



In Situ Raman Analyses of Natural Gas and Gas Hydrates at Hydrate Ridge, Oregon (OS34B-01)

E. T. Peltzer¹, Sheri N. White¹, R. M. Dunk¹, P. G. Brewer¹,
A. D. Sherman¹, K. Schmidt¹, K. C. Hester², and E. D. Sloan²

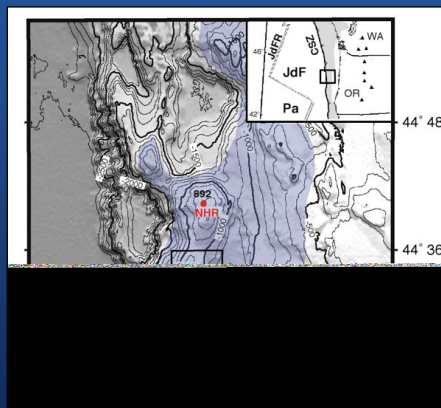
¹Monterey Bay Aquarium Research Institute, Moss Landing, CA

²Colorado School of Mines, Golden, CO



Hydrate Ridge Expedition

- July 2004
 - R/V *Western Flyer*
 - ROV *Tiburon*
 - 7 dives
- Cascadia margin
 - North Hydrate Ridge
 - 590 m depth
 - South Hydrate Ridge
 - 780 m depth

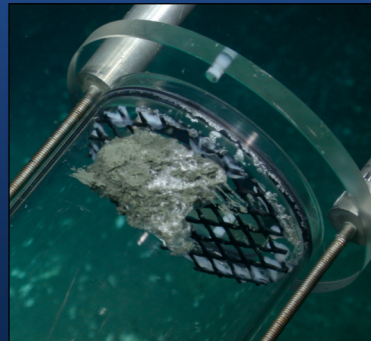


Tréhu, et al., 2004



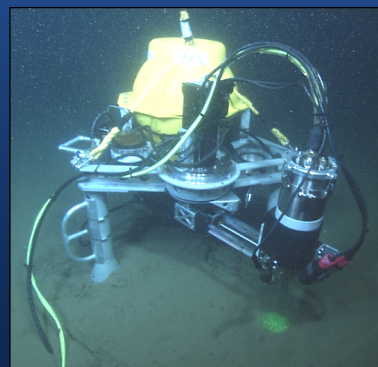
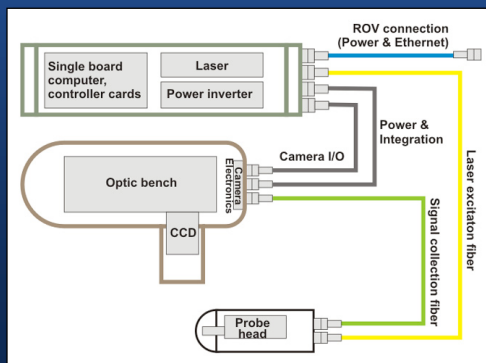
Hydrate Ridge

- Hydrate is formed in the subsurface and held in place by the sediment
- Suess, et al. (2004) suggest that free gas is present within the hydrate fabric



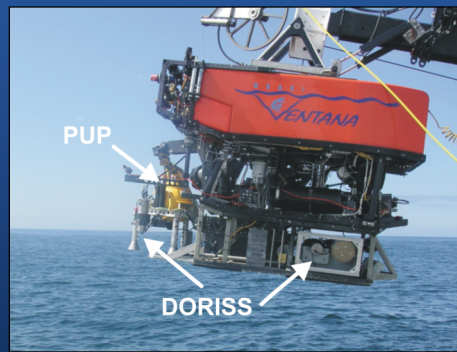
DORISS/PUP

- Deep Ocean Raman *In Situ* Spectrometer
- Precision Underwater Positioner



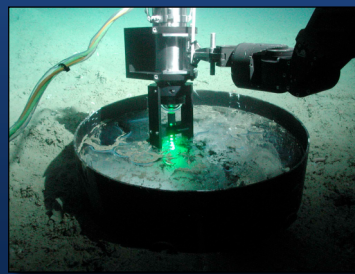


DORISS/PUP Deployment

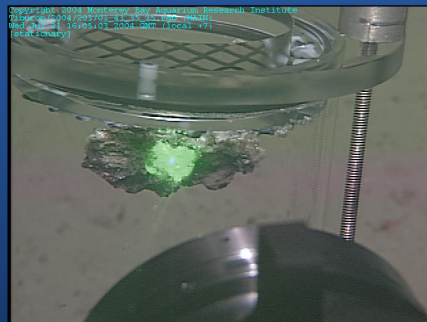


- Electronics and spectrometer housings carried in toolsled
- Probe head and PUP carried on front porch

