

Draft

1/19/2017

Oquirrh Mountains and Tooele Valley

by Donald L. Clark

Overview

Salt Lake Valley is bordered on the west by the Oquirrh Mountains, and west of the Oquirrhs lies Tooele Valley. Human development is rapidly extending from Salt Lake City to the foot of the Oquirrh Mtns and throughout adjacent Tooele Valley. The Oquirrh Mtns are well known for a mining history that spans from 1863 to the present, and includes one of the largest copper mines in the world, the Bingham Canyon mine (Kennecott/RioTinto). Tooele Valley contains suburban communities of the Salt Lake metropolitan area, the Tooele Army Depot, agricultural land, and public land. UGS is nearing completion of a sought-after intermediate-scale geologic map covering this area—the Tooele 30'x 60' quadrangle.

Purpose

The area west of Salt Lake Valley, informally known as the West Desert, has generally not seen as high a concentration of 7.5'-quad mapping, and accordingly UGS and USGS have put resources into intermediate-scale mapping. 7.5'-quad mapping in the eastern half of the Tooele 30x60 has been focused on the mining districts of the Oquirrh Mtns (Bingham, Stockton, Ophir, Mercur), and to assist geologic hazards evaluations along the margins of the Oquirrh Mtns and in Tooele Valley.

In a 2007 Map User Poll, Tooele was selected as the highest priority for remaining 30x60 quad mapping. The area has many issues associated with rapid population growth, industrial development, military construction, and resource management needs. The quad also carries the Interstate 80 transportation corridor.

Previous Mapping

Bedrock geologic mapping in the Oquirrh Mtns and Tooele Valley is largely by USGS and mining geologists (Boutwell and Keith, 1905; Gilluly, 1932; Slentz, 1954; Thomas, 1955-57; Tooker and Roberts, xxxx; Swenson and Kennecott staff, 1991; Laes and others, 1997). More recently, UGS geologists conducted 7.5'-quad geologic mapping of Quaternary deposits in the Oquirrh Mountains and Tooele Valley (Solomon, 1993), and of surficial deposits and bedrock in the eastern foothills of the Oquirrh Mtns (Biek and others, 2007; Solomon and Biek, 200x).

Geology

The Oquirrh Mtns are composed of sedimentary and volcanic bedrock of Paleozoic and Tertiary age. Surficial deposits of lacustrine, alluvial, eolian, and glacial environments fill Tooele Valley and cover parts of the mountains. The area lies in the Sevier fold-thrust belt (Cretaceous-Tertiary age), and was affected by subsequent Cenozoic basin-and-range normal faulting. Thrust plates of Paleozoic sedimentary rocks are juxtaposed in the mountains (Tooker, xxxx; Presnall, 1997), but these faults are difficult to trace under adjacent valleys; hence determining a coherent structural geometry has been problematic. Tertiary volcanic and sedimentary rock caps underlying bedrock and fills deeper parts of the valley. Pleistocene Lake Bonneville, the precursor to Great Salt Lake, was centered near here; its transgressions and regressions lead to a complicated stratigraphy (ref). Major fault zones including the West Valley, Oquirrh, and Great Salt Lake cut Quaternary deposits; some faults are active and therefore have a high seismic risk (ref).

Challenges/Problems

No mapping project is without challenges and problems. Kennecott Utah Copper Corporation kindly provided access to the Oquirrh Mtns for our geologic mapping purposes. However, this access was somewhat delayed due to Kennecott's urgent need to focus time and resources on the massive landslide that occurred at the Bingham Canyon open pit mine in April 2013 (Pankow, 2014; Krahulec, 2016).

Geologic mapping requires that stratigraphic and structural evaluations be conducted hand-in-hand. The Oquirrh Mtns have long been plagued by issues related to stratigraphic nomenclature and structure. Decades of geologic research have gone into interpretation of the current geologic framework. Part of this challenge is attributed to the Oquirrh Formation/Group and overlying Permian strata. This thick and lithologically monotonous package of rocks has been difficult to subdivide into formations and members. In addition, the mountains are intensely folded and faulted as part of the Sevier belt. Review of the geology in the Oquirrh Mtns indicates that geologic interpretations have been fraught with disagreement. Most notably between USGS geologists (Ed Tooker and Ralph Roberts) and mining geologists (John Welsh and Jaren Swenson). Hence, two differing sets of geologic mapping have been released by these two groups. In more recent years, UGS has collaborated with Kennecott geologists on geologic mapping projects and issues.

Results of Revised Mapping

UGS is nearing completion of the Tooele 30 x 60 quad (Clark, 2017). This intermediate-scale mapping was accomplished over a four-year period by compiling prior mapping where available, reconciling differences, and updating the geology through photogeologic interpretation and

limited field work. 7.5'-quad mapping was generally available for the eastern half of the map area, while less detailed mapping was available for parts of the western half. Updates to Quaternary deposits were conducted across the map area with the assistance of Charles "Jack" Oviatt (Emeritus, Kansas State Univ.), an expert on Lake Bonneville (see also Oviatt and Shroder, 2016). David Dinter (Univ of Utah) provided mapping of the Great Salt Lake fault zone and Carrington fault (also see Dinter and Pechmann, 2014). Clark contributed updates to bedrock stratigraphic nomenclature and structural geology. This map updates prior regional-scale geologic maps of the area by Stokes (1963) and Moore and Sorensen (1979) with greater detail and geospatial accuracy, mapping of Quaternary-Tertiary surficial deposits, and new geochronologic, paleontologic, geochemical, and tectonic data.

References

Photos/Figures