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LOCKATONG FM. DETRITAL CYCLES (LATE TRIASSIC, NEWARK BASIN, N.J. AND PA.), GIANT LAKES, AND ECOSYSTEM EFFICIENCY

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Lockatong Fm. detrital cycles were produced by the rise and fall of giant lakes. These sedimentary cycles show a pattern of total organic carbon (TOC) which tracks the other features in the cycles. The black, often microlaminated siltstones produced during lake high-stands have a high TOC (1.5-7.0%) while the surrounding gray or red shallow-water siltstones formed during lake expansion and contraction have a lower TOC (0.0-1.5%). Traditionally, this would be read as changing organic productivity, but I offer a different interpretation.

One measure of the success of a lacustrine ecosystem at converting the energy trapped by photosynthesis into living organisms can be defined as an ecosystem efficiency, which in this case, equals the ratio of the rate of dissipation of organic carbon by growth, respiration, and reproduction of all organisms in the ecosystem (R_{eco}) to gross photosynthetic productivity (GP). In this simple case, GP-R_{eco}=rate of accumulation of organic carbon.

In lakes, ecosystem efficiency is depressed by increased depth with chemical stratification, and is very low in meromictic lakes. In the high-stand, microlaminated portion of cycles the low ecosystem efficiency is shown not only by the high TOC, but also by the preservation of delicate microlaminations and whole fish and reptiles. Ecosystem efficiency is promoted in shallow lakes; evidence of high productivity and high ecosystem efficiency in the transgressive, regressive, and low-stand gray and red siltstones of cycles is intense bioturbation by animals or roots and low TOCs.

Changing ecosystem efficiency controlled by lake depth and stratification, not changing productivity, resulted in the pattern of TOC seen within Lockatong detrital cycles.