

Play-fairway analysis for geothermal exploration: Examples from the Great Basin, western USA

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Elevated permeability within fault systems provides pathways for circulation of geothermal fluids. Future geothermal development depends on precise and accurate location of such fluid flow pathways in order to both accurately assess geothermal resource potential and increase drilling success rates. The collocation of geologic characteristics that promote permeability in a given geothermal system define the geothermal 'fairway', the location(s) where upflow zones are probable and where exploration efforts including drilling should be focused. We define the geothermal fairway as the collocation of 1) fault zones that are ideally oriented for slip or dilation under ambient stress conditions, 2) areas with a high spatial density of fault intersections, and 3) lithologies capable of supporting dense interconnected fracture networks. Areas in which these characteristics are concomitant with both elevated temperature and fluids are probable upflow zones where economic-scale, sustainable temperatures and flow rates are most likely to occur.

Employing a variety of surface and subsurface data sets, we test this 'play-fairway' exploration methodology on two Great Basin geothermal systems, the actively producing Brady's geothermal system and a 'greenfield' geothermal prospect at Astor Pass, NV. These analyses, based on 3D structural and stratigraphic framework models, reveal subsurface characteristics about each system, well beyond the scope of standard exploration methods. At Brady's, the geothermal fairways we define correlate well with successful production wells and pinpoint several drilling targets for maintaining or expanding production in the field. In addition, hot-dry wells within the Brady's geothermal field lie outside our defined geothermal fairways. At Astor Pass, our play-fairway analysis provides for a data-based conceptual model of fluid flow within the geothermal system and indicates several targets for exploration drilling.