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Thrusting and Extensional Structures and Mineralization in the Beaver Dam Mountains, Southwestern Utah

SILVER REEF MINING DISTRICT, REVISITED
WASHINGTON COUNTY, UTAH

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ABSTRACT

The Silver Reef mining district in southwestern Utah lies across Interstate 15 at Leeds. The district centers on outcrops of the Springdale (Silver Reef) Sandstone of the Jurassic Moenave Formation. This crops out on the northeast trending Virgin anticline and two subsidiary folds to the west. Flank thrust faults repeat the ore zone three times and form the White, Buckeye and Butte reefs of the main district. Within the mining district three members of the Triassic Moenkopi Formation, the Middle Red, Shnabkaib and Upper Red, the overlying Chinle Formation and its Shinarump and Petrified Forest members, the Early Jurassic Moenave Formation with the Dinosaur Canyon and Springdale Sandstone, capped by the Kayenta Formation and the Jurassic Navajo Sandstone comprise the major stratigraphic units. Recent basalt flows, Boulder Alluvium and younger alluvium complete the exposed section.

Ore zones occur in lense-like bodies related to deposits in paleostream channels and carbonaceous plant remains, and in some shear and fault zones of northerly trend, all within the Springdale Sandstone. Ore minerals were oxidized and concentrated as cerargyrite, malachite-azurite, and carnotite-autunite-torporbite above the water table.

The ore cell of the district contains sulfur isotopes suggestive of biogenic origin. Mercury and selenium and also Mo, Zn, Pb, Ni, Co, As and V are pathfinder elements, while gold is in trace concentrations only. Anomalous concentrations of silver occur in the Springdale sandstone well beyond the boundaries of the mining district.

Iron oxide concretions, and some of chalcocite and calcite in Petrified Forest bentonitic shales contain anomalous concentrations of copper, silver and gold. Bentonites such as these far to the southeast of the district are probable sources of the metals in the stream-deposited Springdale sandstone. Folding and faulting of the beds established hydraulic gradients and movement of groundwaters essential to the localization and concentration of the metals in the permeable and syngenetically mineralized Springdale sandstone.

INTRODUCTION

In 1869 high-grade silver chloride float discovered near Harrisburg, Utah resulted in considerable prospecting excitement. Sixteen mineral claim locations were made, and these abandoned by 1871 (Burchard, 1883). The Harrisburg district was organized in 1874, and 27 claims were recorded that year. Arrival of William Tecumseh in July, 1875, his departure and later return in fall 1875, and subsequent discovery of 400 ounce per ton silver ore on Tecumseh Hill, was the major impetus to mining in the district. Ten and a half tons of ore, shipped to Salt Lake City averaged $503 per ton. Other ores were shipped to the silver mining city of Pioche, Nevada.

While a small population has been suggested for Silver Reef in 1876, the map of figure 1 indicates a much greater population and considerable activity. Five saloons, Catholic and Presbyterian churches, mining offices, a union hall, jail, hotel, restaurant, printing office, I.O.O.F. and Good Fellows Lodge, and a large number of Chinese residences or business are among those listed on
First patented claims in the district were granted in May, 1877. The first mining mill was completed in fall, 1877 and four other mills subsequently completed and operated. Tailing piles of the Barbee and Walker and Leeds mills, both on the White Reef, and the Christy mill on the Buckeye Reef are shown on figure 9. Major mining activity in the district lasted through 1888. This was followed by lessee operations through 1909 when operations essentially ceased. The uranium boom of the early 1950's revitalized the district and silver and uranium were recovered in this period. Present dollar value of the 1875–1910 silver production approximates $48,000,000 for about 8,000,000 ounces of silver from this unusual silver mining district. More detail on the history of the district appears in an earlier publication (Proctor, 1953). Precipitous drop in silver prices, increased labor costs, lower grade ore and possibly water in the lower levels of the mines were major factors in the district's demise. Figures 2, 3, 4 and 5 are views of the old townsite, and general views of the district. A detailed study of this well-known and unique Silver Reef mining district appeared in 1953 (Proctor, 1953). Details concerning the stratigraphy, primary and secondary structures, and mineral deposits and production are included in that report. Since then major changes in regional stratigraphic nomenclature have occurred and geochemistry has become a major investigative tool. The current authors identified the more recently named formations and members in the district and added additional structural details to the geologic map. An extensive geochemical study of the Springdale (Silver Reef) Sandstone, the ore-carrying unit in the district, was also initiated. Highlights of this investigation, which is still underway, are included in this report.

Geological and geochemical work began on the Springdale sandstone in February, 1985 under a faculty research grant from the Brigham Young University. The study was extended in September, 1985 under a similar grant to investigate the geochemical ore-cells within the mining district. Thanks are due Dr. Morris Shirts, David Christiansen, Robert Clayton, Mike Hugentobler, Jeffrey Low, Uwe Kackstaetter and Rod Horrocks for assistance in the field and laboratory and to Dale Claflin for his special aid in preparation of illustrations.

GEOLoGIC SETTING

The Silver Reef mining district is situated within the St. George Basin in the transition zone between the Basin and Range province to the west and the Colorado Plateau to the east. The Hurricane fault escarpment lies 4 1/2 miles east of Silver Reef and separates the two structural provinces. Folds and faults characterize the structure of the St. George basin, while flat-lying beds and minor steep-angle faults occur on the plateau.

STRATIGRAPHY

A thick and well exposed Triassic and Jurassic section occurs within and on the margins of the mining district. Formations include the Triassic Moenkopi and Chinle and Early Jurassic Moenave and Kayenta formation. The Jurassic Navajo Sandstone and Carmel Formation bound or lie just outside the district boundaries. Quaternary basaltic flows and cinder cones occur in and to the southeast of the district (figure 6). Boulders, cobbles and pebbles in a fine-grained unconsolidated matrix lie at three major levels and unconformably overlie the folded, faulted and eroded Mesozoic rock units (Figure 7).