

SEISMIC PROPERTIES OF SHALLOW-WATER SEDIMENTS: A COMPONENT OF THE STRATAFORM PROGRAM

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LONG-TERM GOAL

The long-term scientific objective is to enhance our knowledge of the ocean environment (in this case the littoral seafloor) and the processes which govern it.

SCIENTIFIC OBJECTIVES

The project objectives are to aid in the understanding of the formation of stratigraphy on margins. This particular part of this effort is focussed on the measurement of seafloor shear velocities off Humboldt Bay, the west coast STRATAFORM site. Shear wave velocity is the most variable of the seismic parameters and has the most potential as a "remote-sensing" diagnostic tool.

APPROACH

The approach used is to fire a few small (1/2 lb) seafloor shots and measure the dispersion of seafloor interface (Scholte waves) and then to invert the dispersed waveform to obtain seafloor structure.

WORK COMPLETED

This grant supported field work to collect Scholte-wave data in the Strataform study area. We report here on seafloor seismic observations made during August of 1996 off Humboldt Bay, Northern California, in the 50m-200m water depth range. Scholte interface waves generated by four half-pound seafloor explosions were observed by ocean-bottom seismometers and hydrophones.

RESULTS

The data giving information about sediment shear velocities are in the 2-7 Hz frequency range. Initial examination of the group velocities reveals the following:

1. At 200 m water depth, on a bottom reported to be gassy mud, the group velocity centroid is about 100 m/s and is strongly dispersed. See panel (a) in accompanying figure.
2. At 50m water depth, on a "sandy" bottom, the group velocity is 200 m/s and the dispersion is slight. See panel (b) in accompanying figure.

These observations are consistent with rapid deposition in the shallow region and slower deposition (with accompanying compaction) in the muddy area.

The values in the sandy area are comparable to shear velocities observed off Southern California. The group velocities observed in the muddy area are slower than in the sandy area, but are several times faster than the velocities found in pelagic muds.

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The noise levels are fairly high because of the shallow depth and bumpy weather. Some impulsive noises recorded on the seismic sensors are correlated with lower-frequency pressure waves recorded on hydrophones.

Three OBSs were equipped with geochemical fluxmeters (Brown and others 1996) and these generally showed fluid outflow.

IMPACT/APPLICATION

Shear velocity has some potential to be an indicator of shear strength, which is probably related to resistance to mechanical slumping.

TRANSITIONS

The shear velocity of clathrate-containing sediment should be higher than that of non-frozen sediments. Presence of bubbles should lower the compressional velocity markedly, but not change the shear velocity nearly as much.

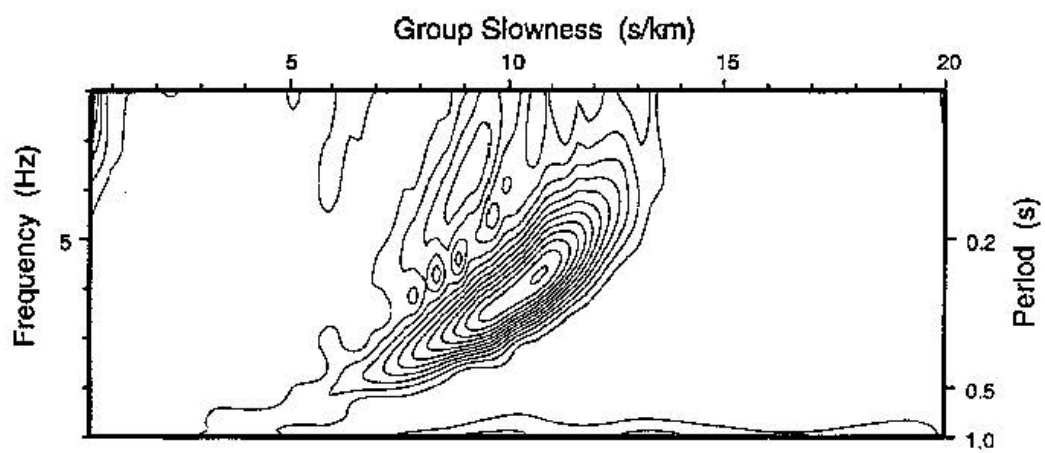
RELATED PROJECTS

Some similar work measuring Scholte wave velocities using interface waves has been carried out off Southern California. See WWW reference below.

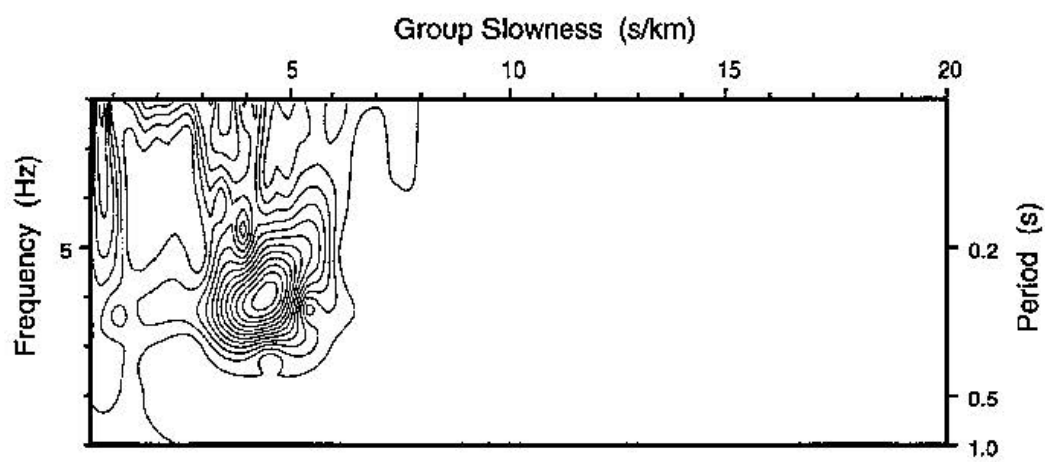
REFERENCES

There is related shallow-water work at <http://www-mpl/obs/reports/abm>.

- Dorman, L. M., Sauter, A.W., Bradley, C.R., Wiggins, S., Kanjorski, N., Avera, W., and Bibee, L. D., Seafloor Shear Velocities off Humboldt Bay, EOS, Transactions AGU, 97, 1996.
- Brown, K. M., Sauter, A.W., and Dorman, L. M., A new fluid and geochemical flux meter for surface measurements in convergent margin and ridge flank environments, Geophys. Res. Letts., in revision, 14, 1996.



a) from "gassy sediment" site



b) from "sandy" site