

EBA ENGINEERING CONSULTANTS LTD.

Biogeochemistry of Hydrocarbon Impacted Arctic Waters

H. Ziervogel, A. Nelson, E. Murdock,
J. Selann and B. Adeney



Acknowledgements

J.B. Services
Nunavut Power



Overview

- What are mats?
- Previous research on mats
- Mats and chemical cycles
- Arctic microbial mats and hydrocarbons
- Concluding remarks

What are Microbial Mats?

- Minimal ecosystem of cyanobacteria, bacteria, diatoms and sediments.

What are Microbial Mats?

- Responsible for stromatolites
- Formed Earth's modern atmosphere
- Dominant ecosystem on Earth in past



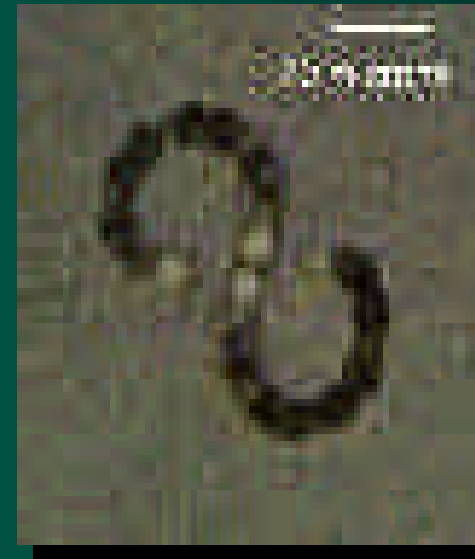
What are Microbial Mats?

Four conditions for growth of microbial mats

- Water
- Sufficient energy supply
- No significant protozoan or animal grazing
- No significant mechanical disturbance

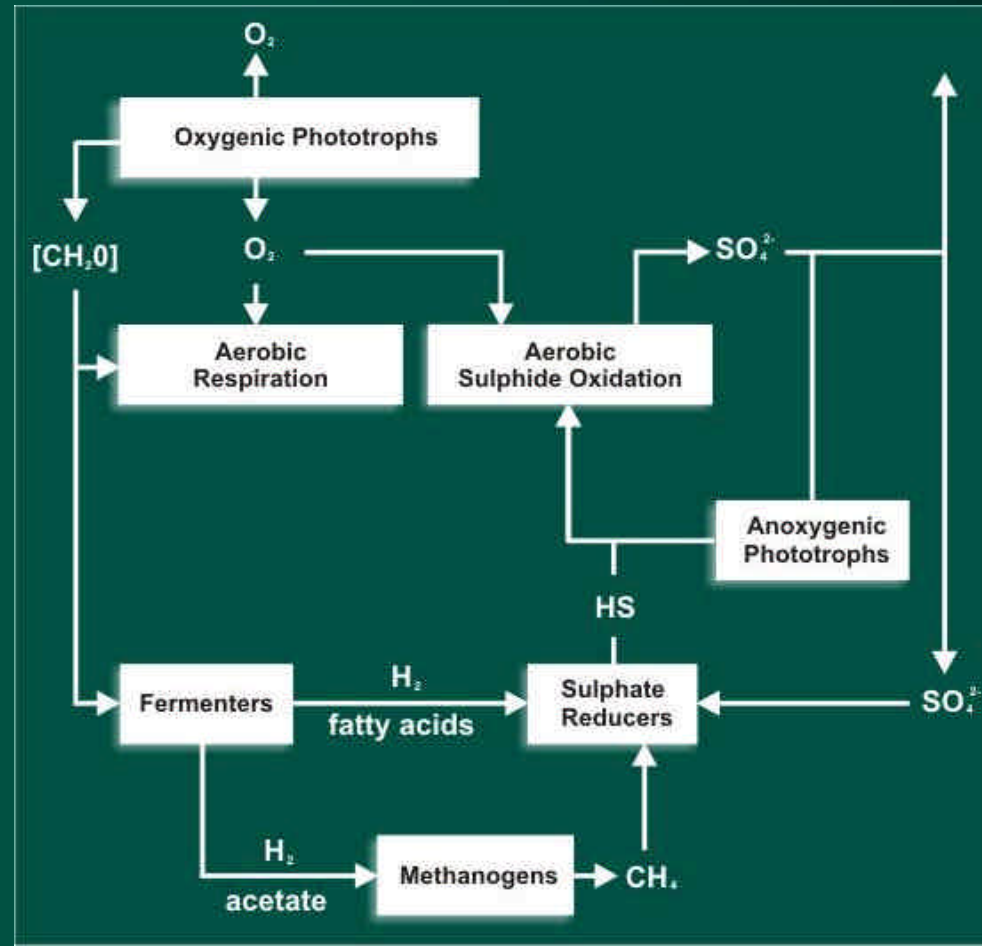
What are Microbial Mats?

