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Frank Woods McQuiston, Jr., "Metallurgist for Newmont Mining Corporation and U.S. Atomic Energy Commission, 1934-1982," an oral history conducted in 1986 and 1987 by Eleanor Swent, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 1989.



FRANK WOODS McQUISTON, JR.

Catalogue card

MCQUISTON, Frank Woods, Jr. (1904-1987) Metallurgist
Metallurgist for Newmont Mining Corporation and U.S. Atomic Energy Commission,
1934-1982, 1989, xiv, 213 pp.

Growing up in Arizona mining towns; University of California College of Mining, 1931; employment at ASARCO, Selby, CA; mining in Western states; pioneering flotation, extractive metallurgy of gold, copper, lead, zinc. From 1948-1952: organizing Raw Materials Division, AEC, and uranium procurement in Colorado, Belgian Congo, Morocco, South Africa. Development of ion exchange, equipping acid plants for uranium processing. Mill planning: O'okiep, Palabora, South Africa; Tsumeb, Southwest Africa; Granduc, Similkameen, British Columbia; Carlin, Nevada. Supplementary interview with Robert Shoemaker, chief metallurgical engineer, Bechtel Corporation.

Introductions by David Christie, vice president (retired), and Plato Malozemoff, chairman emeritus, Newmont Mining Corporation.

Interview conducted 1986 by Eleanor Swent for Western Mining in the Twentieth Century series.

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PREFACE

The oral history series on Western Mining in the Twentieth Century documents the lives of leaders in mining, metallurgy, geology, education in the earth and materials sciences, mining law, and the pertinent government bodies. The field includes metal, non-metal, and industrial minerals, but not petroleum.

Mining has changed greatly in this century: in the technology and technical education; in the organization of corporations; in the perception of the national strategic importance of minerals; in the labor movement; and in consideration of health and environmental effects of mining.

The idea of an oral history series to document these developments in twentieth century mining had been on the drawing board of the Regional Oral History Office for more than twenty years. The project finally got underway on January 25, 1986, when Mrs. Willa Baum, Mr. and Mrs. Philip Bradley, Professor and Mrs. Douglas Fuerstenau, Mr. and Mrs. Clifford Heimbucher, Mrs. Donald McLaughlin, and Mr. and Mrs. Langan Swent met at the Swent home to plan the project, and Professor Fuerstenau agreed to serve as Principal Investigator.

An advisory committee was selected which included representatives from the materials science and mineral engineering faculty and a professor of history of science at the University of California at Berkeley; a professor emeritus of history from the California Institute of Technology; and executives of mining companies.

We note with much regret the death of two members of the original advisory committee, both of whom were very much interested in the project. Rodman Paul, Professor Emeritus of History, California Institute of Technology, sent a hand-written note of encouragement just a few weeks before his death from cancer. Charles Meyer, Professor Emeritus of Geology, University of California at Berkeley, was not only an advisor but was also on the list of people to be interviewed, because of the significance of his recognition of the importance of plate tectonics in the genesis of copper deposits. His death in 1987 ended both roles.

Thanks are due to other members of the advisory committee who have helped in selecting interviewees, suggesting research topics, and raising funds.

Unfortunately, by the time the project was organized several of the original list of interviewees were no longer available and others were in failing health; therefore, arrangements for interviews were begun even without established funding.

The project was presented to the San Francisco section of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) on "Old-timers Night," March 10, 1986, when Philip Read Bradley, Jr. was the speaker. This section and the Southern California section provided initial funding and organizational sponsorship.

The Northern and Southern California sections of the Woman's Auxiliary to the AIME (WAAIME), the California Mining Association, and the Mining and Metallurgical Society of America (MMSA) were early supporters. Several alumni of the University of California College of Engineering donated in response to a letter from Professor James Evans, the chairman of the Department of Materials Science and Mineral Engineering. Other individual and corporate donors are listed in the volumes. The project is ongoing, and funds continue to be sought.

Some members of the AIME, WAAIME, and MMSA have been particularly helpful: Ray Beebe, Katherine Bradley, Henry Colen, Ward Downey, David Huggins, John Kiely, Noel Kirshenbaum, and Cole McFarland.

The first five interviewees were all born in 1904 or earlier. Horace Albright, mining lawyer and president of U.S. Borax and Chemical Corporation, was ninety-six years old when interviewed. Although brief, this interview will add another dimension to the many publications about a man known primarily as a conservationist.

James Boyd was director of the industry division of the military government of Germany after World War II, director of the U.S. Bureau of Mines, dean of the Colorado School of Mines, vice president of Kennecott Copper Corporation, president of Copper Range, and executive director of the National Commission on Materials Policy. He had reviewed the transcript of his lengthy oral history just before his death in November, 1987.

