UNIVERSITY OF MÁLAGA
Faculty of Sciences
Departament of Ecology an Geology
Spain

Temperature Methanogenesis Regulation in Shallow Temperate Estuaries

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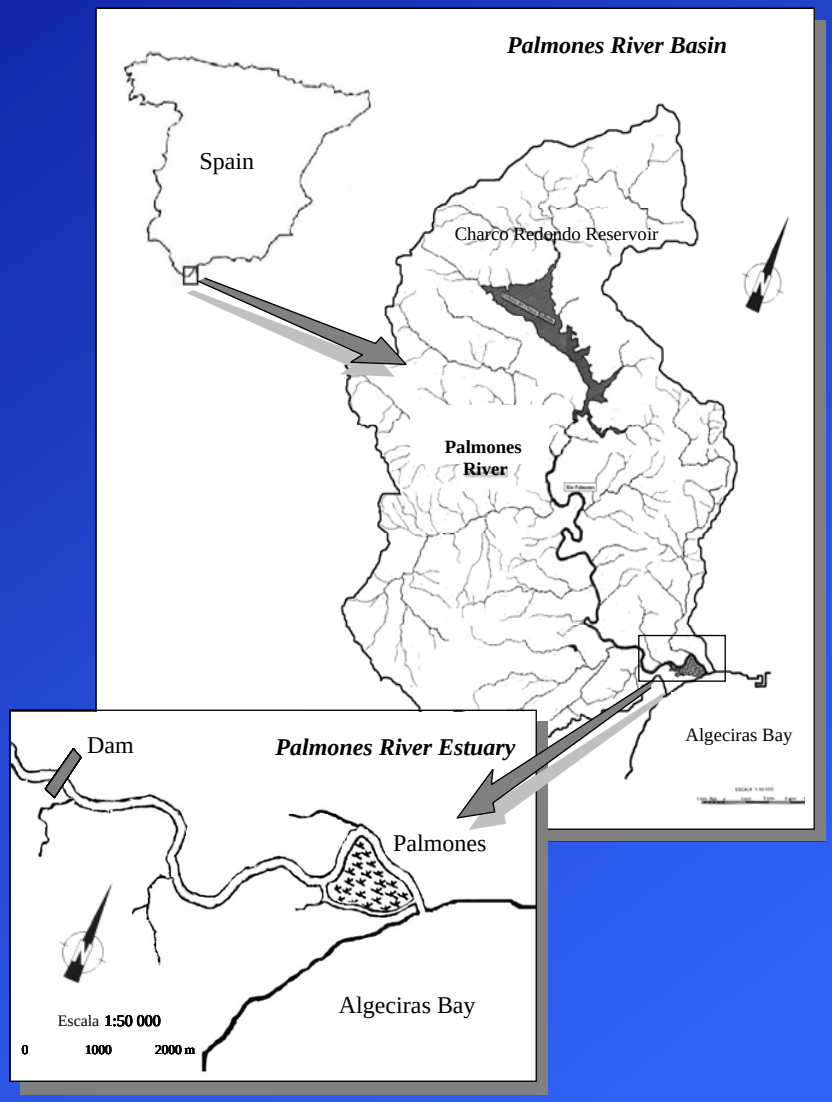

Palmones River Basin
Spain
Charco Redondo Reservoir
Palmones
River
Algeciras Bay
Dam
Palmones River Estuary
Palmones
Algeciras Bay
Escala 1:50 000
0
1000
2000 m

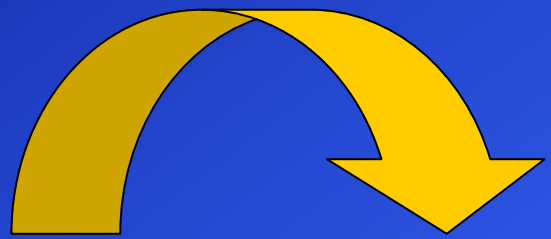
Palmones River Estuary (Spain)

Palmones River Estuary (Spain)

Methanogens (*Archaea*)

Organic matter mineralization

ΔG^o = - 31 KJ



Organic C → Inorganic C + **CH_4**

(acetate, methanol, ethanol...)

Anaerobic environment

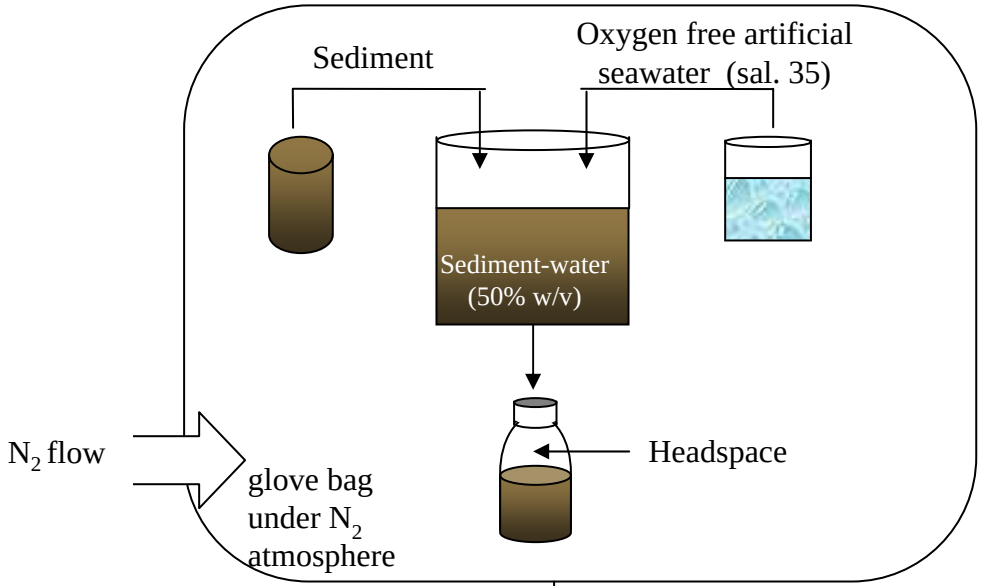
Methane was measured into the sediment and onto it

- PRODUCTION is the diference between the methane concentration measured between two times.Slurry

- EMISION is the amount of methane degaged from sediment during a period of time.Core

- **Methane production rate** was determined using the **slurry technique** described by Smith et al (1978).

