

During the fall, bright red and gold foliage provides a dramatic backdrop for the headframe of Park City Ventures' Ontario No. 3 shaft. This sector of the Wasatch Mountains is characterized by

north-south folding and thrust faulting and is intersected by the east-west Uinta anticlinal structure. Large intrusive bodies further complicate the regional geology.

Ontario project keeps mining alive in Utah's historic Park City district

Lane White, Managing editor

THERE'S A NEW MINE in Utah's Park City district. Located in the Wasatch Mountains east of Salt Lake City, Park City Ventures' 5,000-tons-per-week mine and concentrator came onstream in the spring of 1975, producing lead-zinc-silver ores at depths ranging from 2,000 to 2,400 ft in a mine that was first discovered in 1868. The new mine uses the renovated No. 3 Ontario shaft, sunk in the 1890s, and benefits from the continued functioning of a major drainage tunnel driven during the same era.

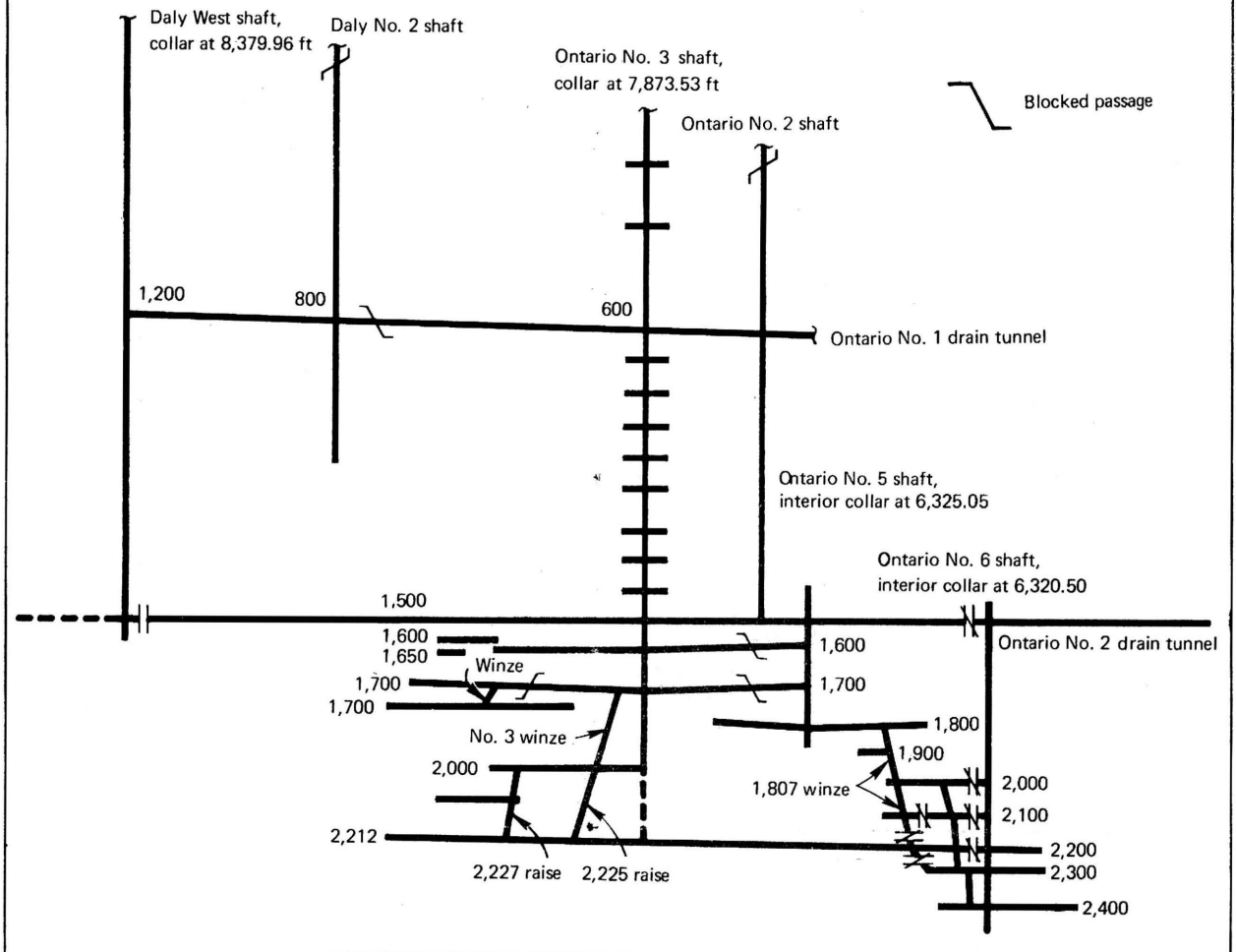
The Park City Ventures project is owned 60% by The Anaconda Co. and 40% by Asarco Inc., with Anaconda as operator. The current Ontario mining operation is based on a lease from United Park City Mines Co., which will receive a one-third royalty on any profits after recovery of invested capital. United Park City Mines was formed in