Philip Bradley, Jr., mining engineer, was a member of the California Mining Board for thirty-two years, most of them as chairman. He also founded the parent organization of the California Mining Association, as well as the Western Governors Mining Advisory Council.

Frank McQuiston, metallurgist, vice president of Newmont Mining Corporation, died before his oral history was complete; thirteen hours of taped interviews with him were supplemented by three hours with his friend and associate, Robert Shoemaker.

Gordon Oakeshott, geologist, was president of the National Association of Geology Teachers and chief of the California Division of Mines and Geology.

These oral histories establish the framework for the series; subsequent oral histories amplify the basic themes.

Future researchers will turn to these oral histories to learn how decisions were made which led to changes in mining engineering education, corporate structures, and technology, as well as public policy regarding minerals. In addition, the interviews stimulate the deposit, by interviewees and others, of a number of documents, photographs, memoirs, and other materials related to twentieth century mining in the West. This collection is being added to The Bancroft Library's extensive holdings.

The Regional Oral History Office is under the direction of Willa Baum, division head, and under the administrative direction of James D. Hart, director of The Bancroft Library.

Interviews were conducted by Malca Chall and Eleanor Swent.

Willa K. Baum, Division Head
Regional Oral History Office

Eleanor Swent, Project Director
Western Mining in the Twentieth
Century Series

1 May 1988
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Western Mining in the Twentieth Century Oral History Series
Interviews Completed or in Process, November 1989

Horace Albright, Mining Lawyer and Executive, U.S. Potash Company,
U.S. Borax, 1933-1962, 1989

James Boyd, Minerals and Critical Materials Management: Military
and Government Administrator and Mining Executive, 1941-1987,
1988

Philip Read Bradley, Jr., A Mining Engineer in Alaska, Canada, the
Western United States, Latin America, and Southeast Asia, 1988

Catherine C. Campbell, Ian and Catherine Campbell, Geologists:
Teaching, Government Service, Editing, 1989

Helen R. Henshaw, Recollections of Life with Paul Henshaw: Latin
America, Homestake Mining Company, 1988

Lewis L. Huelsdonk, Manager of Gold and Chrome Mines, Spokesman
for Gold Mining, 1935-1974, 1988

Frank Woods McQuiston, Jr., Metallurgist for Newmont Mining Corporation
and U.S. Atomic Energy Commission, 1934-1982, 1989

Gordon B. Oakeshott, The California Division of Mines and Geology,
1948-1974, 1988

Samuel S. Arentz, Jr. (Escalante Mine), in process

Donald Dickey (Oriental Mine), in process

A. I. Johnson (Black Hills mining), in process

Evan Just (Engineering & Mining Journal, Cyprus Minerals, Stanford
University), in process

Plato Malozemoff (Newmont Mining Corporation), in process

Langan Swent (San Luis, Homestake, uranium mining), in process

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University of California at Berkeley

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Vice President (retired), Homestake Mining Company

* Deceased during the period of the project

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Introduction by David Christie

The first time I heard Frank McQuiston's name mentioned I was a young engineer working for the O'okiep Copper Company in South Africa. His metallurgical acumen was known even then. This was about the time he went to work for the Atomic Energy Commission.

It wasn't until the late 1950s that I met Frank. I was working for Dorr-Oliver in Stamford, Connecticut, on a fluosolids roast-and-leach process they were promoting. Frank had returned to Newmont and was looking for an economic solution to treat the lead and zinc concentrates at Tsumeb. He contacted Dorr-Oliver, and we investigated the application of the process to their concentrates. For various reasons it did not work out, but I was impressed with Frank's enthusiasm and thoroughness.

In 1960, through the instigation of Marcus D. Banghart, senior vice president of Newmont, I returned to Newmont as director of the metallurgical laboratory in Danbury, Connecticut, eventually reporting to Frank. When Frank got involved in the design of the mill at Palabora, I assisted him and later was transferred to the New York office. During the ensuing years a closely knit engineering group, which included Gene Tucker, Keith Bowley and myself, with Frank as leader, carried out various engineering projects such as Carlin, Granduc, and Similkameen. This period was an unforgettable experience which would be hard to duplicate. There were innumerable problems to solve, lots of traveling, many different personalities to accommodate, with Frank always there to seek the best answers to his many questions.

Frank was a hard taskmaster. Once his mind was made up, it was difficult to convince him otherwise. He loved his work and continued to do his job under often difficult health problems. If he was unable to come into the office his work was sent home to him so he could keep abreast of all his projects. If he were in the hospital, when visiting him the conversation always revolved around the then current project.

