
Acknowledgments

AAPG and AADE thank the following for their generous contributions to
Pressure Regimes in Sedimentary Basins and Their Prediction

BP America Inc.

Knowledge Systems, Inc.

Minerals Management Service

Unocal Corporation

Contributions are applied toward the production costs of publication, thus directly reducing the book's purchase price and making the volume available to a larger readership.

19

The Future of Pressure Prediction Using Geophysical Methods

Alan R. Huffman

Conoco Inc., Houston, Texas

ABSTRACT

The technology of pore-pressure prediction has advanced significantly in recent years. In the future, new methods for pore-pressure prediction will routinely use shear-wave data gathered using multi-component seismic technology. Overburden and fracture gradient will be predicted in three dimensions using gravity and magnetic inversion technology. Seismic inversion, both prestack and poststack, will provide refined estimates of the velocity field in the subsurface, and new seismic-processing methods will allow velocity anisotropy to be predicted accurately so that it can be used to predict both pore pressure and real triaxial stress fields in the earth. These new methods will be used to make advances in the prediction of pressures in nonclastic rocks and to extract information that can be used to accurately predict structural hyperpressuring in reservoirs to assist in drilling difficult wells. Pressure prediction will become a standard tool in basin-scale and prospect-scale evaluation of the hydrocarbon system and will be used to guide the exploration process. In the production environment, pore-pressure prediction will be used routinely to provide a three-dimensional model for the pressure regime in the subsurface that will be critical to effective reservoir simulation and reservoir management.

Despite all these advances, however, pore-pressure prediction will still be limited by the quality of seismic data acquisition and processing technology that is used to prepare the data and by the structural complexity of the subsurface that is to be imaged. Predictions will continue to be limited by the lack of predrill information about the state of compaction in the subsurface that is critical to a robust pressure prediction. Lastly, prediction accuracy will continue to be limited by the presence of secondary pressure in situations where velocity reversals are difficult to detect on seismic data.

INTRODUCTION

Predrill pressure prediction using geophysical data and methods has historically been done using very simple models and overly simplistic estimates of the Earth's velocity field. The methods commonly incorporate a locally calibrated set of curves for pressure that contained imbedded assumptions about the cause of pressure in the geologic section sampled by the control wells. The advent of the effective-stress concept and the pressure-

prediction and the pressure-prediction methods that developed from that concept led to a much needed inclusion of fundamental physics into the art of pressure prediction. The use of effective-stress methods has become the standard for pressure prediction with many variants including the Eaton method (Eaton, 1975), the Bowers method (Bowers, 1994), and the Sperry Sun method (Holbrook and Hauck, 1987), to name a few. The range of software available for pressure prediction has grown significantly in recent years, along with the sophistication of the parameters used. Still, weaknesses remain because of (1) the limitations of the seismic velocities themselves, (2) the lack of understanding of the basic causes of pressure, and (3) the effects of pressure

Huffman, Alan R., 2002, The Future of Pressure Prediction Using Geophysical Methods, in A. R. Huffman and G. L. Bowers, eds., Pressure regimes in sedimentary basins and their prediction: AAPG Memoir 76, p. 217-233.