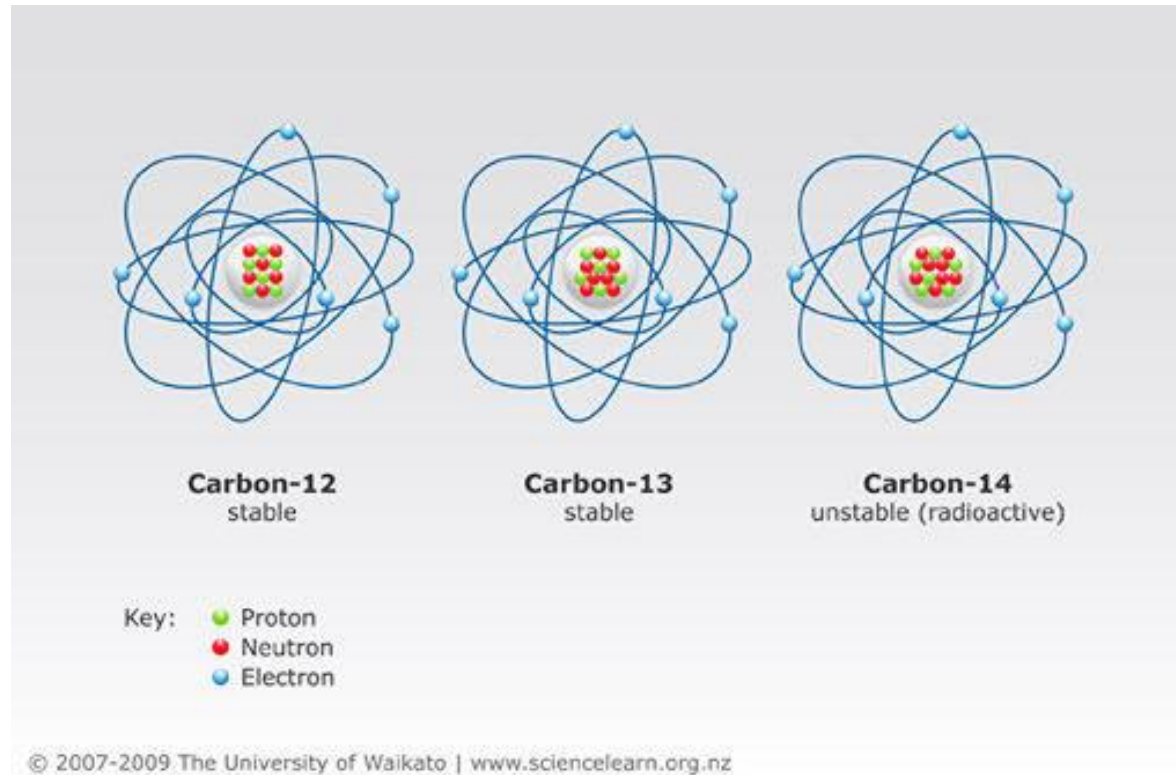
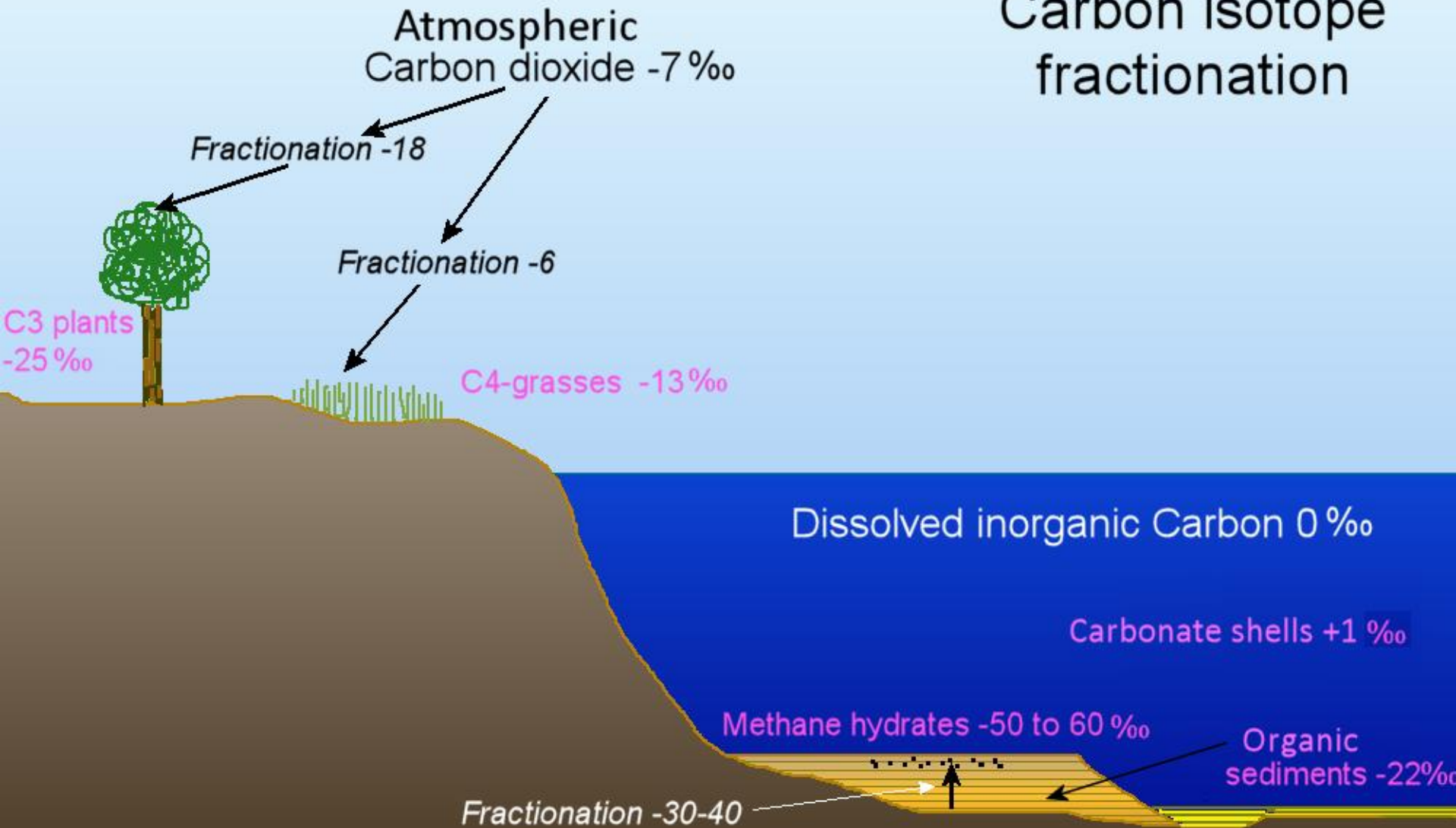


