PRE-STACK DEPTH MIGRATION AND THE IMAGING OF COMPLEX STRUCTURES IN THE WYOMING THRUST BELT

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ABSTRACT

A problem that has always existed for geologists and interpreting geophysicists, is the fact that seismic sections are displayed in time rather than depth. The reflections are distorted by lateral variations in velocity in overburden, producing false structures or structures that are tilted from their true shape. In severe cases the seismic data may not stack properly, due to non-hyperbolic movement.

Prestack depth migration can correct these problems. If a correct model with interval velocities is used, the data will migrate to the true position, and will stack better, assuming the 2D line is a true dip line, or if the survey is 3D.

So, if the model must be known in order to migrate the data, how do we determine the model? I will present a method of deriving a correct macro-model from the data. A starting model is used with a velocity that is approximately correct for the shallowest part of the section. This should correctly image the shallow reflecting interfaces. These events should be flat on the depth migrated CMP gathers. If they are not flat, the velocity model is adjusted, and the line is re-migrated. This process is repeated until CMP gathers for the shallow reflector are flat. Diagnostic tools exist, and are shown, that speed up the convergence. The velocity of this top layer is then held constant, and another layer is added beneath it. The process is repeated for a second reflection, and so on until the desired depth is reached.

The key to the model development process is that the structure of a given horizon being imaged need not be known in advance. Only the overlying structure and interval velocities are needed and they are determined one at a time from the surface down. The interval velocity just above the current horizon is found iteratively, and once determined, will image the next horizon at the correct depth.

The model derivation method will be shown using water tank model data. A few overthrust lines will be shown to demonstrate "real world" results.

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