Slurry technique described by Smith et al (1978)

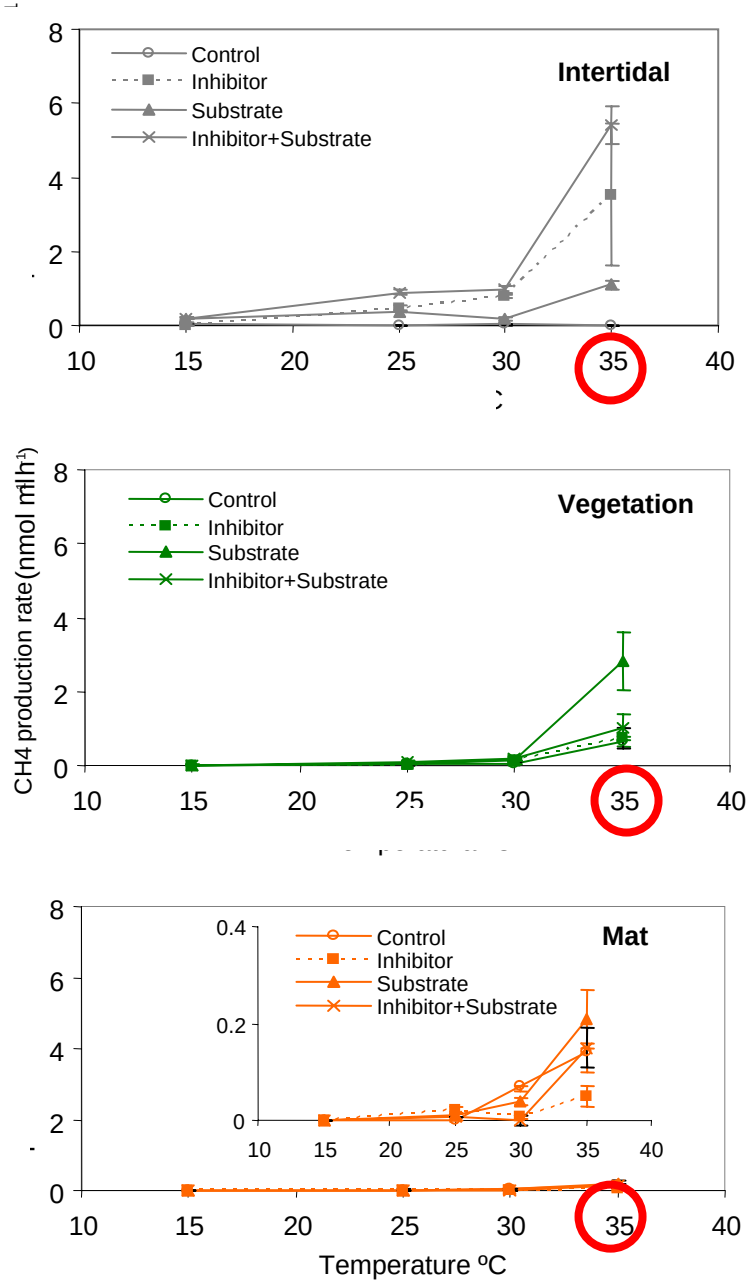


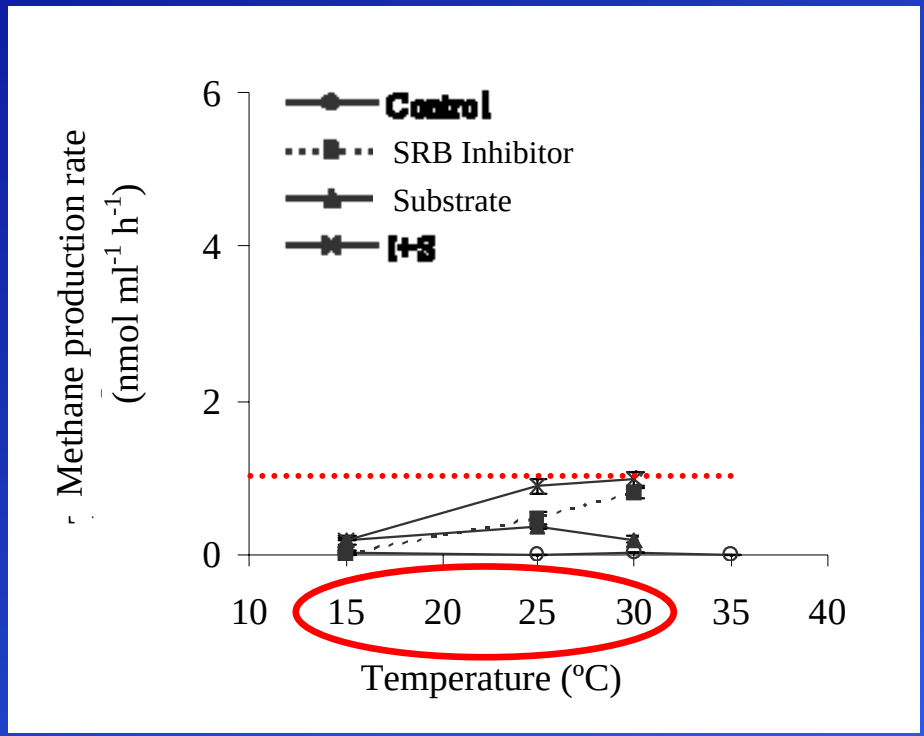
Incubation: 72 h, shake and darkness

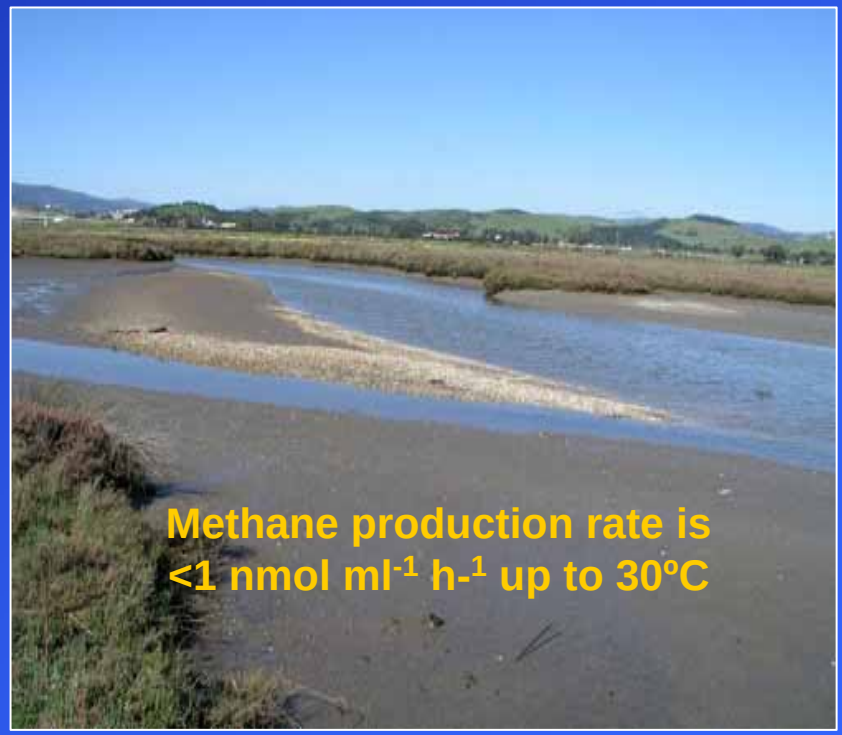
Temperature	**Substrate**	**Competition with SRB**	**Sulpahte inhibition**	**Salinity inhibition**
15, 25, 30 y 35º C Treatments: •Control •Substrate: acetate •Inhibitor: molybdate •Substrate+Inhibitor Sediment: •Intertidal •Vegetation •Mat	35º C Treatments: •Control •Substrate 1: acetate •Substrate 2: methanol Sediment: •River •Intertidal •Vegetation •Mat	35º C Treatments: •Control •Substrate 1: acetate •Substrate 2: methanol •Inhibitor: molybdate •Substrate 1+Inhibitor •Substrate 2+Inhibitor Sediment: River, Intertidal, Vegetation, Mat	35º C Treatments: •Control •SO_4Na_2 (0.1, 1, 5, 25, 50 y 100 mM) Sediment: •River	35º C Treatments: •Control •Gradient of salinity (0, 10, 20, 25, 30 y 35) Sediment: •Palmones River Estuary (Spain) •Tagus River Estuary (Portugal)

