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Low temperature oxidation and long-term paleointensity

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Three current data sets resulting from Thellier analyses are commonly used to constrain paleointensity history: whole rock basalts, submarine basaltic glass, and single plagioclase crystals. The basalt Thellier results are typically interpreted as showing no relationship between reversal frequency and field strength, whereas an inverse relationship is suggested on the basis of analyses of single plagioclase crystals. Recently, studies of submarine basaltic glass have been interpreted as being consistent with a strong Cretaceous field. Moreover, new analyses of oceanic basalts by Wang et al. (2005) revisit an older issue: the higher intensity recorded by the natural remanent intensity of Cretaceous oceanic basalt, noted by Ulrich Bleil (Bleil and Petersen, Nature, 1983). In the new analysis, the authors exclude rock magnetic factors; they also call upon a more intense Cretaceous geomagnetic field. In direct comparisons of Thellier results from single plagioclase crystals and oxidized basalts, basalts yield systematically lower paleointensity values. Although there are mechanisms that can result in paleointensity overestimates in Thellier experiments using basalts, these comparisons and other experiments indicate that low field bias is dominant. This bias masks the inverse relationship between field strength and reversal rate recorded by other data sets.