

Shear Wave Conversion in Reservoir Rocks

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Converted shear waves (P- to S-) are clearly seen at large offsets in conventional seismic reflection profiling using 3-component seismometers. However, at normal or near normal incidence it is unusual. One such observation where the horizontal component signal was more pronounced than the corresponding vertical component prompted this inquiry. Possible explanations are scattering and anisotropy. A different possibility considered here is the conversion due to lateral motion of fluids in the reservoirs. This lateral motion of fluids induces shearing forces on the rock matrix due to a combination of viscous drag and pressure differences. An experiment investigated the influence of fluids on the transmitted wave. Compression and shear motion in two orthogonal directions were induced on one face of the core sample and for each set-up all three motions were recorded on the opposite face. The data suggests that the converted shear is enhanced by the presence of fluids, in this instance, water. This transmission experiment was repeated using oil and a very significant difference between the amplitudes was observed. One has to realize that this demonstration is made at MHz frequencies. However, the original field observation was made at seismic frequencies of ~ 20 Hz; and, hence it behooves us to investigate the relationship between converted shear wave amplitudes and reservoir fluids at seismic frequencies. This may be considered analogous to “bright spot” technology for detection of gas.