Development and Testing of a Deep-Ocean Bottom-Mounted Seismic Source

$150k project
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WHY?

Why do we want a seismic source that is:

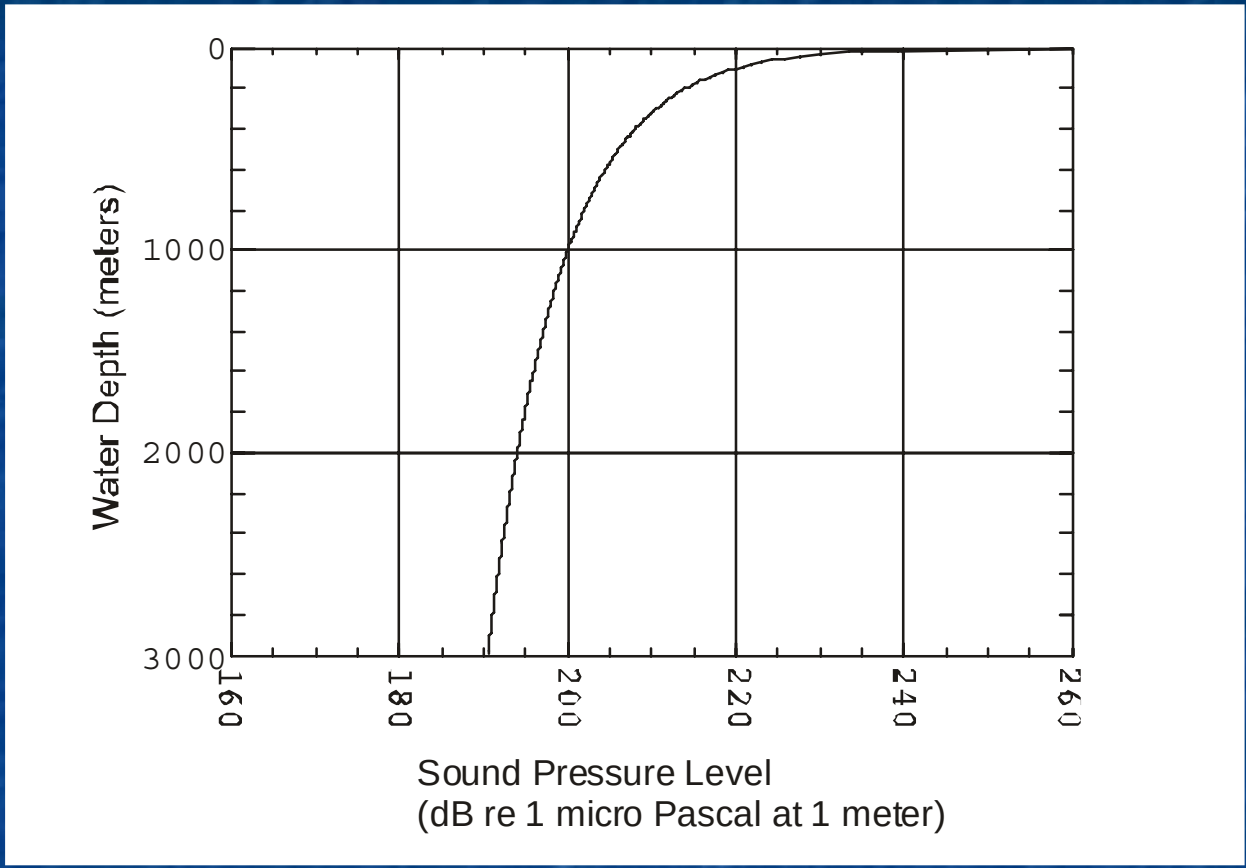
1) Deep
2) Bottom Mounted

How?

How will this help us understand Gas Hydrates?

