Misplaced Confidence in cyclostratigraphy: the case against tests of statistical significance in the search for orbital cycles

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I recommend eliminating 'confidence limits' from searches for orbital cyclicity in power spectra of stratigraphic data. Confidence limits (CLs, e.g. 95%, 99%), widely used as non-binding guides to spectral peak selection, actually express specific (null) hypotheses of randomness vs cyclicity. Such tests of significance represent confirmatory (hypothesis-testing) data analysis. By contrast, searching for cycles in stratigraphic power spectra is necessarily exploratory (hypothesis-generating). The CLs conventionally calculated in cyclostratigraphy are appropriate only for confirmatory tests; their P-values are unavoidably devalued by the multiple-testing nature of exploratory analysis. Such statistical multiplicity arises from (1) the flexible, data-contingent analytical procedures used in cyclostratigraphy, and (2) the need to search power spectra in the absence of pre-defined frequency targets. Abandoning confidence limits will avoid false claims of statistical reliability and need not hinder other – albeit less quantitative – approaches to cycle identification.