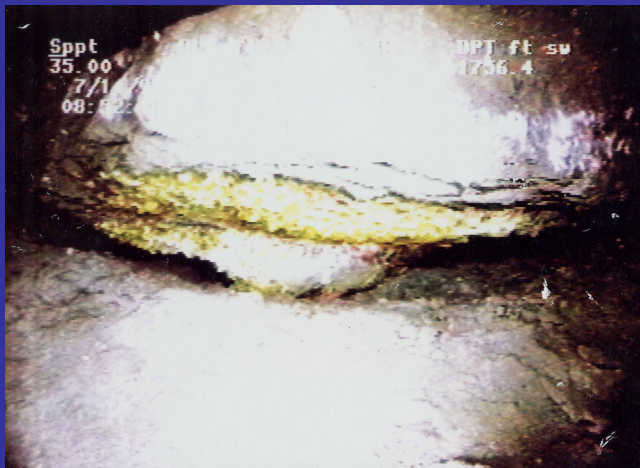


Searching for the Carbon Reservoirs in Gas Hydrates at the Bottom of the Ocean



Stephen Macko

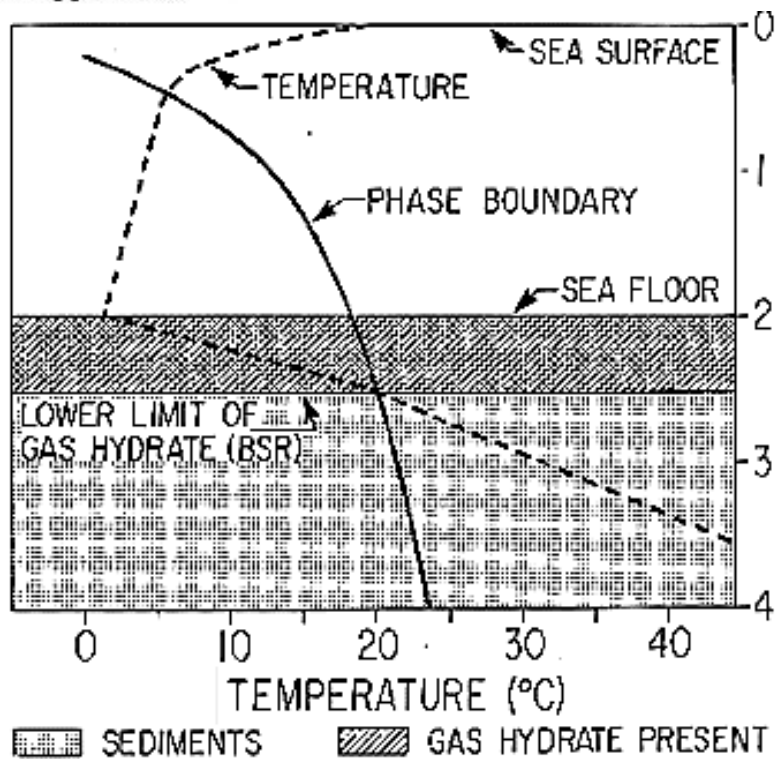
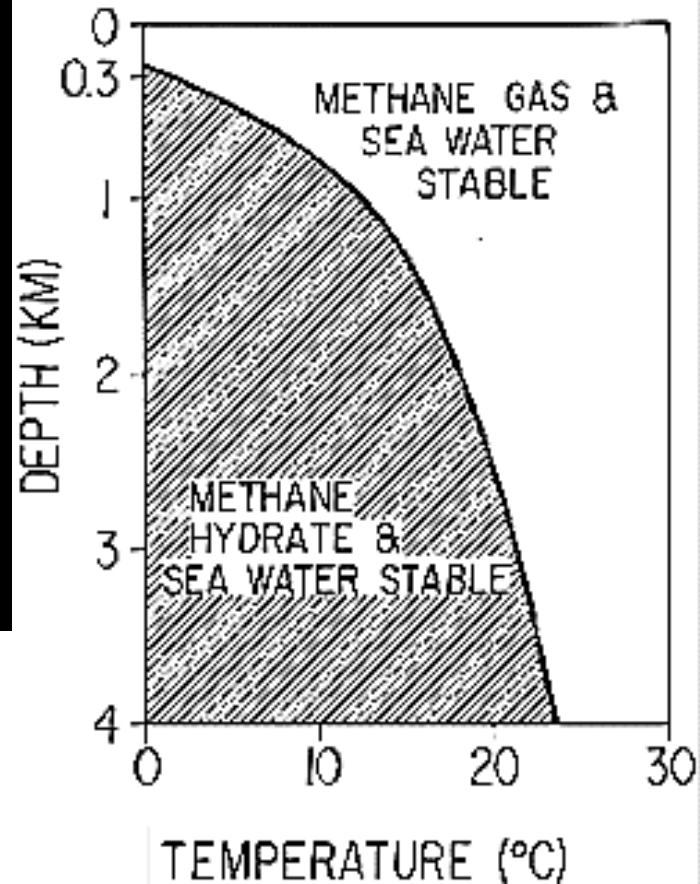
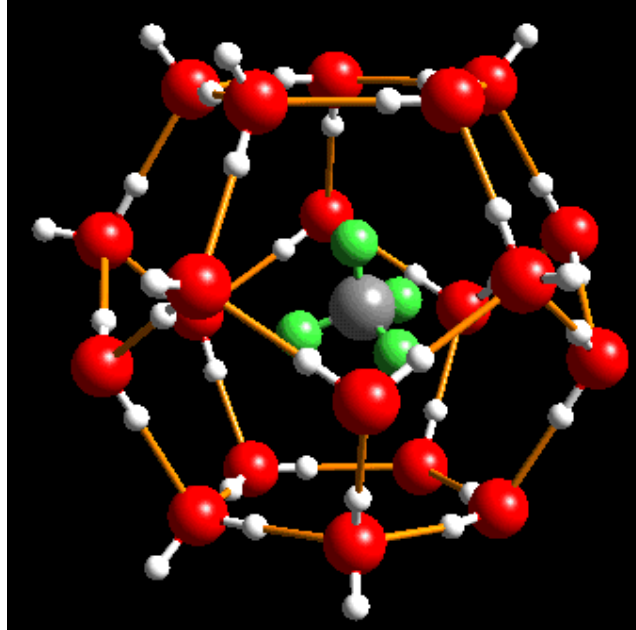
Professor of Oceanography

