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A HISTORY OF THE QUESTA MOLYBDENUM (MOLY) MINES, TAOS COUNTY, NEW MEXICO

JOHN SCHILLING
Geologic Consultant, 1301 Royal Drive, Reno, Nevada 89503

Abstract—The true nature of the molybdenum-bearing veins in Sulphur Gulch (a tributary of the Red River, 8 km east of Questa) was recognized in 1916. Several attempts were made to develop and mine the veins. In 1919, Molybdenum Corp. of America acquired the property and continued development-mining. In 1923, a mill and a camp were built along Red River, and production soared. Ore was extracted by following veinlets down-dip and laterally. Any ore-pockets encountered were stoped, hand-sorted, and the molybdenite was concentrated by flotation. By 1941, the mine extended so deep (260 m) that a mile-long tunnel was driven north from Red River Canyon to connect with the deepest workings. Haulage, drainage, and ventilation costs were greatly reduced. Mining continued down-dip for another 75 m (250 ft) before the high-grade ore ran out. Underground mining ceased in 1958, but exploratory drilling and drifting, begun in 1956, continued. By 1964, a large tonnage of low-grade, open-pitable ore had been delineated just west of the underground mine. The old camp was torn down; a large, modern mill was built on the camp site, and pre-mining stripping began. Open-pit mining began in 1965 and continued until 1981. In 1975, exploratory drilling discovered a large orebody beneath the open-pit mine that extended W-SW from the pit. This "deep" ore was developed by vertical shafts and a 2130-m-long (7000 ft), 10-degree decline from the mill to the orebody. Once again the mill was renovated and enlarged, and underground mining began in 1983. The ore is block-caved, hauled up the decline and milled. A soft molybdenum market forced the mine to shut down in 1986. Prices have since improved, and the mine was reopened in 1989. Through 1989, over 190 million pounds of MoS_2 have been produced.

DISCOVERY AND DEVELOPMENT

Prior to 1916, the bright-yellow, oxidized molybdenum veins in Sulphur Gulch (a tributary to the Red River, 8 km east of Questa) were thought to be sulfur, giving the name Sulphur to the gulch (Fig. 1). The shiny black, flaky molybdenum was mistaken for graphite, and was mixed with grease and used to lubricate wagon wheels, and as a shiny shoe polish which unfortunately rubbed off on everything.

In 1916, the true nature of the veins was recognized when Jimmy Fahy, a local prospector, had a vein sample assayed for gold and silver. When the assayer returned his report, he mentioned the presence of molybdenite and its value. Fahy located the "Phyllis" claims, and the Western Molybdenum Co. was formed, but little was done to develop the property.

FIGURE 1. Sulphur Gulch in 1951, looking west. Bare, landslide area is location of Figure 5; open-pit now covers entire view (see Figure 14). Photo by J. Schilling.

In 1918, the R and S (Rapp and Savery) Molybdenum Company was formed, took over the Western Molybdenum Co. claims, and located the "Sargent" claims. Development work was done during the winter of 1918–1919.

UNDERGROUND, SELECTIVE MINING (1919–1958)

Production began in 1919; the ore was treated in a small converted gold mill—the June Bug, located along the Red River 6 km east of the mine. The Molybdenum Corporation of America was incorporated later in the year, acquired the R and S property and took over mining. Although mining was discontinued because of the depression in 1921, development continued.

In 1923, a mill and camp were built on the present mill site along the Red River (Figs. 2, 3, 4). The camp consisted of an office-company store-warehouse, mill, assay lab, cookhouse, bunkhouse, superinten-