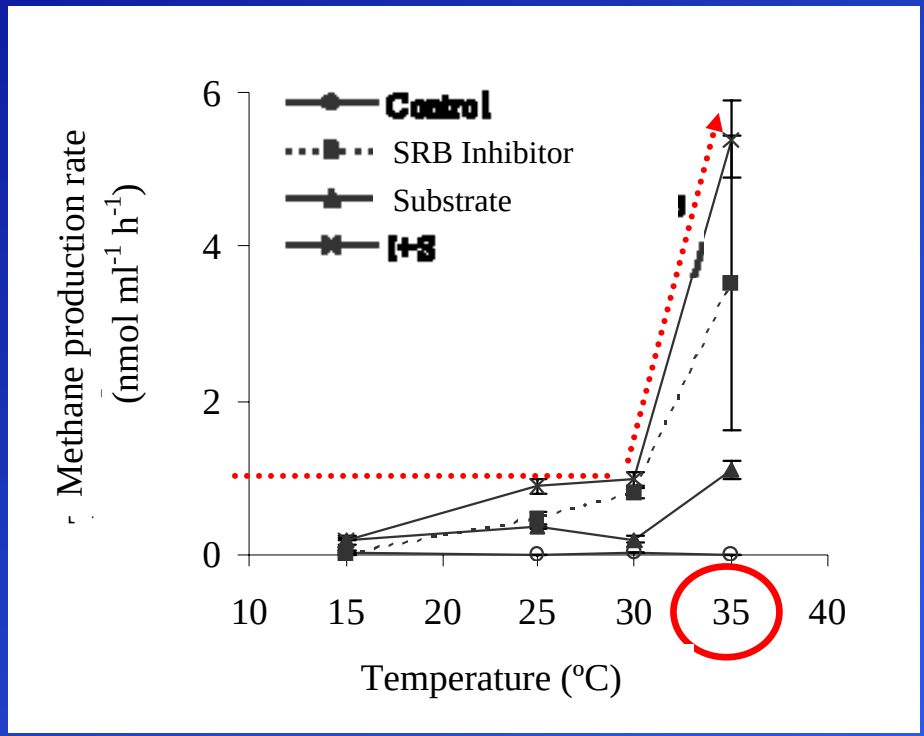
- **Methane production rate** was determined using the **slurry technique** described by Smith et al (1978).

- **Methane concentration** was determined by **gas chromatography**.

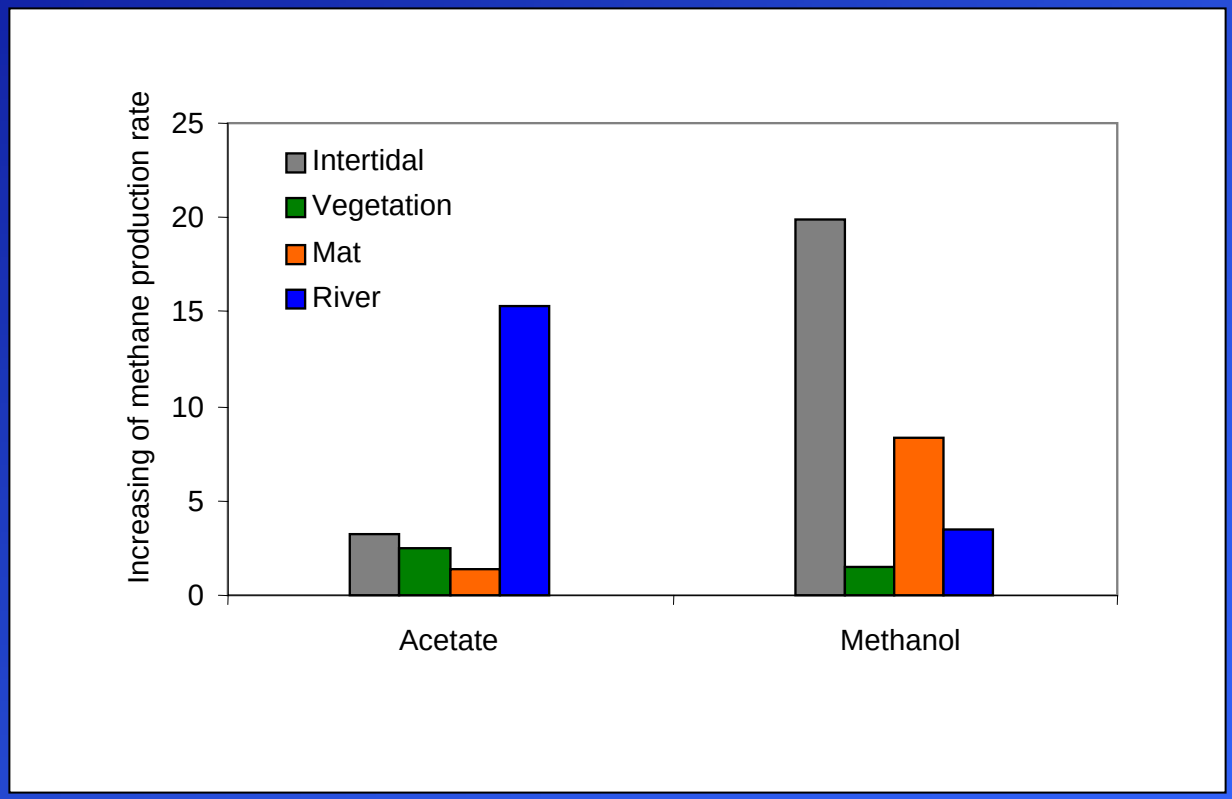

Intertidal
Control
Inhibitor
Substrate
Inhibitor+Substrate
Vegetation
Mat
CH4 production rate(nmol ml-1h-1)
Temperature ºC


Methane production rate
(nmol ml-1 h-1)
6
4
2
0
Control
SRB Inhibitor
Substrate
I+S
10
15
20
25
30
35
40
Temperature (ºC)