- Probe head is positioned by the ROV manipulator or PUP



Hydrate Analysis

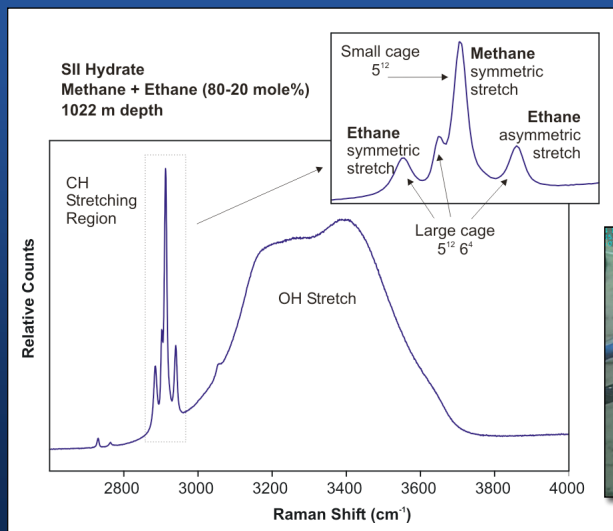


- Hydrates were excavated from the seafloor and held in a glass cylinder

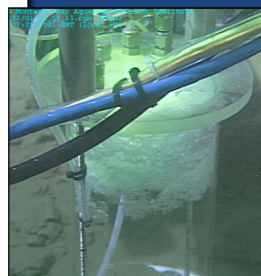




Monterey Bay Experiment

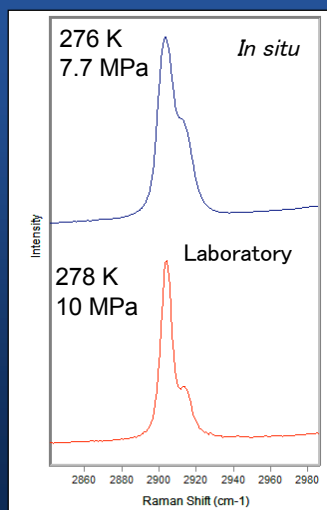


Hydrate formed
in situ from a
80-20 methane-
ethane mixture



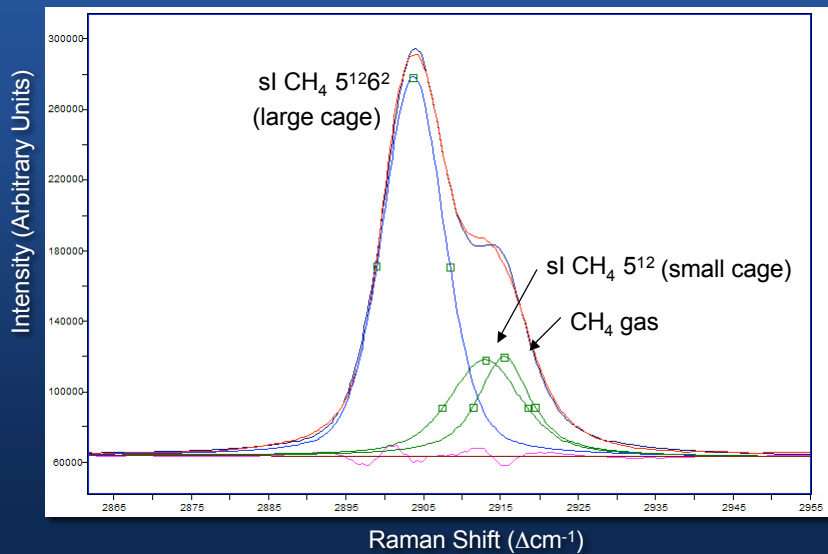
Hydrate Ridge Analysis

- Hydrate is structure I
 - Methane present in both large and small cages (3:1 ratio)
 - No other hydrocarbons are observed
- In situ* data shows more of a shoulder than a second (small cage) peak