There are three main isotopes of Carbon:  
12 (99%), 13 (1%) and 14 (very small)



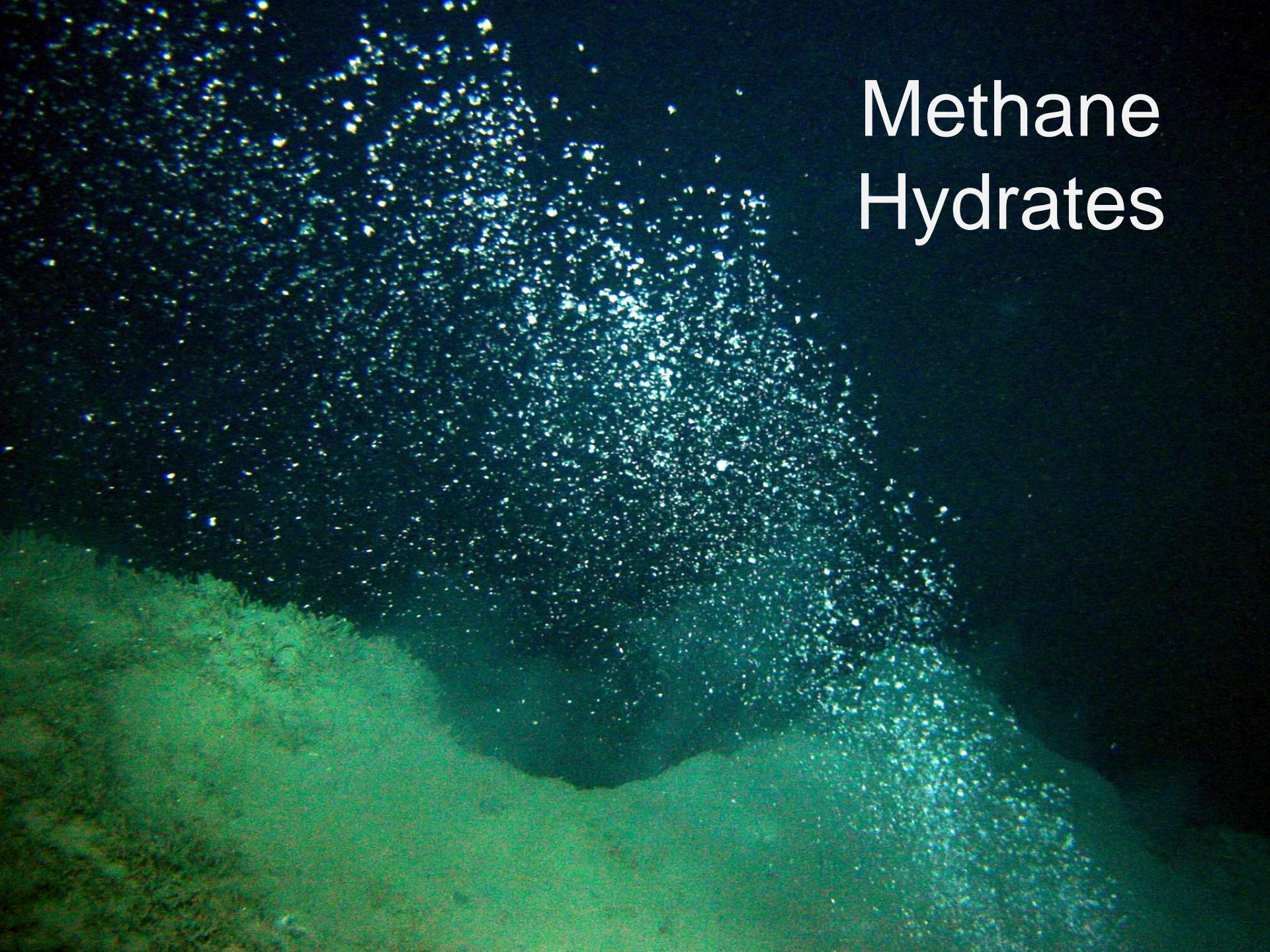
Carbon isotopes are fractionated during  
biological processes.