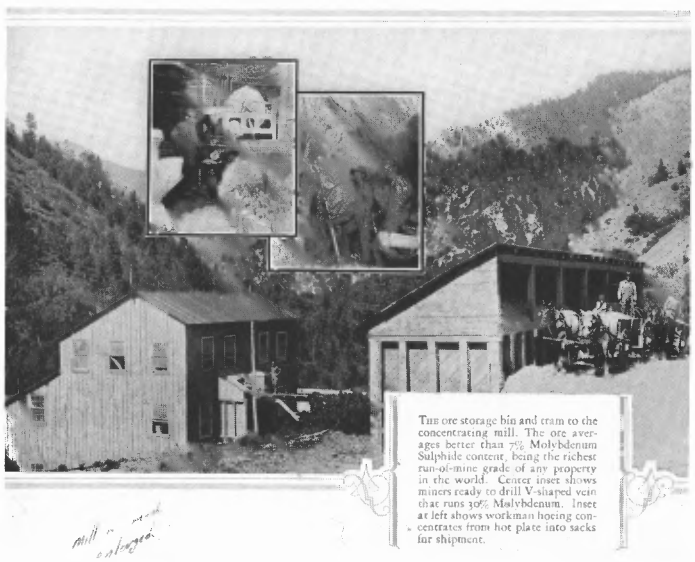

FIGURE 2. Moly mill in 1925. Photo from Moly. Corp. of America brochure.

FIGURE 3. Moly camp in 1925. Photo from Moly. Corp. of America brochure.

FIGURE 4. Moly camp and mill in 1952. Camp and mill were torn down in 1964, and a new mill built on the site. The open-pit is now located in the upper right corner of the photo. Photo by J. Schilling.

dent's and workers' "cottages" and a one-room school. All were painted "battleship" gray. The camp had running water and electricity, and "many families have radio receiving sets and are thus enabled to keep in close touch with the rest of the world" (1926 company brochure). A flume supplied water and powered a water wheel in the mill.

Exploration and development proceeded simultaneously. Adits were driven into the sides of Sulphur Gulch, crosscutting veins and paint-thin veinlets. Drifts were then driven along promising structures, following the "paint" until it widened to a minable vein or was lost. Raises were driven upward from the drifts to determine the vertical extent of any ore shoots. The miners were their own exploration geologists, soon learning that: (1) most ore was near the "red rock" (granite) contact with the "green rock" (andesitic volcanic rocks); and (2) veins were usually thicker in the "red rock," where the contact trended east, and where the contact dipped steeply.

Any high-grade ore encountered during the drifting and raising was mined. Mining continued updip and laterally until each ore shoot was mined out. The ore was hand- or machine-drilled, blasted, hand-trammed to the portals high on the gulch walls, hand-sorted, bagged and hauled on burros to the gulch floor. As production increased, several long pipelike chutes were built at the main portals (Fig. 5), but burros (Fig. 6) still were used to get the ore to the chutes from the more inaccessible workings.

As the ore was mined out between the adit levels and the surface, the "paint" and veins were explored downward by inclined winzes. It was obvious that there was considerable ore below the upper levels. A 90 m (300-ft), vertical winze (Z Winze) was sunk from the lowest adit level, and three new levels were established. Exploration, development and mining methods were the same, except that the broken ore now had to be hoisted up the winze, and the workings dewatered by pumps. Later, a second 90 m (300 ft), vertical winze (2nd Winze) was sunk, extending mining even deeper. Now, ore (and water) had to be moved vertically 90 m (300 ft), horizontally 180 m (600 ft), vertically 90 m (300 ft), and horizontally over 300 m (1000 ft) to the portal! And the workings extended more than 260 m (850 ft) vertically.

The 1923 mill could treat 40 tons of ore per day. The ore was crushed, ground to powder, and the molybdenite separated from the other minerals by the flotation process (Carman, 1932). The molybdenite was dewatered and dried, bagged and shipped to the company's Washington, PA plant where it was turned into products used by the steel industry. In 1929, the mill was rebuilt to improve recovery (Carman, 1932).

By 1941, mining and exploration had extended to such depths that a mile-long adit (Moly Tunnel) was driven north from Red River Canyon (Fig. 7), where it connected with the deepest mine workings. Haulage,

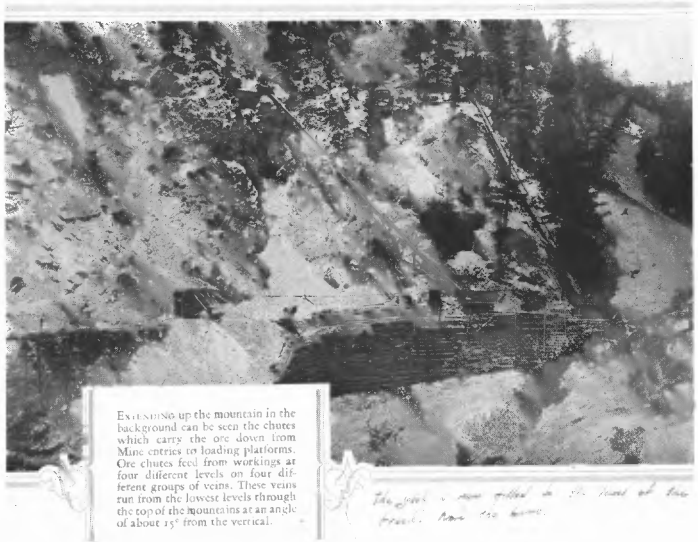

FIGURE 5. Sulphur Gulch in 1925. By 1951 (see Figure 1), a landslide covered this scene. Photo from Moly. Corp. of America brochure.

