Calibrating M-Sequence GPTSs with uncertainty quantification and cyclostratigraphy

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Geomagnetic polarity timescales (GPTSs) are critical tools for dating events in the geological record. GPTSs are based on "block models" of magnetic anomaly lineations measured on the flanks of mid-ocean ridges and a few radiometric dates. The Cenozoic C-sequence (present – 80 Ma) GPTS is more accurate and well understood as there is more information about its constraints, but the M-sequence (124 – 158 Ma) is not very well known. This is primarily because data for this period simply is very scarce. Current GPTSs of the Mesozoic M-sequence lineations are based on unrealistic, constant-spreading-rate assumptions, do not use all available block models, do not incorporate cyclostratigraphic (duration) constraints, and lack stringent uncertainty tabulations. This project does all these things by limiting the variation in spreading rates for ALL magnetic anomaly block models, not merely one or a few. Doing so will result in an improved GPTS since there is no reason to assume that ridges exhibit widely diverse behavior. Our new approach not only uses all available block models, the radiometric age constraints, and information gleaned from cyclostratigraphy, but it also provides exceptional flexibility in updating the timescale for any new data found. The miracle method that allows all this to happen is called the Metropolis algorithm, which employs a Monte Carlo sampling method in a random walk. Taking a stroll down the streets of the Metropolis permits the exploration of possible, likely timescales, and the mean of the sampled GPTSs and its variance are calculated at the end of the journey. The resulting timescale reduced the overall variance in spreading rates compared to published timescales. This final picture of the M-sequence timescale is constrained by more information and is easy to update.