# Carbon isotope fractionation



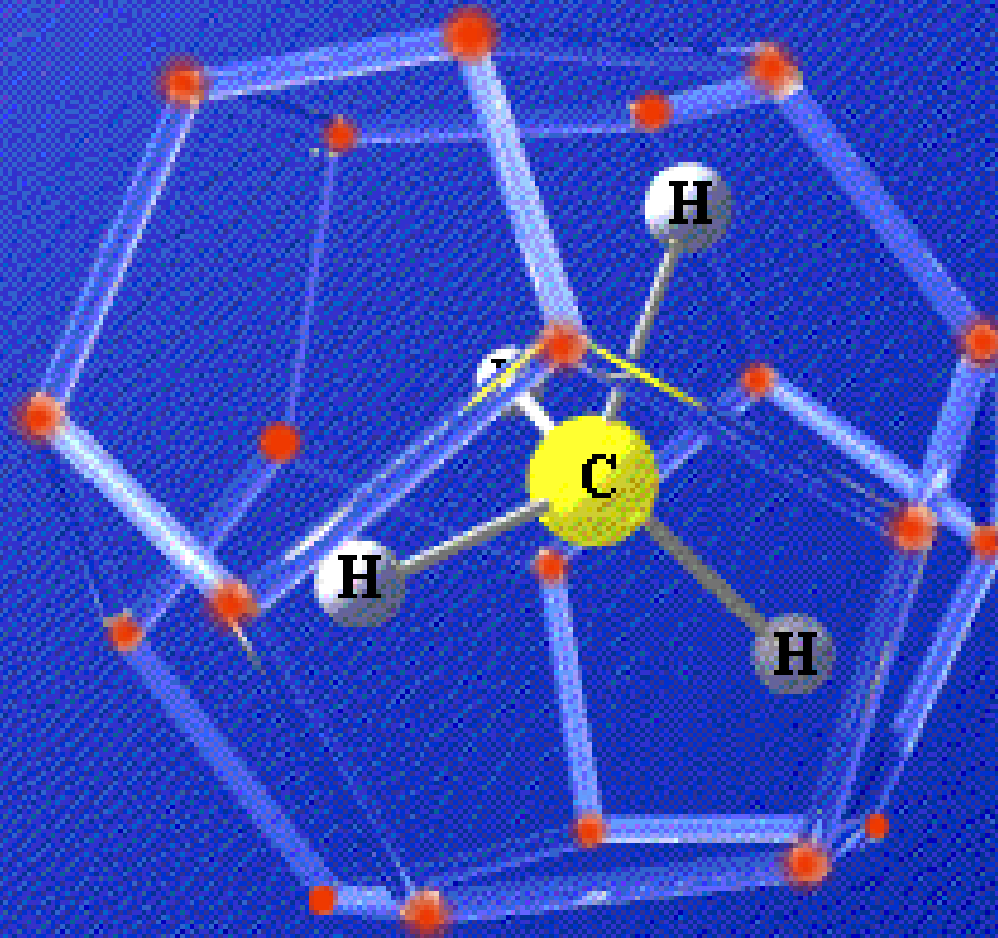


# Methane Hydrates



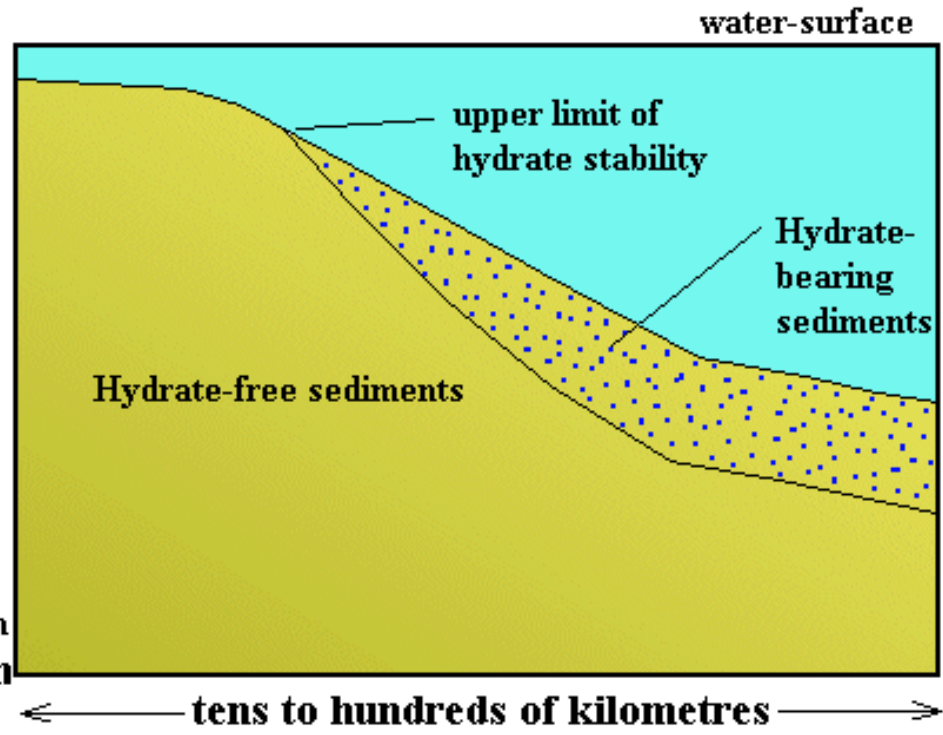
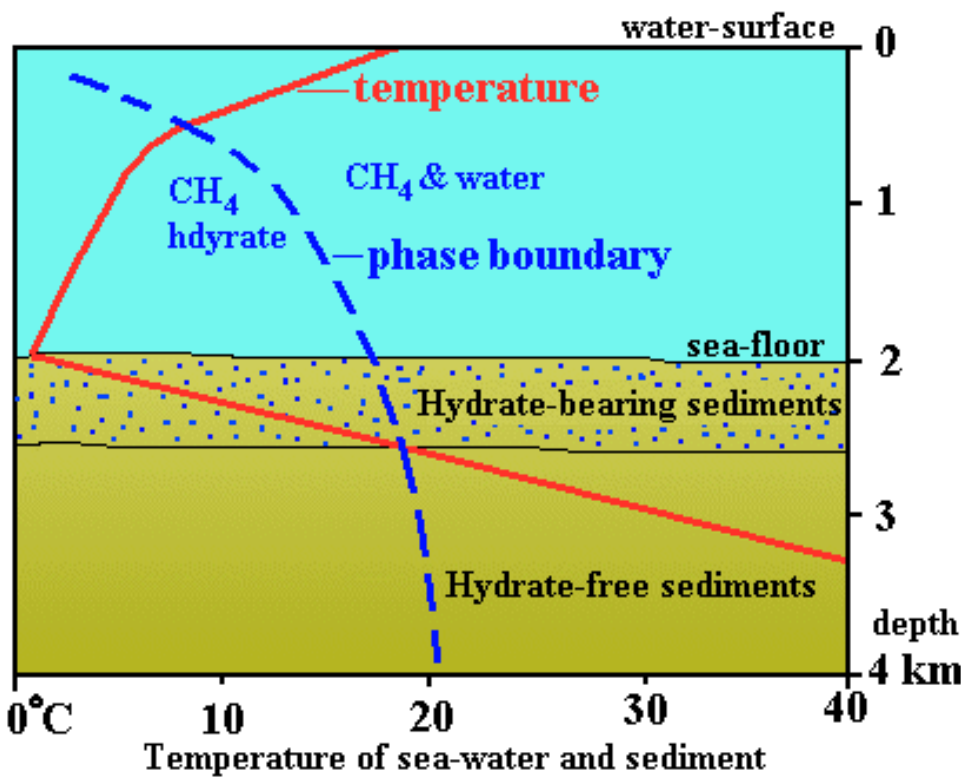


