Azimuthal Frequency-Dependent AVO Inversion and its Application in Deep Carbonate Reservoirs in Tahe Oilfield of China

Xu Kai[1] and Xiao Pengfei[1]

[1]Sinopec Geophysical Research Institute

Abstract

In this paper, we discuss a case study of inversion using wide-azimuth data for fracture-cavity characterization of the deep carbonate reservoirs in Tahe Oilfield. The method is based on Chapman's Theory (2003), assuming that the rock is dispersive, also has the dispersion and azimuthal anisotropy properties. In short, dispersion properties are changing with the azimuth. The result of frequency-dependent AVO inversion shows a good correlation with the post-stack coherence properties, and the ellipse-fitted result of dispersion properties shows a good correlation with the well data. This method has been proved effectively and meaningfully in the carbonate fracture-cavity reservoir prediction. Our theoretical foundation is based on" P-wave attenuation and dispersion which vary with azimuth". First of all, we carry out the work of frequency-dependent AVO inversion in different azimuthal gathers, then we can get different azimuthal dispersive properties; secondly, we use least square ellipse fitting algorithm to fit dispersive properties in different azimuths, thus we could obtain three ellipse attributes, including the major axis, minor axis and major axis direction; at last we can use these properties to describe the reservoir features. In Tahe practical area, the carbonate fracture-cavity reservoir is developed, we proposed a workflow for the special reservoir, the workflow includes data progressing, spectral decomposition, inversion and ellipse fitting, etc., at last, we apply the workflow in Tahe practical area and get a good application results. We conduct an application study of an inversion scheme for wide-azimuth seismic data for the Deep Carbonate reservoirs in Tahe Oilfield of China. The frequency-dependent AVO inversion results show that a good correlation with well log, which was used to predict favorable fracture-pore reservoirs of this Deep Carbonate.