

**SEISMIC IMAGING ON BEHALF OF THE
GULF OF MEXICO GAS HYDRATE CONSORTIUM**

SEPTEMBER, 2003

Prepared by
The Center for Marine Resources and Environmental Technology
of
The University of Mississippi

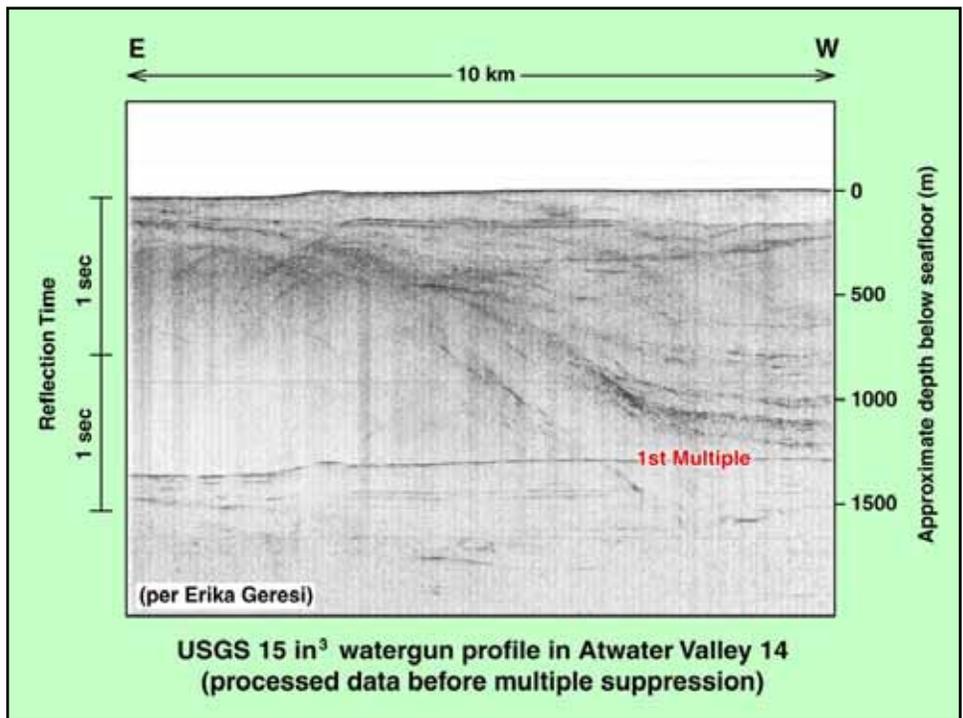
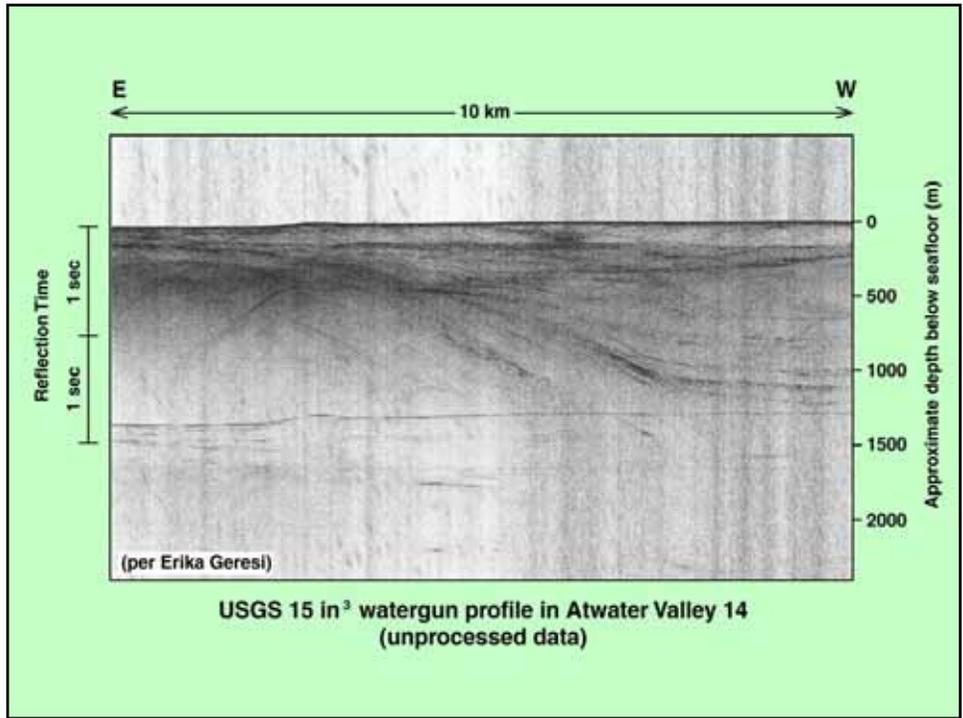
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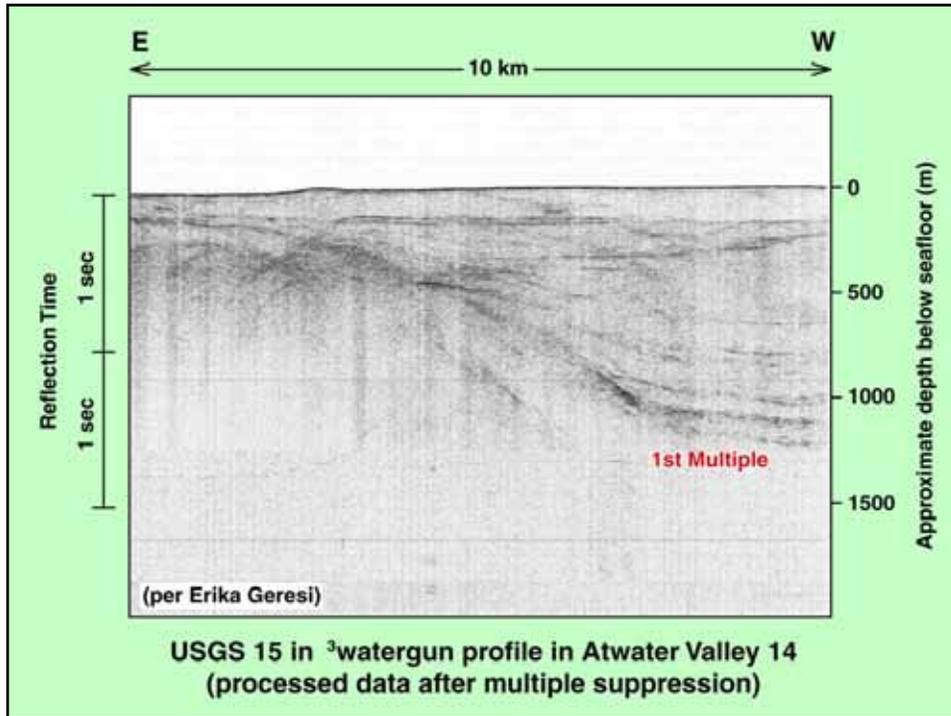


