Fossilization Potential of Soft-Bodied Algal (Fucus) Holdfast Traces

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The history of fossil algae has been studied with varying degrees of success. While the calcareous algae are reasonably well documented (Wray, 1977), little paleontological evidence exists for soft-bodied algae such as kelps and fucoids. The few findings are of the inferred presence of soft-bodied algae through associated invertebrates, and these are relatively recent (Baluk and Randwanski, 1977, and McRoberts and Stanley, 1988).

For this study, argillite substrates carrying several species of the algae genus Fucus collected from wave cut platforms along the north shore of the Gaspe Peninsula, Quebec, Canada. These argillite samples were examined for unusual surface traces produced by the holdfasts of Fucus that could potentially be preserved in the rock record. Algae species were differentiated by the distinctive receptacles found on fertile individuals. The three identifiable species of Fucus studied were: F. vesiculosus, F. edentatus, and F. spiralis. Those individuals that had no fertile receptacles were lumped under the heading of Fucus sp. (Fig. 1).

The substrate samples collected for this study were from turbidite shales of mid-Ordovician age in the Cloridorme Formation. The best exposures of this formation occur along the north shore of the Gaspe Peninsula as sea-cliffs and wave cut platforms (Enos, 1969). On the platforms, the less resistant argillites form the spectacular tide pools interbedded among the more resistant sandstones. Two platforms; one at Grande Vallee and another at Point Mimi 30 kilometers to the east, were chosen as study sites.

Data collected consisted of biological counts taken along transects running from the landward end of the platforms to the sea. Half-meter square grids divided into 25 ten-by ten centimeter squares were laid down at predetermined intervals along these transects in oreder to map the spatial distribution of the various species of algae. "Plant-like" algae were counted by the number of holdfasts, and encrusting algae were counted by estimating their total area in square centimeters.

After the biological data had been recorded, samples of argillite with attached holdfasts were collected from the tide pools at Grande Vallee and Point Mimi. Each sample was sketched, numbered, and the algae species were identified to the degree possible.

In the lab, the holdfast sites of Fucus were marked, and the samples were then soaked for several days in hydrogen peroxide, then rinsed, in order to remove the algae from the argillite substrate. The samples were then dried, mounted, and gold coated. The argillite samples were examined using the Cambridge Stereoscan 100 Scanning Electron Microscope.

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At high magnification, it was found that the appearance of the argillite substrate in the holdfast sites was significantly different from the rock surfaces where no Fucus had been attached. Typically, the argillite substrate was extensively pitted, often in a honey-comb pattern in the holdfast areas. The rough surfaces were also punctuated with sharp peaks or points. Those areas where no Fucus had been attached were relatively smooth and had only rare, single pits (Fig. 2).

This preliminary examination of modern Fucus holdfast sites on argillite substrates has shown that these algae typically leave potential trace fossil markings on these rock surfaces. , Furthermore, it is possible that these scars could be typical for this genus, and that other soft-bodied algae may produce trace fossils. These scars could be potentially helpful in the search for evidence of soft-bodied algae in the stratigraphic record.

