Methane Flux through Bacterial Mats at Southern Hydrate Ridge

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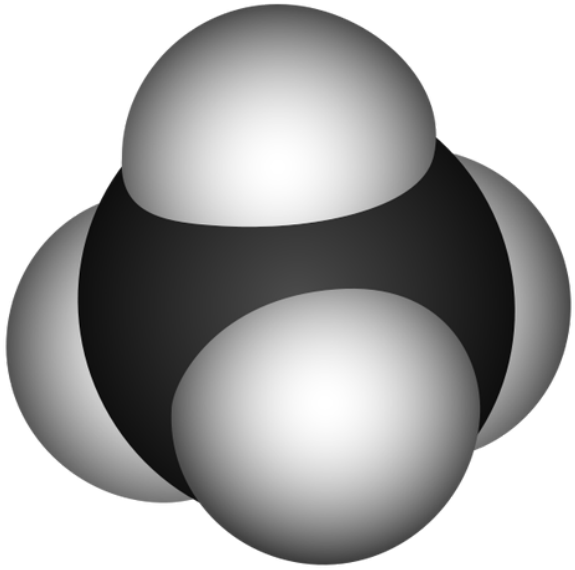
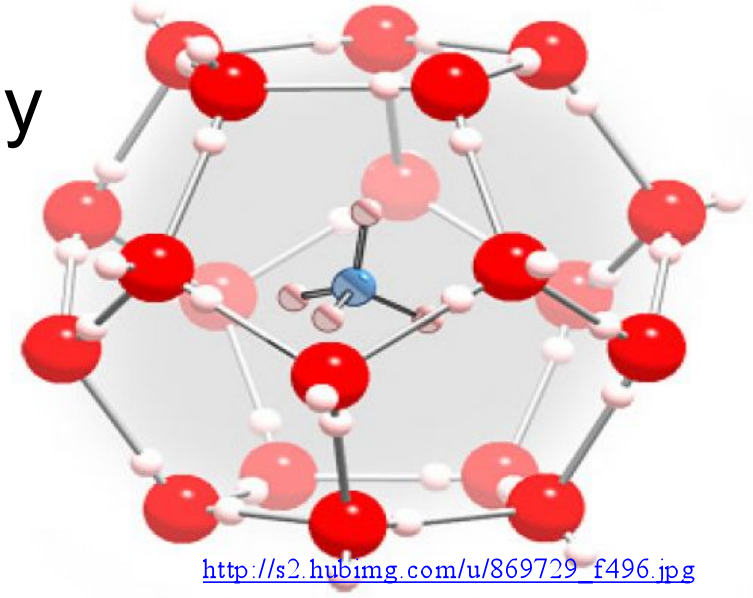


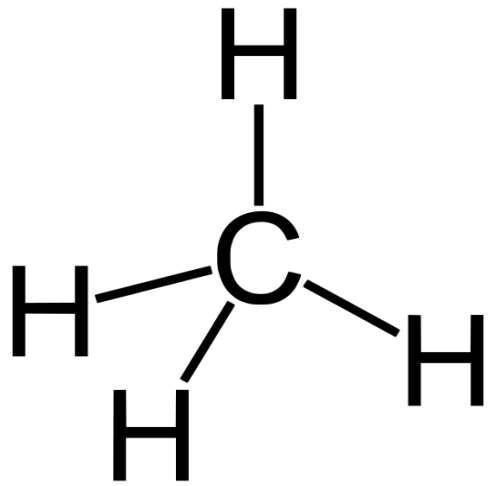
http://chemistry.about.com/od/factsstructures/ig/Chemical-Structures---M/Methane.htm



http://s2.hubimg.com/u/869729_f496.jpg

Project Question

What is the flux of methane through bacterial mat sites and how much is making it into the water column over days/ years?