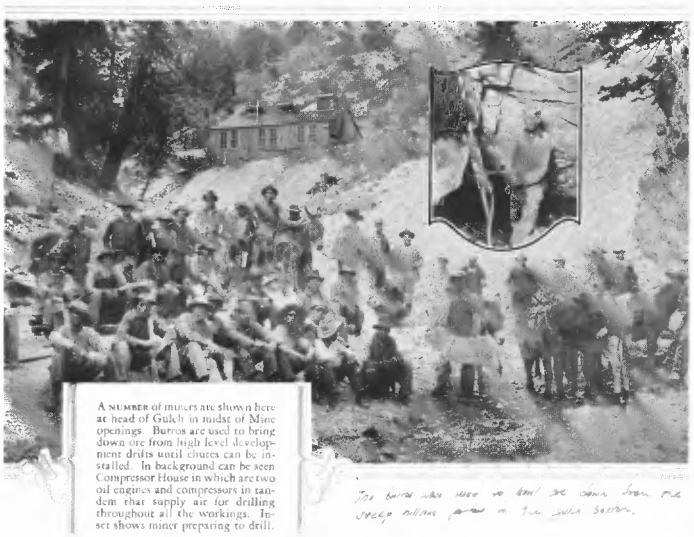

FIGURE 6. Sulphur Gulch in 1925. Photo from Moly. Corp. of America brochure.

ventilation and pumping costs were greatly reduced. In 1946, the mill was again rebuilt with a capacity of 50 tons per day.

In 1950, I spent the summer in New Mexico working as a field assistant to Phil McKinlay (1956, 1957), who was mapping the Taos Range for the New Mexico Bureau of Mines and Mineral Resources, and visited the mine for the first time. During much of 1951–1955, I lived at the mine, mapping the underground workings and surface (Schiling, 1956), and on occasion was mine clerk, surveyor, night watchman, etc.

Mining was still underground, but now extended several hundred feet below the Moly Tunnel (Fig. 8). Mining methods were much the same (Schilling, 1956), except that the burros were gone, and miners (and I) rode a "train" (Fig. 9) the mile into the mountain before walking to their work places. The mines were paid by contract: so much per pound of molybdenum mined and hand-trammed to the winze, so much per foot of drifting, or timbering, etc., minus supplies from the warehouse, purchases from the store and rent or room and board, if any. The underground crew had shrunk to a dozen or so, including the mine foreman, and most no longer lived in camp. A "blacksmith" worked at the portal keeping the compressor going and the drill-steel sharp.

I lived in a room in the office (Fig. 10): in the front room were desks for the manager and mine clerk, a walk-in safe, the company-store counter, a drafting table, a pot-belly stove and the only telephone in camp. There were usually several other persons around—salesmen, the mailman, families buying food (on credit), miners picking up supplies, or the mine foreman discussing what to do next. At night the office

FIGURE 7. Moly tunnel portal in 1952. Photo by J. Schilling.

FIGURE 8. Drift on vein (1952). Ore stoped above and below level.

FIGURE 9. Moly tunnel portal in 1952. Miners waiting to ride into mine.

was occupied by a night watchman who made his rounds once an hour, keeping the pot-belly stoves going and seeing that the all-wood buildings did not burn down; toward morning he also fired up the huge cookstove in the cookhouse. Having spelled the night watchman, I can tell you that it was an easy job *if* you could "punch in" at each "station" on time *and* still keep all 10(?) stoves burning.