**Digital processing to suppress
surface-related multiple reflections
has been applied to seismic data recorded
by the USGS in support of the JIP.**

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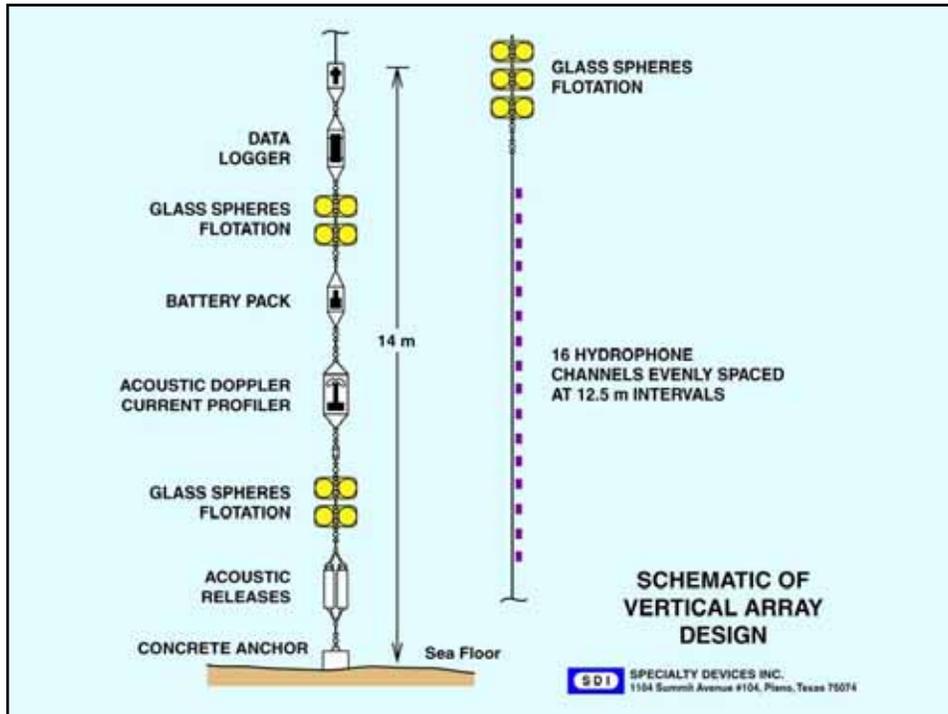




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A prototype vertical line array (VLA)
for recording multi-channel, variable-offset
seismic data in the water column
has been constructed and field tested.

