ACCURACY OF PALEOINTENSITY RECORDS: RECORDING PROCESSES OR FAILURES IN TECHNIQUES?

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Determinations of paleointensity are essential to describe the evolution of the geomagnetic vector through time. Sedimentary and volcanic records basically rely on two techniques that were initially proposed by Levi and Banerjee (1976) and Thellier and Thellier (1955), respectively. Despite considerable work to improve the quality of the records, these methods remain basically unchanged and have proved to be the most suitable techniques so far. One of the major difficulties with sedimentary records is linked to changes in the response function caused by the physical properties of the sediment. Unfortunately, their origin remains undetected, although in most cases this is a direct consequence of changes in paleoenvironmental conditions. However this can yield to a paradox as a highly climatically contaminated natural magnetization may be very adequate for paleointensity, provided that the normalizing parameters are also climatically impregnated. We will discuss several techniques that have been proposed to compensate for these effects in order to extract reliable paleointensity signals. Determinations of absolute paleointensity from volcanic material are frequently associated with large dispersion within the same lava flows which can reach 15-20% of the field value. Surprisingly also, multiple determinations performed on contemporaneous flows using different protocols provide the actual field value only if a very large number of determinations has been obtained. Thus field intensity is most frequently not obtained with better accuracy than within 20% of the field value, which in the case of volcanics increases the amount of uncertainty, given that the non dipole components represent another 20% of the total field. However these uncertainties do not preclude to extract the dipole component provided that we are dealing with time averaged field values over long enough time intervals. This has been done with great success with volcanics for the past 50 kyrs, which
are in satisfactory agreement with the stacked curves of relative paleointensity. The problem resides in the second-order, with the presence of fluctuations superimposed on the overall trend in the most detailed records, which may not be indicative of actual field changes. For similar reasons, the changes in the amplitudes inherent to the saw-tooth pattern recorded in sediments from the equatorial Pacific are subjected to debate. Thus, integration of volcanic and sedimentary data is essential to validate the geomagnetic origin of the changes as long as we cannot improve the techniques and solve the problems inherent to the recording processes. We will also review the major results obtained so far by combining various approaches.