On the other side of the dirt "highway" along Red River Canyon, a few steps down the hill was the mill. A maze of pulleys, belts and shafts from the Pelton waterwheel powered the ball-mill, classifier,

FIGURE 10. Moly mine office-store-warehouse in 1952. Photo by J. Schilling.

flotation machines and other equipment. A diesel engine was added to augment the waterwheel. One had to be extremely careful not to get caught in the belts and other moving parts, and not to slip on the foam from the flotation machines, which on occasion covered the floor like a giant bubble bath. The mill operated two 8-hour shifts with 2 men on each shift. The mill was quite noisy, and if I were asleep at midnight when it was shut down, the absolute silence would always wake me up.

Along the road between the mill and the office were orebins and a tiny assay lab. Ore from the mine was hauled by truck from the mine to these orebins, and grab samples were assayed in the room-for-one-person lab.

The bunkhouse and cookhouse were just west of the office. Room and board was a dollar a day. The cookhouse had a dining room with a long table, a kitchen with a huge wood-burning stove, a pantry with walk-in refrigerator and rooms in the back for the lady cook and schoolteacher. There were only five regular boarders; each had a set place at the table. Often there were guests. The meals were plain, hardy fare, served family style. Occasionally the cook would fix liver and onions for herself and me, but everyone else would insist upon, and get, some more "edible" meat.

Later, after I had married and brought my bride to camp (Fig. 11), she volunteered to fill in during the cook's absence. One day she decided to make pie which she proudly set out, only to have the filling eaten and the crust left completely intact on every plate, silent witness to her poor pastry-making.

On Sundays the mine, mill and office were closed. The cook left for her "ranch" in Colorado, and any of us left behind had to fend for ourselves. The boarders were allowed to raid the pantry, especially the bread and the huge "logs" of baloney. Being lazy, I never had anything but fried baloney and mustard sandwiches.

The cookhouse was something of a social center. If the cook returned with cream, everyone was invited for ice cream. Someone would collect icicles from the flume, the hand-crank freezer was brought out, the cook baked a cake or cookies, and we all cranked the freezer, or commented on what a lousy job the cranker was doing in getting the cream to freeze.

The "management" houses were along and above the highway. The miners' cottages, the few that remained, were below the road in the river bottom, as was the one-room school.

By 1953, the end was in sight—the high-grade veins were nearly mined out, and exploratory drifting and winzing was finding less and less ore. The workings now extended almost 360 m (1200 ft) vertically. A last effort was made to find deeper high-grade, and a drift was driven to the west. Only a small amount of high-grade ore was found, and it was soon mined out. But many thin "paint"-filled fractures were encountered. The high-grade was gone, but what about the molybdenite in these stockwork veinlets (Schilling, 1956)? Such low-grade, disseminated mineralization was being mined at Climax, Colorado, the largest molybdenum mine in the world.

In 1957, exploration began under a $255,000 Defense Minerals Exploration Administration contract; the company being required to spend an equal amount of its own money. Drifting, crosscutting, and core and rotary drilling was done (Fig. 12). Underground mining ceased in 1958. The ore mined had averaged more than 4% MoS_2 with some stopes running as much as 35 percent.

FIGURE 11. Our cottage (1954). Built by John Carman, mine manager for many years, it was the only log cabin in camp. Photo by J. Schilling.

OPEN-PIT, MASS MINING (1969–1981)

In 1959, I lived in Red River while examining the mineral resources of Taos County (Schilling, 1960), and visited the mine frequently. In 1960, I moved to Nevada, but still visited the mine (and Taos County) as often as possible, and watched developments with keen interest. Exploration continued after the DMEA program was completed in 1960, and by 1963 included extensive bulk sampling underground as well as over 170,000 feet of drill-hole samples.

In 1964, the decision was made to open pit mass-mine the low-grade ore that had been found. Preproduction stripping began in September. The old camp was torn down, and a huge, modern, 10,000-tons-per-day mill, offices, warehouses and parking lot were built on the site. The only thing left from the good old days is a small pine tree which stood next to the house where my wife and I had lived. The primary crusher was located high on a ridge above the mill, and a 13 km (8 mi) pipeline was built in the canyon to Questa, to carry the mill-tailings to the disposal ponds.

Mining began late in 1965. In 1969, the mill was expanded to 15,000 tons per day, and stripping was increased to 120,000 tons. The mine and mill operated 24 hours a day, 7 days a week. Four rotating-schedule crews were needed to handle the continuous operation of the mill and mine. The open-pit was developed with benches that were 40 ft high and at least 130 ft wide. Ore and waste was drilled and blasted. Two 17-yard shovels were used to strip the waste which was hauled to the dumps by 120-ton trucks. Ore was mined by two 10-yard shovels, and hauled to the primary crusher in 85- or 100-ton trucks.