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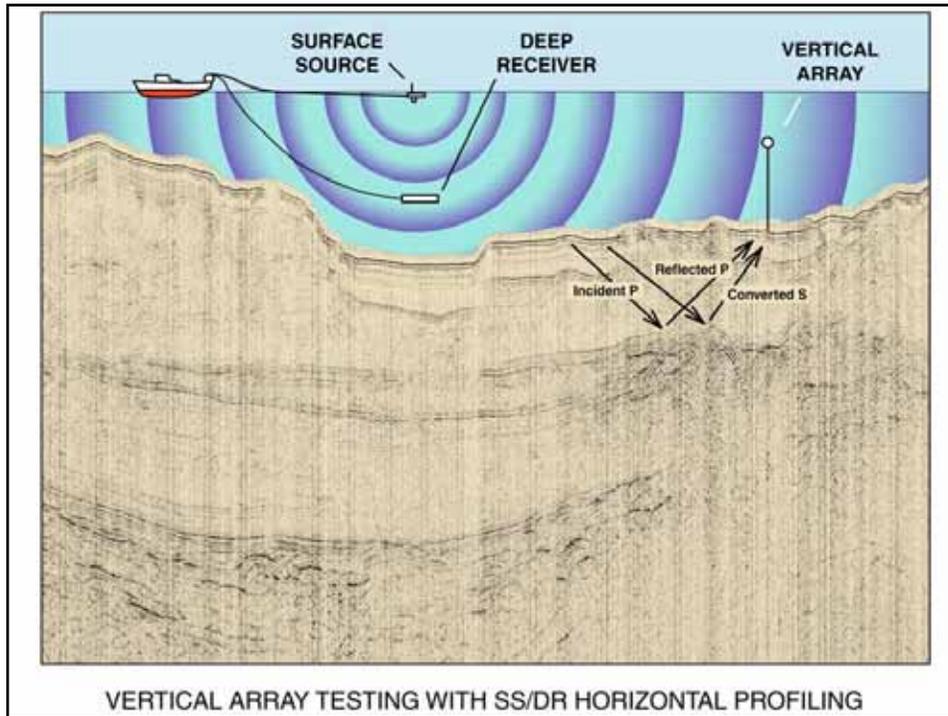


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The VLA was deployed in 830 meters of water where previous heat-flow measurements had indicated the base of the hydrate stability zone (BHSZ) to be about 400 meters below the sea floor.

A deep-towed hydrophone was also deployed to provide surface-source/deep-receiver (SS/DR) profiles simultaneously with the VLA recordings.

