Full Elastic Seismic Modeling and Prestack Depth-Migration on High Complex Fields with Igneous Intrusions

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Seismic imaging of high complex oilfields with igneous intrusions has been one of the most difficult tasks geoscientists have been facing in order to get reliable subsurface pictures. In fact, most of the times the conventional approach based on CDP-stacking is far from being the convenient one. The high lateral velocity variation and the great number of diffractions provoked by the igneous intrusions almost always offer poor result. We believe that the imaging of such structures must rely on Prestack Depth-Migration.

First we define a model composed of structures generated by igneous intrusions. Then we perform a full elastic modeling. We generate about two hundred seismograms and some sets of snapshots. Finally we apply our schemes for Acoustic and Vectorial Reverse Time Migration using several imaging conditions. As it is done in the modeling phase, we use finite-differences type techniques where the parameters are introduced as their geometric averages calculated along the grid lines.

Specifically, we get a quite good seismic image from each of the following reflected waves: P-P, P-S, S-P and SS. The correlation of up-going and down-going wavefields at each grid point also gives us very good result. Even nearly vertical features may be mapped when we use a smooth version of the true velocity field.

We believe that Prestack Depth-Migration combined with a careful velocity analysis accomplished jointly by geologists and geophysicists is the best strategy to increase the accuracy of our interpretation in areas of tectonic activity associated with igneous intrusions.