investigate the structure of the continental shelf off northwest Britain. A long-range (69 km) expanding spread profile reveals that the crystalline basement off northern Scotland is covered by sedimentary sections up to 2.5 km thick, and is divisible into two seismic units with velocities of 6.1 km/s and 6.6 km/s. Prominent supercritical Moho reflections indicate a crustal thickness of 26.7 km. Strong sedimentary and basement refractions, together with oblique reflections from the vicinity of the Moho, have been profiled at a constant air gun–receiver offset of 10 km across a sedimentary basin west of the Orkney Islands. On the Outer Hebridean shelf to the west of mainland Scotland, the metamorphic basement lies within 250 m of the sea floor, *P*- to *S*-wave conversion occurs at the basement surface; V_p/V_S gives a Poisson's ratio of 0.27–0.31 at depths of 300–1000 m. Marked changes in mode conversion efficiency are observed on constant offset profiles and are attributed to variations in the velocity structure of an uppermost low-velocity (4.9 km/s) layer of weathered basement. The deeper crustal velocity appears uniform with depth, although there is some evidence of significant lateral velocity changes (6.28–6.61 km/s). In contrast to the shelf north of Scotland, reflections from within the basement and from near the base of the crust are recorded only sporadically on constant offset profiles. A strong event at 10.4 s two-way reflection time appears to have arisen from a seismic discontinuity within the upper mantle. The difference in seismic character of the basement on the two-ship profiles suggests significant variations in crustal structure within the Caledonian foreland of northern Britain.

E. Rafavich, C. H. St. C. Kendall and T. P. Todd. *The relationship between acoustic properties and the petrographic character of carbonate rocks*

Laboratory studies of the detailed relationships between acoustic properties and the petrographic character of brine- and air-saturated carbonate rocks with a wide range of facies, porosities, lithologies, and rock fabrics indicate that porosity is the major factor influencing both *P*- and *S*-wave impedance and velocity. Primary lithology and secondary mineralogy have only a small influence on impedance and velocity. Combined use of *P*- and *S*-wave velocity data discriminates porosity changes from lithologic changes. All other variables, including pore-fluid type and petrographic fabric, have no significant influence on velocities. Laboratory measurements of *P*-wave velocity under simulated in-situ conditions reproduce well-log velocity values reliably. Laboratory porosity-velocity trends agree with the time-average equation when the correct matrix velocities are used. Rock property results were used to interpret porosity/lithology variations for an inverted seismic section from the Williston basin. Where well control was available, the porosity/lithology interpretation was found to be in agreement with the subsurface control.

W. J. Ostrander. *Plane-wave reflection coefficients for gas sands at nonnormal angles of incidence*

The *P*-wave reflection coefficient at an interface separating two media is known to vary with angle of incidence. The manner in which it varies is strongly affected by the relative values of Poisson's ratio in the two media. For moderate angles of incidence, the relative change in reflection coefficient is particularly significant when Poisson's ratio differs greatly between the two media. Theory and laboratory measurements indicate that high-porosity gas sands tend to exhibit abnormally low Poisson's ratios. Embedding these low-velocity gas sands into sediments having 'normal' Poisson's ratios should result in an increase in reflected *P*-wave energy with angle of incidence. This phenomenon has been observed on conventional seismic data recorded over known gas sands.

G. R. Sutton. *The effect of velocity variations on the beamwidth of a seismic wave*

The effect of depth and lateral velocity variations on the width of a seismic beam propagating through the earth is investigated. The model used is unusual and provides an interesting alternative insight to the conventional models appearing in the peophysical literature. Some basic calculations show that, at frequencies and depths of interest in oil exploration, a significant lateral shift in the centre of the seismic beam occurs in addition to the expected broadening of the seismic beam.

D. W. Oldenburg, S. Levy and K. Stinson. *Root-mean-square velocities and recovery of the acoustic impedance*

The loss of low-frequency information in reflection seismograms causes serious difficulties when attempting to generate a full-band impedance profile. Information about the low-frequency velocity structure is available from r.m.s. (stacking velocities). We show how r.m.s. velocities can be inverted with additional point velocity constraints (if they are available) to construct either smooth or blocky velocity structures. Backus–Gilbert averages of the constructed velocity are then autoregressive solutions for recovering a full band reflectivity from band-limited seismograms. Our final result is therefore a full-band acoustic impedance which is consistent with the seismic data section, stacking velocities, and available point constraints.

O. Yilmaz and R. Chambers. *Migration velocity analysis by wave-field extrapolation*

Velocity information is essential to both common midpoint (CMP) stacking and migration. CMP stacking provides the basis for conventional velocity estimation techniques in that, for a number of trial velocities, the stack response of a CMP gather is computed and displayed in the form of a velocity table. An alternative approach to velocity estimation makes use of the basic ingredients of migration—downward extrapolation and imaging of seismic wave fields. The procedure involves migration of a CMP gather with a number of trial velocities and collection of the zero-offset information, again in the form of a velocity table. Operating on a CMP gather, the migration-based approach produces results similar to those of the conventional method. Analyses of synthetic CMP gathers using both methods show essentially equivalent treatments of seismic signal, and similar dependence of accuracy and resolving power on recording geometry. We have extended the migration-based approach to include more