

DISCUSSION

ATTENUATION OF SEISMIC WAVES IN SEDIMENTS

Chairman: E. V. KARUS, All-Union Institute for Geophysical Methods of Exploration (USSR)

Scientific Secretary: S. A. RAIKES, British Petroleum Development (Overseas) Ltd. (UK)

The problem of attenuation of seismic waves in sediments is of great theoretical and practical importance for further development of seismic prospecting. Much emphasis has been placed on the use of attenuation measurements in investigations of inhomogeneity and fracturing in real rocks, the checking of porosity, and direct searches for oil and gas. This great practical interest arises because attenuation is more sensitive than seismic velocities to changes in lithologic structure, the presence of gas and the state of strain in the rock.

The authors of SP 3, Drs. R. MEISSNER and F. THEILEN, presented a good review of the present state of this problem, including many experimental results of investigations in boreholes, in shallow marine sediments through seismic profiling using a variety of sources, and in the laboratory. Their most important practical conclusion is that the attenuation parameters for both *P*- and shear waves should be used together with velocity information in studying lithology, because variations in the ratios of the quality factors Q_P/Q_S as a function of the velocity ratio $(V_P/V_S)^2$ give a clear indication of lithological changes. Furthermore, they have demonstrated the importance of the frequency dependence of attenuation in distinguishing different rock types.

Dr. RAIKES (UK) raised the problem of determining attenuation at depths of interest in oil exploration (c. 2–3 km). In reply, Dr. MEISSNER said he believed this would be possible, but accurate measurements could only be obtained if the noise level were less than 10%, and even then the resolution would be limited to depth intervals of 5 to 10 wavelengths.

Answering questions put by specialists from Spain and Switzerland, Dr. MEISSNER stressed the need for broad-band investigations for both *P*- and shear waves, especially in zones where velocity dispersion is low (e.g. in sandstones).

Dr. KARUS asked about the interpretation of general equations describing the theory of absorption of seismic waves in real media. Dr. MEISSNER replied that his results supported the theory of Biot, and its extension to a standard linear solid, and confirm the importance of fluid flow as a mechanism for attenuation in saturated sands. However, he agreed that this did not apply to partially saturated rocks, and that there were also problems associated with the viscosity of the pore fluid. Further investigations are needed into the influence of the degree of saturation and sediment type on the mechanism of attenuation (fluid flow or electrochemical processes) and its dependence on frequency.

HOW GEOLOGICAL MATHEMATICAL MODELS CAN REDUCE EXPLORATION RISKS

Chairman: H. MODARRESSI GHAVAMI, National Iranian Oil Company (Iran)
Scientific Secretary: J. R. BLOOMER, British Petroleum Development (Overseas) Ltd
(UK)

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