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### **Integrated 4-D Structural Restoration and Basin Modelling**

Automated structural restoration forms the basis for petroleum systems analysis in four dimensions. Struct3-D is a newly developed software tool that builds, visualises and restores three dimensional earth models composed of lithological horizons, surfaces, faults and unconformities. Individual horizons are restored sequentially back through time to their pre-deformational state using the vertical shear construction. In each retro-deformation time-step, the displacement vector field that defines the geometry of restoration is calculated using an automatically defined heave azimuth based on 'piercing points' which are uniquely defined matching points on the fault hangingwall and footwall cut-offs. At each retro-deformation time-step, the uppermost 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. A number of restoration stages are saved as three dimensional Earth models to be used in the forward modelling stage of petroleum systems modelling involving source rock maturation, migration and mapping of hydrocarbons.