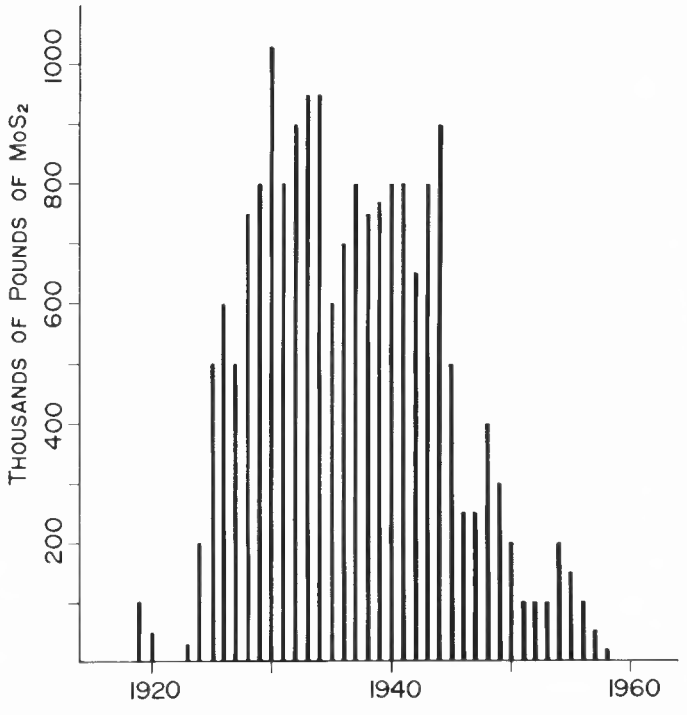

FIGURE 12. Molybdenite production at the Questa (Moly) mine during underground, selective mining. From Schilling (1960).

The coarse ore was further crushed to <5/8-inch pieces in cone crushers; then ground to powder in ball mills, and the molybdenite concentrated by flotation machines. The concentrate was then filtered, dried and packaged for shipment in 8000-pound "tote" containers or, if it was to go overseas, in 800-pound metal drums. The process was much the same as in the old mill, but on a much grander scale. The 500+ employees were paid over $5 million a year. 120,000 tons of rock were mined each day. A stripping shovel cost $750,000, and one tire for the haulage trucks cost $4000.

In 1969, extensive drilling was done on the western flank of Flag Mountain, 6.4 km (4 mi) west of the mill, at the Log Cabin Canyon prospect. This drilling outlined another, smaller orebody, which can be mined in the future. In the 1930's MCA had driven a long adit into the molybdenum mineralization, and in 1959 had drilled two vertical drill holes (Schilling, 1956).

In 1975, exploratory drilling, looking for downward extensions of the open-pit mineralization, discovered several orebodies. The largest of these contained 135 million tons averaging 0.3% MoS_2. Open-pit mining was to continue until underground production could supply the mill (Fig. 13).

In 1976, production peaked at 11.5 million pounds. By 1980 production had dropped to only 3.7 million pounds (Fig. 14). Because of the soft market, open-pit mining ceased in August 1981, even though the pit still contained some ore. The ore had averaged about 0.17% MoS_2.

UNDERGROUND, BLOCK-CAVING MINING (1983–)

Development of the "deep" orebody had begun in 1979. Two vertical shafts were sunk to what would be the haulage level. The 400-m- (1315-ft-) deep ventilation shaft was completed in 1981. The 398-m- (1305-ft-) deep service shaft was completed in 1982; it was used to transport men and supplies, hoist muck and as a fresh-air intake. And, a 2133 m (7000 ft), 10-degree decline was driven from the mill to the haulage level. The mill was modified to increase its capacity from 15,000 to 18,000 tons per day, as well as to handle the softer ore. Over $350 million was spent to develop the mine, revamp the mill and refit the smelter in Washington, Pennsylvania.

In August 1983, mining and milling of the "deep" ore began; initially ore also was mined from the open-pit. Employment reached a high of 875. Block-caving is used to mine the ore—the ore is undercut and blasted to initiate gravity caving, the broken rock falls into "draw" raises and is carried down to waiting cars on the haulage level, hauled

FIGURE 13. Open-pit mine in 1981. See Figures 1 and 10 for location. Photo courtesy of MolyCorp.