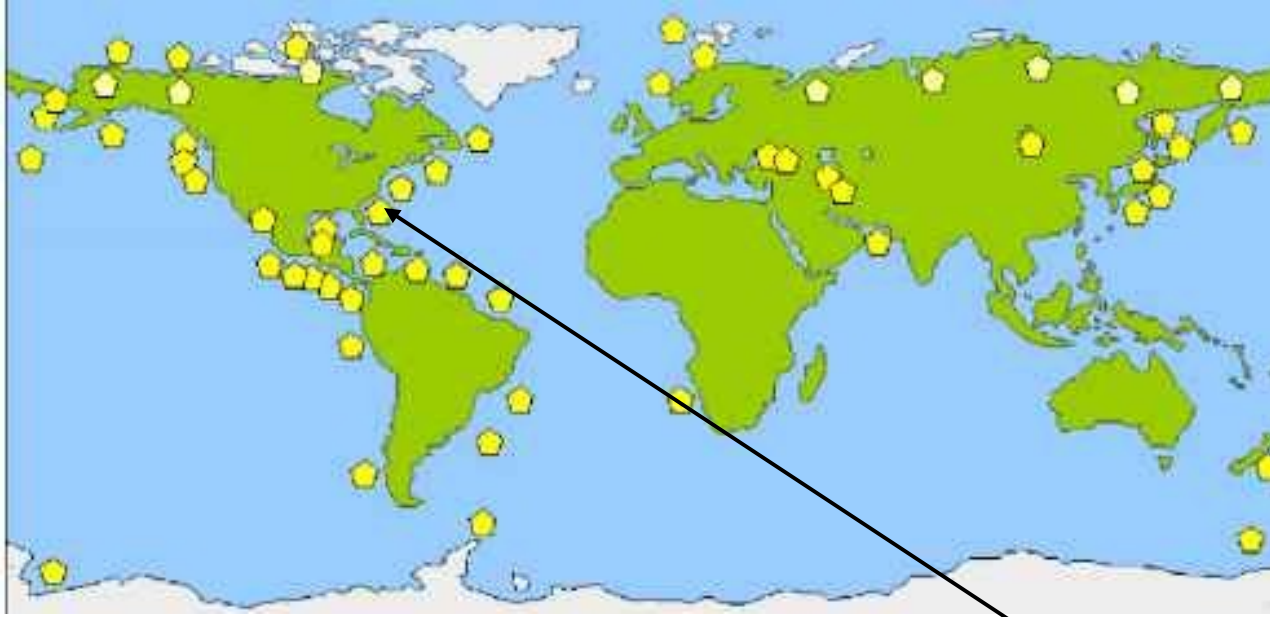
University of Virginia

sam8f@virginia.edu

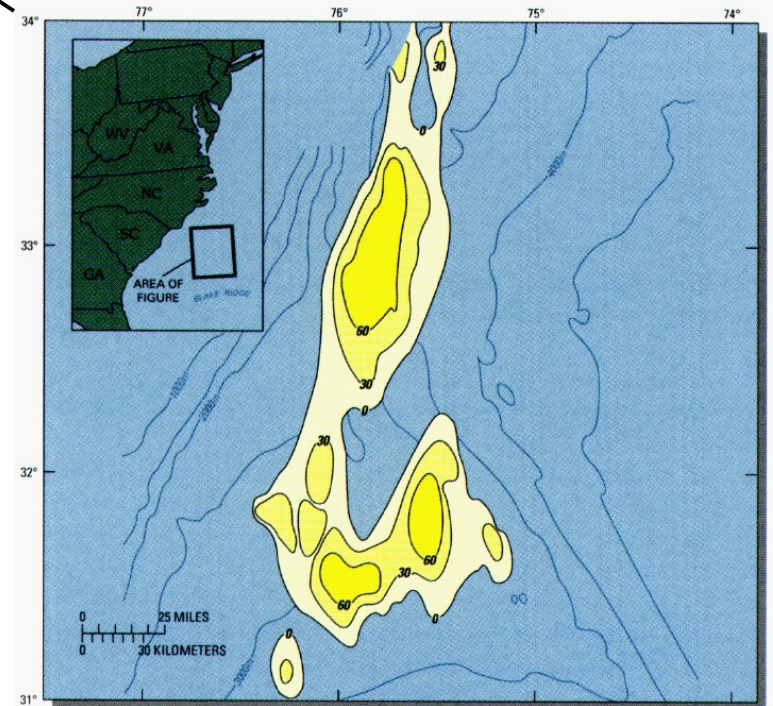