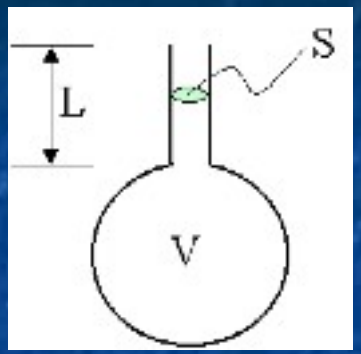
Advantages of Depth

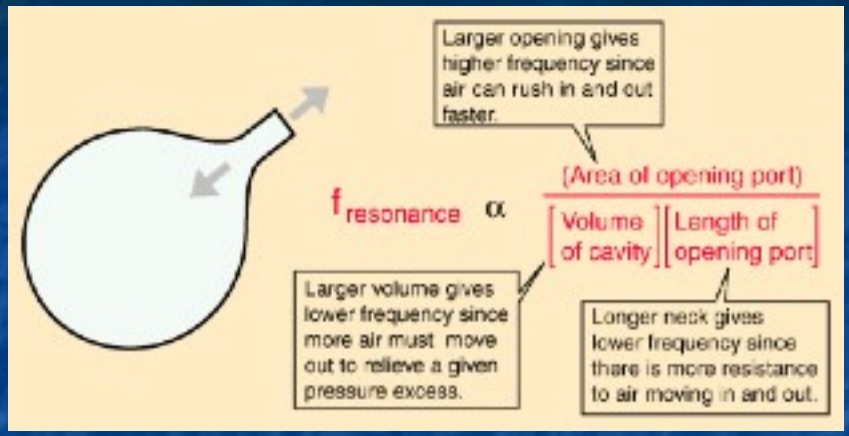
Proximity to target

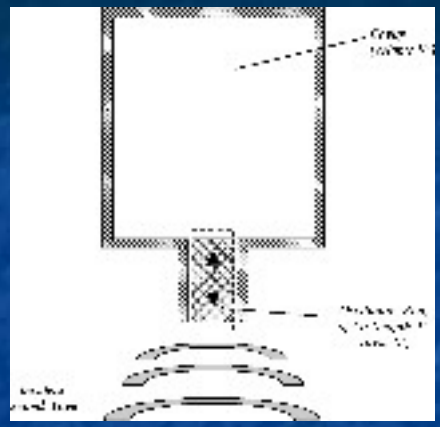


Disadvantage: Air guns don't work at depth, so we must use a transducer. Transducers work poorly at low frequencies, so boost low frequencies with a Helmholtz resonator.

