...f us in states presently considering registration. ...we should examine other courses of action. ...reasonable simple alternative to statutory regis... by individual states is a direct two-step plan: ...up certification by a national group embracing ...scientists. 2) Secure recognition of this certifica... ...the secretary of state of each state and foreign ... One professional geoscience organization, one ...fee, world-wide recognition, world-wide prac...

...*leum in the Marine Environment*

...AN M. HUNT

...will continue to be dependent on fossil fuels for ...ercent of our energy requirements through the ...2000. This means there must be substantial in... ...e in domestic production and the importation of ...leum. The continental margin offers the best ... of additional major domestic reserves.

...troleum is a complex mixture of hydrocarbons, ... of which are harmless and others quite toxic to ...e organisms. Major oil spills have a residence ... of only a few weeks at the surface, but once oil ... the sediments it can persist for years. The ...ity and types of benthic organisms along a coast ...de an accurate measure of the level of pollution. ...onically polluted areas, the edible shellfish all ...oil incorporated in their body tissues.

... tankers are the major source of pollution in the ...e environment. In order to meet our energy re...ments, and also minimize pollution of our coast... it is preferable to have controlled offshore dril... rather than the relatively uncontrolled increase in ...kers along our coasts. Also, government regula... should be altered to favor the production and ...tation of gas, which is the cleanest fossil fuel ...the least damaging to the marine environment.

...*ctions on Refraction Records in Hammer Seismic ...eys*

...A. HUNTER AND GEORGE D. HOBSON

...flections from the overburden-bedrock interface ... been interpreted from hammer seismic refrac... records taken with the FS-3 seismograph. The ...ence of these events has been further substantiated ...nventional wiggle-trace records. In the areas stud... the bedrock reflection appears to be a prominent ... persistent later event where overburden is thick ...00 ft). Record analyses utilizing both reflected ...refracted events may result in greater reliability of ...pretations in shallow seismic prospecting.

...*ASPER Air Gun Refraction Technique for Deter...ng Detailed Oceanic Crustal Structure*

...NALD M. HUSSONG AND GEORGE H. SUTTON

...cent advances in the ASPER (air gun-sonobuoy-...ion-echo-recorder) seismic refraction exploration technique have made it a reliable tool for determining marine deep crustal structure. The method is not only inexpensive, but yields more detailed interpretations when compared to conventional, two-ship explosion seismic methods.

The procedure relies on the enhancement of low S/N refracted arrivals by simple phase-correlation techniques. This utilization of low-level signals has permitted the use of small air guns as sources for obtaining the velocity structure of the complete crust and uppermost mantle. Also, simple modifications of military sonobuoys have extended their useful radio range to over 80 km, well beyond the distance needed for P_n first arrivals in practically all oceanic regions.

The high data density available through the use of 10-sec firing rate airguns and the extensive use of enhanced second arrivals are responsible for the increased geologic sensitivity of the method. Representative data from various parts of the Pacific Ocean illustrate how the ASPER technique is supplementing other seismic data and altering our ideas of ocean crustal structure.

Resistivity Inversion

JOSEPH R. INMAN, JR. AND JISOO RYU

DC resistivity measurements are usually interpreted via comparison of the field data with the characteristic curves from a catalog of models. A machine inversion process without human interference can directly invert field data to structural parameters.

The generalized inverse technique, often referred to as the Backus-Gilbert inverse, is applied to Schlumberger resistivity sounding data. Since, in most cases, the problem will be overconstrained (i.e., the number of data points will be greater than the number of model parameters) the data will be fit in a least-squares sense. The relative effect of each parameter on the obtained model and the resultant fit of the model to the data can be determined by examining the information distribution of the data in resolving the model parameters. The ability with which these parameters can be resolved from the data can be analyzed. From this knowledge field procedures may be designed so as to yield data from which can be resolved the model parameters sought.

The technique developed will be applied to three basic types of data: noise-free, theoretically generated data, theoretically generated data with random noise added, and field data.