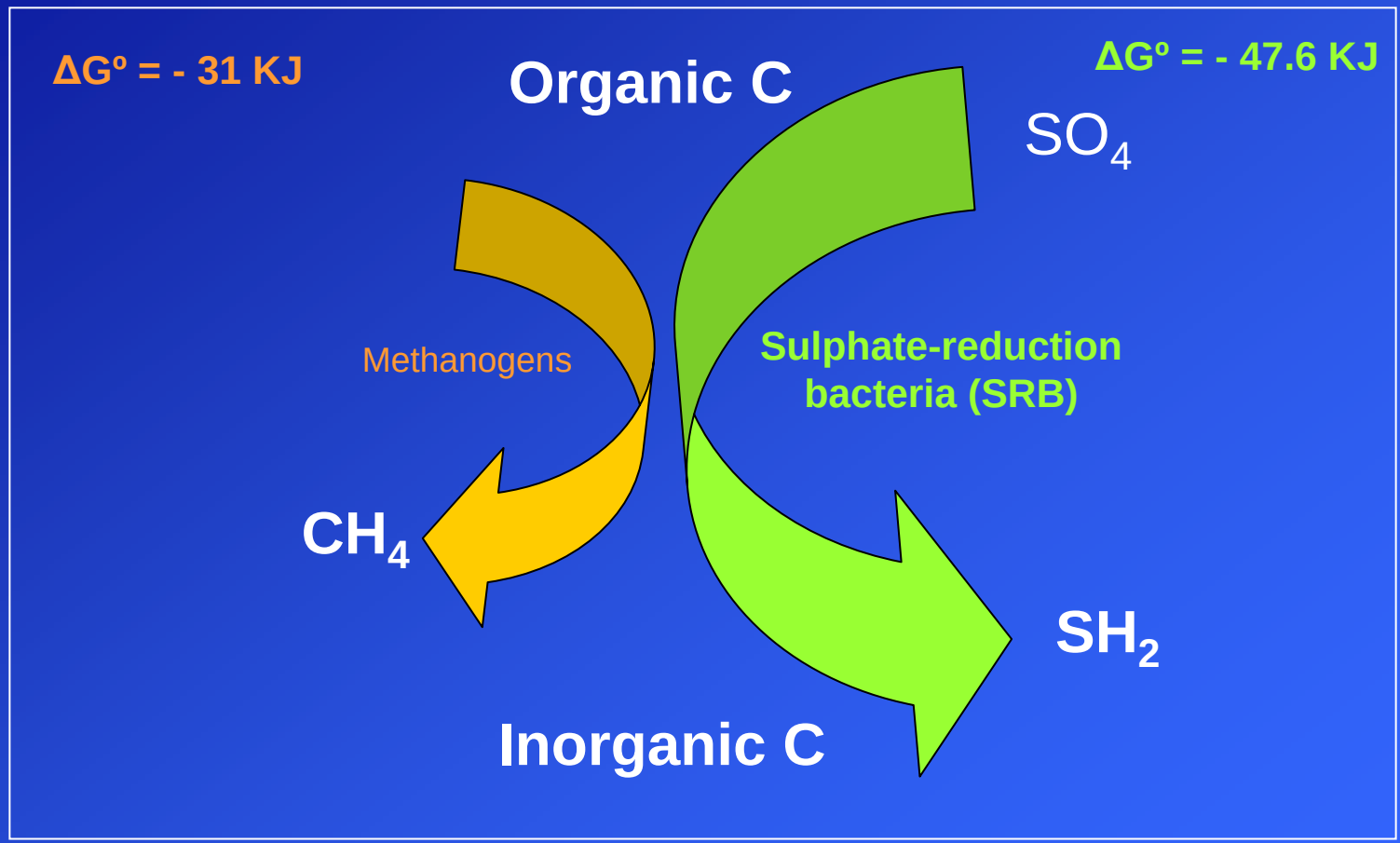

Methane production rate is
<1 nmol ml-1 h-1 up to 30ºC


Methane production rate
(nmol ml-1 h-1)
6
4
2
0
Control
SRB Inhibitor
Substrate
I+S
10
15
20
25
30
35
40
Temperature (ºC)


Methane production rate increases
6 times to 35º C

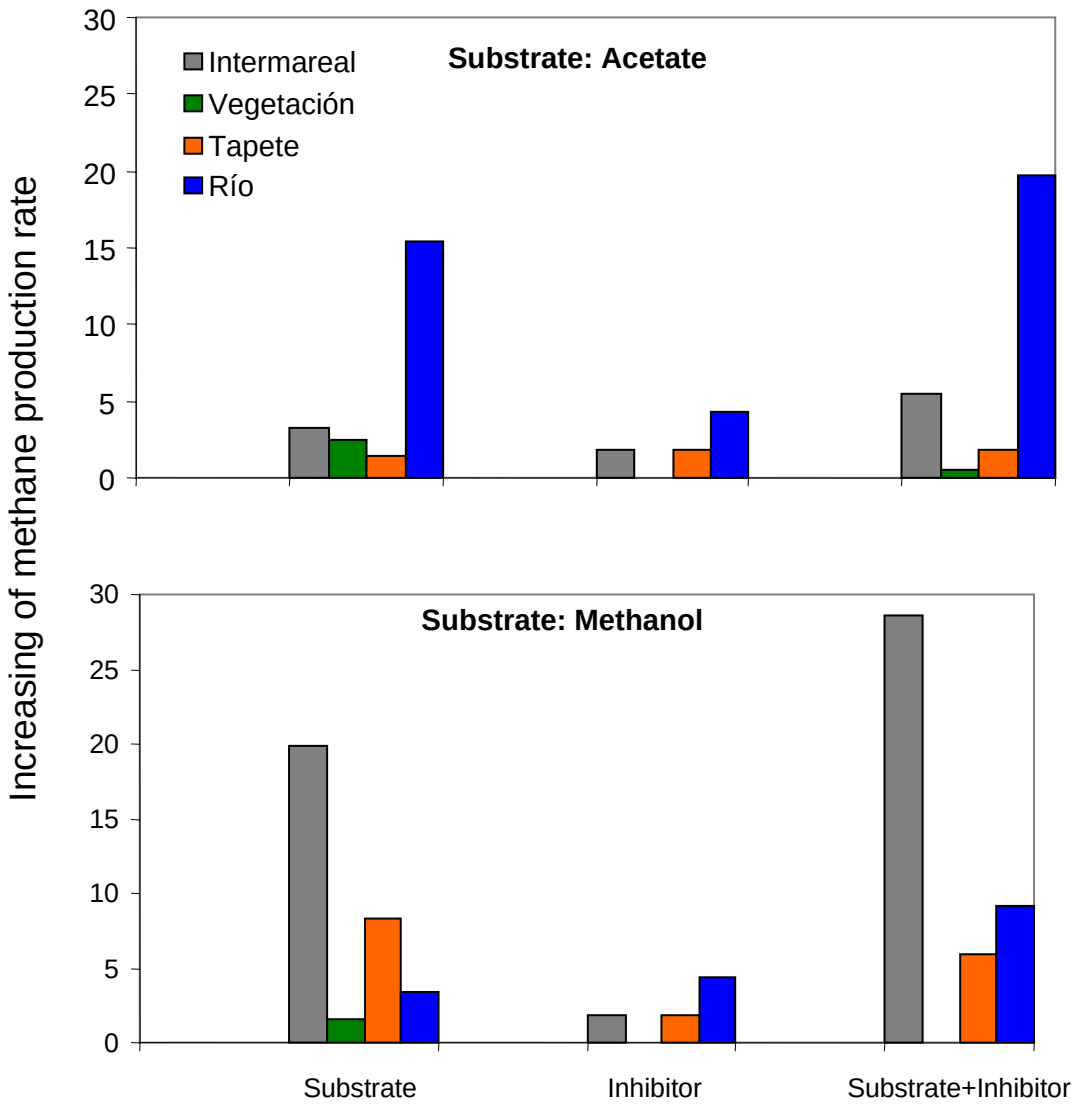

Increasing of methane production rate
25
20
15
10
5
0
Intertidal
Vegetation
Mat
River
Acetate
Methanol

