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Updating the Late Cretaceous-Eocene Geomagnetic Polarity Time Scale with Marine Magnetic Anomalies: A Progress Report

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Marine magnetic anomalies that result from the magnetization of basaltic rocks formed at seafloor spreading centers are found on mid-ocean ridge flanks worldwide. These anomalies record the history of geomagnetic field reversals, and the width of magnetized polarity blocks can be combined with absolute ages and some assumptions on the variation of spreading rates to generate a Geomagnetic Polarity Time Scale (GPTS). Accurate GPTSs are important in many fields of the earth sciences to constrain the history of seafloor spreading and plate motion, determine past rates of change, and guide sediment cycle identification in astrochronology. Our goal is to establish an improved GPTS for the Late Cretaceous-Eocene interval (Chrons C33-C13, 83-33 Ma). The current GPTS is based on magnetic anomaly records assembled more than twenty years ago and on an assumption of smoothly varying spreading rates in the South Atlantic. The global marine magnetic anomaly record has grown since, and our project aims to substantially update the time scale information provided by marine magnetic anomalies by extending the analysis originally done in the South Atlantic to several spreading centers. We assembled magnetic anomaly profiles over 33-83 Ma old mid-ocean ridge flanks from the Pacific-Antarctic Ridge (23 profiles so far), the Northern Pacific (36), the South Atlantic (42), and the Indian Ocean (40). The profiles have been projected onto plate tectonic flow lines determined from published finite rotations. Distances to magnetic polarity block model boundaries have been estimated on each profile with a Monte Carlo algorithm that achieves a best fit between modeled and measured anomalies by iteratively changing the block model distances and the anomaly skewness. Distance data from each profile were then assembled to generate a summary set of block model distances over each ridge flank. The final GPTS will be obtained with another Monte Carlo algorithm that iteratively perturbs ages of polarity chron boundaries to simultaneously minimize the variability of spreading rates over all ridge flanks while fitting an up-to-date set of radiometric dates. This process will account for all uncertainties in polarity block distances, radiometric dates, and their location within a chron. The final result will be a GPTS that minimizes the global fluctuations of spreading rate and has quantified uncertainties, which can be further reduced by incorporating independent information from astrochronology on polarity chron durations.