Seismic Noise In Geothermal Areas

H. M. IYER

Studies in New Zealand and the U.S. have shown the existence of seismic noise with characteristic frequencies in the 1–5 hz band and contourable amplitude anomalies in geothermal areas. Why sub-

surface reservoirs of hot water should generate seismic noise is not yet clearly understood, but if a definite correlation between geothermal systems and noise anomalies can be established, noise surveys may provide a valuable tool in the complex field of geothermal exploration. Unfortunately, noise anomalies in the 1–5 hz band can also have natural and cultural sources or be caused by refraction of seismic waves by topographical and geologic features.

The U.S. Geological Survey conducted seismic-noise measurements in two geothermal areas of California: The Geysers (120 km north of San Francisco) and the East Mesa region of the Imperial Valley (30 km east of El Centro). Portable seismic stations capable of recording for several days were used to study space and time variations of the noise field. Seismic arrays were used to measure the velocities and direction of travel of the seismic waves. The results indicate that noise generated by proximity to towns, heavy machinery, freeway traffic, airplanes, canals and water drops, agricultural pumps, and movements of trees and bushes in the wind, contribute to the noise field in a given area. However, carefully designed experiments and data analysis can give an idea of the amplitude variations and other properties of the "residual noise field" that is characteristic of a given region. This may make it easier to determine whether the noise is of geothermal origin or not.

Attenuation of Near-Surface Noise in Aeromagnetic Maps

S. Jain and R. R. Hartman

It often happens that the magnetic anomalies due to surface or near-surface features suppress the basement features in an aeromagnetic map. In this paper, some classical and spectral techniques of suppressing these undesired shallow anomalies are discussed.

The attenuation of shallow anomalies is a serious problem due to the sensitivity of the magnetic anomalies and their interpretation to the distortion inevitably introduced by any filtering. Thus, any operator (or filter) designed to enhance deep anomalies must also preserve their characteristics as faithfully as possible. Model studies tend to show that this is better achieved with data migrated to the pole. This is also intuitively obvious since the inclination and declination of the magnetic field are taken out of consideration in the interpretation of migrated maps.

The operators suggested by Saxov and Nygaard (1953), Strakhov (1964), and Naudy and Dreyer (1968) are discussed in terms of suppression of a shallow and distortion of deep anomalies. Linear filtering based on spectral analysis is also discussed. The techniques were applied to synthetic as well as real data. It appears that generally these techniques are fairly successful. However, the interpreter must cooperate closely for the selection of the best technique and optimum use in solution of the specific problem.

Streamer Tow Noise: Post Acceleration-Canceling Hydrophone Era

Roy C. Johnston and John T. Thomson

Acceleration-canceling hydrophone streamers have been used routinely for more than a year now. Their use has resulted in better data quality because greatly reduced streamer tow-noise levels. Acceleration-induced noise was the predominant component of tow noise in conventional (or nonacceleration-canceling) streamers. Results of recent experiments indicate that this is no longer generally true. For example, traces near the boat can still be (as before) limited by acceleration-induced noise throughout most of the seismic frequency range while traces further back in the streamer are usually *flow noise* limited in most of the seismic passband.

A reordering of tow-noise components is presented and discussed in light of these recent findings.

Random Noise from Seismic Sources

R. N. Jolly

We have been able to form a qualitative picture of how and where random noise is generated by comparing field experimental correlation functions with those from idealized near- and far-field theoretical models and with results from a three-dimensional seismic model. Our inferences have also been substantially aided by a study of the coherence of noise traces recorded by a single geophone from several separate sources as opposed to the coherence of those recorded by several single geophones from one source.

The following are some of the noise characteristics which may be inferred from measurements made in representative land areas: (1) random noise is derived from coherent waves of the PL-mode type propagating in relatively uniform layers below the LVL, (2) randomization or "scattering" of these waves as they leak upward to the surface occurs in nonuniform layers located only a small fraction of a wavelength from the measurement points, and (3) spatial correlation functions may vary greatly from area to area, but when normalized with respect to the parent PL mode, wavelengths tend to have the same shape.

An Analysis of the Decay Curve of Induced Polarization

Fu-Shyong Ju

Published measurements of decay curves of induced polarization are analyzed and found to be approximated by a linear combination of two exponential functions. The parameters of the exponential functions can be determined from the decay curves. A theoretical model has been constructed on the basis of de