Depth migration on parallel processors of Lithoprobe Alberta Basement seismic data

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Lithoprobe seismic data acquired across Alberta often contains steep dips and numerous diffraction patterns. Events deep in the crustal seismic sections migrate several kilometers laterally. At the University of Alberta seismology laboratory a fast parallel finite difference depth migration is used to image these data. Finite difference depth migration accommodates lateral velocity variations better than time migration and is more suitable for deep crustal data. An omega-x depth migration code, accurate to 70 degree dips, was developed and implemented in the PVM (Parallel Virtual Machine) programming environment.

The proper migration of these deep crustal data sets requires special care. In particular, complications arise from the significant thickness of sediments of the Alberta Basin. The velocity model must be of high enough quality that the known depth to basement is obtained. In addition, the high amplitude reflections returned from the shallow sedimentary section folds back and contaminates the deeper section of the profiles. Filtering, balancing, and tapering of the data at all edges are necessary to reduce this noise

The most crucial step is the preparation of the interval velocity model. A preliminary velocity model is derived from a variety of sources including stacking velocity measurements and deep seismic refraction studies. After the initial migration, the velocity model is updated on the basis of the examination of features improperly imaged, such as un-collapsed diffraction hyperbolae. A number of iterations are sometimes necessary in order to optimize the velocity model. An advantage of the parallel implementation is the ability to do several iterations very quickly and efficiently. A high quality depth image is finally provided for better geological and tectonic interpretation. All the lines in the Lithoprobe Alberta Transect are being processed with these individually optimized velocity models and carefully prepared input profiles.

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