His secretary (who later became my wife) agrees Frank was a hard taskmaster but with the redeeming quality of a colorful personality. She remembers how he would often pause while dictating and chuckle. She knew he was about to recall one of his amusing stories of his early mining days, such as blissfully smoking away and reading in bed with the four legs of the bed resting in kerosene to keep the crawling things from joining him in bed.

Frank's interest in what was pertinent at the moment never waned. I'm sure if he didn't have a problem to chew over he wasn't happy. When he retired in August, 1970, to keep himself current and busy he became involved

in the dump leaching of silver. He also consulted for Newmont with emphasis on the Carlin gold operation, which was his pride and joy.

I had a great life in the mining industry, and my association with Frank McQuiston was one of the highlights of my career, an experience I would happily repeat.

David Christie
Retired Vice President-Metallurgical Operations
Newmont Mining Corporation

March 1989
Darien, Connecticut

INTRODUCTION by Plato Malozemoff

I first met Frank W. McQuiston at the Hearst Mining Building at the University of California where we were both in the same class, graduating with Bachelor of Science degrees in 1931. Our paths did not cross again until the late thirties when Frank was employed at the Empire-Star Mine at Grass Valley, California, which was owned by Newmont Mining Corporation. I was then employed by the Pan-American Engineering Company promoting the use of jigs in the ball mill circuits at gold mines.

After spending part of the day with me in discussing the merits of the installation, he invited me to come to his house that evening, where I met Fran, his wife. This became the start of a friendly relationship between him and me that lasted the rest of his life.

Frank had a good deal of practical experience in working at mills and mines even before he enrolled in the College of Mines, and still more after he graduated and before he took the job at Empire-Star. I looked up to him as a senior engineer with much more experience than I had at the time.

His personality was a great asset to him. He was basically a cheerful man, with a sense of humor and a kindly regard for those with whom he associated. His warmth and respect for others made him popular with everyone. His smile, enhanced by a perfect row of teeth, was irresistible. One could not but like him. Yet he was firm in his convictions and did not hesitate to express them and argue for his point of view, even with his superiors--who may not initially have agreed. I liked that quality particularly in my relationship with him when I headed up Newmont. Yet he was not doctrinaire in his opinions, and listened carefully to opposing views, yielding if he saw real merit in them. The other attribute of being a "team player" made his presence even more valuable. He would join in a group effort or organize it with wisdom and a sensitivity to personal relations which made that effort more effective and expeditious.

It was men like Frank McQuiston, with his outstanding knowledge, experience and judgment that everyone respected, who enhanced so much the reputation of Newmont. I was proud to have had him with us for his valued contribution to the technical excellence that we always strived to achieve. I feel privileged also to have had him as a friend for all those years we worked together. He overcame his physical handicap with heroic courage and patience, born of a great mind and heart.

Plato Malozemoff, Chairman Emeritus
Newmont Mining Corporation

January 1989
New York, NY

INTERVIEW HISTORY

Frank Woods McQuiston, Jr. was selected by the advisory committee to be interviewed for the series on Western Mining in the Twentieth Century because of his important role in mining metallurgy. Mr. McQuiston was born into a mining family; his father and members of his mother's family were connected with mining in the West. As he tells in his oral history, his first independent metallurgical enterprise was sorting through an Arizona mine dump at the age of thirteen, and selling a few burro loads of ore.

From this beginning he rose to become known worldwide as Newmont Mining Corporation's vice president for metallurgy, in charge of the research facility at Danbury, Connecticut, which grew out of the research office he initiated in Grass Valley, California, where he solved difficult metallurgical problems for mines of both base and precious metals in the Western states. In Africa, he succeeded in separating minerals from the ores at Tsumeb, which he considered the most difficult in the world; there were 128 different minerals, of which some forty-five were from the copper-lead-zinc-germanium family. As a result, the Tsumeb Mine was one of the most profitable mines in existence at that time. He also developed the mill at Palabora, which became the lowest-cost, major copper producer in the world. His success in Africa was followed by innovative mill design in Canada. He was a pioneer in uranium metallurgy. The project which, according to his wife, he especially considered his "baby" was the mill at the Carlin Mine in Nevada, which pushed Newmont to the top of American gold production.

