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When Isotopic Uncertainty Becomes Narrative: Revisiting Temporal Dispersion in a "Post-Errorchron" Era

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Geochronology increasingly recognises that rocks may record complex age distributions rather than a single crystallisation event, yet terminology describing such patterns remains unsettled. In light of recent criticism of the term "errorchron"[1], we explore two tentative, process-neutral descriptors that may offer clearer communication. We use "*variachron"* to describe data scatter with overdispersion, and "*divergochron"* for variachrons that display interpretable multi-generational structure.

Rather than discarding overdispersed datasets or filtering for a smaller MSWD, we consider variachrons worth examining thoroughly, as this may lower the risk of type-II errors and retain valuable information on geological complexity. A possible analytical workflow includes: (1) checking whether analytical uncertainties have been underestimated, as this alone can produce an apparent spread; (2) investigating whether directional trends exist—in which case the pattern might be better described as a "divergochron"—and recognising that further geochemical investigation could help clarify the processes causing the divergence; and (3) performing quantitative assessments, for example via Bayesian mixture modelling using Markov chain Monte Carlo (MCMC) or Hamiltonian Monte Carlo (HMC). For typically small geochronological datasets (e.g., $n \approx 10–30$), model comparison methods such as Pareto-smoothed importance sampling leave-one-out cross-validation (PSIS-LOO) and Bayesian bootstrap pseudo-Bayesian model averaging (BB-pseudo-BMA) may serve as practical alternatives to calculating marginal likelihoods, which can be computationally intensive.

Reference:

[1] Vermeesch, P. (2025) 'High MSWDs are not the problem, low ones are', *National Science Review*, 12. doi:10.1093/nsr/nwaf036.