Helmholtz Resonator



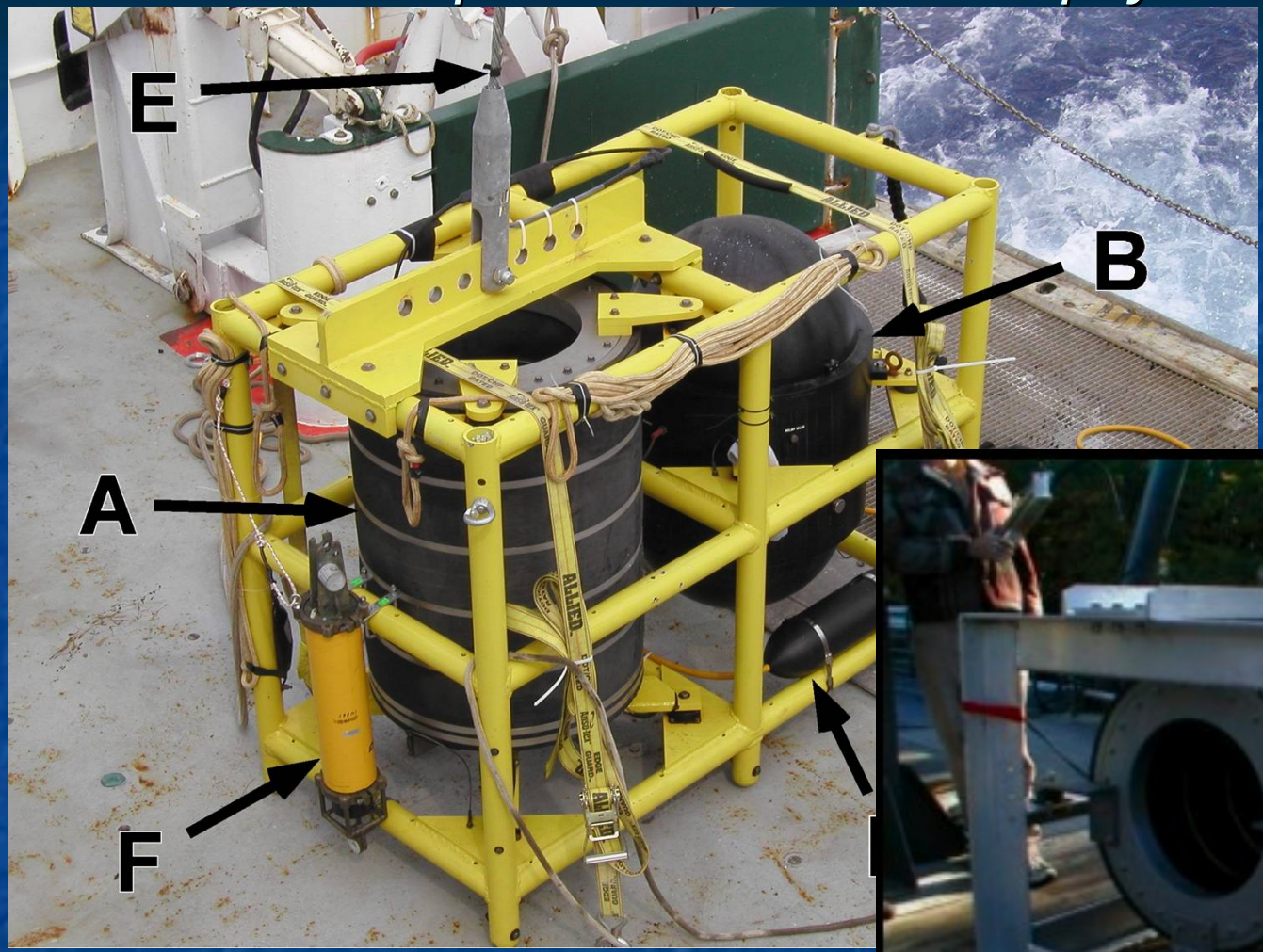


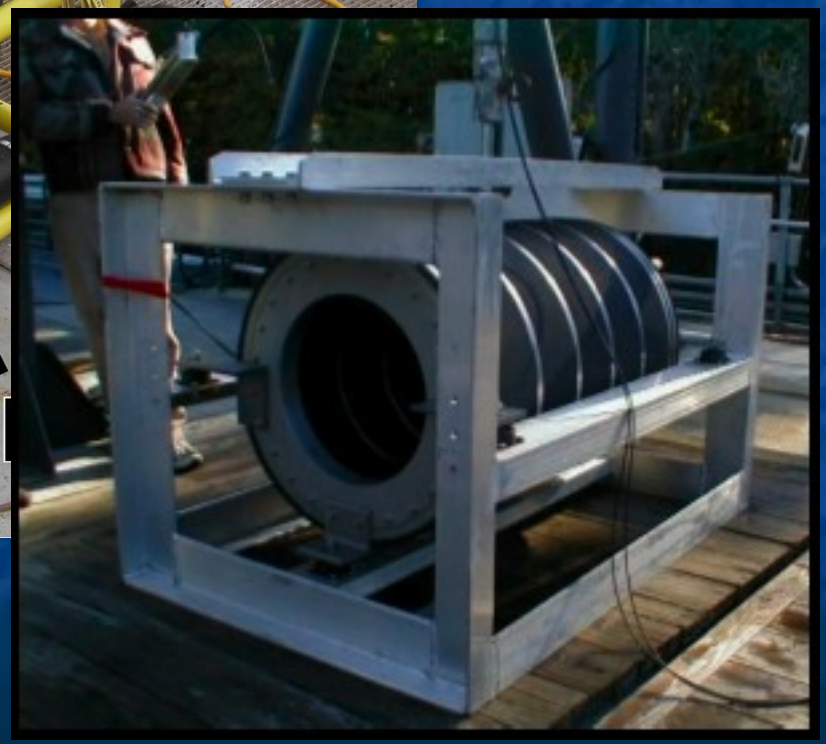


http://upload.wikimedia.org/wikipedia/commons/thumb/8/80/Helmholtz_resonator.jpg/552px-Helmholtz