From 1948 to 1952 he was on leave from Newmont to the Atomic Energy Commission, Raw Materials Division, launching what he says was the biggest drive ever to obtain a single mineral, uranium. Rejecting the advice of a distinguished committee of experts, he investigated the Colorado Plateau and surrounding areas, finding resources which resulted in significant mining for decades thereafter. He also conducted highly sensitive work in Africa, particularly in developing the mill at Shinkolobwe in what was then the Belgian Congo. He worked with scientists from Dow Chemical Company and Rohm and Haas Company to develop the ion exchange method of extracting uranium, used in the mills he planned in South Africa. He was awarded a decoration by the Moroccan government for his work developing base metal mining projects there. His account gives evidence that, apart from being kissed on both cheeks by a French general, he greatly enjoyed the work he did to win this award.

When the oral history series on Western Mining in the Twentieth Century was first being organized, we knew that Mr. McQuiston's health was fragile. He was invited to participate on June 10, 1986, and seven interviews were conducted between June 23 and July 11, 1986. It would have been advisable to begin with the high points of his career, but Mr. McQuiston was a methodical engineer who could not tolerate a disorderly process; therefore, we began at the beginning and proceeded step by step. Regrettably, this meant that interviewing had to stop before we had reached some of the most important

events in his life, the developments at Granduc, Similkameen, and Carlin. He died on March 17, 1987.

Fortunately, Robert Shoemaker consented to be interviewed regarding their work together at Similkameen and Carlin, their joint publication of the gold and silver metallurgy books for the Society of Mining Engineers, and as partners in AgAu Exploration Ltd. and Tuscarora Associates, independent mining ventures. These interviews are included in the volume. Harvey Parliament also wrote a supplement about their work together at Granduc. Introductions were written by long-time Newmont associates David Christie and Plato Malozemoff.

The interviews took place in Mr. and Mrs. McQuiston's apartment at Villa Marin in San Rafael, California. The beautiful decorations of Moroccan brass and African wood told graphically of an international experience. Mr. McQuiston would not admit to disability, and still bore strong resemblance to the strikingly handsome man in the photographs on the walls. He was at first impatient with the tape recorder, disliking to have even the slightest imperfect expression recorded, but gradually became accustomed to it.

One day he felt well enough that we had lunch together with his charming wife Frances, and then he displayed the amiability which served him in sensitive negotiations with the French and others, which he discusses in his oral history. He and Mrs. McQuiston were both active in student affairs at the University of California, and began their married life in the Mother Lode area of California. Many UC alumni will be interested in his first-hand account of stealing the hands of the Mariposa County courthouse clock.

The first section of the transcript was sent to Mr. McQuiston for review, but he was not well enough to go over it. Robert Shoemaker and Plato Malozemoff were consulted, and corrected the spelling of some names. If errors remain, Mr. McQuiston would surely have caught and scrupulously corrected them. Some sections of the tapes were rearranged for better continuity. The tapes of his interview and Mr. Shoemaker's are deposited in The Bancroft Library.

Eleanor Swent, Project Director
Western Mining in the Twentieth
Century Oral History Series

March 1989
Regional Oral History Office
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San Francisco Chronicle**Saturday, March 21, 1987**

Frank W. McQuiston Jr.

Frank W. McQuiston Jr., a mining engineer and consultant, died on Monday at age 82 at his San Rafael home after a long illness.

A native of Pueblo, Colo., and a 1931 graduate of the University of California at Berkeley, Mr. McQuiston spent most of his career with the Newmont Mining Corp. in Grass Valley, rising to vice president before he retired and became a consultant in 1969.

He was decorated by France in 1951 for his mining services to the

Moroccan government and by the American Institute of Mining Engineers in 1968.

Mr. McQuiston, who married the former Frances Haseltine of San Francisco in 1934, was a consulting metallurgist in 1951 and 1952 with the U.S. Atomic Energy Commission.

He was a member of numerous mining and metallurgical organizations and of the Metropolitan Club of San Francisco and the Silverado Country Club in the Napa Valley.

Besides his wife, who lives in San Rafael, Mr. McQuiston is survived by his son, Michael, of San Ramon, and a granddaughter.

At his request there will be no services. Contributions are preferred to the Colorado School of Mines scholarship fund or to the University of California's Department of Mineral Engineering, Hearst Mining Building, Berkeley 94720.

MCQUISTON, FRANK WOODS, JR.