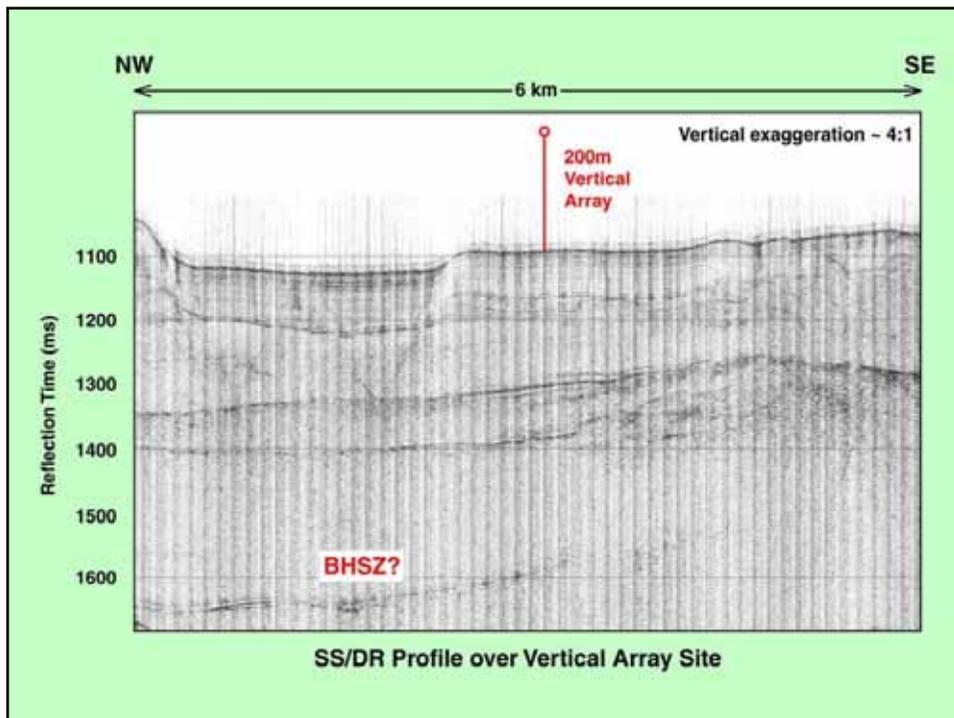
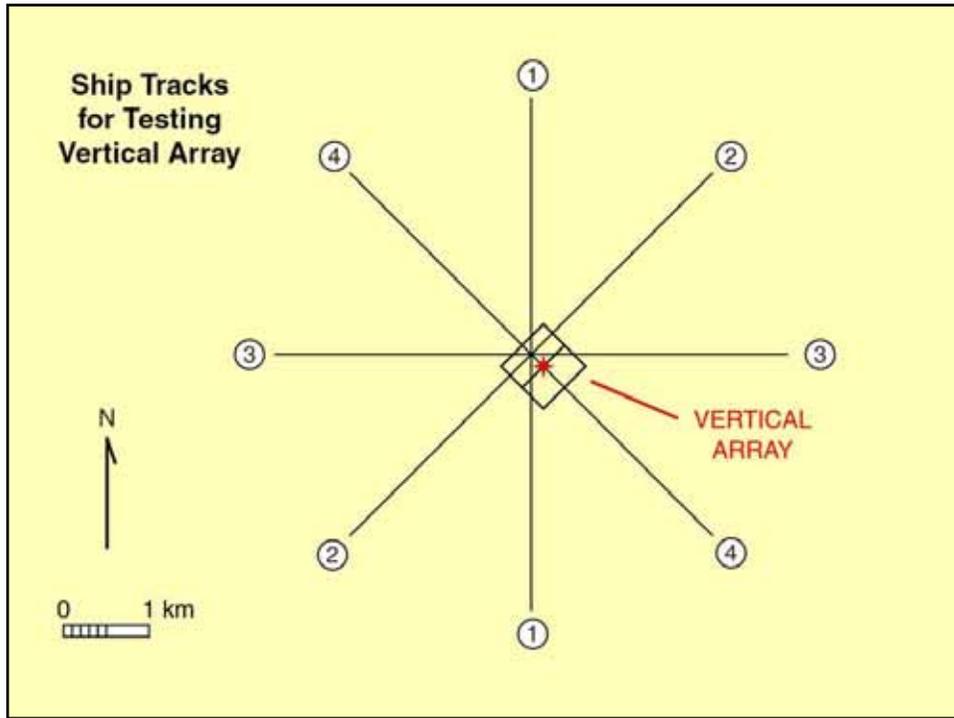
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A pattern of test tracks was run using
both an 80 in³ watergun and ship noise
as acoustic sources.

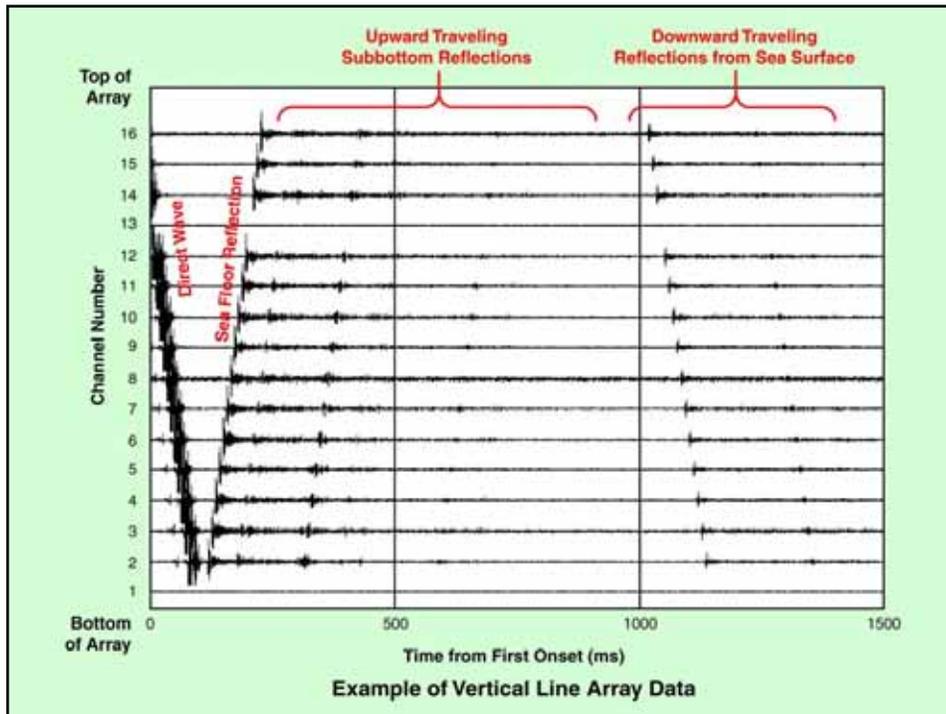
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The next illustration shows a single shot of VLA data.