1953, when Park Utah Consolidated Mines Co. (including the Ontario, Daly West, and Daly Judge mines) merged with Silver King Coalition Mining Co. United Park City leased the mineral rights for its properties to Ventures in an agreement that became effective in August 1970.

Current Ontario production draws on delineated reserves of about 1 million tons occurring as erratic replacement and fissure deposits in the Mississippian Humbug formation. However, Ventures is confident that it will continue to develop new reserves as mining proceeds, general manager Bill Norem said when E/MJ visited the property. The geology of the mine area favors extensive mineralization, but the scattered nature of the ore pockets requires an extensive and continuous program of development work to match the production schedule.

JOHN R. WILCOX

Simplified section through the Ontario mine



Target ores for the new Ontario mining operation occur in both the east and west flanks of a north-south trending regional anticline. Deposits in the Humbug formation were first mined in the 1950s along the crest of the anticline at the 1,500 level of the Ontario mine. In the Ontario, the Humbug consists of limestone, sandy limestone, quartzite, sandstones, and calcareous sandstones irregularly repeated in a section about 350 ft thick.* Replacement ores occur at various intervals through the entire formation. Ore pockets in the Ontario mine range in size from 5,000 to 50,000 tons.

Production in 1976 is planned at 22,000 tons of lead concentrate and 37,000 tons of zinc concentrate from ores grading 7% Pb, 9.9% Zn, and 4.5 oz of Ag per ton. The Ontario concentrates also carry cadmium, antimony, and copper in amounts sufficient for byproduct recovery. Anaconda's 60% share of Ontario production is shipped to the Bunker Hill smelter at Kellogg, Ida. Asarco's 40% share of lead concentrates is shipped to the Asarco smelter at East Helena, Mont., while its 40% share of zinc concentrates is routed to the National Zinc smelter at Bartlesville, Okla.