Home: 230 Kaanapali Drive
Napa, CA 94558

Born: Aug. 18, 1904, Pueblo, CO



1931 BS Mining, University of California, Berkeley

1978-1982 AgAu Exploration Ltd., President, Napa, CA
 1969-1982 Newmont Mining Corp., Consultant, Napa, CA
 1964-1969 Newmont Mining Corp., V.P., New York, NY
 1952-1964 Newmont Mining Corp., Chief Metal., New York, NY
 1950-1952 US Atomic Energy Comm., Deputy Director Raw
 Materials, Washington, DC
 1948-1950 US Atomic Energy Comm., Consulting Metallurgist, Raw
 Materials Division, Washington, DC
 1942-1948 Newmont Mining Corp., Consulting Metallurgist,
 Western US States, Grass Valley, CA
 1938-1942 Newmont Mining Corp., Research Supervisor, Grass
 Valley, CA
 1934-1938 Empire Star Mines, Ltd., Mill Foreman, Grass Valley,
 CA
 1931-1934 Assayer, mill man, miner, Jackson, CA

Member: SME of AIME; Canadian MI; AIME Distinguished Member
 Class 1975; Silverado Club; Napa Valley, CA;
 Metropolitan Club, San Francisco

Awards: French Order Ouissam Alaouite-Cheritien Morocco,
 1951; Robert H. Richards Award (AIME) 1968; Honor
 Member AIME, 1978

Author: Contributor AIME: Mining Engineering Handbook; Surface
 Mining; Gold and Silver Cyanidation Plant Practice
 Vol. I-II; Primary Crushing Plant Design

BIOGRAPHICAL INFORMATION

(Please write clearly. Use black ink.)

Your full name Frank Woods McQuiston

Date of birth Aug. 18 1904 Birthplace Pueblo, Colorado

Father's full name Frank W. McQuiston

Occupation Mining engineer Birthplace Pennsylvania

Mother's full name Elise Kiser McQuiston

Occupation house wife Birthplace Fremont, Ohio

Your spouse Frances Harshline McQuiston

Your children Michael Charles McQuiston

Where did you grow up? Colorado, Arizona, California

Present community Marin County, California

Education B.S. degree College of Mines, University of California
1934

Occupation(s) Mining Metallurgist

Areas of expertise Responsible for some twenty mineral beneficiation
and extractive metallurgical plants for recovery of gold,
silver, copper, lead, zinc, nickel, germanium, molybdenum,
and uranium.

Other interests or activities

Published many technical articles - co-authored
chapter in AIME Froth Flotation volume.

Organizations in which you are active Distinguished Member

American Institute of Mining and Metallurgical Engineers.
also CMI, AME

I GROWING UP WITH ORE PROCESSING

[Interview 1: 23 June 1986] ##

Colorado

McQuiston: I was born in Pueblo, Colorado, in 1904. Pueblo was the heart of the smelting industry for the various gold-silver mines in Colorado, who would ship their ores from the mines to Pueblo. This was the principal industry at that time. It is interesting to note that after the mining operations achieved their own method of reduction, Pueblo became the center of a large steel industry; CF&I Company [Colorado Fuel & Iron] developed it into a large steel production center.

Swent: Did your father work for CF&I?

McQuiston: No. My father was the shippers' representative from the various mining companies who needed an umpire to be sure that they got their just returns from the smelting of the ores. Prior to moving to Pueblo, he operated a mine known as the Silver Carbonate Mining Company in Leadville which was at an elevation of 10,300 feet. During his period of operation the mining camp of Leadville became embroiled in a labor dispute

##This symbol indicates that a tape or a segment of a tape has begun or ended. For a guide to the tapes see page 194.

McQuiston: between the miners and the mine owners. The mines comprised small areas of very rich ground and in turn had, I believe, fifteen different smelter units because that was the only method of separating the silver from the lead. However, it was a very simple ore to smelt.

Because of the strike in Leadville, which had shut down a majority of the mines, my father, having a short lease and option on this mine, decided he would go to Missouri and round up a crew of hardy miners, which Missouri mines were noted for. He brought back thirty men on the train to Malda, which was the railroad town eight miles from Leadville, and transported his men in wagons with what protection he could get from the local authorities. In the meantime, while he was going to Missouri and back, his remaining crew at the mine built a stockade of two-inch planks eight feet tall around the workings which enclosed mine dormitory, mine mess hall, and, of course, the timber-bolted headframe for working the mine. All the mines in the district were underground.

The opposition of striking miners mounted a Civil War cannon on a hill overlooking his operation and loaded the cannon with kerosene-soaked clothes and some steel pellets for the weight to carry the wads of kerosene clothes. And they fired the cannon and set fire to the mess hall, the dormitory, and eventually caught fire to the headframe, which, as I mentioned, was a wood structure. And then in due time, because they had no water except a small spring for drinking purposes, the stockade burned down. Everything was burned down.

Swent: Was this your father's own investment?

McQuiston: Well, they always had some partners.

Swent: But that would be a major blow, wouldn't it?

