



Systematists Follow the Fossils

David M. Raup

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from similar environments throughout the Phanerozoic. Exhaustive collections of a few of the most diverse assemblages such as the study by Kanakoff and Emerson (1959) cited by Durham (1967) might produce meaningful data which could be compared by rarefaction procedures.

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Systematists follow the fossils

David M. Raup, Department of Geological Sciences, University of Rochester, Rochester, New York 14627

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The situation described by Sheehan is something of a chicken-and-egg problem. Does high species diversity produce paleontological interest or the reverse? Three variables are correlated with each other: outcrop area, number of species described, and number of interested paleontologists. The correlation coefficients are all high and statistically indistinguishable from each other. It is thus difficult or impossible to decide which is the primary causative factor. Sheehan's interpretation is as follows: geologic systems with more exposed rock attract more paleontologists and this, in turn, leads to more species descriptions. The alternative I prefer (but cannot prove) is: geologic systems with more rock contain more species and this leads to more species being described. By this second scenario, the manpower correlation is just an inevitable consequence of paleontologists going preferentially to fossiliferous rocks! The second scenario also predicts that more monographs are devoted to the more fossiliferous sequences, more museum drawers, more type catalogs, more motel registrations by field paleontologists, and so on *ad infinitum*. But

there is really nothing in the data so far presented to allow a rigorous choice between the alternatives.

For those readers tempted to delve more deeply into the statistical problems, it should be noted that the correlation coefficients in Raup (1976) are based on raw data whereas Sheehan used the normalized data. The latter procedure is somewhat dangerous because errors in the geologic time scale will tend to increase the calculated values of *r*.

With regard to what the data tell us about overall patterns of species diversity in the Phanerozoic, I completely agree with Sheehan that ". . . the apparent number of species is strongly dependent on sampling and . . . many of the changes in diversity seen in the Phanerozoic are artifactual" (Raup 1976, p. 289). But Sheehan has set up a straw man in this context by saying that I am one of a group that contends that the actual diversity changed little. Although it is no secret that this is my *hunch*, I have been careful not to present it as a documented conclusion. Rather, I have stated (Raup 1976, p. 289) that because of the sampling problems ". . . there is *no compelling evidence* for a general increase in the number of invertebrate species . . ." and ". . . diversity *may* have been in dynamic equilibrium . . ." (italics added). There may or may not have been a general increase in diversity. Both the equilibrium model (Raup 1972) and the diversity expansion model (Valentine 1973) are possible and plausible, but world-wide species lists are not sufficiently bias-free to allow rigorous analysis. I agree with Sheehan that Bambach's approach shows greater promise. Ironically, Bambach's (1977) data suggest that the truth lies somewhere between the extremes cited above.

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