Biology/Geology 350
Invertebrate Paleontology: The History of Life on Earth
Exam Number Two

QUESTION FIVE
THE ECOLOGY AND GEOLOGICAL RECORD OF STROMATOLITES AND BENTHIC PROTOCTISTS

BACKGROUND:

In lab we examined the structure, anatomy, and taxonomy of stromatolites and benthic protoctists. I am going to assume that you know and understand that knowledge, and will not ask questions about it. Instead, here we are after interpretations of these organisms, and the fossils they produced. That is, the environmental conditions which control their distribution, determine how they fit into ecosystems, and make them valuable for interpreting the earth's and life's past.

One of the major problems we have in paleontology is that we are working with the remains of organisms which are dead. Not only that, virtually all of the environmental variables which existed at their time are not preserved. Paleontologists thus have a problem biologists do not have; we cannot experiment with our fossil organisms, exploring where, how and why they lived. We can, of course, experiment with descendants of our fossils - if they are still around, and then try to extrapolate that knowledge back in time. But there are always dangers in doing that, and some probability we are wrong.

The approach that is often taken, then, is to try to take theoretical principles derived from modern biology, or chemistry, or physics, and make deductive arguments to come up with hypotheses to explain the distributions we see. Once that is done, we must then test these ideas in a bottom-up manner, by doing experiments, or predicting observations that will definitively conform or deny the hypothesis.

QUESTIONS:

(A) Until 10 or 20 years ago stromatolite paleoenvironmental interpretations were restricted simply to "intertidal." Studies of modern stromatolites, such as those in Hamlin Pool of Shark Bay, Australia show this to be much too simplified.

- ☺ Describe, illustrate, and name the main types of blue-green algal mat communities which build **non-stratiform** stromatolites and the kinds of conditions controlling their morphogenesis.
- ☺ Thoroughly and definitively discuss how mat type (including stratiform types), environments, and physical processes interact to control the morphogenesis and distribution of different stromatolite communities and stromatolite structures. Draw and discuss whatever charts, diagrams, tables, or drawings you need to illustrate your arguments.
- ☺ Discuss any problems you see with trying to extrapolate knowledge of modern stromatolites back to interpretations of the fossil record of sromatolites.

(B) Concisely and definitively discuss the importance of calcareous algae in paleoenvironmental interpretations by listing the kinds of limiting factors which control their distribution and discussing, with the help of charts, diagrams and/or environmental cross sections, how light intensity and quality, temperature, water movement and other environmental variables affect the distribution of representative specific groups or individual species (e.g. Rhodophyta, Chlorophyta etc.).

(C) ***Given with the test*** a series of cross sections reconstructing modern and ancient benthic calcareous algal distributions (taken from Wray, "Calcareous Algae") discuss for each: (1) the application of the principles in (B) to explain the distributions, and (2) what we learn about doing (paleo)environmental interpretations from this data.