Ontario benefits from experienced work force

In the Park City district, which has been mined almost

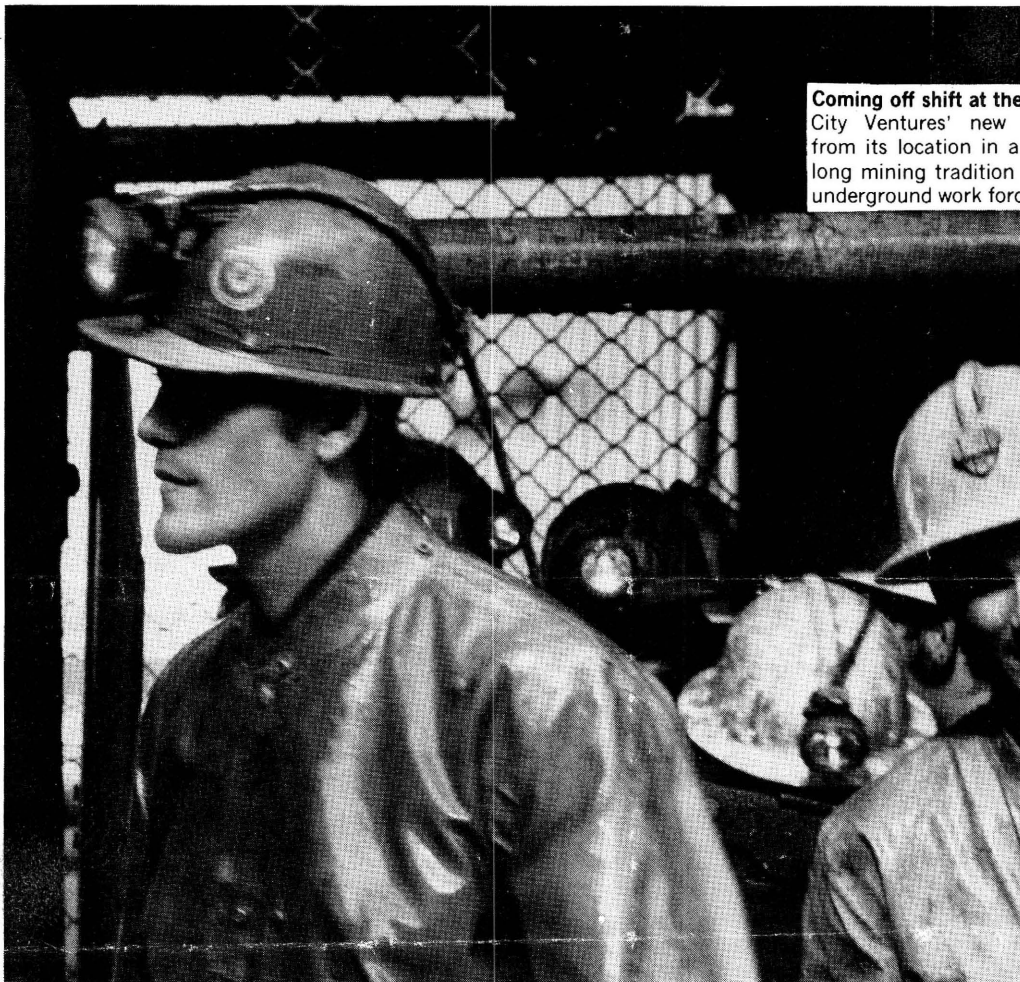
continuously since the 1870s, an experienced underground work force has developed that would be hard to match for quality at most new mine operations, Norem said. Total employment at the Ontario mine is expected to rise to about 350, with about 190 working underground. Production crews work two shifts per day in the stopes, and tramming, hoisting, and maintenance crews work three shifts per day in the underground operation.

During the 1960s, when mining in the district was at a low ebb, Park City began to develop as a ski resort and tourist attraction. Real estate values boomed out of reach of working miners and of many salaried professionals, and though the new Ontario operation is just a mile south of the city limits of Park City, many of its workers commute about 15 mi from Heber City.

Development of the new Ontario mining operation began with renovation of the old, caved Ontario No. 3 shaft, with steel sets installed on 5-ft centers and concrete lining replacing the original timber. Concrete lining was set over about 70% of the shaft length, with open intervals of up to 100 ft.

Ventures deepened the 7 x 19-ft, three-compartment No. 3 shaft, which bottoms in the west flank of the Park City anticline, to the 2,200 level and began a further deepening program to the 2,400 level in January 1976. (See accompanying diagram.) On the 1,500 level, a main haulage drift connects the No. 3 shaft with the No. 6 interior shaft over a distance of nearly 6,000 ft. Ventures deepened the

*Ore Deposits in the United States 1933/1967, J. D. Ridge, Ed., AIME, New York, 1968.



Coming off shift at the Ontario mine: Park City Ventures' new operation benefits from its location in a district that has a long mining tradition and an established underground work force.

No. 6 shaft to the 2,400 level, where it bottoms in the east flank of the anticline. About 50% of the ore is now mined in the east flank and 50% in the west flank. All ore is trammed to the No. 6 shaft, hoisted to the 1,500 level, trammed to the No. 3 shaft, and hoisted to the surface. Hoisting of west flank ore from the deeper levels of the No. 3 shaft is scheduled for third-quarter 1976.

Development of Ventures' operation, in addition to shaft sinking and renovation, included 33,350 ft of drifting and 152,972 ft of development drillholes.

Ventures equipped the No. 3 shaft with a Canadian Ingersoll-Rand double-drum hoist powered by two 450-hp, 4,160-v ac motors and 4-ton Lakeshore bottom-dump jeto skips for hoisting to the surface. Maximum speed of the hoist is 750 fpm, using a 1½-in. cable at a maximum pull of 23,300 lb. A 150-hp Ottumwa single-drum hoist also services the No. 3 shaft, operating at a maximum 300 fpm on a 1½-in. cable having a maximum pull of 13,600 lb.

A trolley locomotive pulling a 15-car string of 60-cu-ft cars over 60-lb, 18-in.-gauge track trams ore from the No. 6 to the No. 3 shaft. On production levels at 100-ft vertical intervals from the 2,400 level to the 2,000 level, 4-ton battery powered locomotives pull eight-car strings. Ventures equips newly opened levels with 24-in.-gauge track.