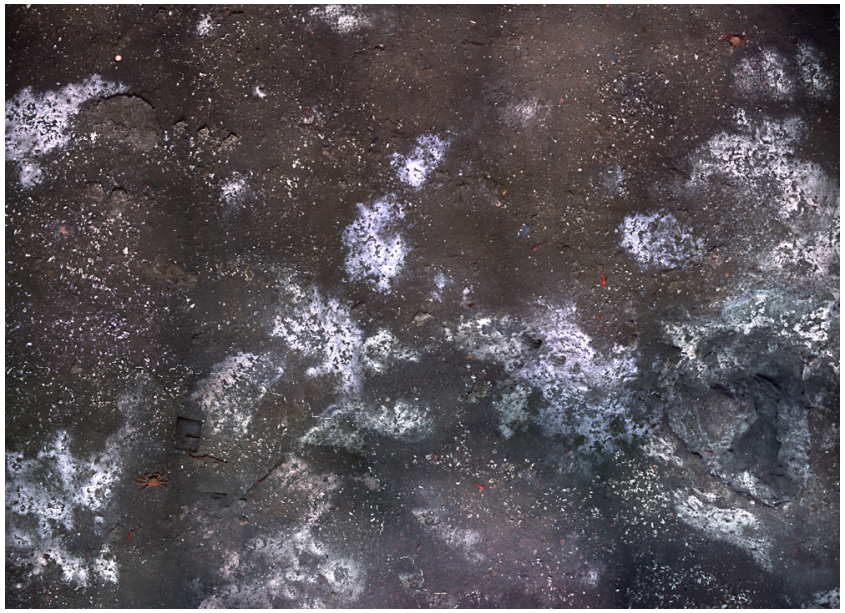


http://upload.wikimedia.org/wikipedia/commons/thumb/7/72/Methane-2D.svg/568px-Methane-2D.svg.png

