

## MODERN ALGAL MATS IN INTERTIDAL AND SUPRATIDAL QUARTZ SANDS, NORTHEASTERN MASSACHUSETTS, U.S.A.

BARRY CAMERON, DIANE CAMERON, AND J. RICHARD JONES

Acadia University, Wolfville, Nova Scotia BOP 1X0; Brow Mountain Road, Glenmont, Nova Scotia BOP 1H0;  
and University of Texas, Austin, Texas 78712

### ABSTRACT

Occurrences of algal mats at Plum Island along the northeastern coast of Massachusetts at 43°N latitude consist of laminated quartz silt and sand bound by mucous-secreting, filamentous blue-green algae (Cyanophyta). Recent discoveries of modern algal mats in quartz sands along cool, temperate coasts further confirms the fact that algal mat-forming organisms have wide temperature and salinity as well as substrate tolerances.

At Plum Island, algal mats occur along the high intertidal to low supratidal margins of a metahaline pond in a swale on a recurved spit at the southern end of the island. They are also found along the margin of the marsh next to the edge of the backdune area of the island's dune field.

The algal mats on Plum Island are vertically stratified into three major zones. The upper 1 mm of the mat in the spit area is dark brownish green due to filaments of *Lyngbya*, *Microcoleus*, and other smaller filamentous blue-green (?) algae. Coccoid cyanophytes (including *Eurokryptos*?), diatoms, *Euglena*, and nematode worms also are present. Below this upper green layer, there is a thinner, pinkish layer containing anaerobic, photosynthetic purple sulfur bacteria. Underlying the pinkish layer, there usually is a third layer composed of organic-rich black sand, 1-10 cm thick, indicating anaerobic conditions. This black layer contains the remains of buried older surface mats whose laminae can be recognized as alternating layers of decaying organic matter and layers of water-laid sands and wind-blown silts. Gelatinous material aiding filament-binding of sediment extends 1-7 mm below the upper surface. No carbonate cementation was found.

The larger structures associated with these algal mats include gas domes, desiccation polygons, elongated ridges, rolled mats, mounds, and distorted mats redeposited after flotation.

Algal mat growth affects physical sedimentation in part of the interdune area of the spit by stabilizing silt and sand after erosion and/or sediment deposition. By stabilizing each new sediment surface, these mats aid upward growth of low, ponded areas of the spit. Overturned and rolled mats produce mounds that become colonized by vascular plants and thus initiate dune development on low, flat areas.

Ancient quartzose algal mats may be difficult to recognize in the stratigraphic record, but occurrences are known. Preservation potential is low because of the lack of carbonate cementation. Possible criteria for recognition include fine sand and silt laminae, desiccation cracks, elongated ridges, mounds, and overturned mats.

### INTRODUCTION

Much of the literature on modern algal mats and stromatolites notes that their occurrence today is generally restricted to arid to semi-arid, tropical to subtropical carbonate marine environments (e.g., Bathurst, 1975). However, Awramik et al. (1978) pointed out in their review that modern stromatolite analogs or algal mats occur in many marine environments, not just the intertidal and supratidal zones, as well as in lakes, streams, and thermal springs. They and a number of other authors (usually in the context of other studies) also have noted that modern algal mats can occur in siliciclastic sediments, but not as much is known about these occurrences as is known about their carbonate counterparts. The purposes of this report are to (1) provide a description of the recently discovered cool temperate, quartzose algal mats at Plum Island along the northeast coast of Massachusetts (Jones and Cameron, 1978a); (2) describe their geologic environment; and (3) evaluate their geologic and paleontologic significance and fossilization potential.

A stromatolite is a laminated biogenic sedimentary structure "... formed by sediment trapping and bind-

ing and/or mineral precipitation with prostrate microbial communities termed algal mats ... Algal mats form more or less cohesive fabrics of intertwined filaments and/or gelatinous matter produced by both filamentous and coccoid microorganisms" (Golubic, 1976a, p. 113). These microorganisms are principally blue-green algae (cyanophytes) (Awramik and Margulis, in Walter, 1976, p. 1; Golubic, 1976b).

The algal mats at Plum Island consist of uncemented, laminated quartz silt and sand bound by mucous-secreting, filamentous blue-green algae (Cyanophyta). These algal mats are similar in community structure and generic composition to other modern occurrences in warmer and/or more arid climates which contain a cosmopolitan flora (Golubic and Awramik, 1974).

### STROMATOLITE AND ALGAL MAT OCCURRENCES

Stromatolites first appeared over three billion years ago (Golubic, 1973; Gebelein, 1976) when the only known organisms were procaryotic, such as blue-green algae and bacteria (Kingdom Monera). Although the diversity of stromatolite forms has significantly de-

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