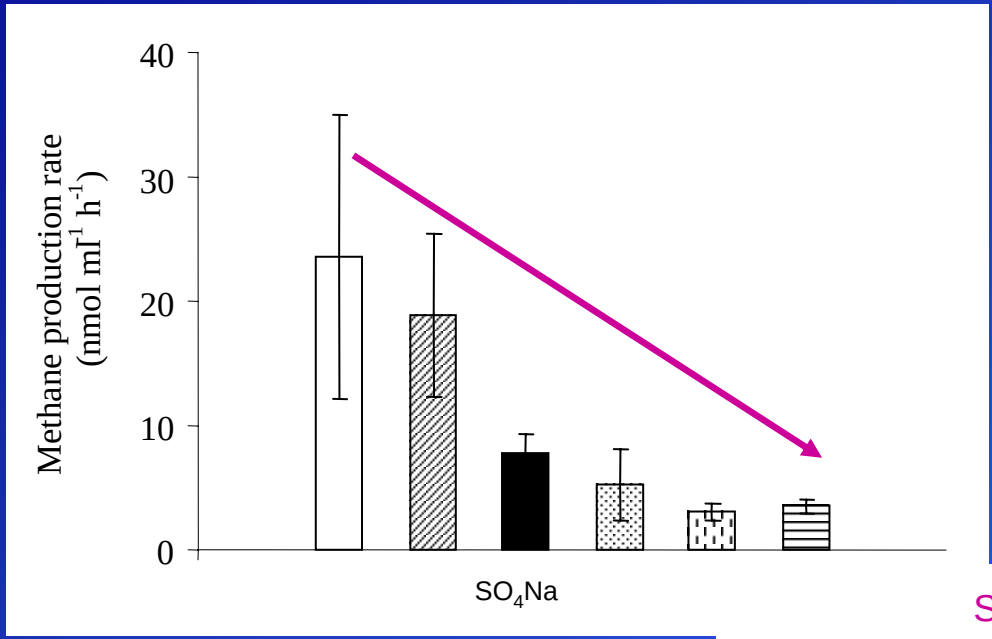
ORGANIC MATTER MINERALIZATION



Rich-sulphate environment

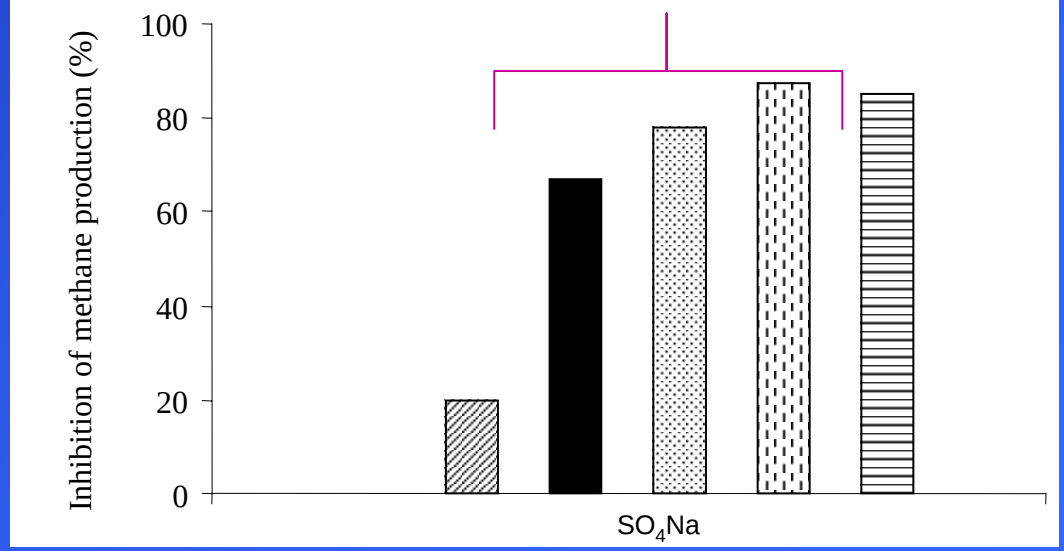
Anaerobic environment


Increasing of methane production rate
Substrate: Acetate
Intermareal
Vegetación
Tapete
Río
30
25
20
15
10
5
0
Substrate: Methanol
30
25
20
15
10
5
0
Substrate
Inhibitor
Substrate+Inhibitor



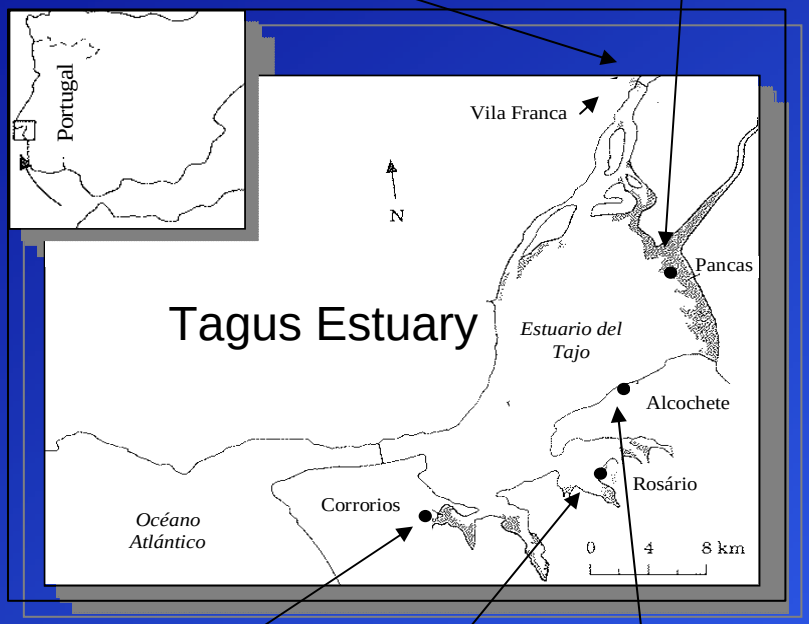
Inhibition of methane production 50 - 90%

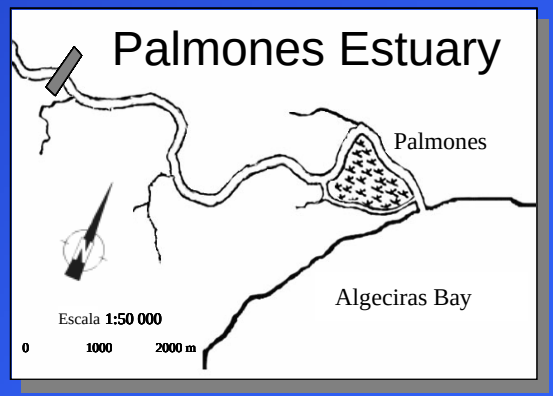
SO_4Na concentration in Palmones (5-50 mM)