A flaming gas snow ball

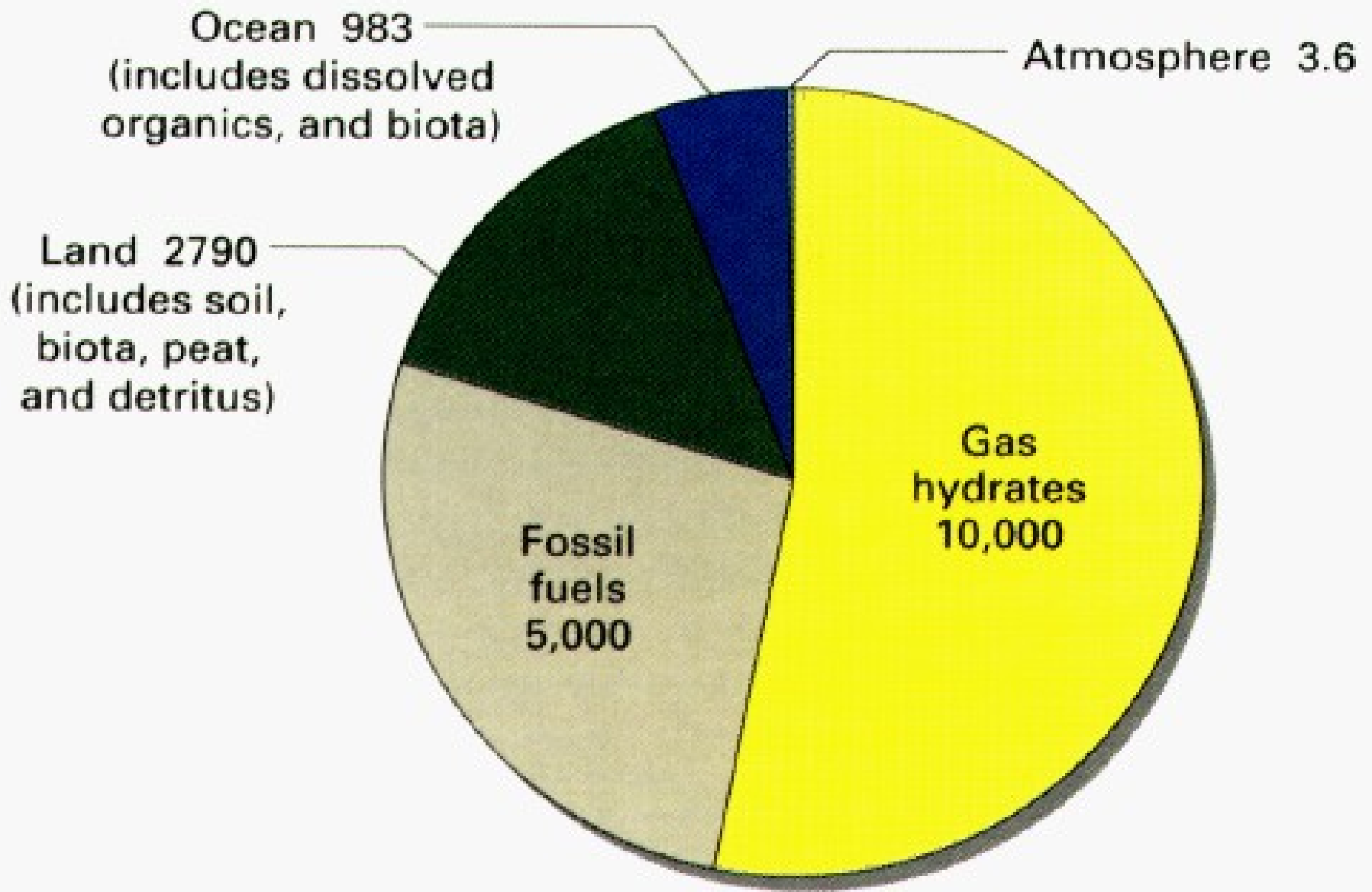




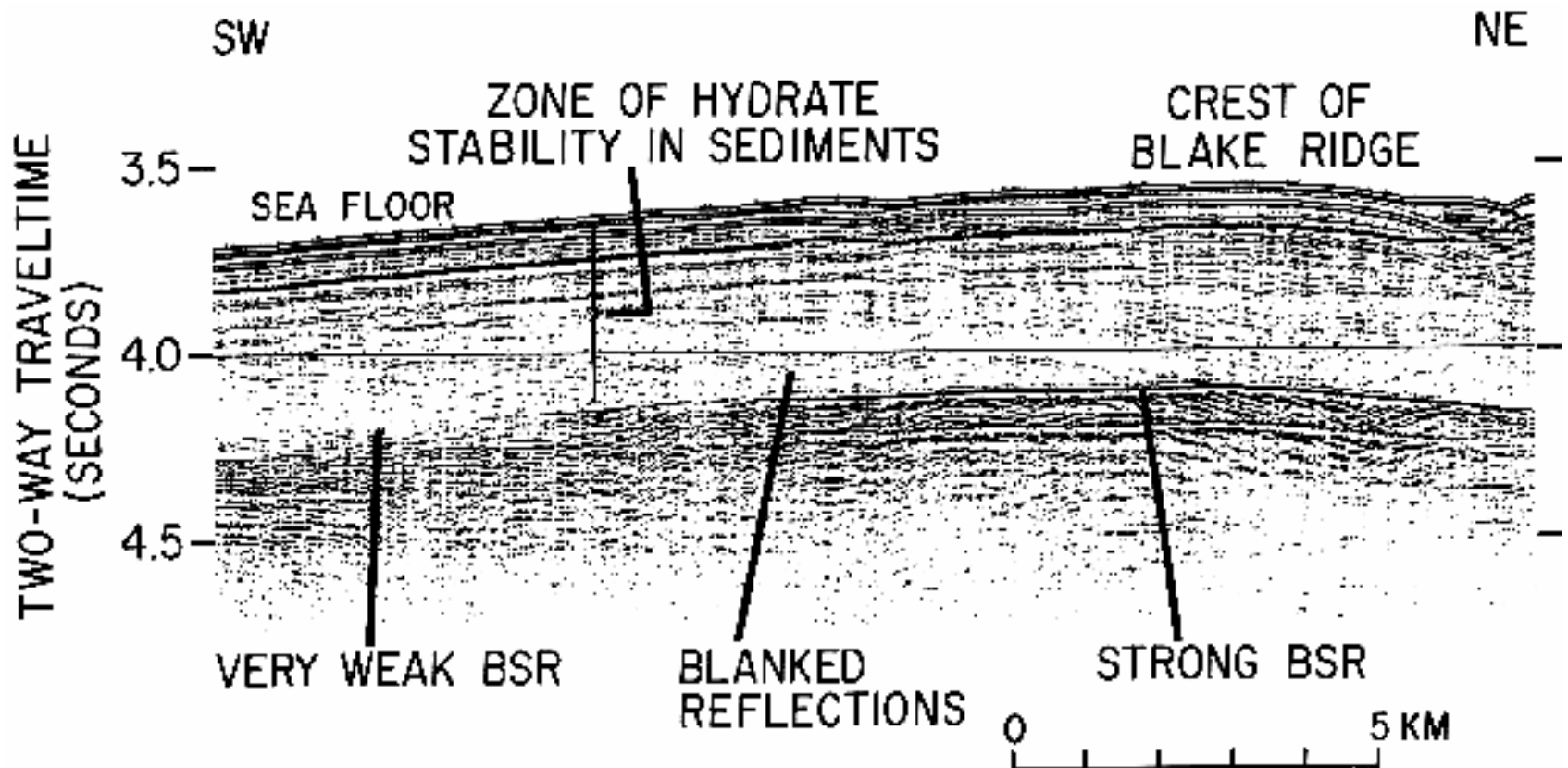
