DIVERSITY VERSUS DISPARITY: EXAMPLES FROM PRESENT (COLEOIDS) AND PAST (AMMONITES) CEPHALOPODS

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The concept of morphological space (considered here to be a complement to the traditional analysis of taxonomic diversity), is especially usefull for understanding how the diversity (morphological expression of differences) of a set of organisms is structured and consequently for interpreting shape changes in terms of evolution or adaptation : disparity is the measure of how fundamentally different organisms are. This concept is illustrated here by two examples.

1. Ammonoid morphological signal versus sea-level changes : adaptative aspects of form disparity

Workers investigating ammonites ecology have suggested a correlation between shell morphology and sea-level variations. If such correlations could be generalized, ammonites might then be used as paleo-environmental markers. In practice, establishing correlations runs up against a major difficulty posed by sample selection. In this work we adopt a new approach to test for correlations between morphology and environment in a series of four Upper Callovian (Middle Jurassic) and two Oxfordian (Upper Jurassic) populations from Côte-d'Or (Burgundy, France). This approach is based on minimizing taxonomic constraints when forming samples for analysis. It allows morphodiversity to be read directly without interference from taxonomic subjectivity. The biometric method used is based on mathematical equations (Raup, 1966) whose graphical plots are analogous to the organism's morphology.

2. Exploration of morphospace in statoliths and beaks of cuttlefish and squid : evolutionary aspects of form disparity

This work reports on a study using a Procrustes type analysis (Bookstein, 1991) of shape in exploring the morphospace of cephalopod statoliths and beaks. This method is based on the utilization of anatomically conspicuous points (landmarks). Comparison of their relative positions warrants localization and quantification of morphological differences between ontogenetic stages, individuals or taxa. The aim of this study is (1) to explore morphospace patterns in statoliths and beaks of several decabrachian groups, and (2) to assess biological form disparity between statoliths and beaks in terms of morphological distances that are testable against the phylogenetic trees derived from molecular methods. This approach should allow us to consider two evolutionary aspects complementary to one another, namely adaptive significance versus genetic fixation of statolith and beak morphology.

Bookstein, F.L., 1991, *Morphometric tools for landmark data. Geometry and biology*, Cambridge University Press, pp. 1–435.

Raup, D.M., 1966, Geometric analysis of shell coiling, *Journal of Paleontology*, 40(5):1178–1190.