A 300-hp flat rope hoist lifts ore to the 1,500 level in the No. 6 interior shaft, winding a 5-in. x ¾-in. cable at a maximum speed of 1,100 fpm.

Mining by overhand cut and fill

Ontario ores, which occur in irregular pockets in beds

dipping from 20° to 90°, are mined from overhand cut-and-fill stopes. In the fall of 1975, Ontario crews were working 22 stopes and planning was in progress to open a total of 33 stopes. Stopes are opened with 10-ft-high cuts and slashed to 20 ft high. Widths range from 8 to 20 ft. Drills include Gardner-Denver 53 and 63 jacklegs. The explosives used are Hercules "Unigel," 50% strength, and Atlas 1½ x 8-in. stick powder, with some ANFO also used in dry ground. DuPont "Detaprimes" are used on a No. 6 cap.

The sand fraction of concentrator tailings supplies about 75% of the required backfill, with a storage tank for backfill provided at the 600 level of the No. 3 shaft. The remainder of the backfill is taken from an old tailings pond.

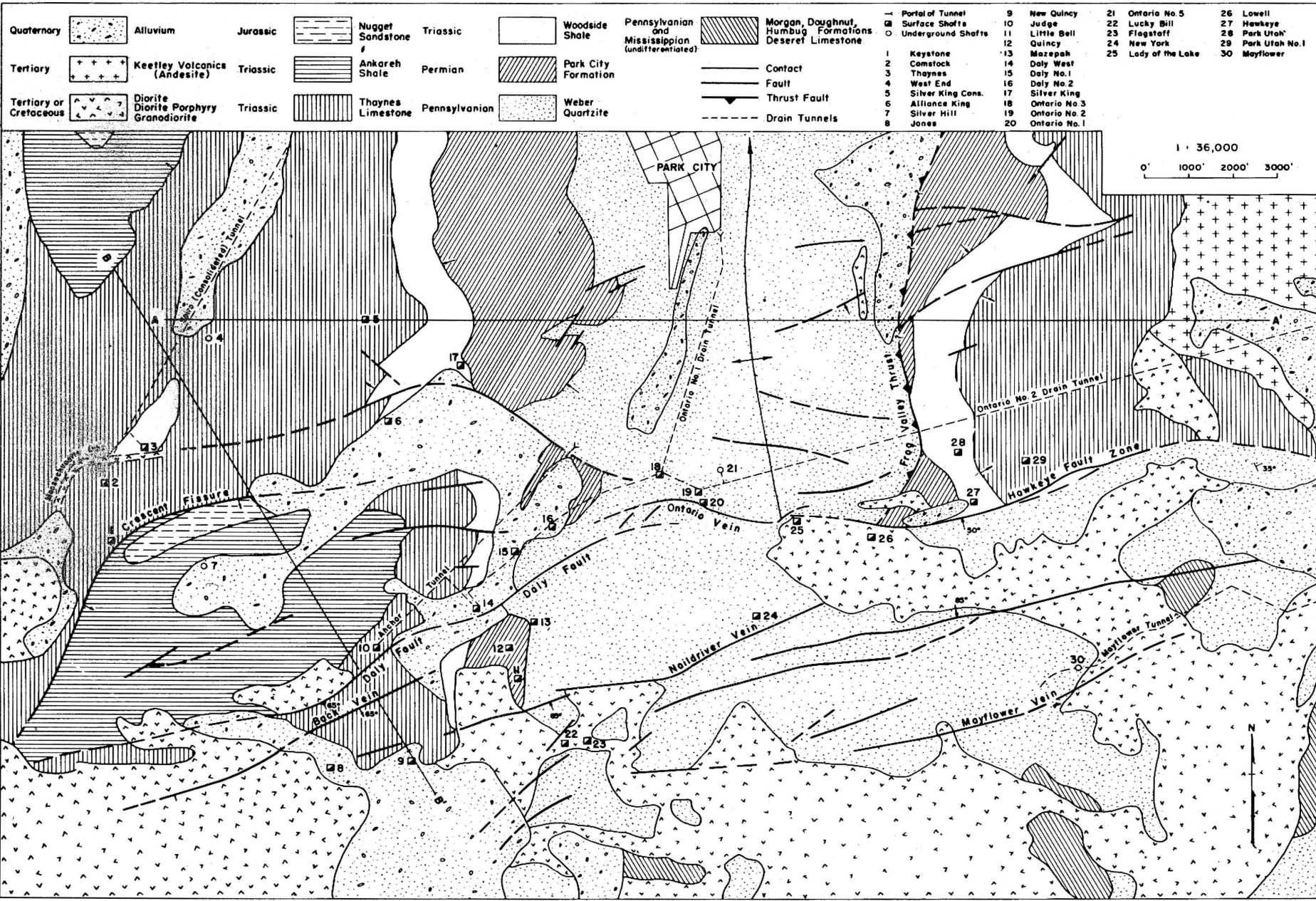
Slushers powered by 15-hp electric motors pull muck to ore passes. Some consideration has been given to moving up to 30-hp motors, Norem said.