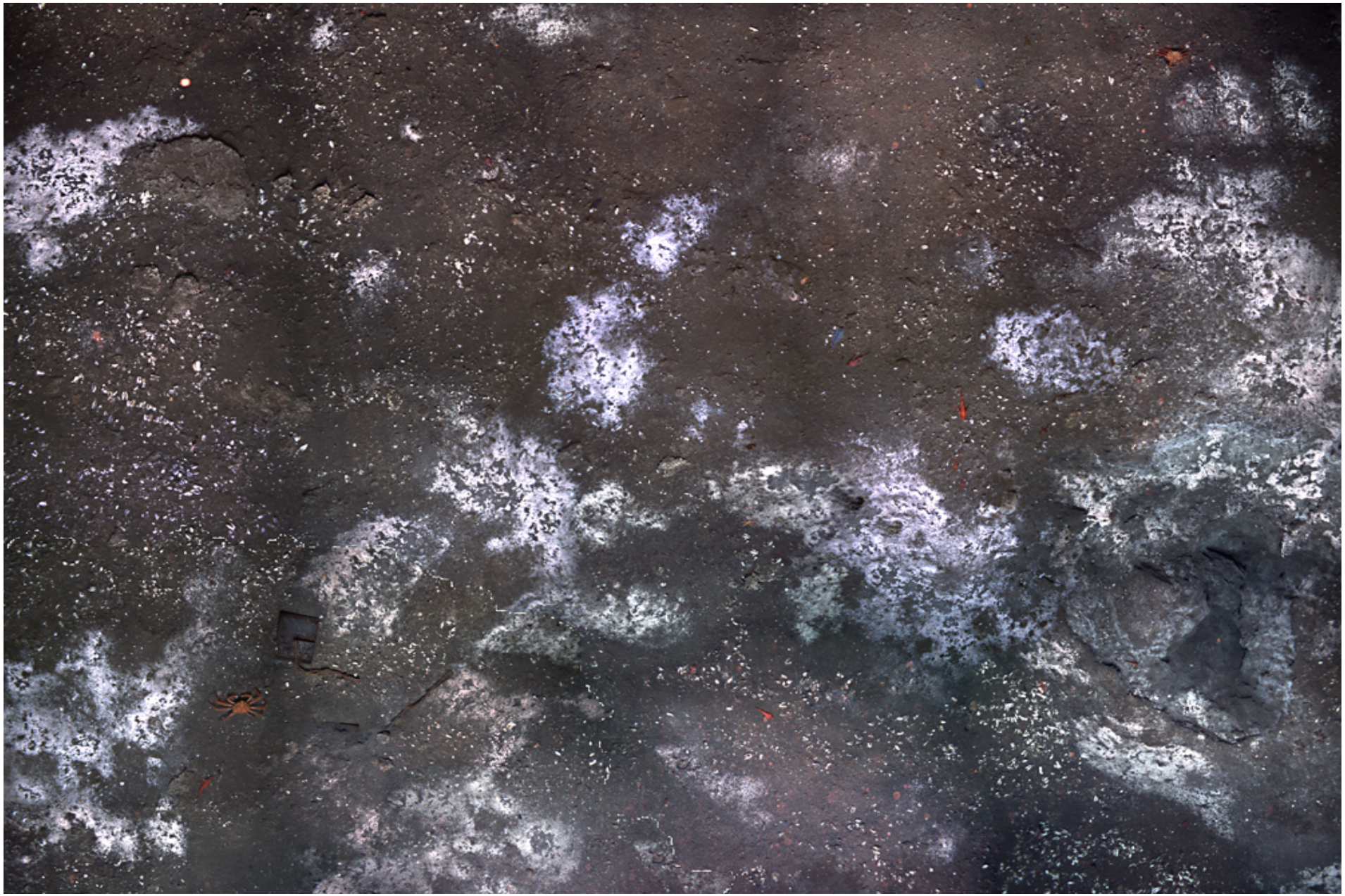
Assumptions

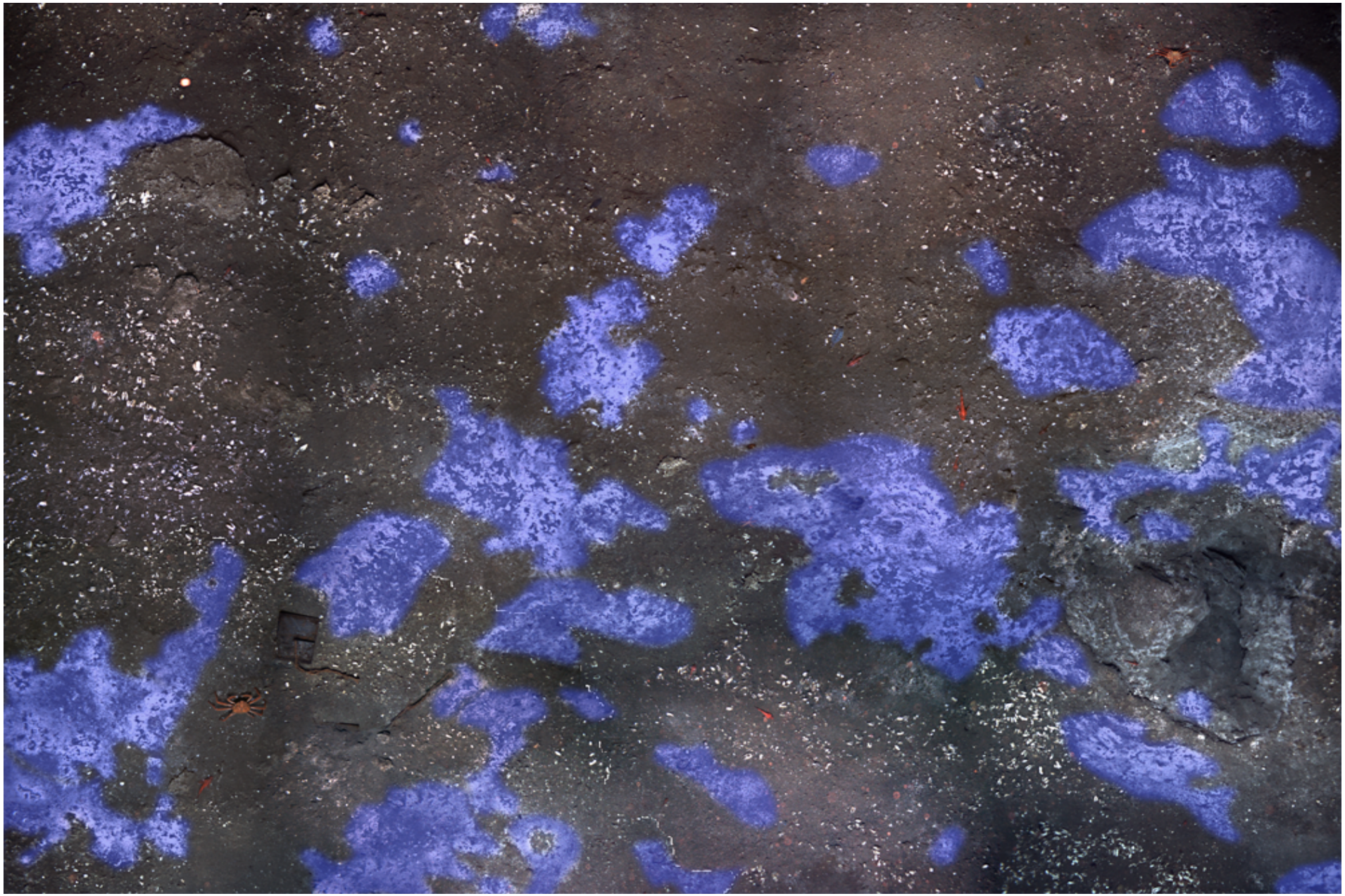
1) The fluid flow rate is unchanging.
2) Bacterial mats are the identical .
3) Methane is at it's saturation point with respect to gas Hydrate.