# Dodecahedral Methane Hydrate Structure



●  $H_2O$  molecules

*after USGS*





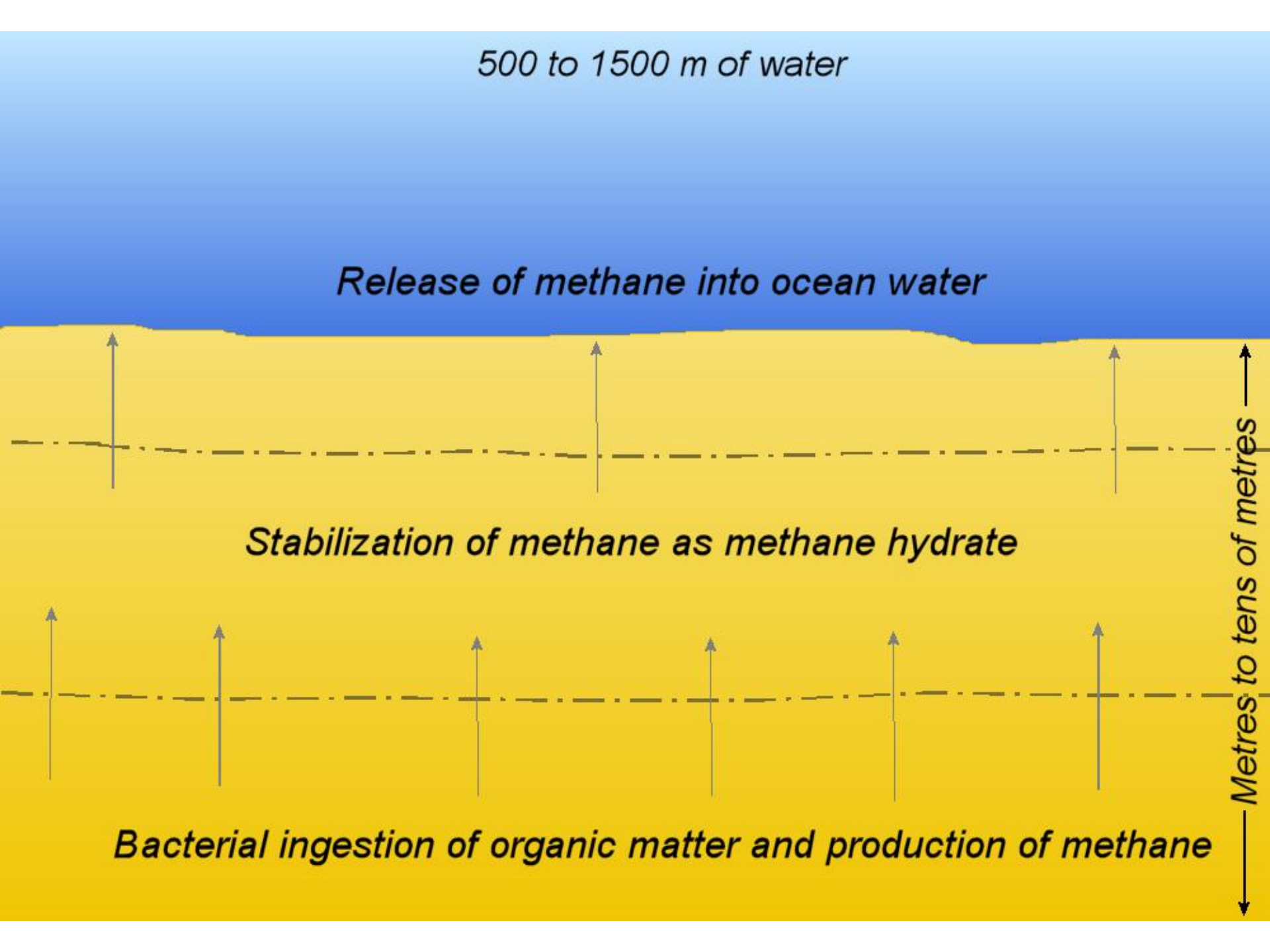
500 to 1500 m of water

*Release of methane into ocean water*