Sal. 0

Sal. 25

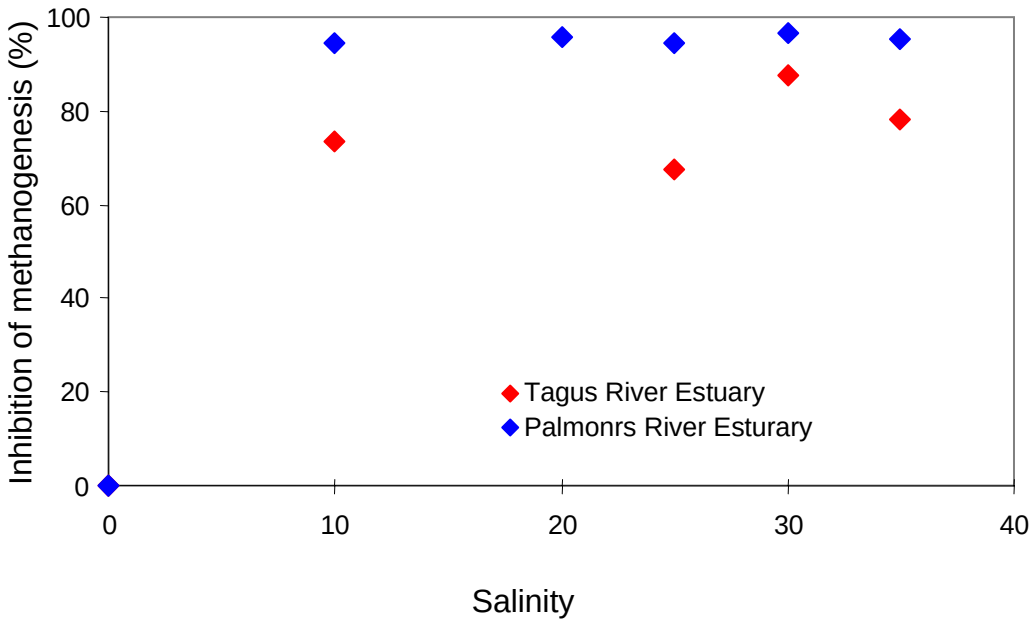


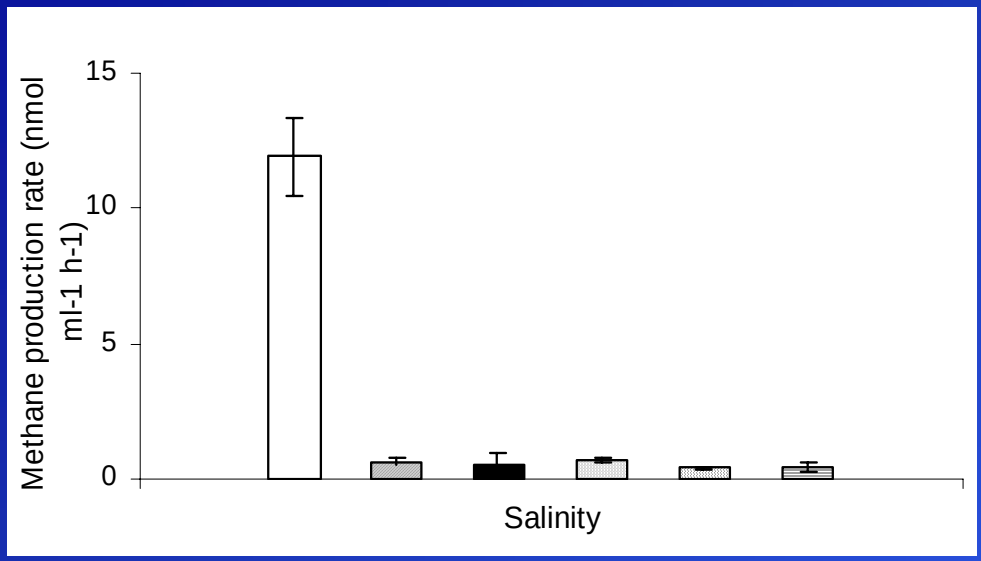


Sal. 35 Sal. 30 Sal. 10

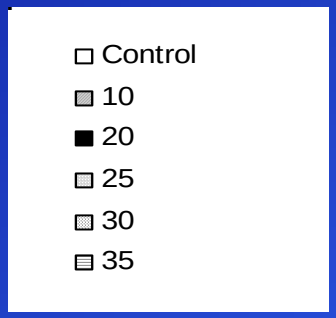
Sal. 35

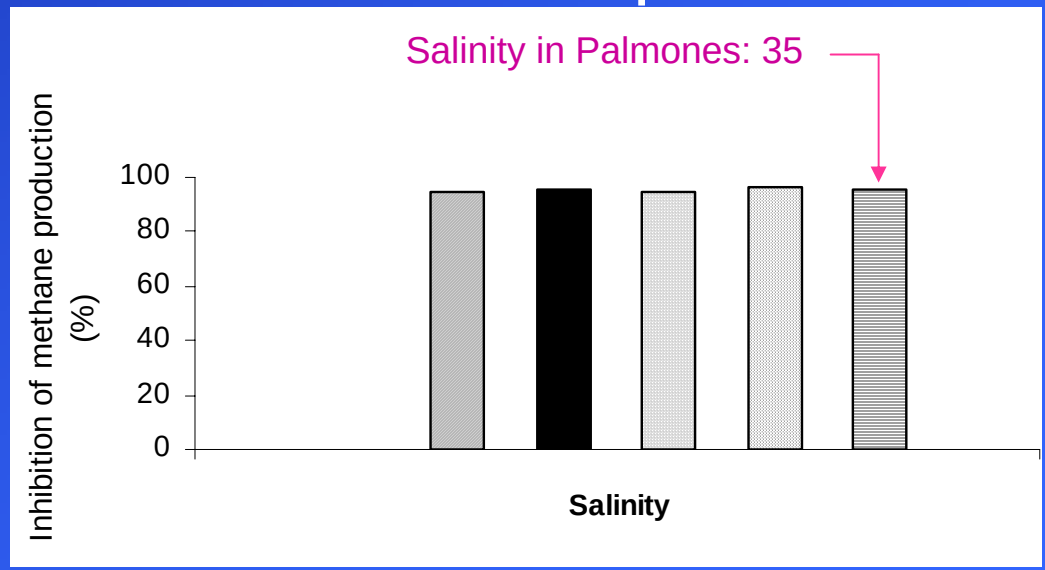
Methane Production vs Salinity



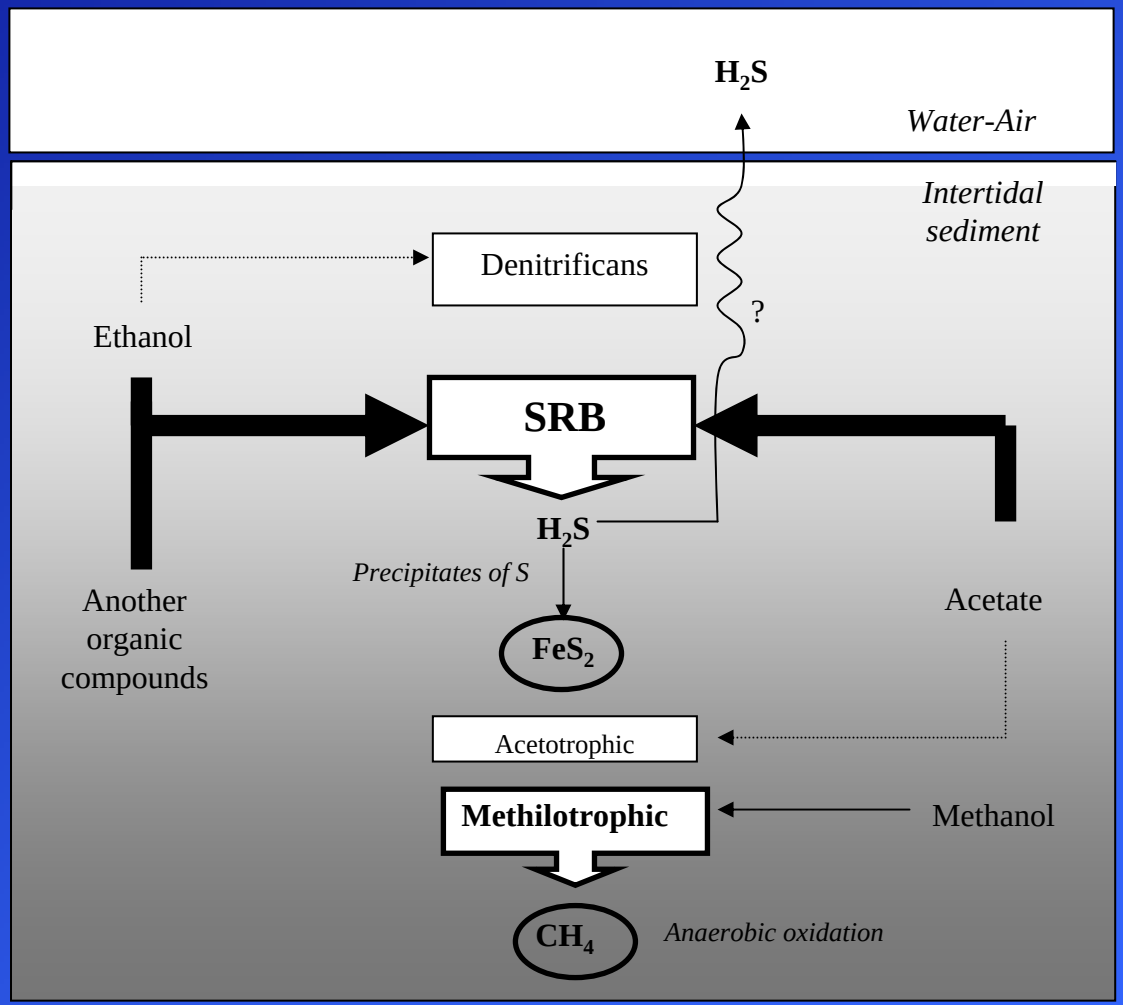


Inhibition of methane production 95%

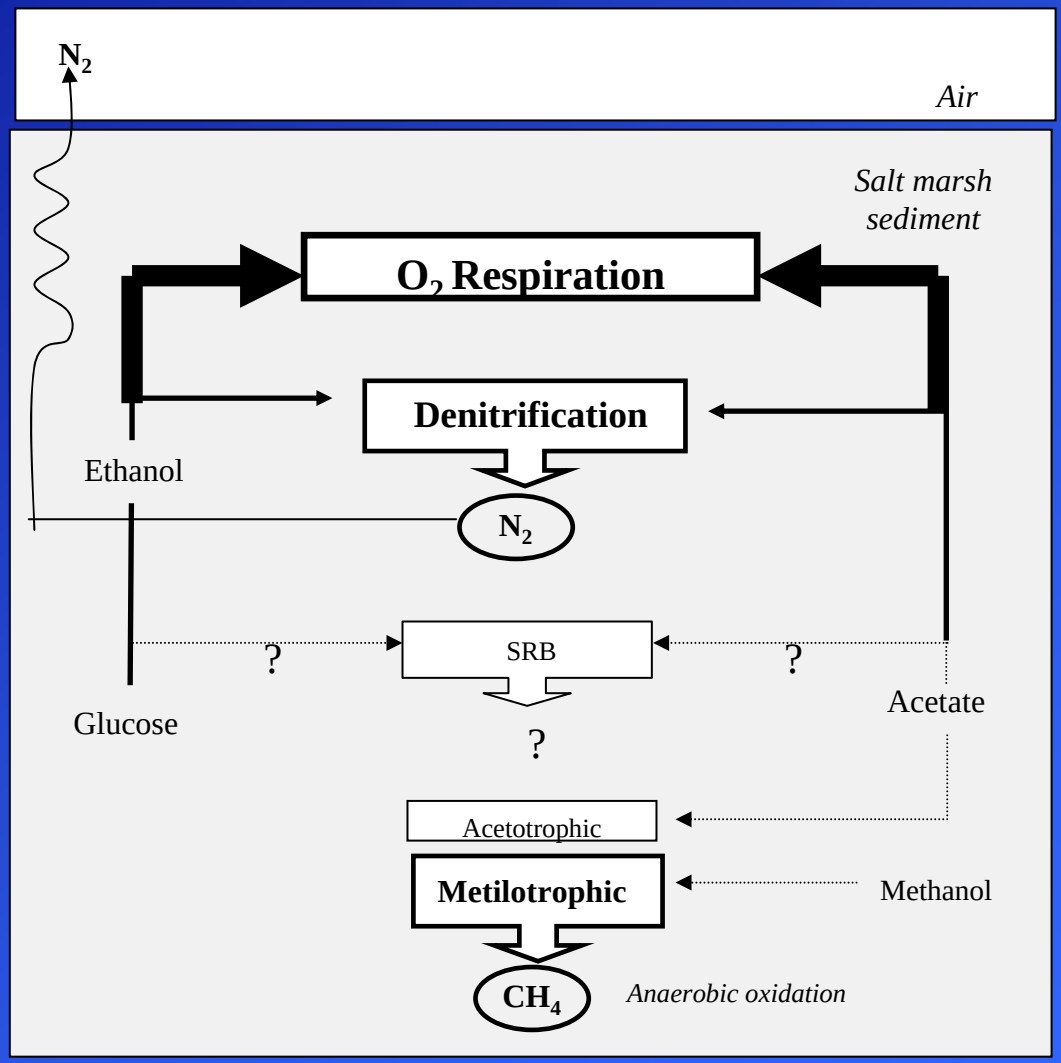




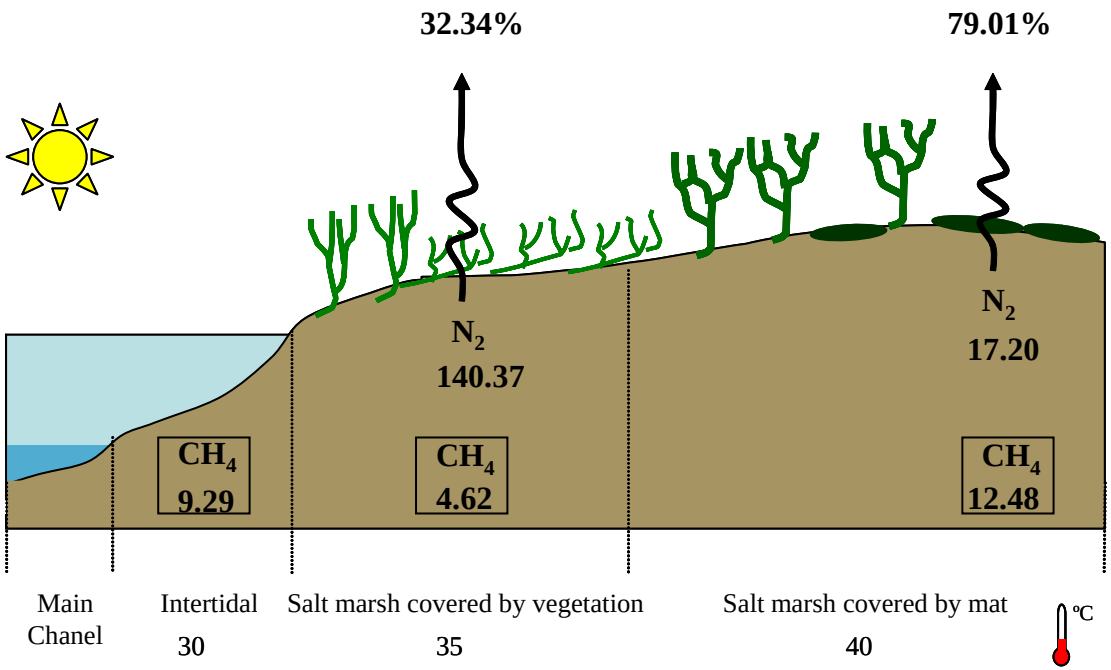
The Mineralization Processes Implicated in Gas Dynamics in the Intertidal Sediment



The Mineralization Processes Implicated in Gas Dynamics in the Salt Marsh Sediment



