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M. W. Asten. Array estimators and the use of
microseisms for reconnaissance of sedimentary
basins

A 'natural field' seismic technique is possible to attain by
observing microseisms with a suitably designed array and by
digitally processing the data to obtain estimates of the phase
velocities of Rayleigh waves. Wavelengths of interest in
detecting depth to the basement of sedimentary basins are in
the range 2 to 20 km, and correspond to wave periods from 1
to 7 s. An array of five or seven seismometers deployed as an
expanding cross configuration simplifies field procedures and
is adequate for phase velocity measurements of Rayleigh
waves in the required wavelength range, provided high-
resolution frequency-wavenumber spectral analysis is used.
This analysis can be implemented on a minicomputer in the
field. Results obtained from observation in a sedimentary
basin of known structure show predominantly fundamental-
mode Rayleigh wave propagation. The scatter of velocity
estimates is small enough to allow inversion by curve match-
ing, and depth to the basement can be computed to an
accuracy of ±30 per cent without requiring restrictive
assumptions of a seismic velocity structure.

D. E. Biswell, L. F. Konty and A. L. Llaw. A
gphone subarray beam-steering process

The outputs of geophone array elements are conventionally
summed into a single output trace. This summation attenuates
incoherent noise, horizontally propagating surface waves, and
obliquely incident events. The geophone subarray beam-
steering process is a plane-wave stacking technique which
removes the differential moveout and improves the resolution
of seismic data by directing the subarray peak gain to the inci-
dent angle of the seismic wavefront. The plane-wave stacking
process transforms the data from the offset domain to the ray
parameter (p) domain, and restricts the range of p as a func-
tion of time. Studies of synthetic and marine field data show
that the beam-steering process improves the signal-to-noise
ratio of obliquely incident events as compared to conventional
subarray summing operations. The beam-steering process,
compressing high-density data while preserving the high-
frequency content of the seismic signal, is a cost-effective
technique to process large quantities of closely spaced
seismic data for stratigraphic exploration.

R. Wilkens, G. Simmons and L. Caruso. The ratio
V_p/V_s as a discriminant of composition for siliceous
limestones

The ratio of the velocity of compressional waves, V_p, to the
velocity of shear waves, V_s, is an important parameter for in-
terpreting geophysical field data. Recent studies have em-
phasized the role played by pore geometry in controlling V_p/V_s
in homogeneous rocks. We measured the carbonate content
of a set of siliceous limestones of varying proportions of car-
bonate and silica and observed the pore structures of these
samples using a scanning electron microscope. The range of
V_p/V_s of individual samples during increasing confining
pressure is consistent with crack-closure theory. However,
the value of V_p/V_s within the sample set as a whole is
dominated by its carbonate content. Variations in V_p/V_s due
to total porosity and pore geometry are around 0.1, whereas
the change due to composition is 0.4. Values of pore aspect
ratios gained from comparison of the velocity-porosity-
composition data with theory are in good agreement with the
electron microscope observations.

R. L. Kirlin, L. A. Dewey and J. N. Bradley. Opti-
mum seismic velocity estimators

Six 'optimum' estimators for the root-mean-square (rms)
seismic velocity are given and analyzed by simulation for rms
error. Two of the estimators are used to test use of a priori
velocity information in a Kalman-type improvement on the time
measurements. Parameters varied include centre-point depth
(time), a priori velocity variance, and interdelay-estimate cor-
correlation. The maximum likelihood estimator is shown to be best
when a priori information is relatively good, but a least-mean-
square estimator is equally good otherwise.

W. S. Harlan, J. F. Claerbout and F. Rocca.
Signal/noise separation and velocity estimation

A signal/noise separation must recognize the lateral
coherence of geologic events and their statistical predictability
before extracting those components most useful for a par-
ticular process, such as velocity analysis. Events with
recognizable coherence we call signal; the rest we term
noise. Let us define 'focusing' as increasing the statistical in-
deherence of samples with some invertible, linear transform
L. By the central limit theorem, focused signal must become