World Academy of Science, Engineering and Technology
International Journal of Geological and Environmental Engineering
Vol:10, No:10, 2016

Seismic Data Analysis of Intensity, Orientation and Distribution of Fractures in Basement Rocks for Reservoir Characterization

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Abstract : Natural fractures are classified in two broad categories of joints and faults on the basis of shear movement in the deposited strata. Natural fracture always has high structural relationship with extensional or non-extensional tectonics and sometimes the result is seen in the form of micro cracks. Geological evidences suggest that both large and small-scale fractures help in to analyze the seismic anisotropy which essentially contribute into characterization of petro physical properties behavior associated with directional migration of fluid. We generally question why basement study is much needed as historically it is being treated as non-productive and geoscientist had no interest in exploration of these basement rocks. Basement rock goes under high pressure and temperature, and seems to be highly fractured because of the tectonic stresses that are applied to the formation along with the other geological factors such as depositional trend, internal stress of the rock body, rock rheology, pore fluid and capillary pressure. Sometimes carbonate rocks also plays the role of basement and igneous body e.g basalt deposited over the carbonate rocks and fluid migrate from carbonate to igneous rock due to buoyancy force and adequate permeability generated by fracturing. So in order to analyze the complete petroleum system, FMC (Fluid Migration Characterization) is necessary through fractured media including fracture intensity, orientation and distribution both in basement rock and county rock. Thus good understanding of fractures can lead to project the correct wellbore trajectory or path which passes through potential permeable zone generated through intensified P-T and tectonic stress condition. This paper deals with the analysis of these fracture property such as intensity, orientation and distribution in basement rock as large scale fracture can be interpreted on seismic section, however, small scale fractures show ambiguity in interpretation because fracture in basement rock lies below the seismic wavelength and hence shows erroneous result in identification. Seismic attribute technique also helps us to delineate the seismic fracture and subtle changes in fracture zone and these can be inferred from azimuthal anisotropy in velocity and amplitude and spectral decomposition. Seismic azimuthal anisotropy derives fracture intensity and orientation from compressional wave and converted wave data and based on variation of amplitude or velocity with azimuth. Still detailed analysis of fractured basement required full isotropic and anisotropic analysis of fracture matrix and surrounding rock matrix in order to characterize the spatial variability of basement fracture which support the migration of fluid from basement to overlying rock.

Keywords : basement rock, natural fracture, reservoir characterization, seismic attribute
Conference Title : ICOGPE 2016 : International Conference on Oil, Gas and Petrochemical Engineering
Conference Location : Barcelona, Spain
Conference Dates : October 03-04, 2016