- Cyanobacteria key constituent of mat communities
- Oscillitaria and Phormidium common in cold regions
- Single cell and colonial forms (filaments, sheets and hollow balls)



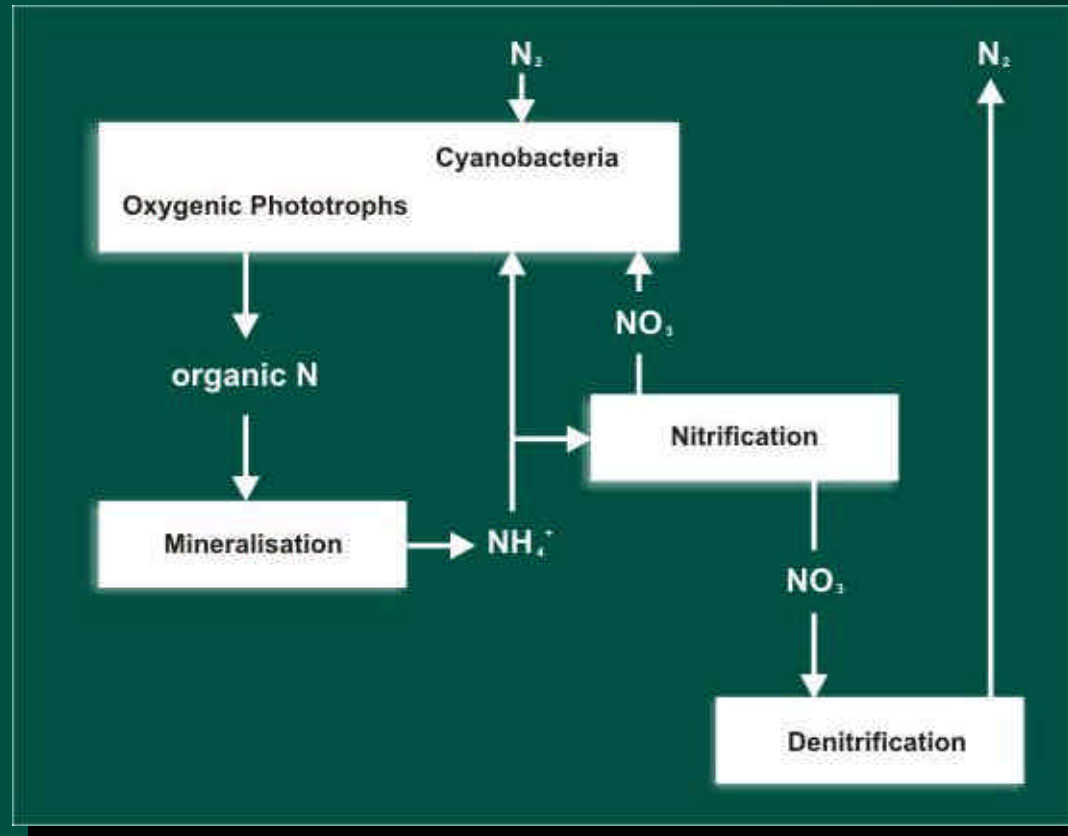
Mats and Chemical Cycles

- Carbon, Sulfur and Oxygen Cycle
- Fenchel et al (1998)



Mats and Chemical Cycles

- Nitrogen Cycle
- Fenchel et al (1998)



Mats and Hydrocarbons- Previous Studies

- Arctic: Miller et al (1978) and Atlas et al (1976) and Snow et al (1975)
- Kuwait: Al-Hasan et al (2001, 1993)
- Gaza Strip: Abed et al (2002)
- Europe: MATBIOPOL