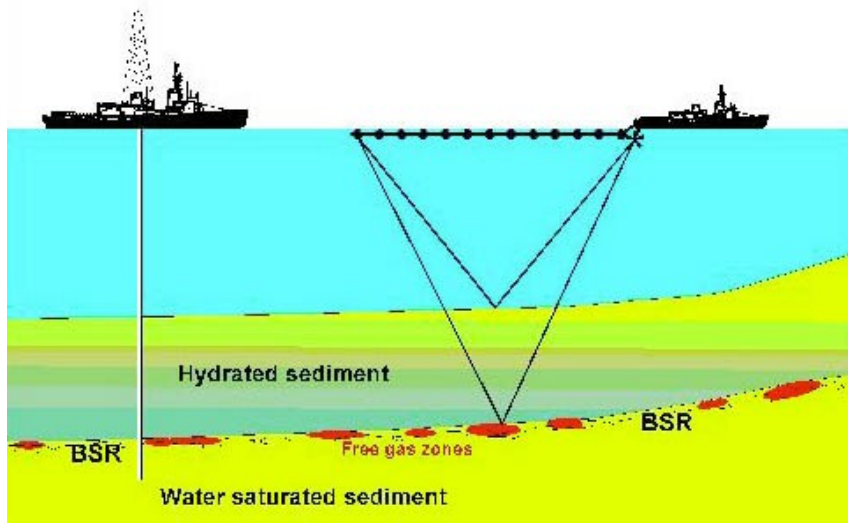
Blake Ridge contains 100x the US natural gas consumption or 1.3×10^{15} cubic feet in an area 30,000 sq km