www.emeraldinsight.com/Insight/viewContentIte

DTAGS Deep Towed Acoustic/Geophysics System





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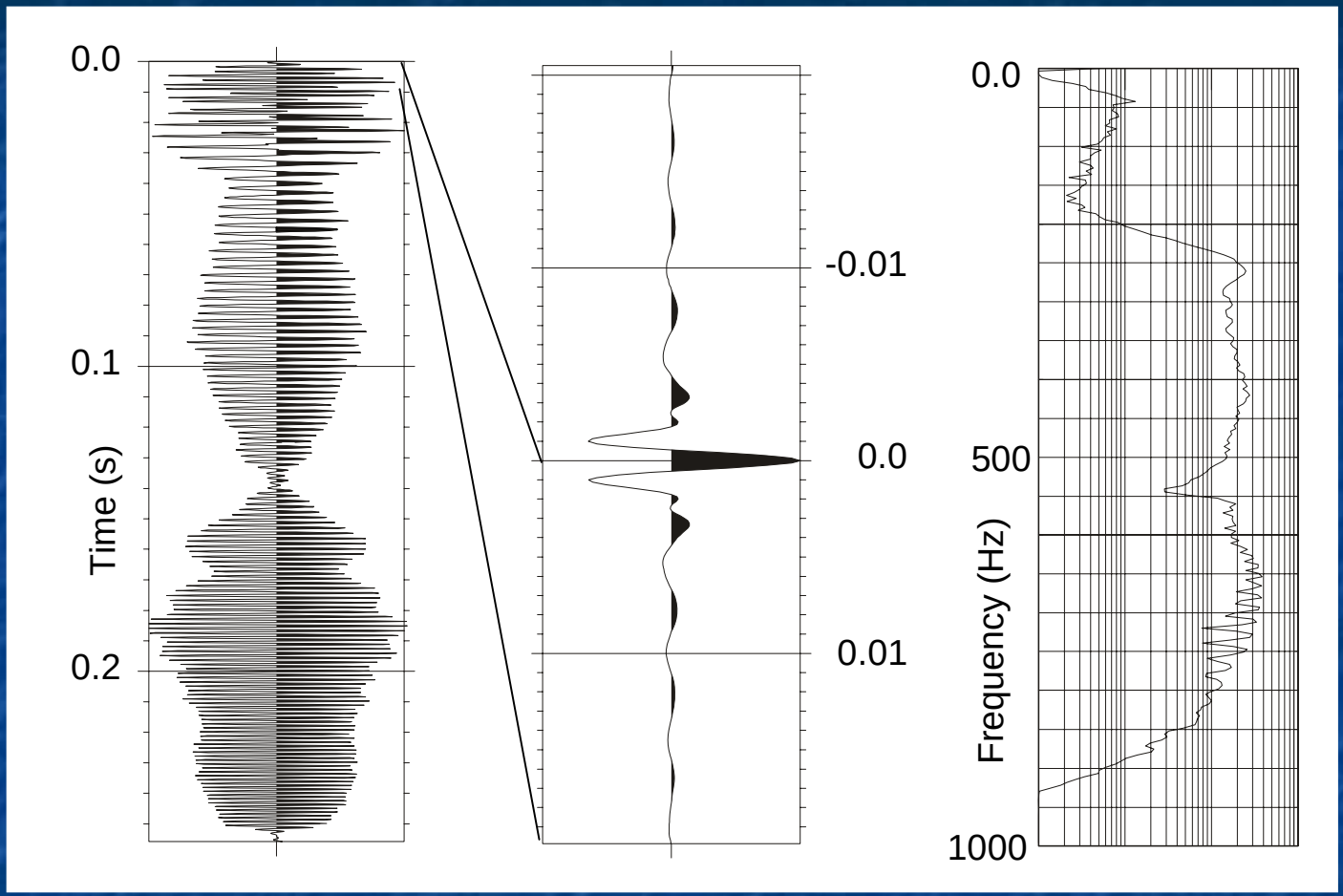
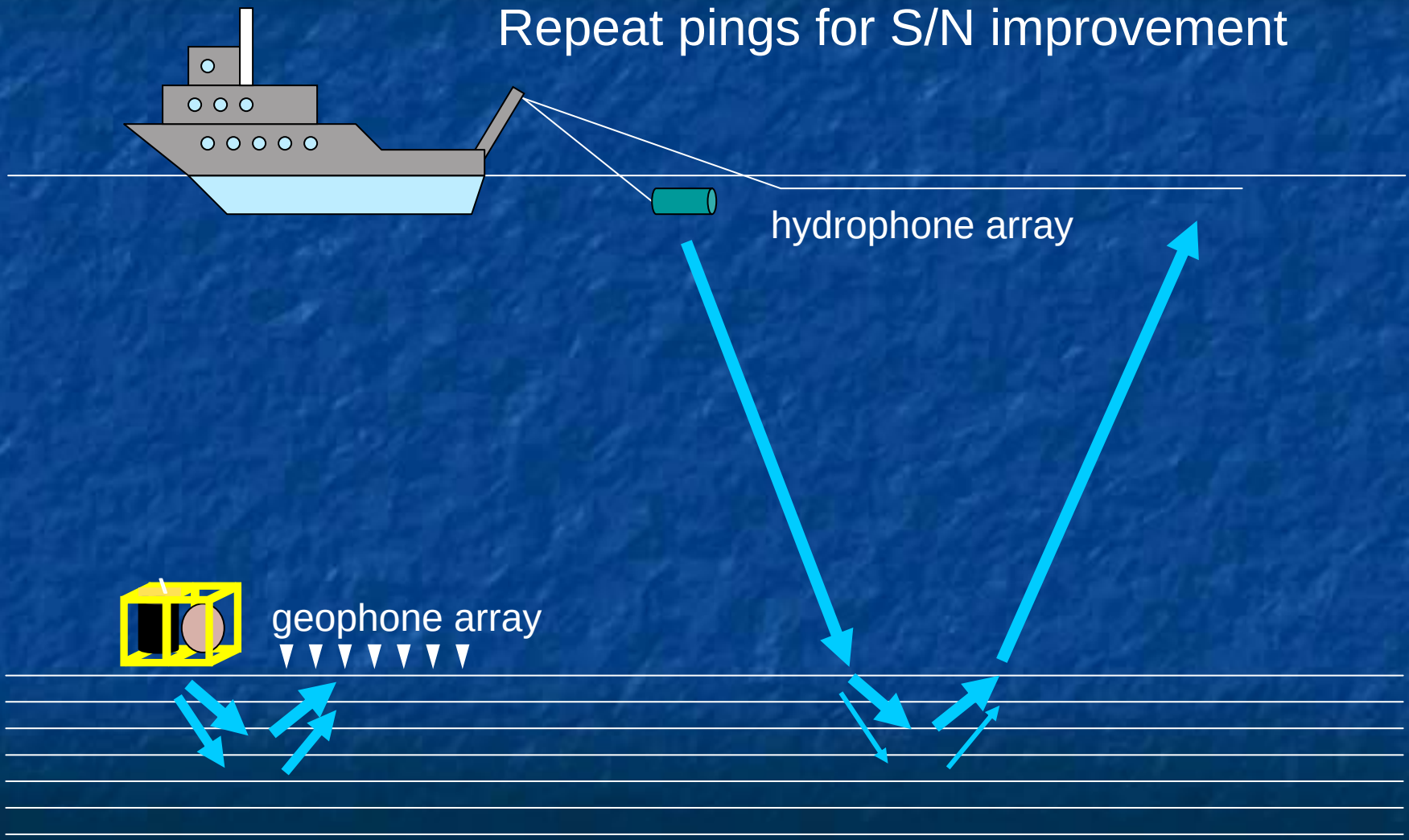


