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# Abstracts of Papers Appearing in *Geophysics*, Volume 49, Number 11, November 1984

**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 matching, 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. Liaw.** *A geophone 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 incident 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 function 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 interpreting geophysical field data. Recent studies have emphasized the role played by pore geometry in controlling $V_P/V_S$ in homegeneous rocks. We measured the carbonate content of a set of siliceous limestones of varying proportions of carbonate 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.** *Optimum 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 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 particular 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 independence of samples with some invertible, linear transform $L$. By the central limit theorem, focused signal must become