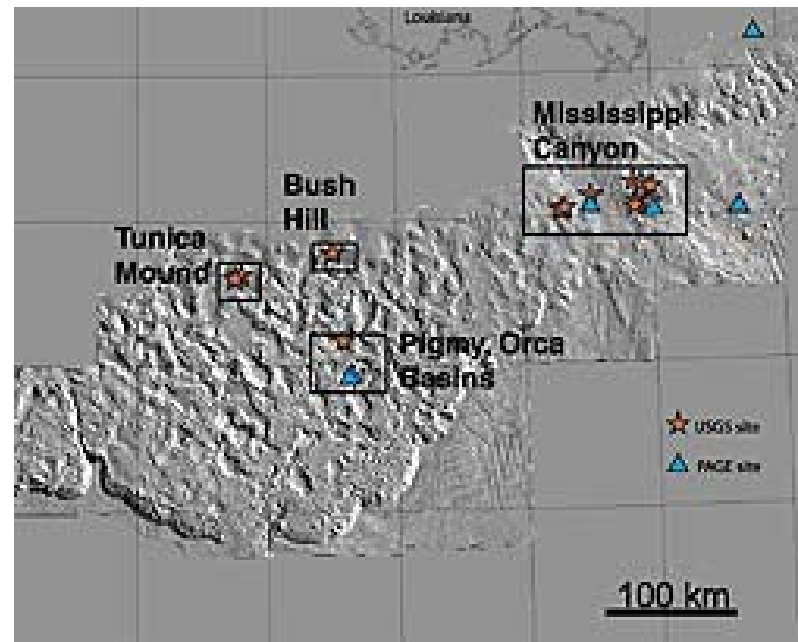


Map showing location and inferred thickness (in meters) of hydrates within sediments in the high concentration area off North Carolina and South Carolina.