Sound pulse is spread out over 0.25s, and amplified mathematically after the fact, making it more cetacean friendly

Advantages of Bottom Mount

Far greater shear conversion
Repeat pings for S/N improvement

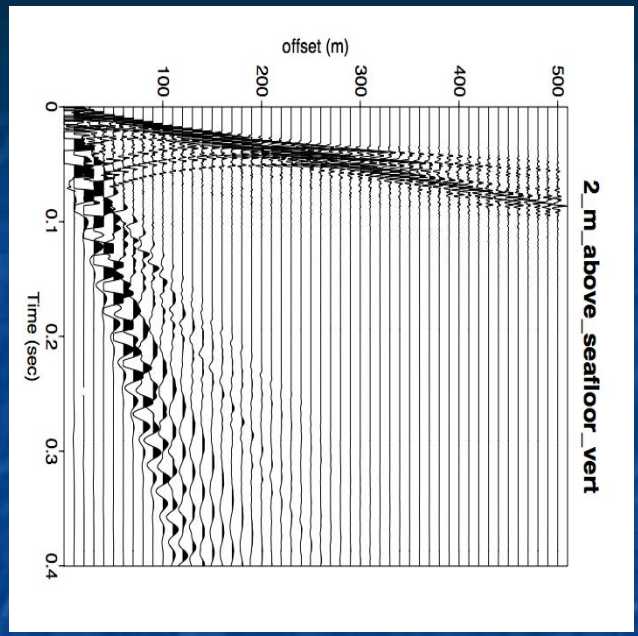


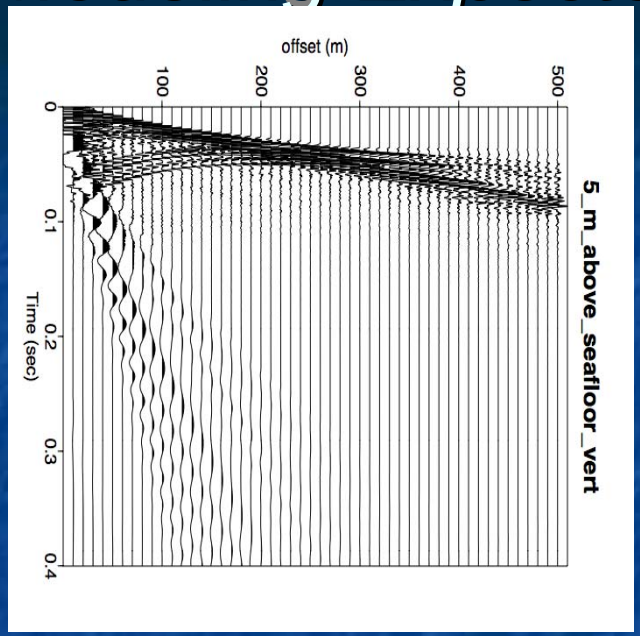
Modeling Expected Bottom Mount Response

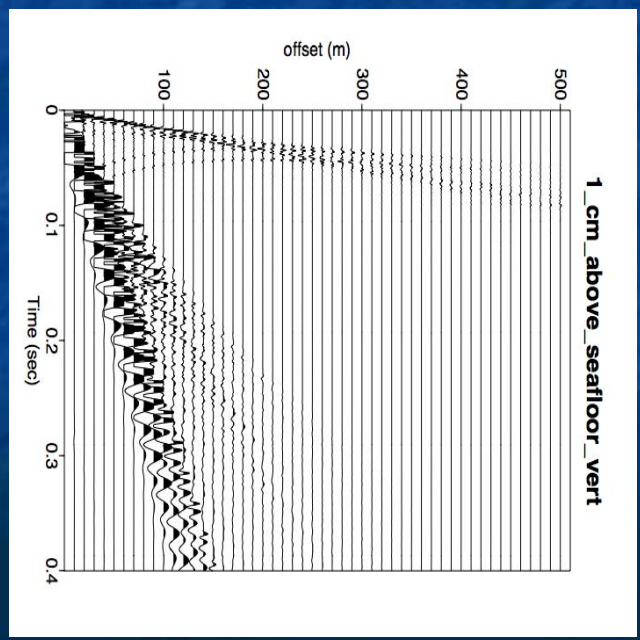