Conventional raising in the Ontario uses jackleg drills and timbering, with some ore passes bored out to 6-ft diameter using a Robbins 41 raise borer.

Two jumbos carrying Gardner-Denver 93 drills and Eimco overshot muckers are used for drifting. Holes are 2½ in. in diameter, and cuttings are sampled at 4-ft intervals.

The Ontario stopes are in an area of flat-lying faults and slip planes, and extraction of fault breccia ore requires close attention to ground control. In some areas, drifting requires steel sets over rather long stretches.

Heavy flows of water have posed a continuing problem for Park City miners since the development of the district's earliest mines, and several major drainage tunnels were



Surface geologic map, Park City District, Utah

E/MJ—February 1976

Source: *Ore Deposits in the United States 1933/1967*, Vol. 2, Ch. 53—"Ore Deposits of the Park City District with a Contribution on the Mayflower Lode," AIME, 1968.

driven in the late 1800s as mining moved to deeper levels. The first of these tunnels, begun in 1881 by the Ontario Silver Mining Co., reached 6,357 ft from the No. 3 shaft to the portal. The Keetley tunnel (Ontario No. 2), begun in 1888 and eventually driven a total of more than 27,000 ft, drains the mine above the 1,500 level.

Ventures pumps from a main pump station on the 2,300 level in a single lift to the 1,500 level for drainage through the Keetley tunnel to the surface. Pumps can operate at a maximum 800-hp capacity, lifting 3,200 gpm.

Drainage grade in the tunnel is 0.25%.

Intake air for Ontario workings is drawn through the Keetley tunnel and the No. 3 shaft and exhausted through old workings to the Daly West shaft.

Utah Power and Light delivers power at 4,400 kva, which is stepped down to 2,300 v for distribution underground and operation of all hoists. The load is further reduced to 440 v for operation of small underground equipment.

Concentrating Ontario ores

At the Ontario concentrator, near the No. 3 shaft headframe, a 25 x 40-in. Telsmith jaw crusher makes a primary reduction of mined ores, followed by screening across a double deck screen and secondary crushing in a Symons 5½-ft Shorthead crusher. A 2,100-ton bin after secondary crushing provides fine ore storage.

A 9 x 9½-ft Marcy ball mill driven by a 500-hp synchronous motor grinds the ore to about 70% minus 200 mesh, consuming 3-in. grinding balls at a rate of about 1½ lb per ton of ore. Grind reagents are ZnSO₄, added at 1.67 lb per ton, and sodium cyanide, added at 0.4 lb per ton. Mill water is drawn from the Daly West mine.

A Krebs cyclone in closed circuit with the ball mill sizes the ore ahead of the flotation circuit—a conventional lead-zinc circuit of Agitair No. 60 flotation cells.

Concentrator operation had not fully stabilized when E/MJ visited the property in the fall of 1975, and recoveries were still improving. The recovery rate at that time was 86% for Pb and 87% for Zn in concentrates grading 69% Pb and 55% Zn. Reagent consumption is 0.053 lb per ton for Z-11 and 0.047 lb per ton for "Dowfroth" in the lead roughers; 2.8 lb per ton for hydrated lime, 0.04 lb per ton for Z-11, and 0.10 lb per ton for CuSO₄ in the zinc conditioners; and 0.013 lb per ton for Z-200 in the zinc roughers. Lime addition at the head of the zinc circuit controls pH at 10.2.