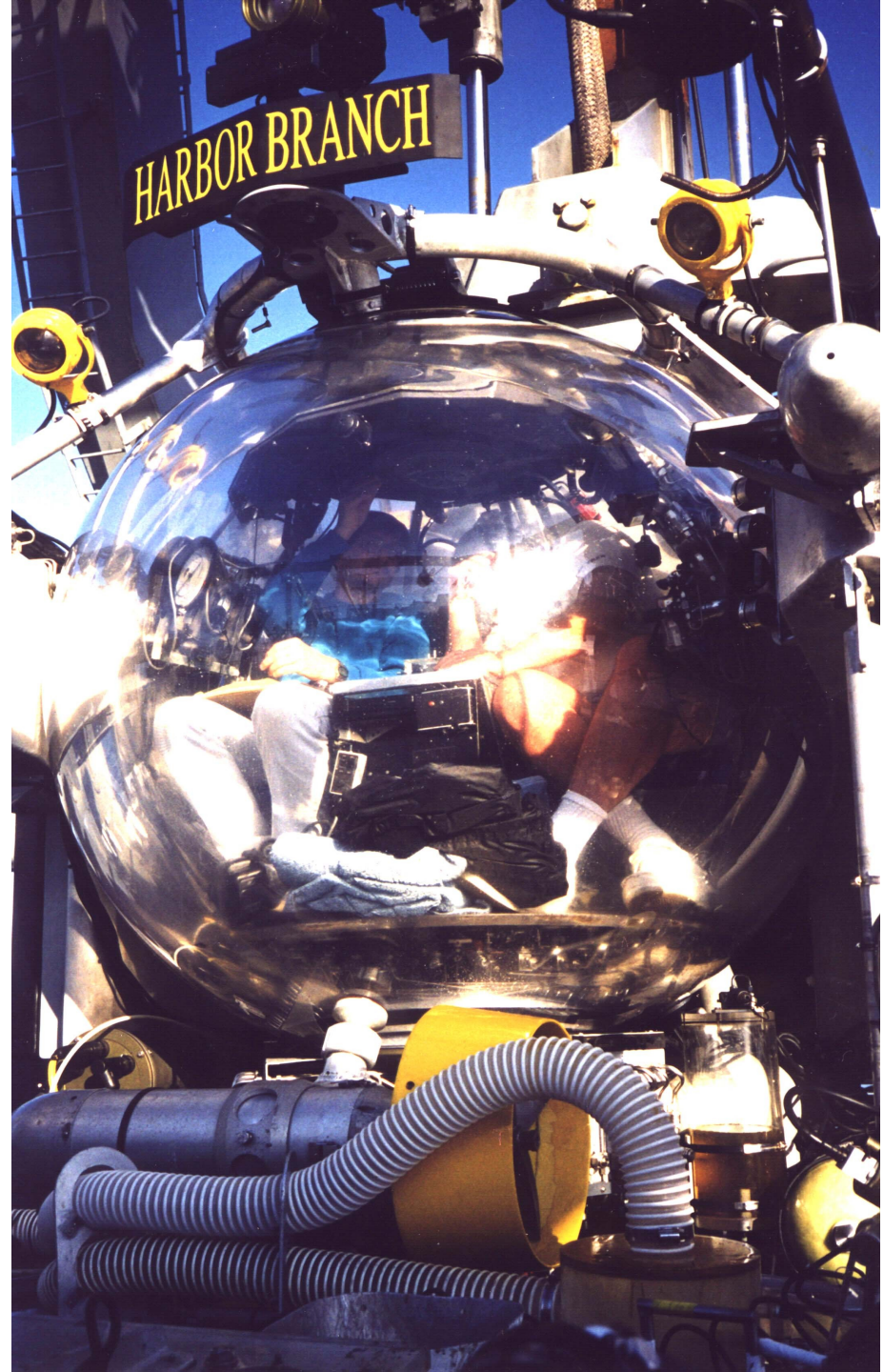
Distribution of organic carbon in Earth reservoirs (excluding dispersed carbon in rocks and sediments, which equals nearly 1,000 times this total amount). Numbers in gigatons (10^{15} tons) of carbon.