Vp	Qp	Vs	Qs	density	thickness
1550	100	400	50	1.2	0.01 m
1550	100	400	50	1.2	3 m
1600	150	600	100	1.3	10 m
1700	200	700	100	1.3	20 m
1800	300	800	100	1.3	20 m
2000	400	900	200	1.4	99999

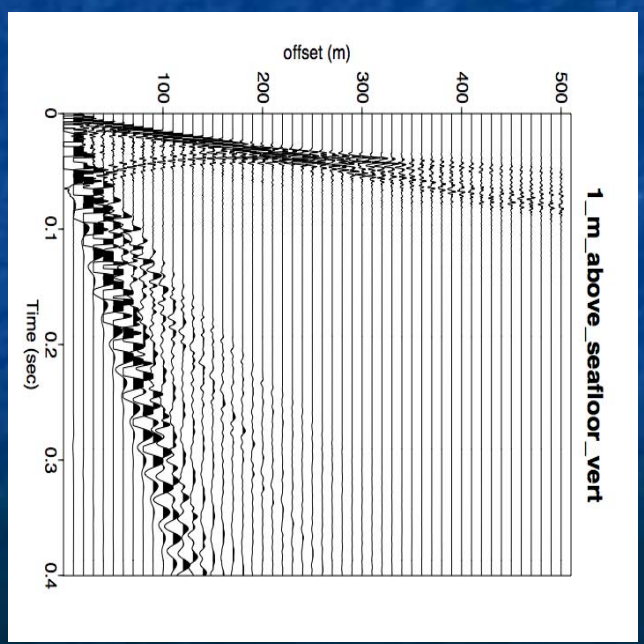
Modeling by D. Lindwall

Modeling Expected Bottom Mount Response









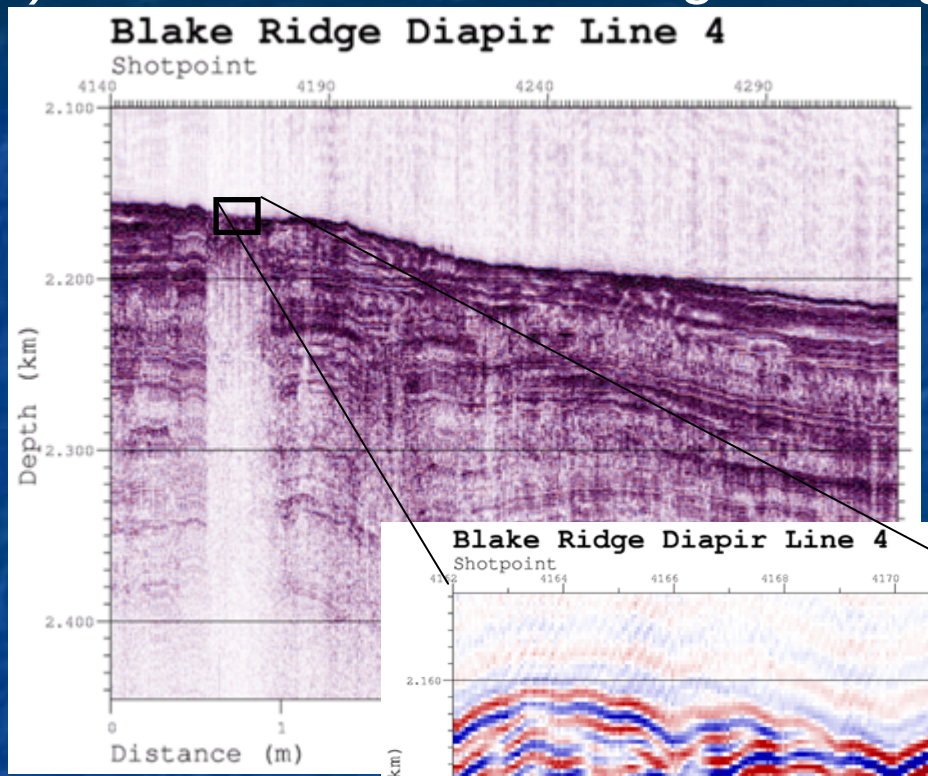
How?