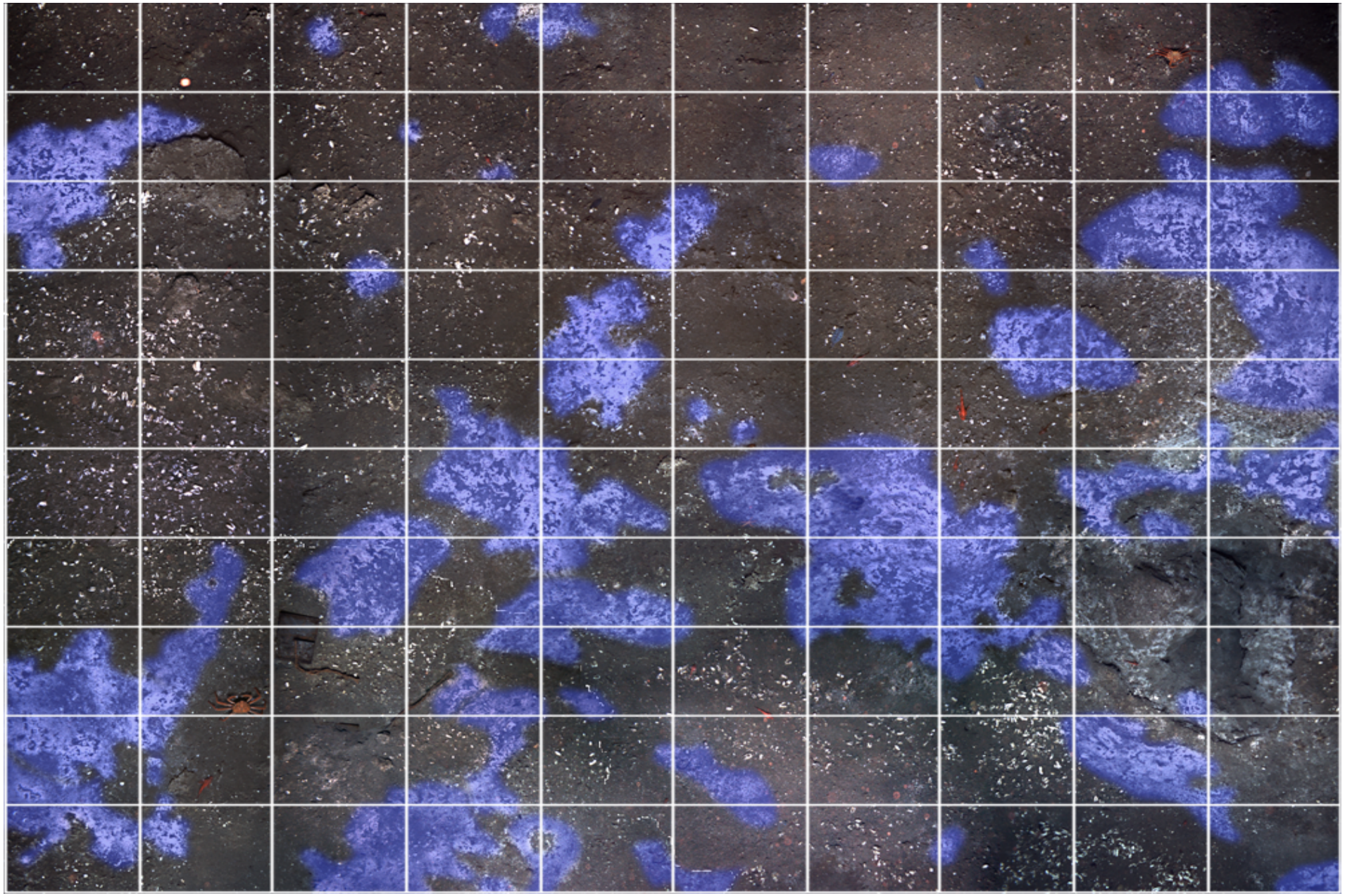
Site of Mosaic

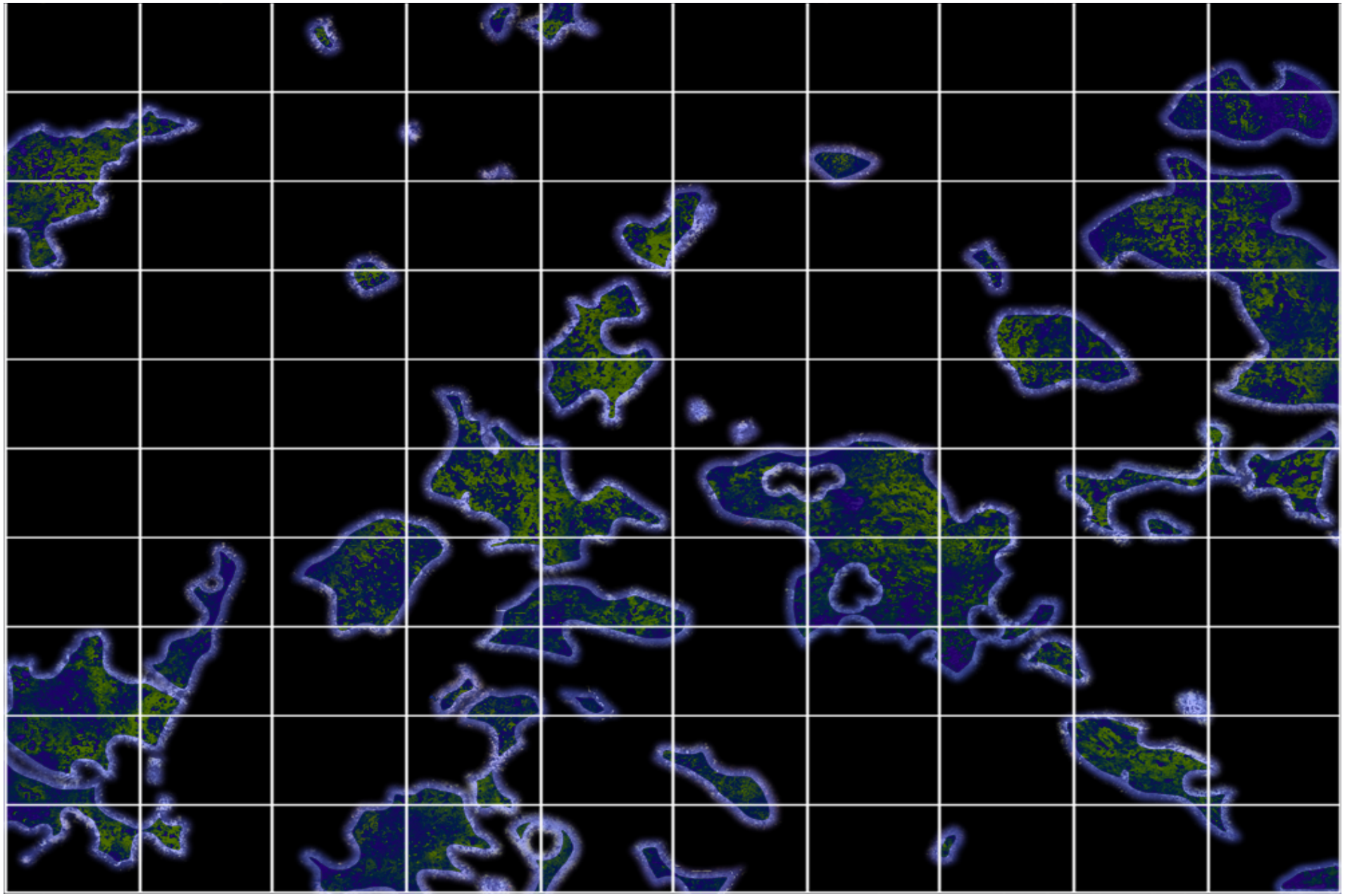


- 2010 August 01
- Southern Hydrate Ridge
- Dive J2-508
- Approximate size 9x6.5m
- Total Area 58.5m²
- Lat 44.6 N Long 125.2 W
- Altitude 4.35m









Calculations

Total Area of Site - 9.0m x 6.5m (58.5 m²)

Total Percent Abundance of Bacterial Mats - ~25%

25% of total area = 14.625m²

Methane (CH_4) flux through bacterial mat sites is estimated to be between (30 – 100) mmol/m² day.

Convert to grams/m² day = (.4815 – 1.605) grams/m² day (CH_4)

Calculations

Finding the estimated total methane flux for this site

CH_4 conc. 50mmol/L → 50mmol/m^3

50mmol/m^3 x .2m/yr = 10000mmol/m^2yr x 1000mol/mmol = 10mol/m^2yr

10mol/m^2yr x 14.625m^2 = 146.25mol/yr x 16.05g^{CH4}/mol = 2347.31g/yr

Repeat with upper flux range of 100cm/yr

Low estimated value: 2347.31g/yr or 6.43g/day

High estimated value: 11736.56g/yr or 32.15g/day

What could this mean for the future?

Within 1 year – (2.3 - 11.7) Kg/year (CH_4)

5 years – (11.7 - 58.7) Kg

10 years – (23.5 - 117.4) Kg

50 years – (117.4 - 586.8) Kg

100 years – (234.7 - 1173.7) Kg

These estimates may look small but remember this is over an area of 58.5 meters.

It is very possible that we are underestimating the amount of methane that is escaping into the water column and then into our atmosphere from hydrate seeps.

Oxidation

Archaea within the sea floor sediment use methane oxidation for energy producing sulfides which are oxidized by organisms such as *Beggiatoa* and clams *Calyptogena* and *Acharax*.

Assuming that ~70% of all escaping methane is oxidized by organisms or other processes before it can escape into the water column.

A flux range of -
1 year (0.69 - 3.51) Kg

5 year (3.51 - 17.61) Kg

100 year (70.41 - 352.11) Kg

A hundred years on the geologic time scale is minute and over a much broader area the amount of methane released into the water column would be astounding.

Why is this Important?

http://www.bing.com/images/search/ch4_methane_global-warming.jpg

1. Can be used to approximate the CH4 being released into the water column through bacterial mat sites.

2. Methane is a green house gas and it contributes to the overall abundance in addition to other gases such as CO2.

3. Methane in water produces a product of CO2

4. Further research could give insight to the total amount of Methane being released into the oceans on a global scale.

5. The potential for the oceans to become carbon sources instead of sinks.

END.