*Stabilization of methane as methane hydrate*

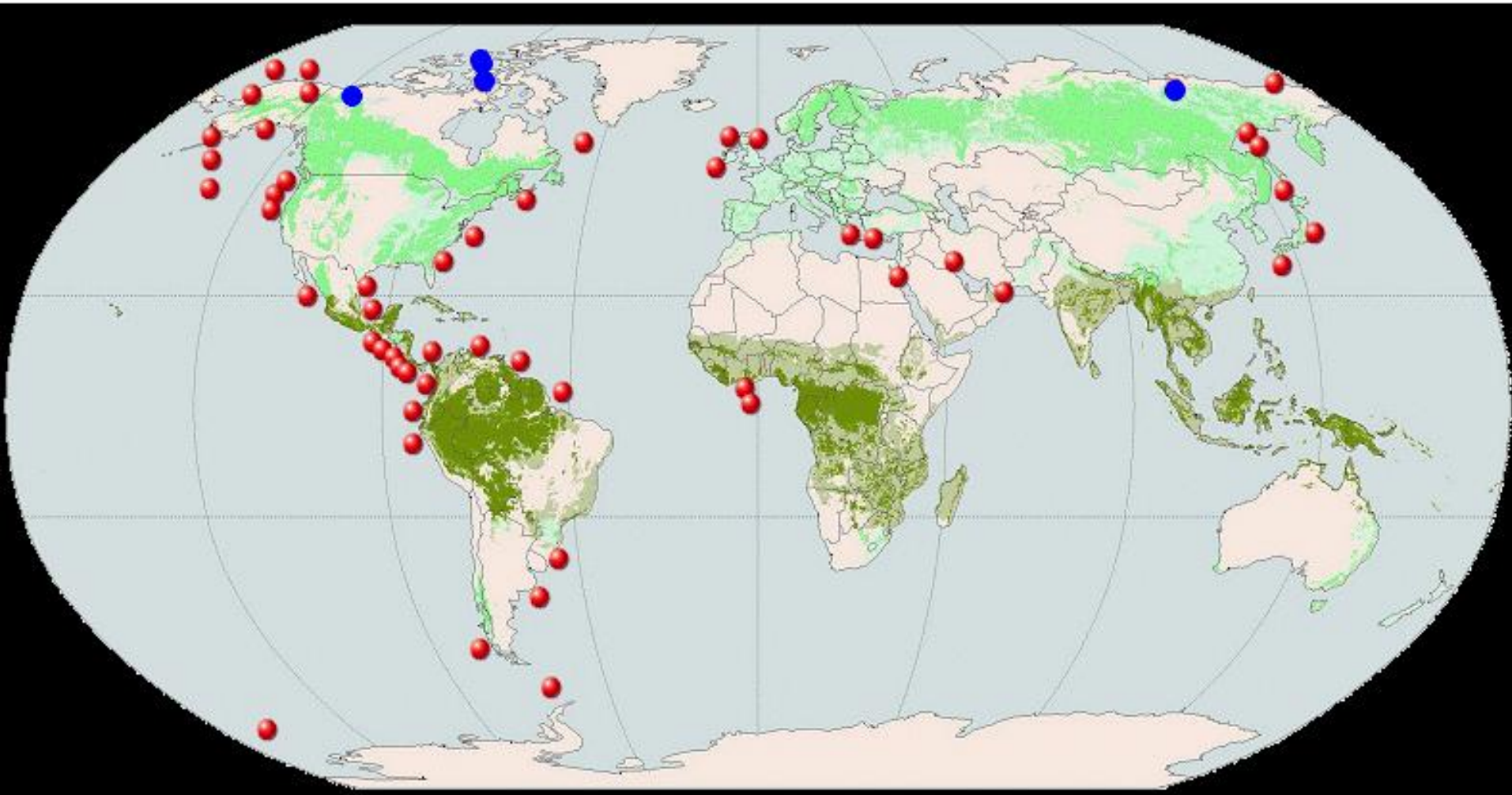
*Bacterial ingestion of organic matter and production of methane*