Concentrates are thickened in 36-ft-dia Eimco thickeners and filtered through 10 x 10-ft Eimco filters prior to shipping.

Tailings are deslimed, and tailings sands are used in mine backfill. Tailings are then pumped 6 mi downhill to a new tailings pond built by Ventures over an old tailings disposal area. The company is committed to a program of reseeding for all disturbed surface areas.

Park City's past: bonanza to bust and back again

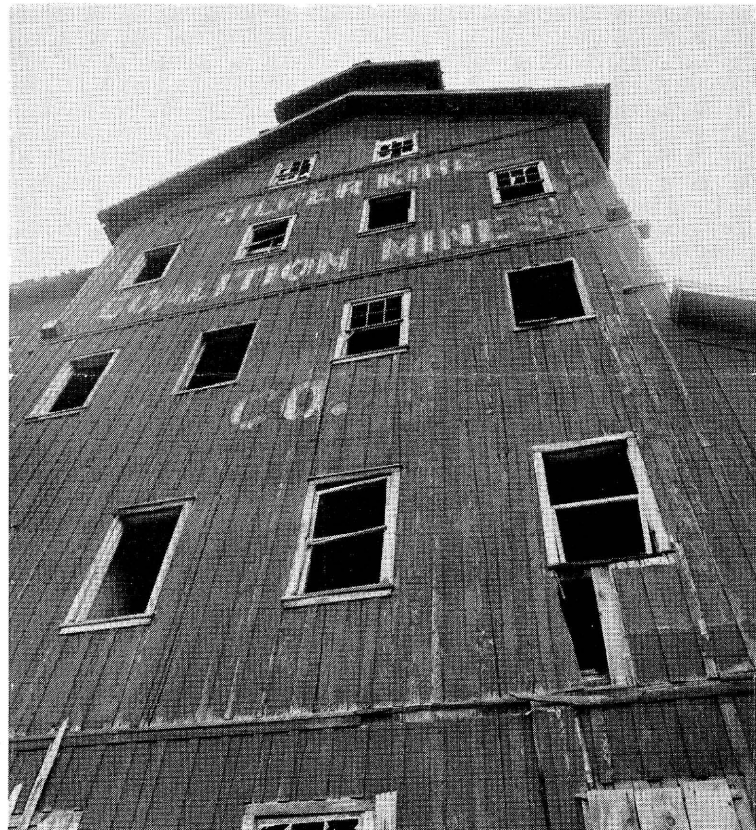
Soldiers from Col. Patrick Edward Connor's California Volunteers are reported to have made the first discovery of ore in the Park City district in the fall of 1868. A threatening snowstorm prevented them from following up on their discovery, but they marked the spot and returned the next summer. The first ore sample assayed 96 oz silver per ton, with additional lead and gold, and the discovery became the Flagstaff mine.

The first major strike in the district was made in 1872 in Ontario Canyon, immediately to the east of the current Ontario No. 3 shaft. Rector Steen, a California Gold Rush veteran, Herman Buden, James Kane, and Augustus Dwell staked claims that yielded samples assaying 100 to 400 oz of silver per ton. These claims, which were purchased by George Hearst and J. B. Haggin of San Francisco for \$27,000, became the foundation of Ontario Silver Mining Co., a producer of some \$15 million in dividends through 1956.

The lively mining town of Park City developed to serve the diverse interests of the Ontario, Daly, Anchor, Daly West, Mayflower, Silver King Consolidated, Silver King Coalition, Thaynes, Alliance, Crescent, and other mines. The "Old Park City Bunch," numbering about 20 millionaires at the turn of the century, wheeled and dealt in mining properties.

In the 1880s, Thomas Kearns arrived in Park City at the age of 21 with a pack on his back and some experience prospecting in the Black Hills and mining in Tombstone, Ariz. He worked shifts at the Ontario mine, prospected and developed a number of mines including the Silver King, and in 1900, at the age of 38, was elected to the US Senate.

Cornish "Cousin Jacks," numerous Scots, and a large Irish contingent came to Park City to work the mines. Scandinavian lumbermen arrived to run the sawmills. Chinese



The Silver King Coalition building stands as a reminder of Park City's mining past. The Silver King mine produced 4.7 million tons of ore containing 86 million oz of silver, plus gold, lead, zinc, and copper, during a production run from 1882 to 1964.