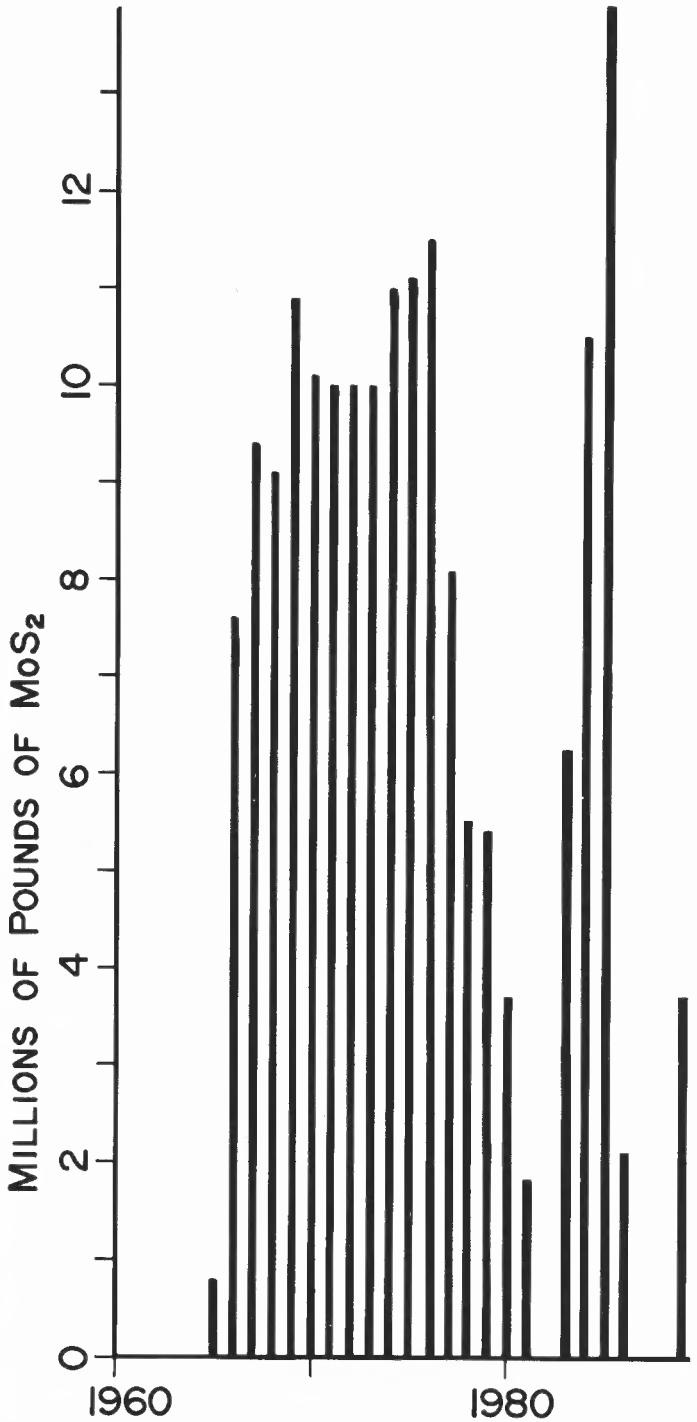

FIGURE 14. Molybdenite production at the Questa (moly) mine during open-pit (1969–1981) and block-caving (1983–) mining. From U.S. Bureau of Mines Minerals Yearbooks, Molybdenum Corp. of America Annual Reports, and other sources.

to the decline, transported down to waiting cars on the haulage level, hauled to the decline, transported by conveyor belt up the decline to the crushers and into the mill.

In October 1985, production was cut 25%, and 150 employees were laid off because of the continuing soft market for molybdenum. In 1986, the bottom fell out of the market, and the mine was closed. Prices have since crept up, and the mine was reopened in late 1989.

My visits to Taos County have become less and less frequent as excuses dwindled—consulting, friends, time. The area is still my favorite in all the world, and although developments at the mine are watched with great interest, the "good old" mining-camp days are gone. The mine has become a big, modern, world-class, industrial complex with as much, if not more, ore than has been mined, remaining to be mined.