McQuiston: Yes, it would. After the mine buildings and headframe were burned down he left Leadville and settled in Pueblo, Colorado, in connection with the smelters previously mentioned. It is interesting to note at this time that the Guggenheim brothers, who were the founders of the American Smelting and Refining Company, had a small smelter in Leadville and decided that they would buy more smelters because there was no other way of recovering the silver from the mine ores. So this was the birth of one of the largest

McQuiston: mining companies in the world, the ASARCO, as it is now called. They were in this business for the next hundred years.

Swent: Did your father know the Guggenheims?

McQuiston: Yes. I've forgotten their names, they were the founders, yes.

Utah

McQuiston: At an early age our family moved to Utah in 1910, again because of my father's interest and connections in mining. We lived at Tooele, and then in Sandy, Utah, not far out of Salt Lake City, where I started the first grade.

Swent: Did you have brothers and sisters?

McQuiston: I had one brother who was three years older. In Sandy, this little Mormon town, there were only two non-Mormon families: the doctor, his wife, and two sons; my father and mother, and their two sons. So after very few years my mother decided that she did not want her sons to grow up and marry Mormon girls. This was the time of Zane Grey's stories. However, I have had many fine Mormon friends, and strange as it may seem, when we moved from Sandy, with the doctor and his wife and their two sons, to get away from the Mormons, we arrived in Mesa, Arizona, which was a Mormon stronghold.

Arizona, with a Southern California Interlude

McQuiston: We actually moved to Prescott, Arizona, so that we could enter school, my brother and myself, there. And it was very close to the famous Jerome village, which was the home of the Phelps Dodge Copper Company.

Swent: And it was booming then, I suppose?

McQuiston: Yes. The smelter for the Jerome ores was at Clarkdale, where my father again had much business with the smelters.

Swent: But you lived in Prescott?

McQuiston: We lived in Prescott.

Swent: It's a nice town, isn't it?

McQuiston: Oh, lovely. During this period of early Utah and Arizona days my father became interested in Rhyolite, Nevada, which is in the southern part of the state, and the center of considerable gold mining. He and other friends such as Clyde Jay, a famous mining executive, built and operated one of the early cyanide plants in the United States at Rhyolite. This was in 1906.

Swent: Do you want to tell me about the picture [indicates a photograph]?

McQuiston: This is a picture of Rhyolite, Nevada, dated January 20, 1907, a town of 10,000 people.

Swent: Oh, it was a pretty big town, then, wasn't it?

McQuiston: This is the little town that built a home out of beer bottles.

Swent: Tell me about that!

McQuiston: Well, there was lots of beer drinking, so the house of beer bottles, or rather what is left of it, sits in the Amargosa Desert a few miles east of Death Valley. In 1908 this town had 10,000 people, two railroads, three newspapers, electric lights, an opera house, a telephone company, and a seventy-five-member stock exchange. Today it has six permanent residents. So my father's idea of building a custom cyanide plant for the treatment of the local gold ores was a sound investment.

Swent: You didn't actually live in Rhyolite, though?

McQuiston: No, we just couldn't move around.

Swent: Your mother and the family stayed put.

McQuiston: That's right.

Swent: But you learned from an early age what the mining life involves.

McQuiston: From Prescott, where I went to the third and fourth elementary grades, we moved to Hayden, Arizona, in 1914. Hayden was a milling town or in a layman's terms, an ore processing center. It was part of Kennecott Copper Company, who had the world's largest copper mine at Ray, Arizona, twenty miles distant by railroad from Hayden. To make a mining story complete, there were the mines, the mill, and the smelter. Kennecott, at that time, did not build smelters. They used American Smelting and Refining Company to smelt their concentrates produced from the mills. This was the case at their large Bingham Pit mines and mills operation; Garfield smelter was operated by ASARCO.

In Hayden it was the same procedure. The mines were some distance, as mentioned, twenty miles away, connected by railroad, operated by the Southern Pacific Company, hauling the ores because of the rugged terrain to the mill, which required a large area for tailings disposal. The mine at Ray was founded in the 1880s but only mined for the high grade near the surface. It was D.C. Jackling, the farsighted head of Kennecott Copper, who recognized that these huge copper deposits, although very low grade, could be mined at great profits by using steam shovels and wagons at that time, and later, trucks.

His chief engineer for the appraisal of the mines, which at that time were Bingham Pit, Ray, and Chino, in New Mexico, was Henry Krumb, a noted mining engineer who examined and sampled these low-grade deposits.

Swent: Did your father work with any of these people too? Or was he independent?

McQuiston: Well, no, he worked for Kennecott at that time. My father, again, was interested in the smelting of the mine-mill products, and became an independent contractor to represent Kennecott Copper Company for the shipment of their concentrates to the Hayden smelters.

Swent: As a boy, then, were you hearing conversations about the mining and smelting?