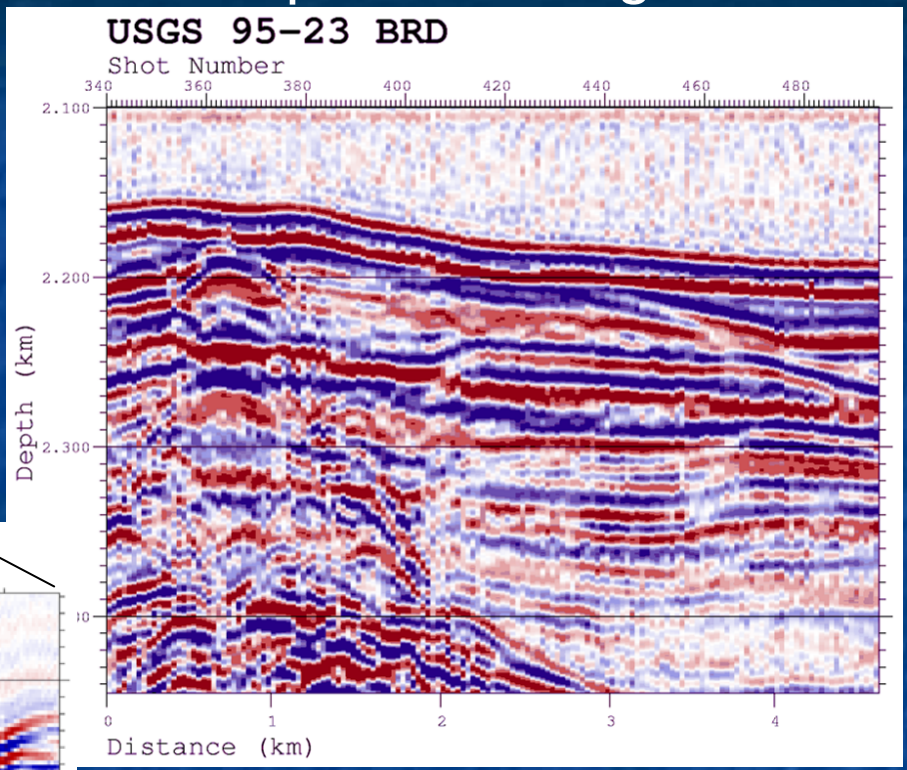
Q: How will a deep, bottom mounted source help us understand gas hydrates?

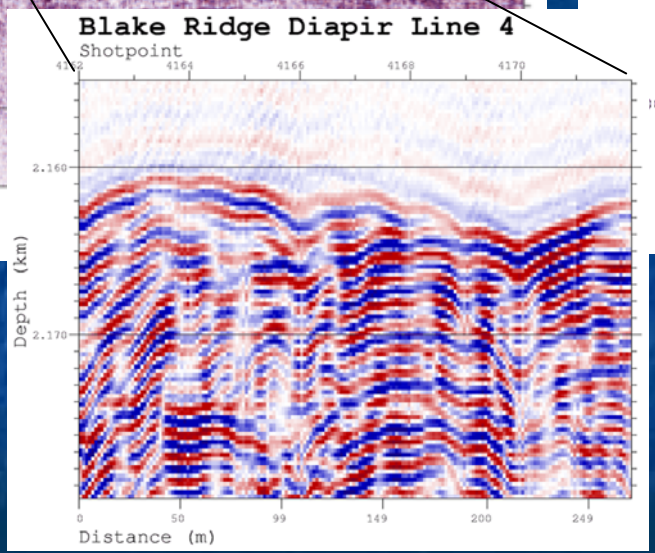
A: By measuring a fundamentally different sediment quantity (shear) along with better quality traditional measurements (compressional).