Waves reflected from the sea floor and sub-bottom interfaces travel upward across the VLA channels.

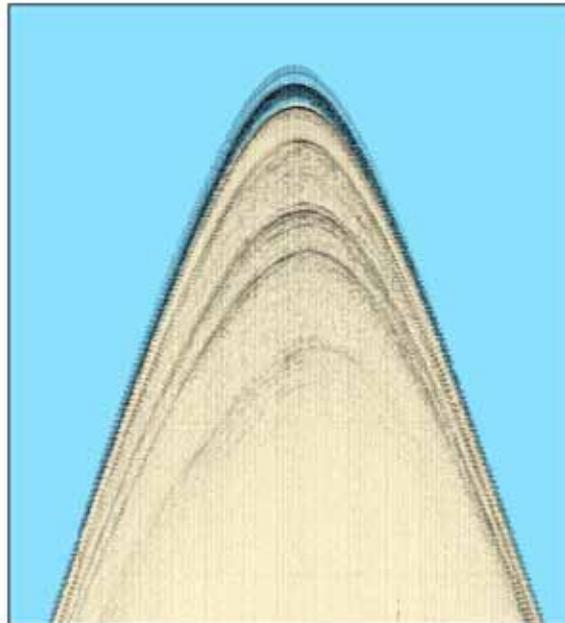
The direct wave and reflections from the sea surface travel downward across the VLA channels.



The next illustration shows one channel
of an entire VLA profile.

The towed seismic source passes directly over
the site of the VLA at the apex of the hyperbola.

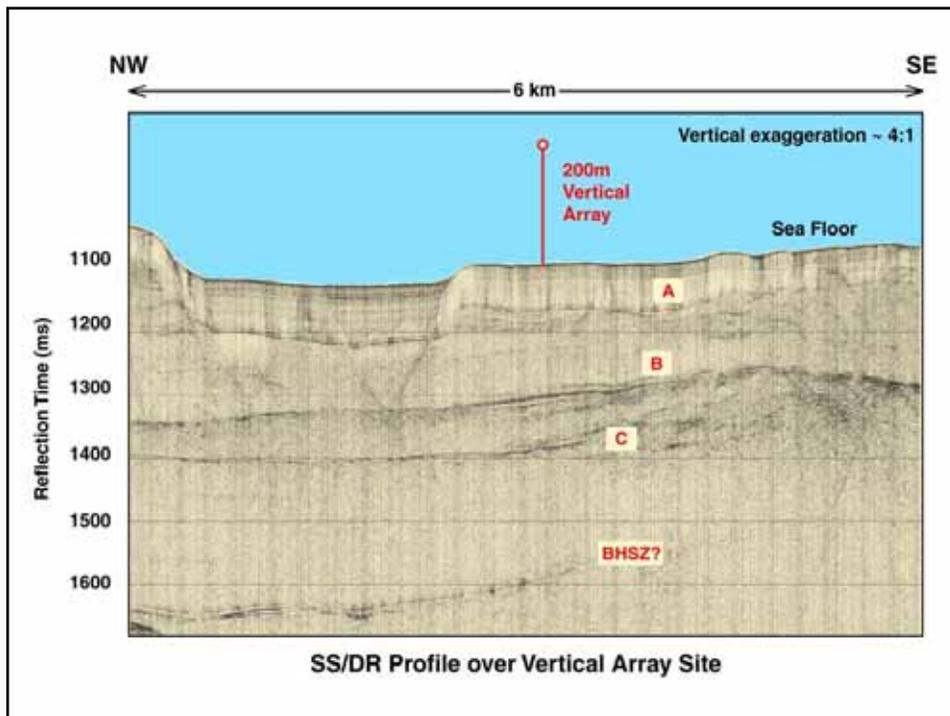
Waves reflected from the sea floor and
sub-bottom interfaces form hyperbolae at
successively longer travel times.



