

An index of morphological turnover across a chronological boundary

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Study on morphological diversity over geologic time has been conventionally based on the patterns of disparity change. Change in disparity across a mass extinction event is determined by the relationship between a temporary decrease in morphological variation and subsequent introduction of new variation after the event. In the case of a balanced relationship, the disparity remains constant throughout the interval, even if the morphology was totally changed. An alternative approach is an analysis of morphological turnover in which appearance patterns of morphospace occupation are compared between the adjacent geochronological units. However, conventional morphospace analyses have omitted abundance of each species. Here, I would introduce an index representing how drastically the pattern of morphospace occupation changes. The index takes into account the abundance of each species based on the collection-based occurrence data deposited in the Paleobiology Database. The analysis of the morphological turnover begins with depicting the landscape of the probability density of data in a morphospace for each chronological bin using multi-dimensional kernel density estimation. The similarity between a pair of the landscapes can be represented by a correlation coefficient of the probability density computed for each point in the multi-dimensional morphospace. The value of 1 minus the correlation coefficient is defined as an index of morphological turnover. This index is sensitive to change in morphospace occupation pattern.

Keywords: morphospace, disparity, mass extinction and recovery