Metres to tens of metres



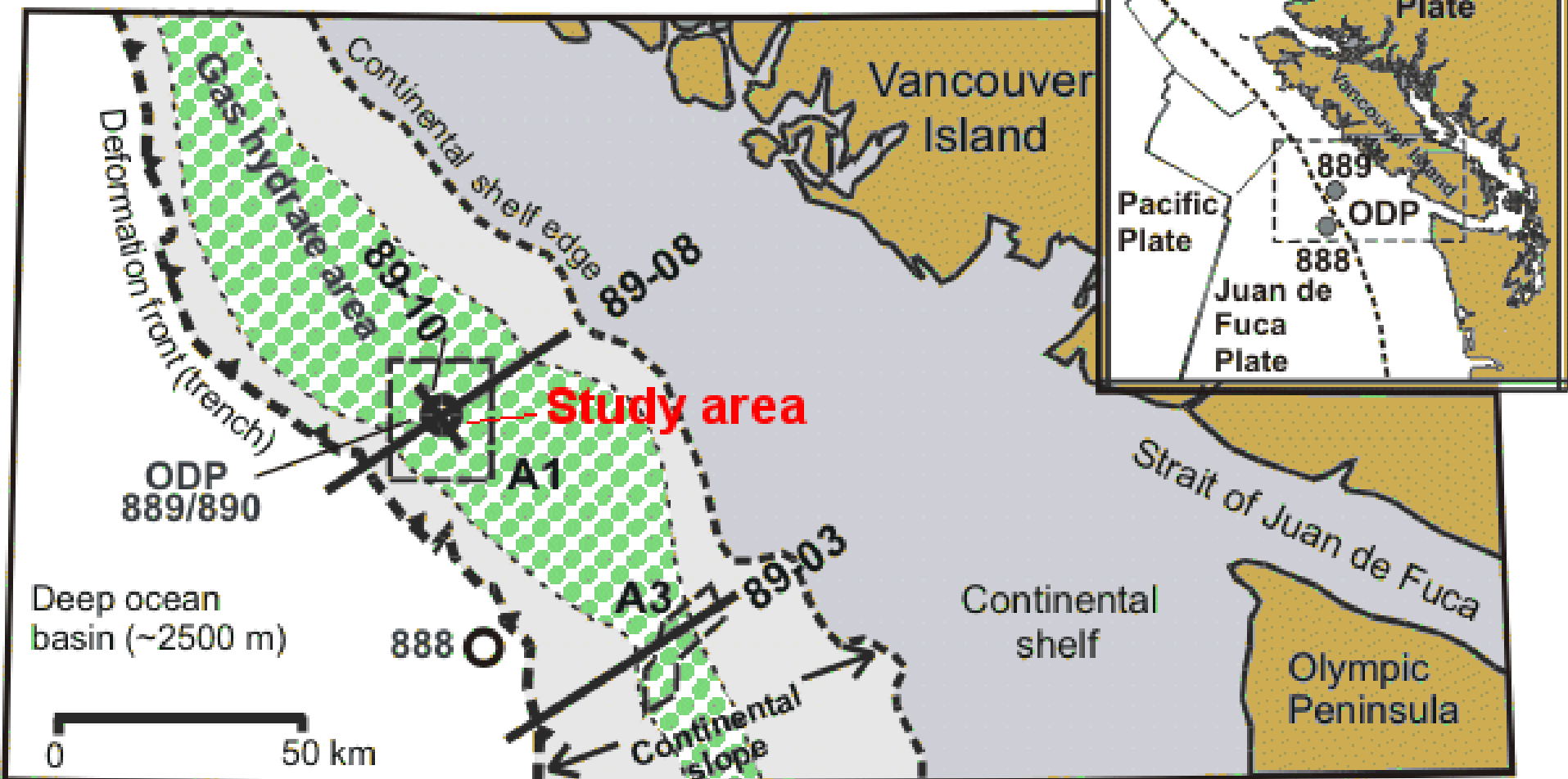


Known methane-hydrate deposits, in the ocean ● and on land ●





(from <http://www.pgc.nrcan.gc.ca>)