Vertical Array Data (Channel 2)

The next illustration shows the SS/DR profile recorded simultaneously with the preceding VLA profile.

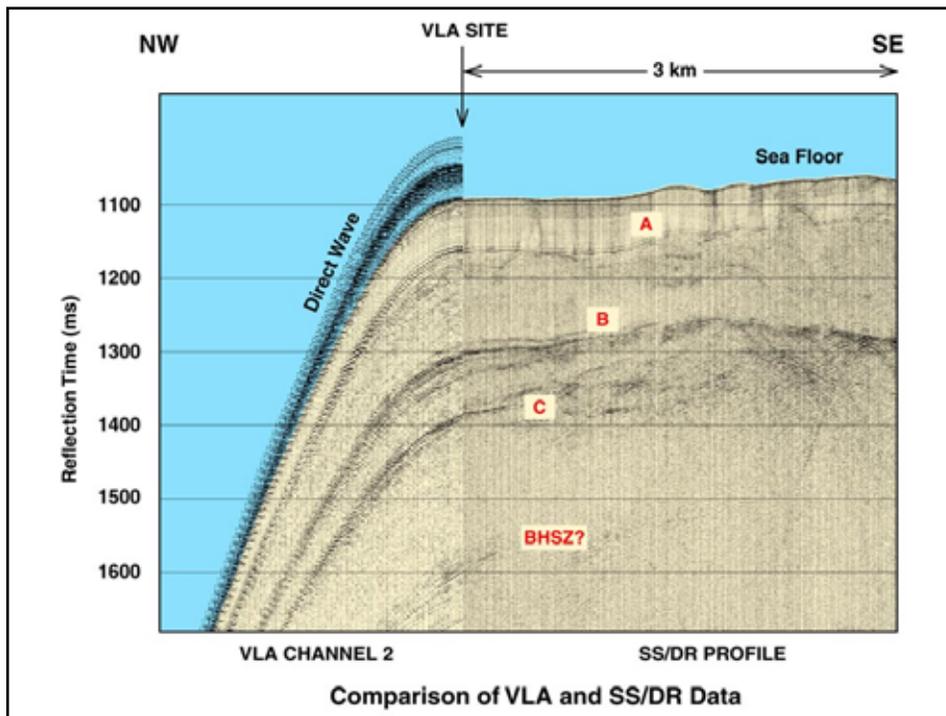
Prominent sub-bottom reflections are identified.



The information contained in the VLA profile is directly comparable to that in the SS/DR profile only where the seismic source passes over the VLA site.

The next illustration shows such a comparison.

The two can be seen to exhibit the same reflections.



Travel time versus horizontal offset on the VLA profile is useful for estimating speeds of propagation and converting seismic reflections from travel time to depth.

Also, VLA data can be used to generate 3-D models of sub-bottom structure and to estimate physical parameters within the sediments.



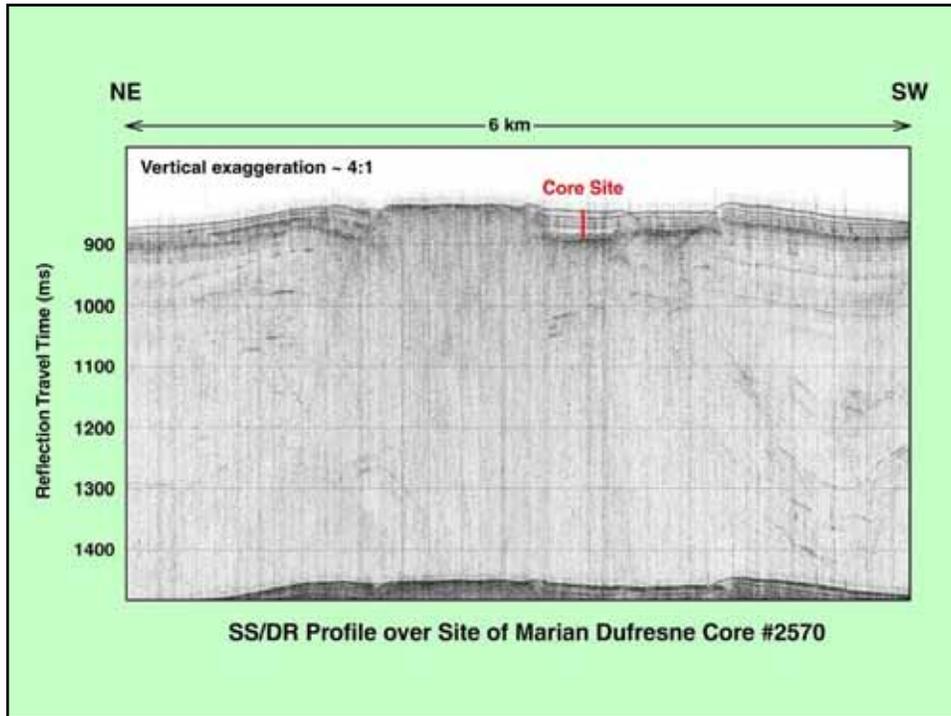
SS/DR profiles were also recorded over the site of a core collected during the July, 2002, cruise of the RV “Marion Dufresne” organized by the U.S.G.S.