How will this help?

1) Shear waves can image through, and help delineate gas





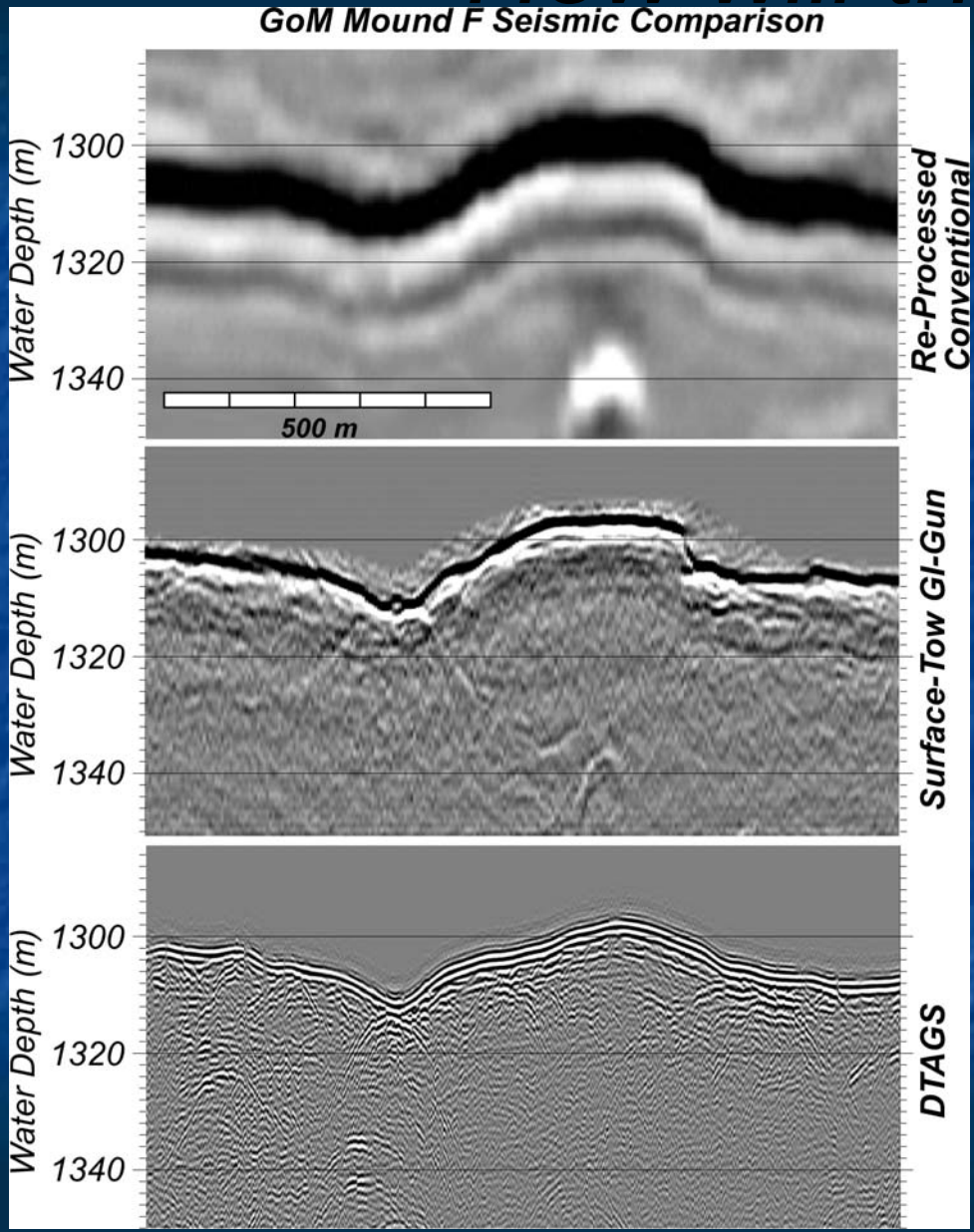


The Blake Ridge Diapir is underlain by gas, manifesting as a low pass filter in the surface tow, and as a wipe-out in the DTAGS. With shear waves high high resolution image could be made through the wipe out.

How will this help?

2) Shear waves provide greater resolution
3) Bottom sources need not be as strong

How will this help?



4) DTAGS frequencies fill a scale gap

A bathymetric mound in the deep Gulf of Mexico was surveyed with oil industry standard seismic (top), a high resolution airgun (center) and DTAGS (bottom). DTAGS data show different aspects of the section, and overall exhibit about one order of magnitude higher vertical and lateral resolution than the industry data.

Thanks!

Seismologist dines on whale in Norway; contemplates irony