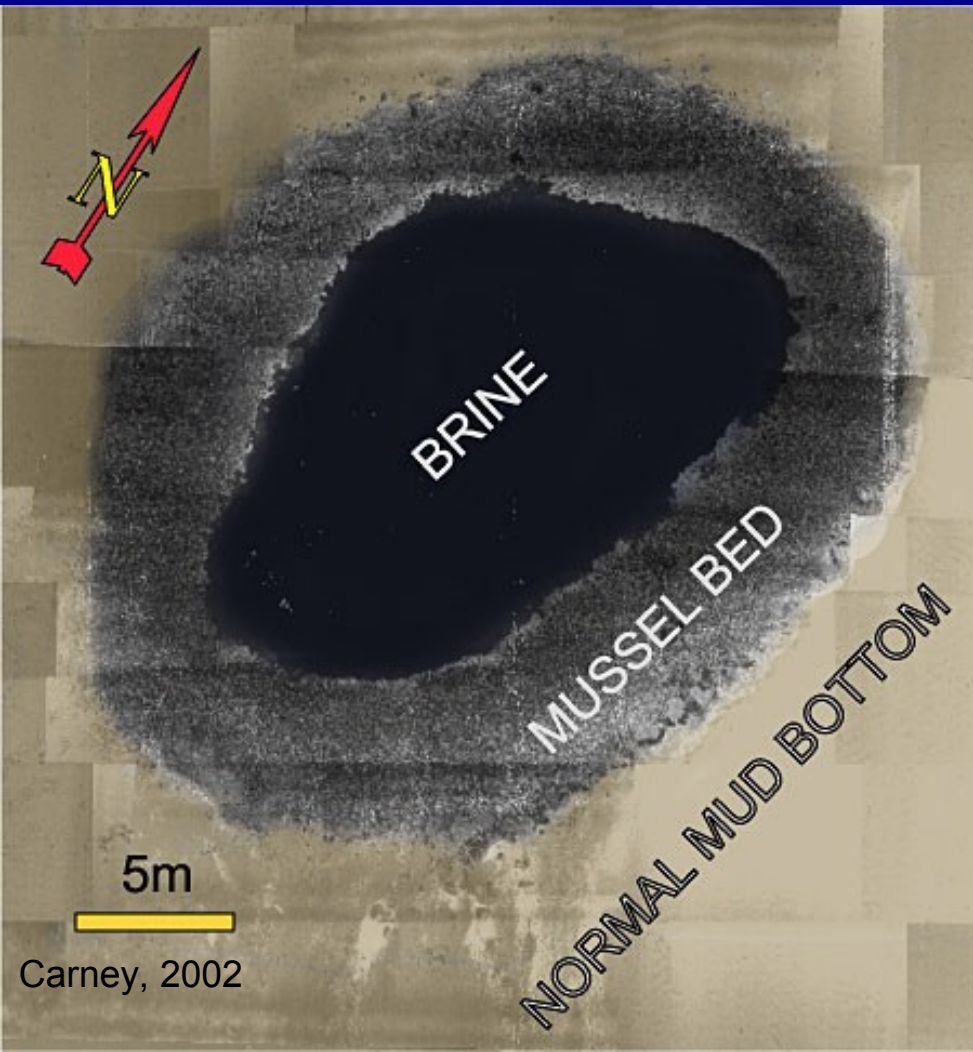
Collection of deep sea fauna at gas hydrate sites

Johnson Sea Link





Gulf of Mexico Brine Pool



Are Chemosynthetic Communities Oases of Life? Tube Worms, Gas Hydrates and Cold Seeps

- Found in 1985:
depths 400-2500m
- Associated with
hydrocarbon seeps
- Dominant fauna:
Mussels and
tubeworms that
harbor
chemoautotrophic
symbionts
- Extent unknown



Gulf of Mexico Hydrocarbon Seep Communities

- Have no mouth or digestive tract
- Symbiotic with sulfide utilizing bacteria
- Oldest living invertebrates currently known
- Dense clusters: 100's to 1000's of individuals



Mussels: *Bathymodiolus childressi* and *Tamu fisheri*

- *B. childressi*
 - symbiotic with methanotrophic bacteria
 - dominate in methane seeps
- *T. fisheri*
 - symbiotic with thiotrophic bacteria
 - found within tube worm bushes



Closely Associated Fauna

Associated small heterotrophs

- Gastropoda, Crustacea, Polychaeta
- some endemic species
- limited mobility



Mobile Heterotrophic Predators

Large, mobile,
benthic heterotrophs

- colonists, vagrants,
some endemics
- hagfish (*Eptatretus*),
spider crabs
(*Rochina*), giant
isopods (*Bathynomus*),
eels
(*Synaphobranchus*),
starfish (*Sclerasterias*)



Do the heterotrophs consume chemosynthetic material? Are these oases in a nutrient poor ocean?

- Grazing of chemosynthetic material?
- Hunted by large, mobile predators?
- Predators as vectors for transport of chemosynthetic production



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JSL 2061 HYDRATE MOUND at GC234



A 20674

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