# Ocean Drilling Project



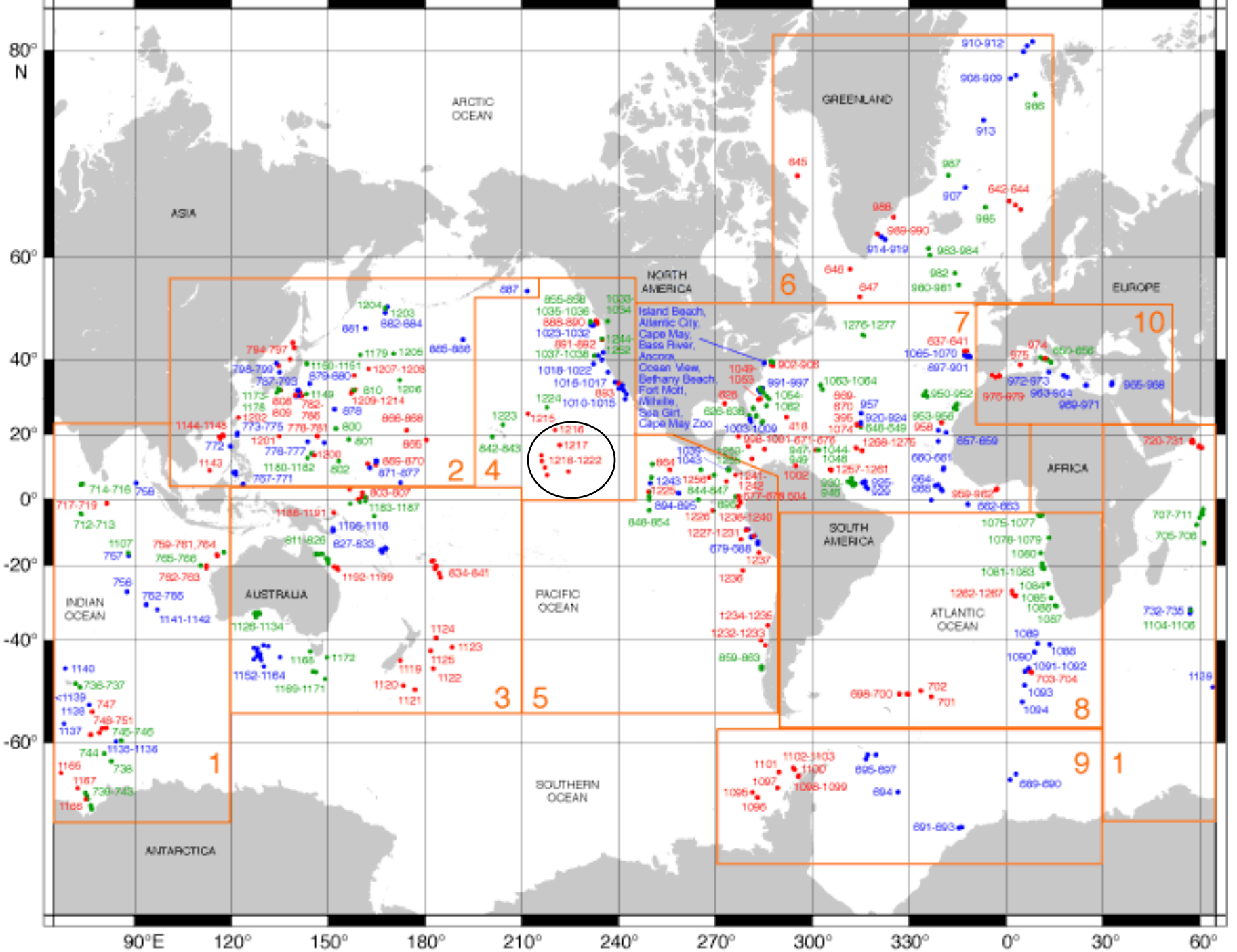


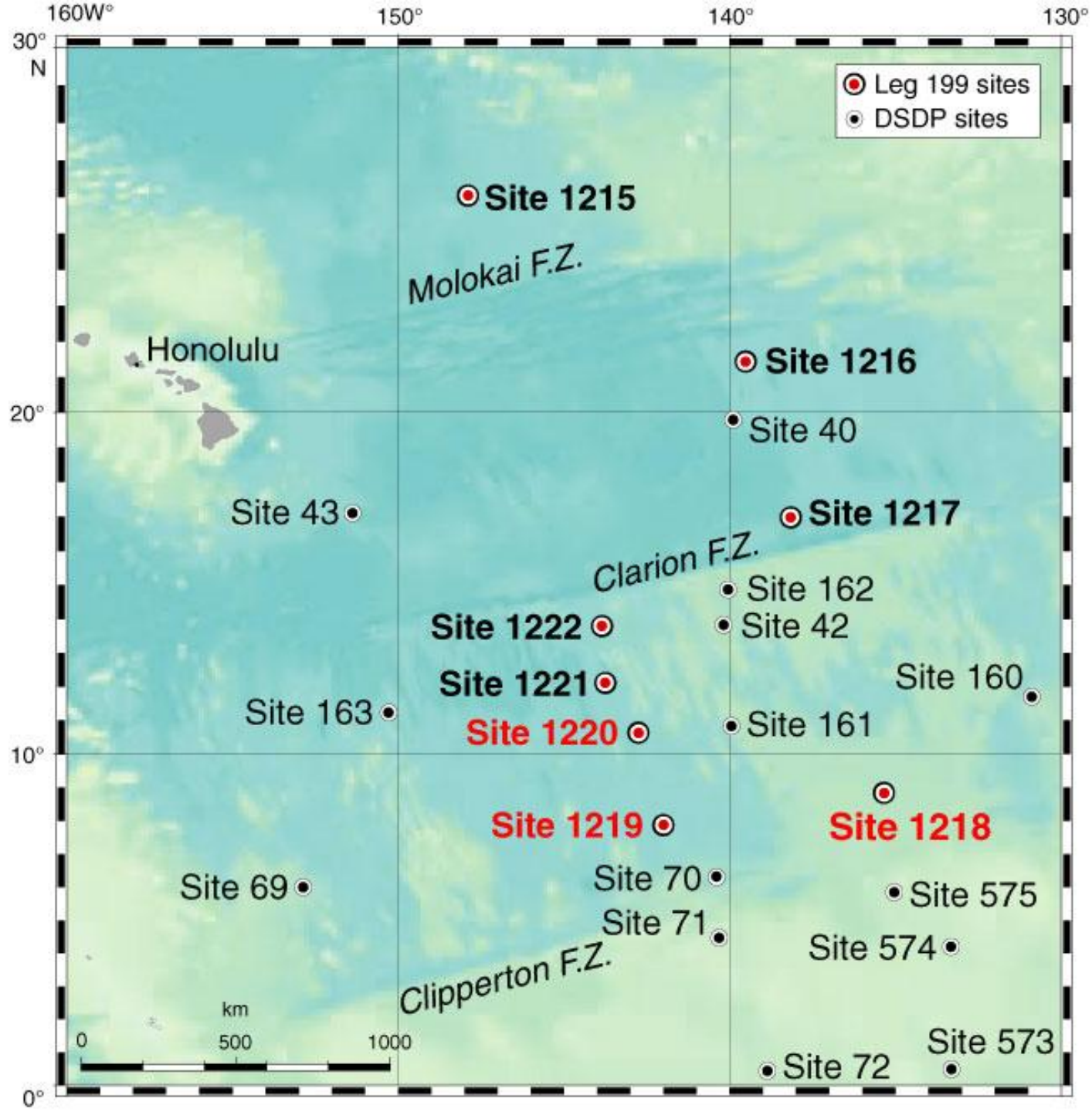
# Joides Resolution









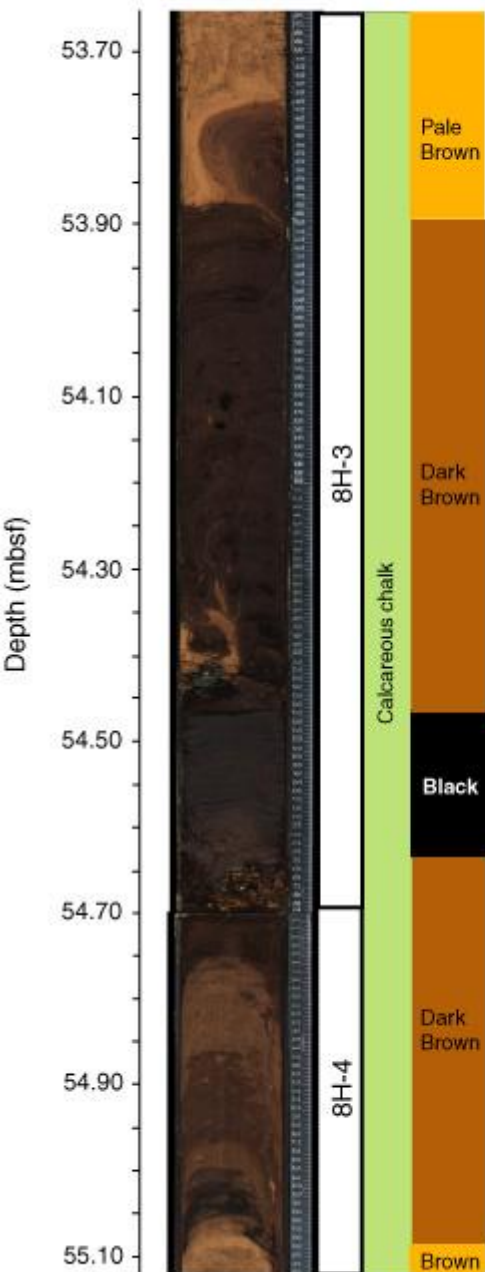




Sections 199-1215A-8H-3

and 8H-4

(top: 53.20)

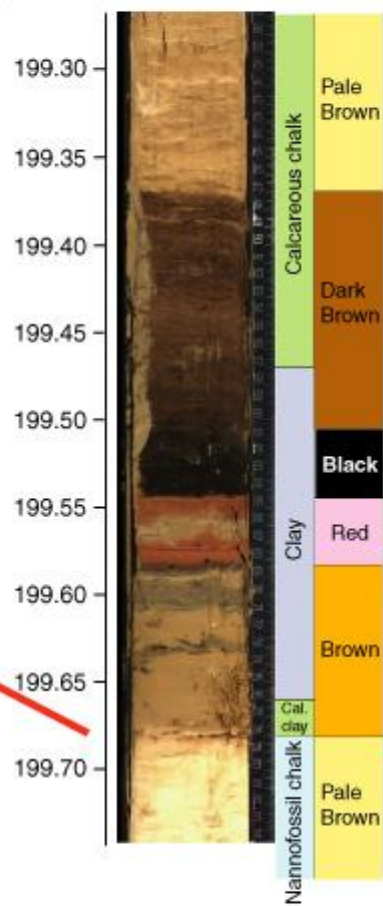


