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Homestead mine

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The Homestake Mine

BY ARTHUR P. METZGER

PARTNER, SAN FRANCISCO OFFICE

Sunk more than a mile deep into the Black Hills that rise above the old buffalo grazing lands of South Dakota is the gold mine of Homestake Mining Company. Homestake has been a client since 1935 when Jim Runser, long the partner in charge of our San Francisco Office, journeyed there to make the first independent audit of the Company.

The Homestake Mine has been a successful enterprise for almost 90 years. Although mining gold today bears little resemblance to the work of the early-day prospectors and miners, it is still confronted with problems that call for the same venturesome spirit, tenacity, and ingenuity.

Getting gold from the earth has always been a tough and risky business—in terms of both human effort and economics. Miners are a hardy breed. Today, Homestake must bring from the depths of the earth more than *three tons* of hard rock in order to extract *one ounce* of gold for which it receives \$35, a price fixed more than 30 years ago by the Federal government, which by law is its only customer.

With constantly rising costs and the need to follow the ore body ever deeper into the earth, Homestake has had to search continually for new methods by which the ore can be mined and milled and the gold recovered more efficiently. Inflation and the fixed price of the product have to some extent obscured spectacular achievements, but the fact that the mine is still profitable is evidence of the Company's character and resourcefulness.

Gold and Indians

Homestake's history begins in 1874, when General George Armstrong Custer carried out a reconnaissance

into the Black Hills, Dakota Territory. Rumors of major gold discoveries soon turned a minor rush into a stampede of prospectors to mountains which were sacred to the Sioux. Custer's Last Stand on the Little Big Horn River in 1876 was not unrelated to this conflict of interest. In the same year, two prospectors discovered the Homestake Ledge or Lead (pronounced "Leed," meaning an outcrop of ore); hence the name of the mining town which grew up around the Homestake Mine.

A San Francisco group including Senator George Hearst, father of William Randolph Hearst, and L. B. Kellogg, an expert and practical miner, optioned the Homestake and one other claim for \$70,000, and the Company was established in 1877. Ox teams hauled equipment almost 300 miles from Sidney, Nebraska, the nearest railhead of the Union Pacific. Homestake's first financial statement for the period to August 31, 1880, reported revenue of \$1,925,000 and dividends of \$600,000. The Homestake Mine has been in almost continuous operation for nearly a century and has produced almost \$1,000,000,000 of bullion at today's price. With annual revenue of over \$20,000,000, the mine today is one of the world's major gold mining properties and the largest gold producer in the Western Hemisphere.

H&S in a Mining Camp

A short uphill walk from our lodgings in the Company's apartments on Main Street brings us to a rather inconspicuous marker which pronounces the altitude to be one mile above sea level. Looking on up the hill to the green line of jack-pine against the snow, we recall tales of how Jim Runser used to walk with his audit assistants through the upper streets of Lead (once at 40 degrees below) for a break before their regular evening

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work. In later years, Mike Chetkovich, now partner in charge of our San Francisco Office, would fortify us for late work with venison stew he cooked in our apartment from an old California mining camp recipe.

Up there on the hill are the mine buildings, dominated by the great headframe of the Yates Shaft (see sketch), where earlier today Dean Madsen and John Crary, our staff accountants on the Homestake engagement, returned from an underground visit. Wearing borrowed hard hats, lamps, safety glasses, boots, and coveralls they had descended to the deepest level of the mine, 6,800 feet beneath the collar of the shaft and more than 1,500 feet below sea level. During the afternoon underground they had seen some of the methods used to keep the mine profitable.

Actually, there is nothing new in Homestake's search for efficiency. At the turn of the century it gained an advantage over neighboring mines, none of which survived many years longer, when a San Francisco chemical engineer, Charles W. Merrill, discovered how to apply the cyanide process, a method for dissolving gold long known in laboratories, to industrial production for Homestake. Cyanidation is still used at Lead to separate from the ore that portion (30 per cent) of the gold which cannot be recovered in the older process known as amalgamation, which depends on the affinity of gold for mercury. All told, Homestake's recovery methods extract 96 per cent of the gold from the ore.

The Depression of the 1930's marked the period of greatest capital development at Lead. Paradoxically, as the economy sagged in the rest of the country things improved at Lead, culminating in the rise in the Government price for gold from \$20.67 to \$35 an ounce. Underground development accelerated at a rapid pace, although this was not necessarily reflected in the Company's balance sheet, since the nature of the mining operation is such that much of the cost of machinery and equipment sent underground and all ordinary development costs are usually expensed currently.

New Machinery Installed

Aboveground the most conspicuous development of that era was the installation of new hoist machinery for the Yates and Ross shafts. Still in excellent condition, thanks to careful maintenance, the two great hoists haul out 6,000 tons of ore a day in "skips," or huge buckets, each holding nine tons of ore containing about \$100 worth of gold. They also raise and lower "cages," or elevators, for men and equipment. As a matter of pride the hoist rooms are kept immaculately clean, as clean as firemen keep their firehouse.

Noteworthy improvements in these hoists have increased their efficiency. Originally the cageman, or tender, could not be reached with instructions once the cage was on its way. Now continuous communication with him is possible through radio waves transmitted around the cable itself. More recently, a television system has been installed which permits the hoist operator to watch the loading and unloading of skips, thereby eliminating the need for men who used to report to him on the completion of these operations. An underground cage hoist has recently been automated so it may be operated like a self-service elevator with further savings in labor.

The Yates shaft plunges to the 4,850-foot level of the mine, the Ross shaft to the 5,000-foot level. An internal shaft, or "winze," about a mile from them underground, carries down from the 4,850-foot level to the present bottom of the mine at 6,800 feet, where normal rock temperature above 120 degrees requires special ventilation. In all, there are some 200 miles of tunnels underground on 30 levels. Ore is hauled to the hoists by locomotives on an intricate 100-mile system of 18-inch gauge track.