One such profile is shown in the next illustration.

Few deep reflections are seen because geologic structure in the vicinity is dominated by deep-seated, nearly vertical, fluid-expulsion features.

Strong reflections near the bottom of the illustration are “ghost” reflections from the sea surface.





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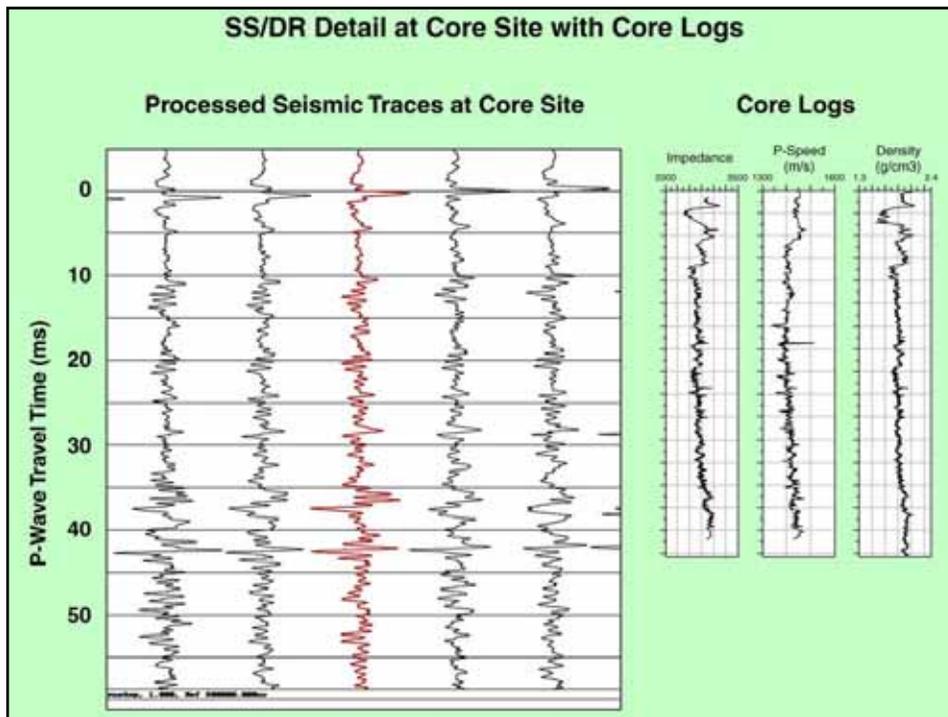
**The 28-meter core was logged onboard
before being split.**

**The split core is stored at Texas A&M University
and has been sub-sampled for further analysis
by consortium members.**

**The shallow portion of seismic traces at the core site
are compared with onboard core logs
in the following illustration.**

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The slide has a light blue background with a dark blue border. The text is in a bold, dark blue font. The logo for the Center for Marine Resources and Environmental Technology (CMRET) is at the top left. The University of Mississippi logo is at the bottom right.