Gas Production and Emission *in situ* (Summer)



CH_4 in Palmones River Estuary and another ecosystems

Site	Ecosystem	Observation	Production (nmol ml^{-1} h^{-1})
Watson and Nedwell (1998) Ellergrower Moss (New Galloway, Escocia)	Peat	"hollow" peat *In situ* temperature :14.9º C	1-6.8
Great Dun Fell (Cumbria, England)		"wet" peat	0.25-0.43
Furtado and Casper (2000) Dagow lake (Brandenburg, Germany)	Eutrophic lake	*In situ* temperature: 12º C	1.25
		Temperature: 22º C	6
Present study (2008) Palmones River Estuary (Algeciras Bay, Spain)	Intertidal	*In situ* temperature: 30º C	0.58
	Salt marsh (vegetation)	*In situ* temperature: 35º C	0.29
	Salt marsh (mat)	*In situ* temperature: 40º C	0.79

1. Estuarine sediments in temperate areas (Mediterranean and South European Atlantic) are not a source of methane emission

2. Methane production into the sediment is limited by:

   Temperature below 30º C

   Salinity at regular concentrations

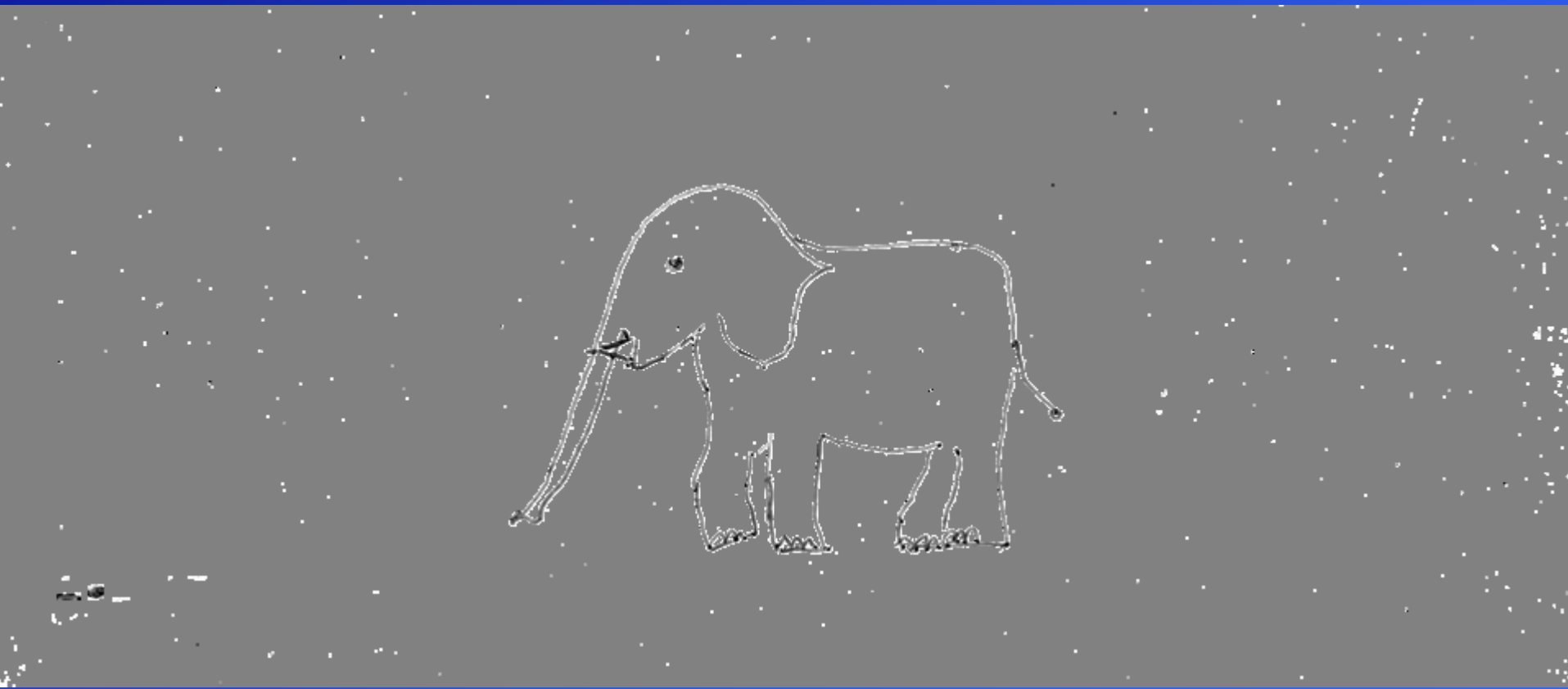
   Organic substrate concentrations

   Competition with sulphate reduction bacteria

3. Emission has NEVER been detected

There are some differencen between text-book explanations and true behaviour of the systems

IS THIS a HAT?



It isn't