Filling Mine with Sand

One of the more significant improvements in efficiency has been in the increased use since 1953 of what miners call "cut-and-fill stoping." It features returning into the mine the mill "tailings," or rock ground to the

fineness of sand and from which gold has been removed. The sand is flushed with water into the "stopes," or chambers, where ore is mined, providing a rising floor from which the miners may reach the ceiling and raise it progressively higher by blasting. Where this technique is used, supporting the stopes with timber can be to some extent dispensed with, saving the considerable labor of timber handling. It is also safer to support stopes with sand than with timbers, and the method provides a certain flexibility in following erratic ore formations. A further improvement being introduced is to mix cement with the backfill for a floor to replace wood floors now laid on the sand.

The drive to prolong the life of the mine by cutting costs is strong all the way from top management to the miners underground. Miners, like farmers who also wrest their livelihood from the earth, are self-reliant jacks-of-all-trades. While supervisors are in touch with them daily, the miners must constantly make operating decisions, such as whether to support stope walls with long rock bolts or with timbers. Over 500 of the more experienced miners, or about half of the total underground force, are paid in addition to their "day's pay" or base rate on a "contract" or piece-rate basis, supplying them with added incentive to maximize profits and cut costs.

After the ore is raised to the surface it is crushed and sent to large revolving drums, some half-filled with tumbling steel rods and the others with steel balls a bit bigger than baseballs, that grind the ore to a consistency ranging from sand to flour. Two pounds of steel rods, balls, and drum liners are consumed in the grinding of

Examining ore specimen and diagram of mine's underground workings are (l. to r.) Dr. John K. Gustafson, President; Michael N. Chetkovich, partner-in-charge of San Francisco Office; James A. Runser, advisory partner and formerly partner-in-charge (San Francisco); and Dr. Donald H. McLaughlin, Chairman of the Board.



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every ton of ore. Automation has reduced the number of mill employees from 55 in 1953 to 23, but one vital step in the process is still done by hand—adding the mercury for amalgamation. Every 20 minutes a small dose of quicksilver is fed into each drum in a cup somewhat smaller than a bartender's jigger.

Controls in the Refinery

Some of Homestake's most effective economies occur in the refinery, where the final steps in the recovery take place. Since three tons of ore must be hauled to the surface and crushed to recover an ounce of gold, which is smaller than a pea, elaborate precautions are taken to prevent the precious product from escaping in the refining process. Water used for washing work clothes and hands is saved and gold dust recovered from it. Work gloves costing only a few cents are burned after three or four days' use to yield 75 cents worth of gold a pair. The refinery walls are vacuumed, and even gold in the furnace smoke is captured on electrodes in the chimneys, a process which has yielded about \$100 each working day since 1938. All told, these salvage methods produce some \$20,000 worth of gold every three weeks.

The refinery, where each week 21 gold bars are produced weighing some 35 pounds apiece and each worth about \$18,500, is one key point in the internal control system. Guards are posted at the gates and bars are stamped with serial numbers and accounted for before they are shipped to the United States Mint in Denver.

All of these controls have been installed with one end in view: to maintain profitability and thus stretch out the life of the mine into a future that holds the likelihood of more inflation and the dim hope of a rise in the price of gold. People at Lead well remember the grim outlook just before the local boom of the 1930's and the new lease on life that came with the devaluation of the dollar. They have not given up hope for another dramatic turn in their fortunes like that one, though they are relying on much more than hopes in their struggle to survive. For survival of the mine determines the future of Lead, and Homestake considers its human resources as important as its investment in the mine itself. No company was ever managed more for the benefit of its employees and shareholders than Homestake. Everywhere you look in Lead is evidence of benefits for employees, many of whose fathers, in-laws, and even

grandfathers worked in the mine. The General Manager, Jim Harder, is the son of a Homestake miner.

Two Friends from Harvard

Leading the management team from their San Francisco headquarters are two men with impressive academic credentials as well as practical experience at the summit of the mining profession. Dr. Donald H. McLaughlin, Chairman of the Board, was Chairman of the Division of Geological Science at Harvard and is completing a sixteen-year term as a regent of the University of California. Dr. John K. Gustafson, Homestake's President since 1961, studied under Dr. McLaughlin at Harvard and wrote his dissertation on the Homestake gold-bearing formation. While the men in Lead carry on their running battle with inflation, officials in San Francisco are answering Homestake's great economic question with diversification.

As with gold, the Company was a pioneer in uranium when in 1953 it made a modest beginning by acquiring two deposits, both discovered by aerial survey, to the northwest of the Black Hills. Mining of the shallow ores on the flanks of the Bear Lodge Mountains in northeastern Wyoming continues today. The Little Beaver was the first of three mines established a few years later in the Big Indian District of the Colorado Plateau; the North Alice is still producing.

Homestake also became general partner in uranium operations in New Mexico. To finance this venture, bank and public bond financing was arranged, the first such significant financing in Homestake's long history. Today, the partnership is one of the major producers of uranium concentrates (U_3O_8 , or "yellowcake") for the Atomic Energy Commission. In 1964, all uranium operations contributed 53 per cent of the Company's consolidated net income.

Together with its established interests in gold and uranium, Homestake also has investments in potash in Canada, lead in Missouri, iron in Australia, and clay products in California. These newer ventures will require substantial capital, and Homestake's policy of diversification has recently been endorsed by its shareholders in a successful raising of capital through the exercise of stock rights. "If these projects come to fruition as we expect they will," says Dr. Gustafson, "we think the future of the Company is assured."