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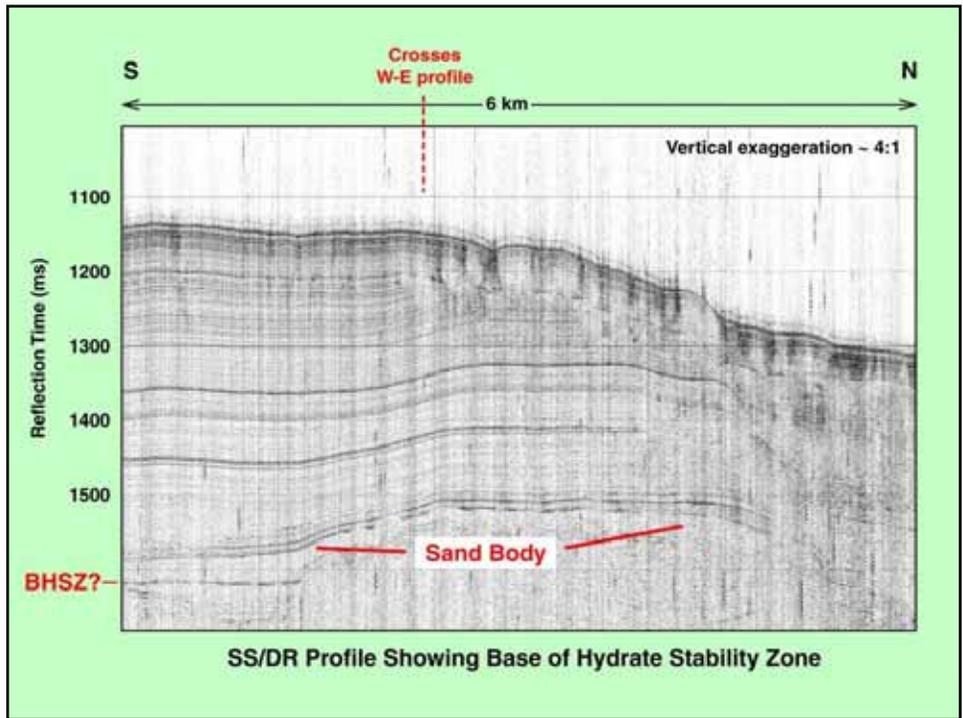
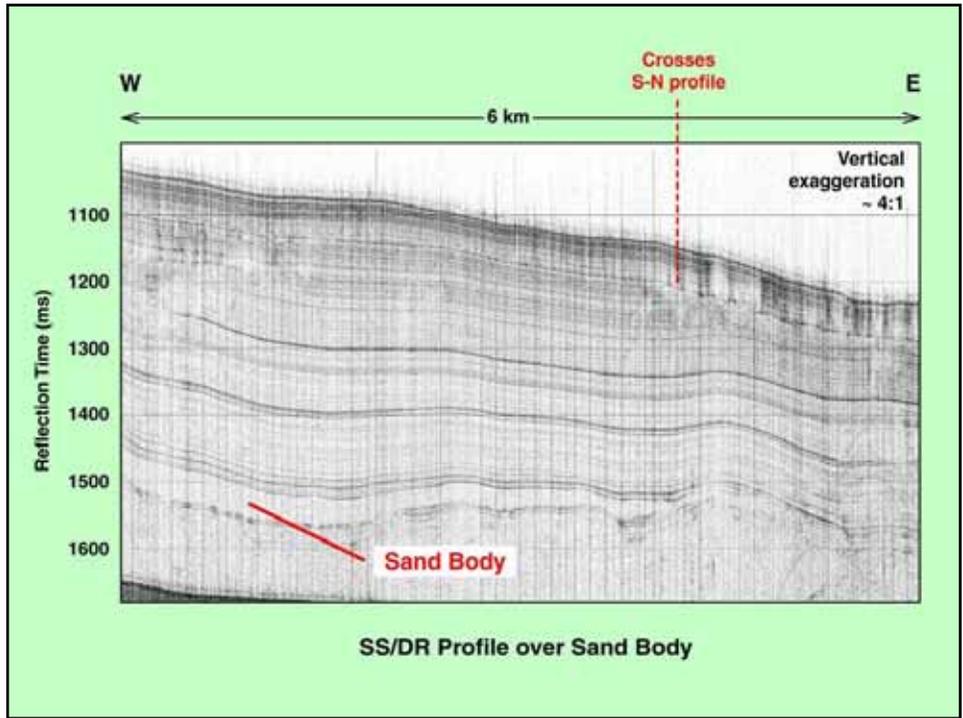
Two SS/DR profiles were recorded over a site where a sand body appears to lie both within and below the hydrate stability zone.

These are shown in the next two illustrations, the sand body being clearly visible on both.

A flat-lying reflection is seen to cross the sand body in the lower left-hand portion of the second illustration.

On close inspection it is seen to be negative, hence it may represent the BHSZ.

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**A seismic cruise scheduled for mid-October, 2003,
will collect VLA and SS/DR data to be used to develop
software for use with the operational sea-floor station.**

**The development will be done by
the University of Victoria in B.C., Canada,
and the University of South Carolina in Columbia, SC.**

**During that cruise, the VLA will be deployed in
Atwater Valley 14 to help characterize the JIP drill site.**