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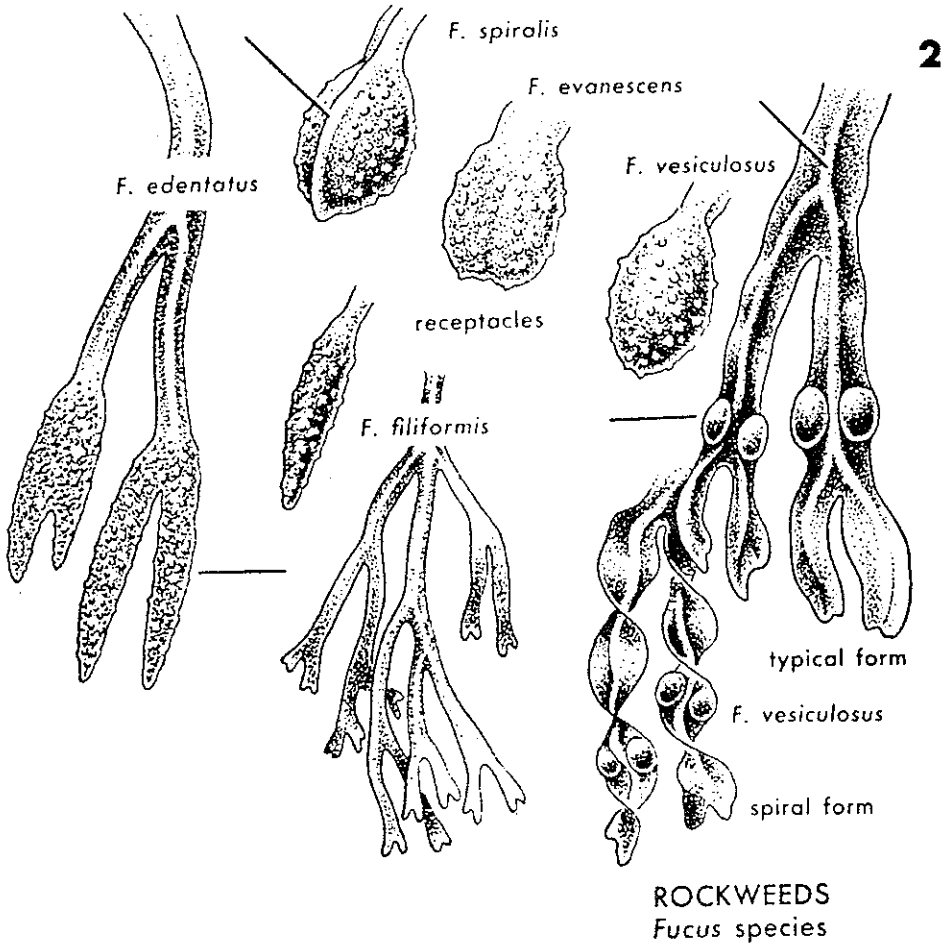

Figure 1.
Identifying characteristics of several species of Fucus (Gosner, 1978, Plate 2).

