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Shiremoor Geothermal Heat Project: reducing uncertainty around fault geometry and permeability using MoveTM for structural model building and stress analysis

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Structural model building software, Midland Valley's MoveTM, was used to reduce uncertainty around fault geometry and analyse the likelihood of encountering fault-driven enhanced permeability for a proposed geothermal heat production borehole in Shirmoor, UK.
Stress analysis was used to predict dilatant or compressional damage zones, and to assess likely permeability, under the present day stress regime. Before assessing whether a particular fault will have increased or decreased permeability, it was first necessary to build a structurally valid, constrained fault framework.
Two seismic lines from the project area show evidence of faulting and deformation of horizons. After a simple depth conversion was applied, assuming average velocities for known lithologies, interpretation of the two lines, with additional information from the geological reports, maps and borehole data nearby allowed the construction of a first pass 3D valid structural model of the site using MoveTM software.
All geological models constructed by Midland Valley use structural geology principles (such as bed length or area balance) and known geometric relationships between faults and folds to build structurally valid models.
This valid geological model was analysed to give insights as to the type of material that might be entrained in the fault cores, the amount of displacement on individual faults and hence potential damage zone sizes and critically the geometry and relationship to key horizons of the fault framework. Stress analysis of the linkage of faults was used to highlight potential areas of either compressional or dilatant damage zones and hence the predicted impact on fault permeability.