Park City's mining atmosphere attracts tourists and its mountain setting has made it a winter sports center. The **PARK RECORD** is Utah's oldest continuously published weekly newspaper.

laborers thrown out of work by completion of the Park City rail spurs in 1880 stayed on to open laundries, work as waiters and porters, and sell fresh garden produce. Park City prospered, and the town developed a buoyant self-regard that still seems to prevail, judging by observations during E/MJ's admittedly short visit.

Controlling water in Park City mines

Park City ores occur over an area about 5 mi long and 4 mi wide and have been mined from the surface to a depth of 2,500 ft. The region's heavy precipitation is soaked up to form strong-flowing underground streams that required control before mining could proceed at depth.

As noted elsewhere in this article, the Ontario No. 1 drain tunnel was the first major effort to drain Park City mines above the Ontario 600 level. The next important accomplishment in mine water control was construction of a

huge Cornish pump—one of the engineering marvels of its time—which pumped water from the 1,000 level of the Ontario to the 600 level for drainage through the No. 1 tunnel.

Housed at the collar of the No. 3 shaft, the drive machinery for the Cornish pump featured a 30-ft-dia flywheel that weighed 70 tons. A 1,060-ft connecting rod was made of 16-in.-square sections of Oregon pine 70 ft long, joined by ¾-in.-thick iron plates 10 in. wide and 35 ft long. Two 20-in.-dia pistons at the 1,000 level moved through a 10-ft stroke to lift 320 gal per stroke and 2,560 gpm.

One day, according to a favorite Park City story, the Cornish pump stopped. The mine's managers tried but failed to restart it, when a miner allowed that he might be able to help. Management was willing to listen.

The miner climbed up high on the flywheel, taking a sledge hammer with him. He struck the wheel a heavy blow, and it started. The mine's happy managers asked the miner what he wanted for his services. "One hundred dollars," the miner replied. Thinking the charge a bit steep, management asked for an itemized bill.

"For striking the wheel a heavy blow, 50¢," the miner wrote. "For knowing where to strike it, \$99.50."

When mining moved below the Ontario's 1,000 level, new solutions had to be found for controlling the district's water flows. Completion of the Ontario No. 2 tunnel at the 1,500 level made the Cornish pump obsolete. Eventually reaching a length of 27,000 ft, the tunnel was 9 ft high, 4½ ft wide at the top, and 5½ ft wide at the bottom. The flume, 21 in. deep, was covered with a tow path and was capable of carrying 13,000 gpm of water.

Other major tunnels in the Park City district included the 6,600-ft Anchor tunnel to drain the Daly Judge mine, the 4,590-ft Alliance, the 13,500-ft Silver King Consolidated (Spiro), and the 12,800-ft Snake Creek tunnel.

Through the first half of the 20th century, Park City's fortunes fluctuated with the ups and downs of the US economy. Now it has miles of ski runs, a golf course, tennis courts, and an important tourist trade to level out the uncertainty of the mining business. Right now that business is on the upswing with the new Ontario mine, and its annual payroll of more than \$4 million is a boost for Park City's economy. □

References

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Thompson, G. A. and Buck, F., *Treasure Mountain Home*, Deseret Book Co., Salt Lake City, 1968.

Production of Park City district from 1875 to 1964

Mining company	Years	Tons mined	Gold (oz)	Silver (oz)	Lead (lb)	Zinc (lb)	Copper (lb)
Ontario Mine	1875-1964	2,238,594	41,289	55,710,608	164,231,209	210,350,684	3,911,102
Daly West and Judge Mines	1899-1951	4,265,346	79,051	51,264,289	744,384,966	401,616,365	31,831,461
Daly Mine	1886-1950	554,088	18,717	12,734,946	11,166,664	10,877,183	371,628
Park Utah Mines	1920-1951	1,238,778	168,264	21,690,417	104,032,694	136,311,084	6,003,021
Silver King Mine	1882-1964	4,698,609	200,224	86,126,781	1,334,765,435	331,859,041	45,801,007
New Park Mine	1936-1964	1,645,501	464,564	10,037,160	182,256,534	224,791,927	21,951,133
Totals		14,640,916	972,109	237,564,201	2,540,837,502	1,315,806,284	109,869,352

Source: *Ore Deposits in the United States 1933/1967*, Vol. 2, Ch. 53—"Ore Deposits of the Park City District with a Contribution on the Mayflower Lode," AIME, 1968.