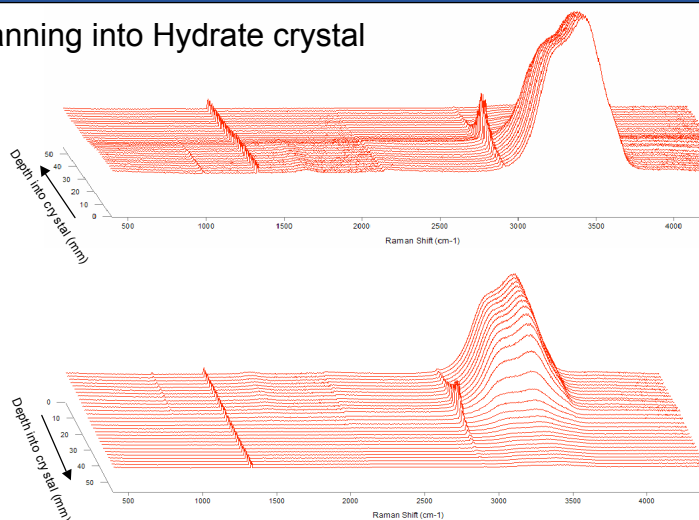


Hydrate Ridge Analysis



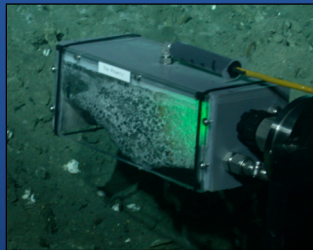
Hydrate Ridge Analysis

Scanning into Hydrate crystal

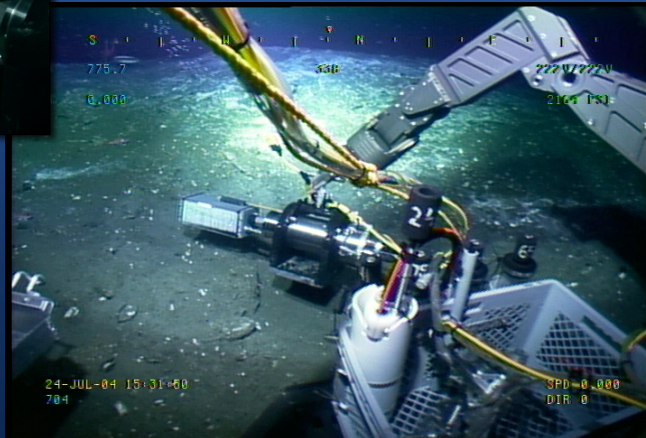




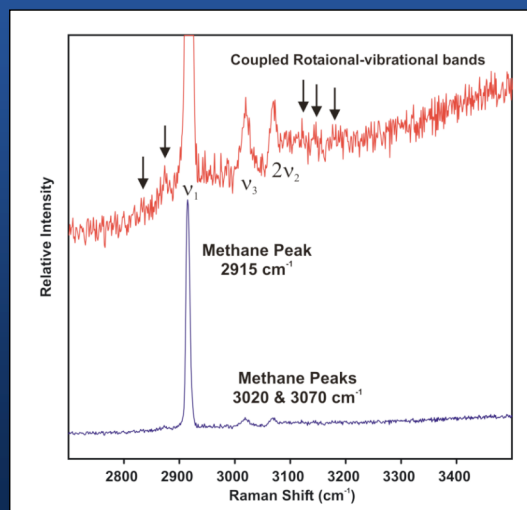
Natural Gas Analysis



Gas collected in heated cube



Natural Gas Analysis





Natural Gas GC Analysis

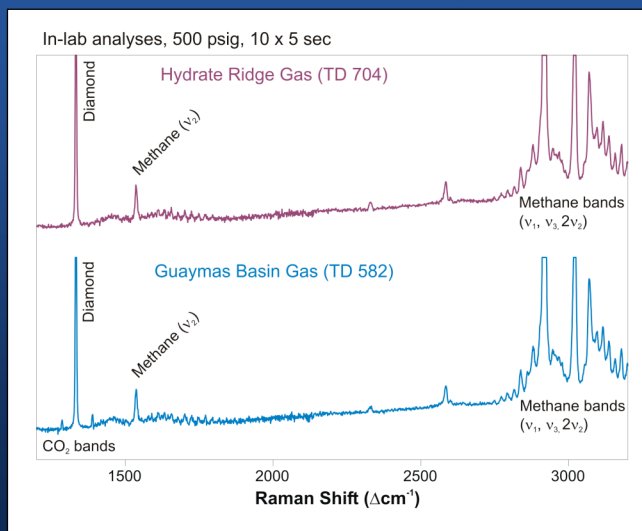
Compound	Mole % (mean)
N ₂	0.79
CO ₂	0.16
Methane	98.56
Ethane	0.089
Propane	0.023
i-Butane	0.006
n-Butane	0.008
i-Pentane	0.005
n-Pentane	0.000



Natural Gas Analysis

~0.16 mole%
CO₂

~3.0 mole%
CO₂





Acknowledgements

- Crew of the *R/V Western Flyer*
- Pilots of the *ROV Tiburon*
- Technical support of John Ferreira, Peter Walz, Mark Brown
- David & Lucile Packard Foundation
- NURP Grant UAF03-0098 to Sloan



Publications

Brewer, P.G., G.E. Malby, J.D. Pasteris, S.N. White, E.T. Peltzer, B. Wopenka, J. Freeman, & M.O. Brown, Development of a laser Raman spectrometer for deep-ocean science, *Deep Sea Res. I*, 51:739-753, 2004.

Pasteris, J.D., B. Wopenka, J. Freeman, P.G. Brewer, S.N. White, E.T. Peltzer, G.E. Malby, Raman spectroscopy in the deep ocean: successes and challenges, *Appl. Spectrosc.*, 58(7): 195A-208A, 2004.

White, S.N., P.G. Brewer, E.T. Peltzer, Determination of gas bubble fractionation rates in the deep ocean by laser Raman spectroscopy, *Mar. Chem.*, in press, 2004.

Posters

OS43B-558 *In Situ* Raman Spectra from the Sea Cliff Hydrothermal Field (Gorda Ridge)

OS43B-557 First Attempts at Direct Raman Detection of the Oceanic Carbonate System