McQuiston: Oh, yes, well, at Hayden, when I was old enough to absorb these things, yes.

Swent: Because now he's in copper, whereas before it was gold and silver.

McQuiston: And in Tooele it was lead.

Swent: So you were getting a pretty broad education at home.

McQuiston: After two years of elementary school in Hayden, my mother, brother, and I moved to Phoenix, Arizona, because he was ready to enter high school, and there was no high school in Hayden. So this was now my fourth grammar school. Sandy, Prescott, Hayden, and Phoenix. In due time we moved back to Hayden and I had a severe accident so I did my eighth grade with a tutor part of the time in the hospital, and part of the time just in bed.

Swent: Do you want to tell about the accident?

McQuiston: Oh, not particularly.

Swent: All right.

McQuiston: Before the accident I attempted on my own to do a little mining. I got several Mexican boy friends to round up a herd of burros, of which there were many wandering around town, and in the nearby hills, that the Mexicans used for bringing in wood for cooking.

So I took these Mexican boys and a string of ten burros to a mine that I had visited previously with my father, which had some rich lead-silver ore on the dumps. The Mexican boys and myself sorted the ores from low grade to the high grade side, put them in bags, used the burros for pack animals, and packed it down to the railroad at Hayden junction where my father arranged for it to be shipped to the El Paso ASARCO smelter. I didn't make much but I made a few dollars out of this first mining venture.

Swent: And how old were you at that time?

McQuiston: I was thirteen.

Swent: Thirteen years old! Your father must have been pretty happy about that.

McQuiston: Yes.

Swent: So that was your first experience in management, also.

McQuiston: Managing the Mexican kids [laughter]! I graduated from Hayden Elementary School with about twenty-four other graduates.

Swent: Have you stayed in touch with any of your elementary school friends?

McQuiston: No.

Swent: You went different ways.

McQuiston: And then, to have my hip corrected, which is a misnomer, we went to Los Angeles, and a noted orthopedic specialist put me in a cast after manipulation, without an operation. I was in the cast for six months, attempting to attend high school in Hollywood, where we lived. At a later date we moved to San Diego, where I entered high school.

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Swent: Had your family had a California connection before that?

McQuiston: None. We went to get a good doctor, because a doctor in Hayden had practically ruined me.

Swent: So you went down to San Diego?

McQuiston: We moved to San Diego where I entered high school, on crutches for a while, but out of the cast, and then later I was able to drive my Model T Ford wherever I wanted to go, and became quite active through swimming, sailing, and water sports, which I found, at the doctor's advice, were quite good for me.

Swent: Your father must have been pretty successful by this time? It sounds as if things were going well.

McQuiston: My father, in the meantime, due to a severe depression in copper, had gone to Oatman, Arizona, which was a sizable gold mining area. It is strange that copper has always been a metal that was either very good or very bad but seldom in the middle. We used to have a saying in copper mining areas that you were either eating T-bone steaks or burro meat.

Then in 1922, after finishing my second year in San Diego High School, we moved back to Hayden, Arizona, where I became quite a figure in high school, having been the only one who had ever gone to school outside of Hayden.

Swent: There was a high school in Hayden by now?

McQuiston: Yes, a good high school.

Swent: And you were the cosmopolitan figure.

McQuiston: Although we only had fourteen or fifteen boys in high school, they were all rather outstanding athletes because they had been together for several years in grammar school, and in three years of high school. So our sports activities placed them very high within the state of the class two high schools. In fact, we won the baseball state championship for the class two group. I couldn't participate--only occasionally in baseball-- but I was the manager of the basketball, football, and baseball teams, so I became interested in athletics from that time on.

Swent: It sounds as if you developed your management skills rather early.

McQuiston: Yes. I was even coach and manager at times when we didn't have a coach. While going to high school in my senior year, I was employed at the smelter in the office as night clerk, whose duties were to check in the afternoon shift at three o'clock, and the outgoing shift at eleven o'clock.

Swent: What sort of checking in did you do?

McQuiston: Just checking the employees, the shift, the crew of men who were coming on to work. They worked three shifts.

Swent: Was there any inspection for stealing high-grade ore?

McQuiston: Oh, no, not in a smelter.

Swent: Just marking to be sure they were at work?

McQuiston: That's right. They had little brass tags that they carried with them, and they would give that tag to you as they passed your window. You would put it in a box with slots in it, so it would be easy to find it again and give it back when they came off shift. And they kept that tag with them. That was their identification.

Swent: What did you do in between?

