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Bedrock geology of Snyderville basin: Structural geology techniques applied to understanding the hydrogeology of a rapidly developing region, Summit County, Utah.
Hydrogeology is the area of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust, commonly in aquifers.

1997, Keighley, K.E.; Yonkee, W.A.; Ashland, F.X.; Evans, J.P. Journal Article

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**No online versions are available.**

**A print version of this publication is not available from the USGS Store**

**Abstract:**

The availability of ground water is a problem for many communities throughout the west. As these communities continue to experience growth, the initial allocation of ground water supplies proves inadequate and may force restrictions on existing, and future, development plans. Much of this new growth relies on ground water supplies extracted from fractured bedrock aquifers. An example of a community faced with this problem is western Summit County, near Park City, Utah, This area has experienced significant water shortages coupled with a 50% growth rate in the past 10-15 years. Recent housing development rests directly on complexly deformed Triassic to Jurassic sedimentary rocks in the hanging wall of the Mount Raymond-Absaroka thrust system. The primary fractured bedrock aquifers are the Nugget Sandstone, and limestones in the Thaynes and Twin Creek Formations. Ground water production and management strategies can be improved if the geometry of the structures and the flow properties of the fractured and folded bedrock can be established. We characterize the structures that may influence ground water flow at two sites: the Pinebrook and Summit Park subdivisions, which demonstrate abrupt changes (less than 1 mi/1.6 km) within the hydrogeologic systems. Geologic mapping at scales of 1:4500 (Pinebrook) and 1:9600 (Summit Park), scanline fracture mapping at the outcrop scale, geologic cross sections, water well data, and structural analysis, provides a clearer picture of the hydrogeologic setting of the aquifers in this region, and has been used to successfully site wells. In the Pinebrook area, the dominate map-scale structures of the area is the Twomile Canyon anticline, a faulted box-like to conical anticline. Widely variable bedding orientations suggest that the fold is segmented and is non-cylindrical and conical on the western limb with a fold axis that plunges to the northwest and also to the southeast, and forms a box-type fold between the middle and eastern limbs with a fold axis that plunges to the northeast. The fold is cut by several faults including the Toll Canyon fault, which we interpret as a west-directed folded hanging-wall splay off the east-directed Mt. Raymond thrust. These complex geometries may be due to at least two phases of deformation. Results from outcrop analyses show that the fractured bedrock aquifers are lithologically (characteristics of a rock formation) heterogeneous, anisotropic (having a physical property that has different value or magnitude when measured in different directions), and compartmentalized. Two exposures of the Toll Canyon fault show that even though the fault cores may be thin, extensive damage zones develop in the Nugget Sandstone and Thaynes Limestone, and shale smears form in the Triassic shales. The damaged zones may be regions of enhanced fracture permeability, whereas the shale smears act as flow barriers. The orientation, density, and hydrogeologic characteristics for predominate fracture sets vary within meters. In the Summit Park area, chronic water shortages required new wells to be sited in the northeast-plunging Summit Park anticline (a ridge-shaped fold of stratified rock in which the strata slope downward from the crest). The anticline experienced two phases of folding and at least one episode of faulting. Structural analysis of the fold defined the geometry of the structure, and a down plunge projection along the fold hinge was used to estimate the location of the Nugget Sandstone at a depth of 700 ft (213 m). The crestal region of the anticline was drilled in order to intercept regions of higher fracture density in the fold. The test well penetrated the Nugget Sandstone at 698 ft depth, and two production wells with long-term yields of 120 and 180 gpm completed. One well in the Sliderock Member (Twin Creek Formation) experiences seasonal fluctuations whereas production in the Nugget sandstone has only subdued seasonal variations, suggesting the Nugget may have great storage. Complex structures work against the typical basin yield approach for water budgets, therefore, water supply estimates may benefit from detailed studies within local areas. The results of this study demonstrate how tradition

| **Additional Publication Details** |
| --- |
| Publication Type | Journal Article |
| Title | Bedrock geology of Snyderville basin: Structural geology techniques applied to understanding the hydrogeology of a rapidly developing region, Summit County, Utah |
| Author | Keighley, K.E.; Yonkee, W.A.; Ashland, F.X.; Evans, J.P. |
| Year | 1997 |
| Series | Brigham Young University Geology Studies |
| Journal Title | Brigham Young University Geology Studies |
| Volume | 42 |
| Issue | 2 |
| Language | English |
| ISSN | 00681016 |
| Number of Pages | 19 |
| Start Page | 325 |
| End Page | 343 |

Page Last modified: 11/21/2014 09:16:10



[U.S. Department of the Interior](http://www.doi.gov/) | [U.S. Geological Survey](http://www.usgs.gov)

URL: <http://pubs.er.usgs.gov/>

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Page Last modified: 11/21/2014 09:16:10