ACKNOWLEDGMENTS

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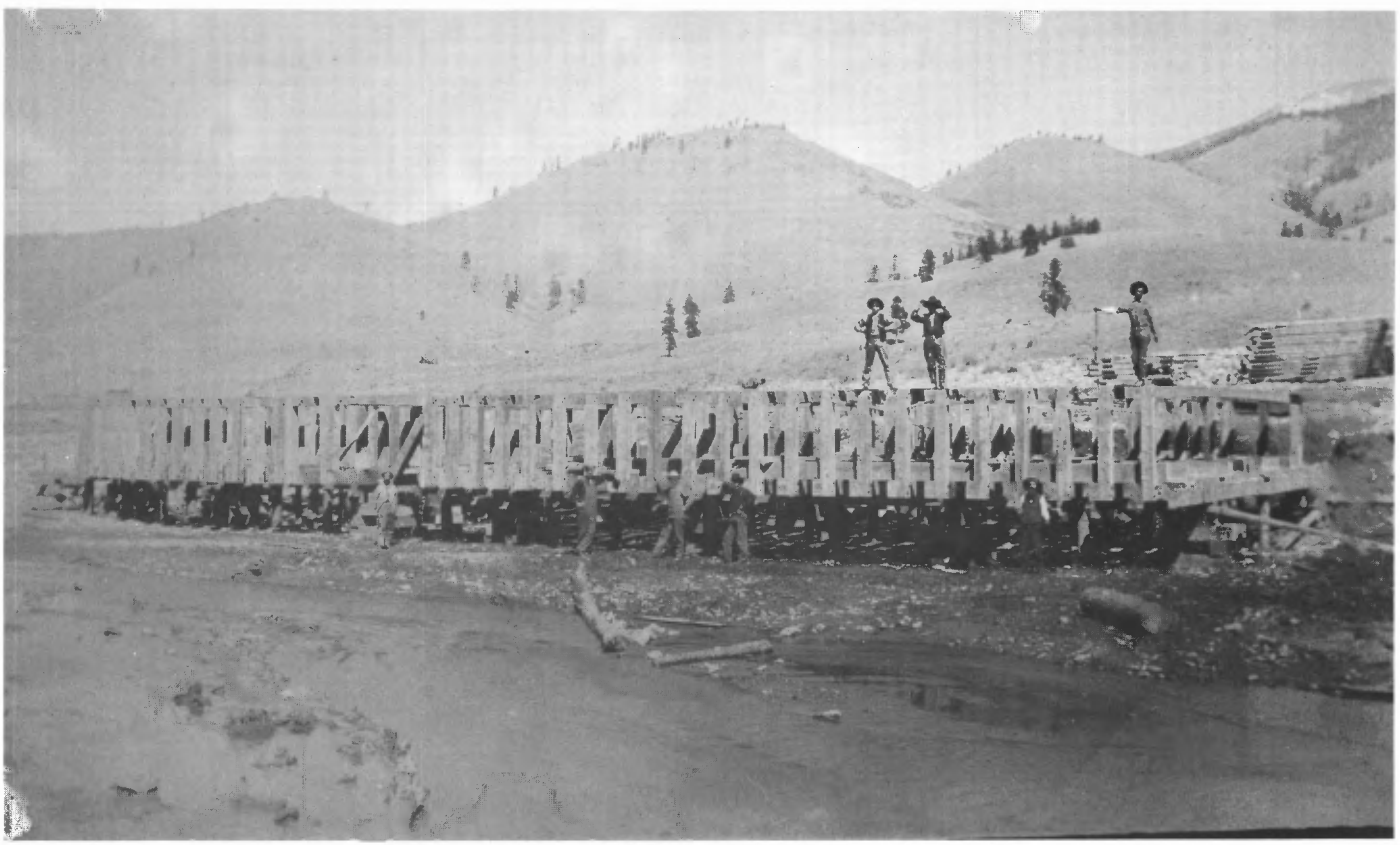

Rare photo showing an early stage in the construction of the gold dredge "Eleanor" a few miles south of E'town. When finished, Eleanor was set afloat when Moreno Creek (shown in foreground) was dammed downstream. She was completed in 1900 and lived a life of pure dredgery until set out to pasture (literally, when the artificial lake was drained). Photo courtesy of Philmont Scout Ranch.