{39}Ar$ data), hence results are presented in two consecutive periods: middle-late Miocene and Pliocene. Based on previous geological and geophysical records, the kinematic evolution of the region was carefully considered, allowing for the independent restoration of the palaeoposition of each sampled site. The identified main magnetic minerals are titanomagnetite, magnetite, and minor hematite, of variable grain size, present as intergrowths, which reflect varying oxidation/reduction conditions during emplacement of high-temperature magmas. We did not observe a clear relationship between the magnetic properties of the different sites and their success rate for PI experiments. This is with the exception of the FORC analysis which showed a fairly good correlation with PI success. Pliocene (Dec=359.2°; Inc= 47.4°; α_{95}=7.6°; and k= 41.43) and Middle-late Miocene (Dec=353.9°; Inc= 38.5°; α_{95}=9.2°; and k= 28.56) mean directions were calculated from 20 sites (10 sites per period), and PI mean values of 29.2 ± 9.1 μT and 23.2 ± 6.3 μT were determined for the two periods, respectively. Compiling global filtered PI data, together with our results, indicates that the strength of the geomagnetic field during middle-late Miocene was weak (virtual dipole moment = 5.0±2.2×10^{22} Am^2) compared to Pliocene (6.4±2.8× 10^{22} Am^2), and also relative to the present-day value (7.6 × 10^{22} Am^2). This indicates the global nature of the low dipole moment during the middle-late Miocene, which is consistent with what was previously concluded that from the past 30 Ma to the present time the magnetic field strength has increased. However, issues related to the Spatio-temporal distribution of PI data still present an obstacle to validating these suggestions; therefore, more reliable data are still needed.