Last occurrence of Paleocene benthic assemblage

Section

199-1220B-20X-2

(top: 198.90)

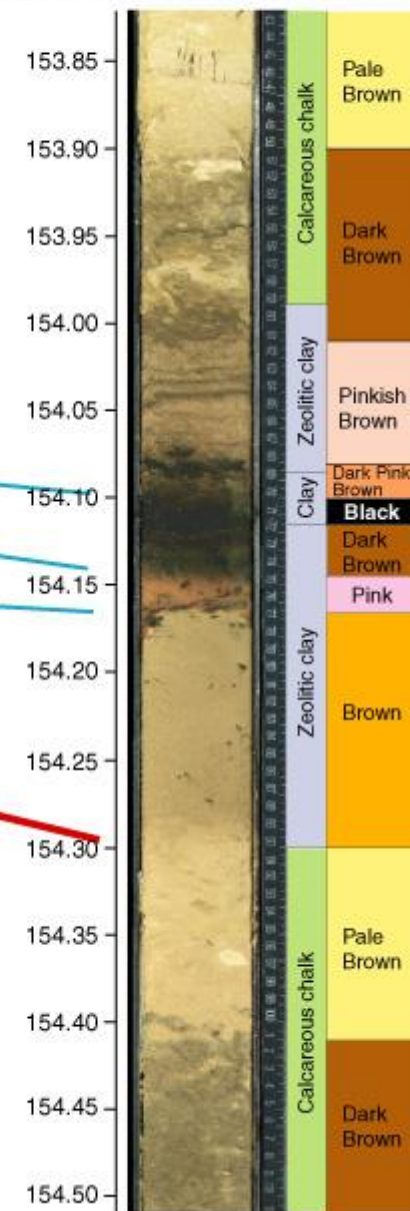


Dominant agglutinated assemblage

Last occurrence of Paleocene benthic assemblage

Section 199-1221C-11X-3

(top: 153.40)



Dominant agglutinated assemblage

