SPATIAL AND TEMPORAL MONITORING OF PHYTOPLANKTON IN WATERS AFFECTED BY OR WITHIN OPEN PIT MINING OPERATIONS USING PIGMENT-BASED CHEMOTAXONOMY

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INTRODUCTION

Rock Mining in Florida penetrates the surficial aquifer. This is especially so in southern Florida where newly proposed rock mining (aggregate pits) are proposed within immediate zones of influence to the Everglades Protection Area.

Very few, actually no, open pit mining operations can maintain either dry pits or pits (mines) that, after filling with water, will not communicate with the surficial aquifer and/or natural surficial water bodies.

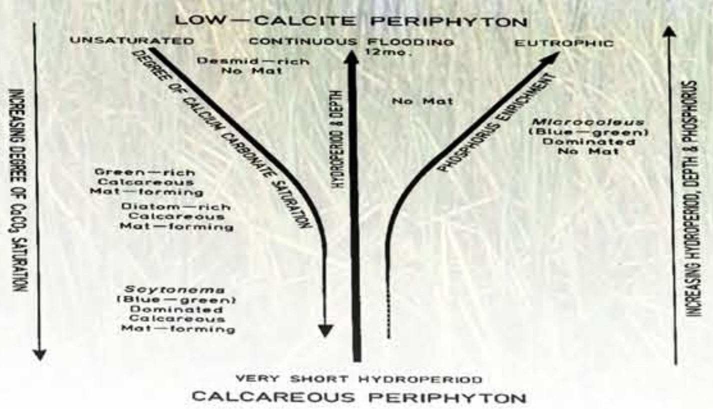
Thus, what goes on in the waters of the pit ***will*** affect all waters with which they exchange. This includes not only materials released by the mining operation but biota and their products that will grow in these new 'aquatic systems'.

PHYSICOCHEMICAL PERTUBATIONS

Regarding algal growth – the quality and quantity of inorganic nutrient, plus light and temperature, determines the resultant microalgal community structure of aquatic systems. This includes phytoplankton, microphytobenthos, periphyton, epiphytes et cetera.

In Florida waters, hardness (mainly the sum of calcium and magnesium cations) and alkalinity (mainly carbonate alkalinity) plus the major nutrients, nitrogen and phosphorous, will determine the resultant microalgal community.

The so-called Redfield–Richards model reveals that carbon-to-nitrogen-to-phosphorous atomic ratios around 106:16:1 are the average for diverse phyto-plankton populations. Diversity usually results in a healthy or desired aquatic ecosystem.



Phosphorous contamination (= pollution) will drive the N:P ratios of waters below about 20:1 and often much less and favor nitrogen-fixing cyanobacteria (= blue-green algae), many of which produce exotoxins (microcystins etc.)

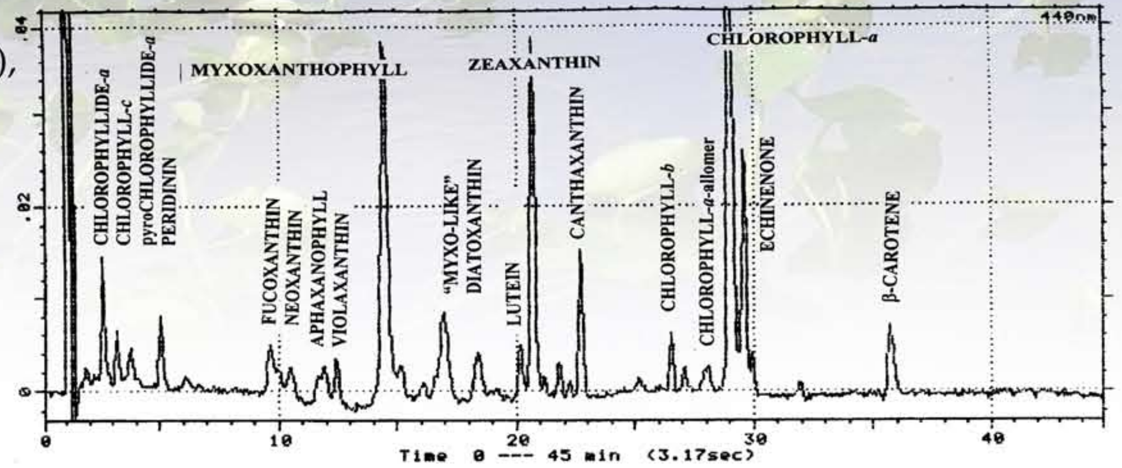
Hardness/alkalinity perturbations also will alter natural microalgal communities, such as shown here for Everglades periphyton.

Thus, mining operations in the highly porous karst or karst prone limestones of Florida cannot fail to alter the chemistry of the waters around them. In so doing, the biota of natural systems will also be impacted.

PIGMENT-BASED CHEMOTAXONOMY

<u>**Basic premise:**</u> The pigment arrays present in a natural community of microalgae can be dissected in such a way so as to allow the back calculation of individual taxon-specific CHLOROPHYLL-a as a proxy for biomass.

<u>**Examples:**</u>
<u>Cyanobacteria</u>; zeaxanthin (coccoidal), echinenone (filamentous), aphanizophyll (nitrogen-fixing), scytonemin (*Scytonema* et al.), and "UNKN VIS Sunscreen" (low hydroperiod types)
<u>Diatoms</u>; fucoxanthin
<u>Chlorophytes</u>; CHL-*b*, (lutein)
<u>Dinoflagellates</u>; peridinin
<u>Cryptophytes</u>; alloxanthin
<u>Anoxygenic phototrophs</u>:
Purple-S bacteria etc.
Bacteriochlorophylls



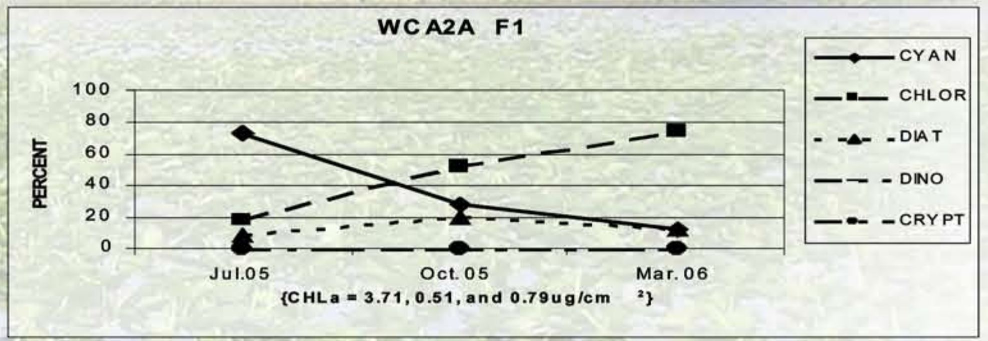
PROPOSED FUTURE STUDY

The utilization of pigment-based chemotaxonomy for the rapid spatial and temporal monitoring of the fresh, estuarine and marine waters of southern Florida is well established (Havens et al., 1996; Steinman et al., 1996;Hagerthey et al., 2006; Louda, 2003, 2008).

It is proposed that pigment-based chemotaxonomy can be utilized as a facile monitoring tool with which to assess environmental/ecological impacts of mining operations in Florida. This would apply to the pits themselves as well as waters in proximity to such operations.

An example of chemotaxonomy described microalgal community changes in response to phosphorous pollution, in this case agriculturally derived, is given below. This being WCA-2A in the Everglades Protection Area.

CHEMOTAXONOMY EXAMPLE



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