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**4D Automated Structural Restoration and Integrated Basin Modelling - Implications for Hydrocarbon Migration and Accumulation**

Struct3D is a structural restoration tool that automatically restores lithological horizons along faults back through time, and thus forms the basis of four dimensional petroleum systems modelling. Automated retro-deformation is achieved using a 'piercing point' technique, which analyses and automatically computes the required displacement vector field needed to restore the displaced geometry. This modelling approach uniquely defines matching points on the fault hangingwall and footwall cut-offs and predicts the required Heave azimuth and magnitude for each restoration step. On complete restoration of each uppermost lithological horizon, the volume of rock is backstripped and the remaining rock volume is decompacted using Athy-type compaction laws. The decompaction step is necessary as the geometry of the surfaces in the model, including underlying fault surfaces change significantly under such volumetric strain. Multiple stages in the restoration process are saved as three-dimensional Earth models that portray well-constrained structural and stratigraphic geometries through time, from the undeformed state of the rock volume to its present-day architecture. The sequential 'snapshots' are then used in forward modelling to provide the foundation for a four-dimensional petroleum system modelling tool that incorporates hydrocarbon maturation, migration and trapping.