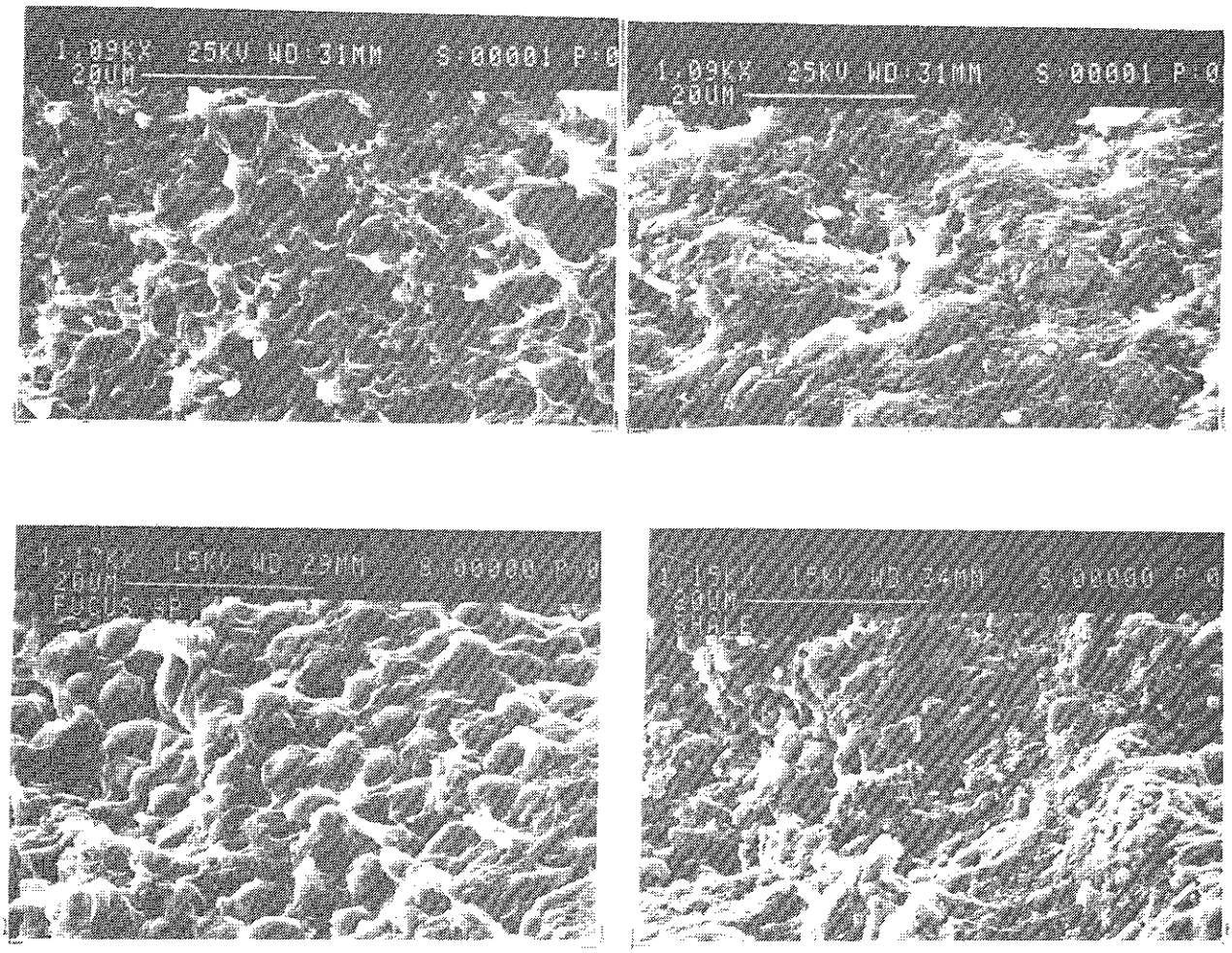

Figure 2.

From top to bottom:
Sample 1 F. vesiculosus scar
Sample 3 F. species scar

From top to bottom:
Sample 1 Argillite
Sample 3 "

Sedimentology and Stratigraphy of the Cap Barre through Saint Yvon Section, Cloridorme Formation, Gaspe Peninsula, Quebec, Canada

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INTRODUCTION

The Cap Barre through Saint Yvon section of the Cloridorme Formation is located on the northern coast of the Gaspe Peninsula, Quebec, Canada. The Cloridorme Formation is of late Middle Ordovician, or Caradocian, age, and is more than 7.0km thick (Enos, 1969). The Cloridorme is a siliciclastic foreland basin flysch sequence. These sedimentary rocks were laid down during the closing of the proto-Atlantic, or Iapetus Ocean, as part of a westward-prograding wedge shed from an approaching system of tectonic lands and volcanoes (see fig. 1) (Hiscott, Pickering and Beeden, 1986).

The purpose of this project is to examine the sedimentology and stratigraphy of the Cap Barre through St. Yvon section of the Cloridorme Formation. The sandstones and shales of this formation have been divided into three lithofacies (A, B, and C) based on bedding thickness and relative proportions of shale and sandstone.

FACIES DESCRIPTIONS

Facies A: Thick sandstone and shale couplets. The lower part of these couplets are made up of medium to thick beds (20cm—1.2m thick) of orange-weathering, calcite-cemented, very fine to fine sandstone. The upper part of these couplets consist of black fissile shale beds, from 50cm—4.5m thick. The contacts between sandstone beds and shale beds are usually sharp but in some cases are gradational.

The sandstone beds contain the following sedimentary structures: convoluted bedding; psuedo-nodule layers; planar and undulatory bedding; flute casts, and in a few examples, climbing ripple lamination. Beds are well sorted and lack grading.

Facies B: Interbedded siltstone/sandstone and shale beds. Resistent-weathering beds consist of very thin to medium-bedded (0.5—40cm thick), orange-weathering, calcite-cemented siltstones to fine sandstones. [These sandstone beds were separated into two thickness populations, B and B', —see table 1] Shale beds have a similiar range of thickness and the overall ratio of siltstone/sandstone to shale is roughly 1 to 1. The contacts between the siltstone/sandstone and shale beds are extremely sharp.

Facies B sandstone beds display no grading, but in nearly all cases they contain climbing ripple cross-lamination. This cross-lamination shows various degrees of soft sediment deformation, usually in the form of convolute bedding. Sole marks and psuedo-nodules are rare in Facies B siltstone/sandstone beds.

Facies C: Medium to thickly-bedded (25—90cm thick), massively-weathering, dark gray, siltstone to fine sandstone beds interbedded with thinly bedded (3-20cm thick) black shale. Many Facies C sandstone beds are