Arctic Microbial Mats and Hydrocarbons

Repulse Bay
2001

-fresh diesel
spill in stream



Arctic Microbial Mats and Hydrocarbons

Repulse Bay



Arctic Microbial Mats and Hydrocarbons

Repulse Bay



Arctic Microbial Mats and Hydrocarbons

Repulse Bay
2002



Arctic Microbial Mats and Hydrocarbons

Repulse Bay



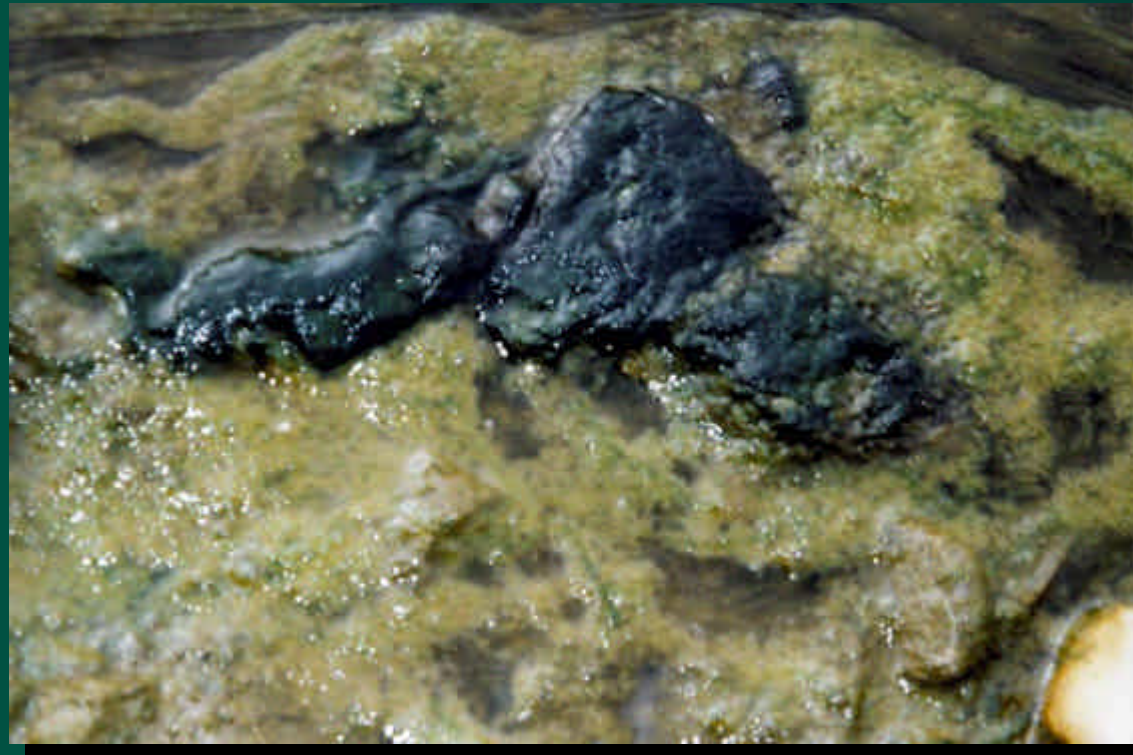
Arctic Microbial Mats and Hydrocarbons

Repulse Bay



Arctic Microbial Mats and Hydrocarbons

Repulse Bay



Arctic Microbial Mats and Hydrocarbons

Iqaluit

- sediments impacted with 30,000 ppm TPH

-spills from 1960's and 1970's



Arctic Microbial Mats and Hydrocarbons

Iqaluit



Arctic Microbial Mats and Hydrocarbons

Grise Fiord

- diesel impacted
surface and
groundwater



Arctic Microbial Mats and Hydrocarbons

Resolute Bay

- recent spill of
gasoline and
diesel



Arctic Microbial Mats and Hydrocarbons

Resolute
Bay



Arctic Microbial Mats and Hydrocarbons

Resolute Bay

-adjacent to
tank farm



Arctic Microbial Mats and Hydrocarbons

Resolute Bay
-adjacent to
tank farm



Arctic Microbial Mats and Hydrocarbons

Resolute Bay

-below old
landfill



Biogeochemistry of Hydrocarbon Impacted Arctic Waters

Concluding Remarks

