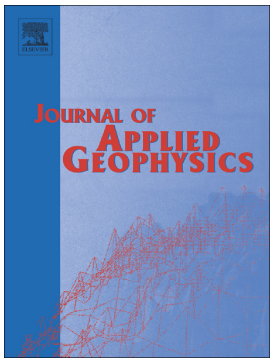

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Abnormal formation velocities and applications to pore pressure prediction

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Abstract

The pore pressure is a vital concept to the petroleum industry and cannot be ignored by either reservoir engineers or geoscientists. Based on theoretical analyses of effective stresses and the grain packing model, a new equation is proposed for predicting pore pressures from formation velocity data. The predictions agree well with both measured pressures and estimations using Eaton's empirical equation, but the application of the new equation to seismic data is simple and convenient. One application example shows that the identification of sweet spots is much easier using pore pressure data than with inverted seismic velocity data. In another application example using field seismic data, a distribution of overpressured strata is revealed, which is a crucial clue for petroleum generation and accumulation. Still, the accuracy of pore pressure prediction is hardly always guaranteed, mainly owing to the complexity of the real geology and the suitability of specific assumptions about the underlying rock physics.

Keywords: Pore pressure; Formation velocity; Sweet spot; Seismic inversion

1. Introduction

An artesian well or a blowout well is probably the most vivid evidence of high pore pressures. An abnormal pressure is ubiquitous in young pelitic sedimentary basins (Selley and Sonnenberg, 2015). For example, the Jurassic to Recent strata in the U.S. Gulf Coast region frequently exhibit overpressures (Chilingar et al., 2002). This phenomenon has a marked impact on petroleum exploration and exploitation from the