Transient complex systems in the punctuated phyletic succession linking G. *pleisotumida* and G. *tumida*

PHILIP F. HENSHAW

HDS research

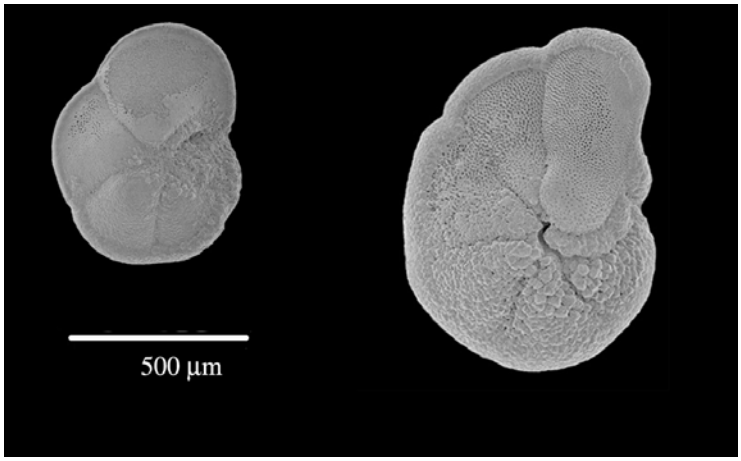
680 Ft Washington Ave., New York NY 10040.

E-mail: id@synapse9.com

Abstract: The evolutionary transition from planktonic foraminifera G. *pleisotumida* to G. *tumida* provides an unusually detailed picture of a single speciation event. The transition is marked by an overall tripling in size over 2 Myr and directly appears to follow trends that accelerate and decelerate. Using a mathematical test of internal symmetry borrowed from fractal theory, the prior interpretation of the data as a random walk is disproved, legitimizing the use of shape analysis to reveal the behaviour of the underlying process. The classic sequence of growth phases bridging two steady states suggests a form of evolving complex system that would also satisfy the requirements needed to fill the typical gaps in the fossil record appearing at the speciation of more complex organisms. The possibility that the transition event was environmentally driven, what's needed for it to represent a transient growth system or provide an example of the general causal mechanism of speciation, and directions in which to look for contradiction of corroboration are briefly discussed.

Keywords: pattern recognition, system identification, punctuated equilibrium, random walk, steady states, transient complex systems, growth, planktonic foraminifera, G. tumida.

2000 Mathematics Subject Classification codes: 00A69-applied mathematics, 68T10-pattern formation, 54C56-shape, 54F15-continua, word count 6 638



G. pleisotumida and G. tumida, electron micrographs taken by H.Hayashi (IGPS).

1. Introduction

The shapes of things generally reflect their underlying structures, with a few notable exceptions. What appear to be trends in the fossil record might or might not reflect the underlying causes of genetic variation and selective pressures. Trends in evolution might also be considered to reflect nothing more than accumulating random variation, since that is one null hypothesis for the mechanism of genetic change. Accumulations of random steps are called random walks, and often appear to have regular shapes or directions even though the underlying process has none. Whether random walks of biological characters actually occur is another question, but theoretically characteristics of an organism that have no effect on survival could randomly wander, appearing to represent trends in evolution that actually aren't meaningful (Bookstein 1987)(Prothero 1992).

1. This study reexamines a classic example of evolutionary trends, the transition between the plankton species Globorotalia *pleisotumida* and Globorotalia *tumida* published by Bjorn Malmgren et all. (1983). His data shows an overall tripling in the size, following a succession of more and then less rapid change, starting and ending with relative steady states. This was later reexamined by Bookstein (1987), and various others. As Bookstein saw it, the appearance of a succession of trends could not be

read as reflecting the punctuated gradualism claimed by Malmgren et all. (1983) because it might have been produced by a random walk. This can now be ruled out with good confidence, using a more direct statistical test for the presence of random walk in the data, and confirming logic.