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Geomagnetic excursions in the Brunhes and Matuyama Chrons: Do they come in bunches?

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Geomagnetic excursions, defined here as brief directional aberrations of the main dipole field outside the range of expected secular variation, remain controversial. Poorly-correlated records of apparent excursions from lavas and sediments can often be assigned to sampling artifacts, sedimentological phenomena, volcanic terrane effects, or local secular variation, rather than behavior of the main dipole field. Although records of magnetic excursions date from the 1960s, the number of Brunhes excursions in recent reviews of the subject have reached the 12-17 range, of which only about ∼7 are adequately and/or consistently recorded. For the Matuyama Chron, the current inventory of excursions stands at about 10. The better quality excursion records, with reasonable age control, imply millennial-scale or even sub-millennial-scale durations. When "adequately" recorded, excursions are manifest as paired polarity reversals flanking virtual geomagnetic poles (VGPs) that reach high latitudes in the opposite hemisphere. At the young end of the excursion record, the Mono Lake (∼33 ka) and Laschamp (∼41 ka) excursions are well documented, although records of the former are not widely distributed. Several excursions younger than the Mono Lake excursion (at 17 ka and 25 ka) have recently been recorded in lavas and sediments, respectively. Is the 17-41 ka interval characterized by multiple excursions? Similarly, multiple excursions have been recorded in the 188-238 ka interval that encompasses records of the Iceland Basin excursion (∼188 ka) and the Pringle Falls (PF) excursion. The PF excursion has been assigned ages in the 211-238 ka range. Does this mean that this interval is also characterized by several discrete excursions? The 500-600 ka interval incorporates not only the Big Lost excursion at ∼565 ka, but also anomalous magnetization directions from lava flows, particularly in the West Eifel volcanics that yield mid-latitude northern-hemisphere VGPs with a range of Ar/Ar ages. The key question is whether such intervals of mid-latitude VGPs denote high-amplitude secular variation or inadequately recorded magnetic excursions. We propose that excursions characterized by high VGP latitudes in the opposite hemisphere should be termed Category 1 excursions, and those manifest by low/mid-latitude VGPs should be termed Category 2 excursions. In the future, improved records may "elevate" Category 2 excursions to Category 1. We do not view this subdivision of Category 1 and Category 2 excursions as necessarily a geomagnetic distinction, but possibly a distinction based on recording fidelity.