28*th* IUGG Conference on Mathematical Geophysics, June 7-11, 2010, Pisa, Italy
Session 4: Brittle deformation and computational seismology

Evaluation of P-wave and S-wave correlations

Mohammad R. Asef[1], Mohsen Farrokhrouz[2], Hamed Haghi[3]

[1] *Tarbiat Moallem University, Tehran, Iran*
[2] *National Iranian Oil Company (NIOC), Shiraz, Iran*
[3] *Tehran University, Tehran, Iran*

Keywords: *compressional wave velocity, shear wave velocity, correlation accuracy, rock types*

Although a number of equations have been suggested for prediction of S-wave without direct measurement, but these prediction equations can be divided into three main groups. The main predicting equations define Vs from Vp which are usually used in rock mechanics and petroleum industry with limited number of Vs measurements. The correlation between such data points are used as a based for the other set in nearby geological sequences. The second group of estimations defines Vs based on other logging data such as resistivity logs, gamma ray, NPHI and etc. Sometimes a mixture of these logging data is used. This method is basically used in petroleum industry where sonic logging costs more than other logging operations and the reason for such predictions are economical concerns. The final series of predicting equations correlate Vp or Vs with some physical properties like porosity, density, quarts content, cementation degree and etc. The purpose of such equations is to identify effective parameters in soil or rock velocity and measure their degree of influence rather than regressions between shear and compressional velocities. Based on this grouping, a number of different correlations were gathered and a new series of data from deep petroleum reservoir was evaluated with this correlations. It was decided to evaluate the degree of accuracy of these equations in new data set and define uncertainty limits. The main shortcoming of previous suggested equations was limitation to rock types. Main prediction equations were suggesting for sandstone which has a simple and predictable framework and grain structure and predicting equations are usually good estimators; but when it comes to other sedimentary rocks like limestone and shale or metamorphic and igneous rocks, major discrepancies occurred in predicted values. It was decided to evaluate predicted equations based on rock types and define the range of accuracy for new data set. The results showed that based on rock origins, predicted equations have better results for sedimentary rocks compared with igneous and metamorphic rocks. Between sedimentary rock types, sandstone showed better results of estimation in comparison with limestone and shale. It seems that fractures and secondary porosity in limestone and bedding and fissility in shale are the main causes of uncertainty in wave velocity predictions. In metamorphic or igneous rocks, porosity seems to be the most important parameter which prevents good estimation.