McQuiston: I had my other duties besides checking the crews in and out, a modified form of bookkeeping, but principally, a lot of reading and my best grades ever, in school, were made during that six- or eight-month period that I worked at the smelter. I also worked for a while in the mill. In the early stages of the Hayden mill, that was back in 1912, and '13, and '14, the ores were crushed, ground, and sent over, placed over, vibrating tables which were called Frue vanners, which concentrated on one end, through the shaking and motion of the long belts, which would separate the sulfide copper from the oxide copper, or the gangue waste material in the ore.

At this time flotation was just making its entry into the copper mines. There were many young men employed in the copper mines as engineers, but even more in the mills because they needed chemical and metallurgical assistance in developing flotation. They developed a reagent and named it Rayconite after the Ray mines. Rayconite was one of the early forms of creosote with something similar to xanthate for collecting the mineral. The early flotation cells were like a long hog trough with a canvas filter bottom which air would percolate through and raise the sulfide mineral to the surface where it could be scraped off in the form of a concentrate. [interruption]

Swent: This is after the war; did the First World War have any influence on you? Were you particularly affected by that?

McQuiston: No, I was in high school in either San Diego or Hollywood at that time. It affected the mind some, because I remember my mother raised her brother's daughter with us; she was older, very pretty. My mother raised this niece. So the young men used to come to our house to see her, and take her out and

McQuiston: all, and I remember several of them going off to war.

Swent: They were older, of course.

McQuiston: Yes, they were through college and working there.

Swent: Usually, during war time metals mining is affected.

McQuiston: It was, it was booming then, because they needed the copper for shells, for the brass.

Swent: Then it slumps back.

McQuiston: Then, after the war, in 1922 and '23, there was a severe copper depression. And the mines curtailed production and reduced employees considerably.

Swent: That's about the time that you were working as night clerk, then? You finished high school in 1924?

McQuiston: In 1924, but they still had to keep a certain number of employees.

II THE UNIVERSITY OF CALIFORNIA COLLEGE OF MINING

Swent: How did you happen to go from Arizona to the University of California?

McQuiston: On graduation from Hayden High School, I was influenced by the manager of the Hayden milling unit of Ray Consolidated Copper Company and the principal of the high school, both of whom were graduates from the University of California.

Swent: What were their names?

McQuiston: Walter Garmes graduated from the UC College of Mines.

Swent: He was the one who worked in the mill?

McQuiston: He was general manager of the milling department. There were three units: the mine, whose manager was William J. Boyd, the mill was Walter Garmes, and then the smelter was a different company. And the lady who was the principal of the

McQuiston: high school was Lucille Herman.

Swent: They had both graduated from UC?

McQuiston: From UC. I have often wondered why they were so interested in having me go to the University of California when just seventy miles away was one of the outstanding mining schools in the United States at the University of Arizona School of Mines. But, anyway, they talked me into going.

A Preparatory Year Working for Shell Oil Company

McQuiston: So I came to California for an interview at their suggestion about becoming enrolled. And at that time I decided on a loophole, that if I went to work, which I badly needed to do for the money to go to university, I decided that if I could become a resident of California, I wouldn't have to pay a nonresident fee. So I worked at Martinez, California, at the Shell Oil Company research laboratory for over a year prior to my entry into the University of California.

Swent: How did you happen to get that job?

McQuiston: Waiting in line. I had no connection with Shell except I knew that I was going to live at Torme because my father and mother had more or less followed me from Arizona to California and he was working for American Smelting and Refining Company at Selby, which was within commuting distance of the University of California, and I could save some money by living part time at home. I canvassed the nearby industrial plants such as the California and Hawaii Sugar Manufacturing plant at Crockett and also was interviewed for a job at Martinez by Shell Oil Company. They had a large control laboratory for the purpose of determining the different constituents of oil and gasoline from all major oil companies to be sure that the Shell product was equal to if not better than their competitors.

I enjoyed the work very much at Shell, although it was shift work. Meaning that you worked three shifts; at two-week intervals you would change and go on to the next shift. Eventually, I became shift boss which gave me a considerable raise in pay and more responsibility.

Swent: That was pretty quick to become a shift boss, wasn't it?

McQuiston: I was a little older than the average student entering Cal. After serving a year with Shell Oil Company as I got ready to go to Cal, I went in to thank the management for their offer of a position which I badly needed to have money to enter Cal with, and the manager was kind enough to offer me a scholarship if I would take chemical engineering at the University of California. Apparently I had had a good record while working at Martinez, but I had no desire at all to become a chemical engineer so I graciously turned him down on the very nice offer.

Swent: It must have been tempting, though.

McQuiston: I guess. But you know, when you're young, nothing is going to stand in your way of what you want to do.

Swent: You had a clear idea of what you wanted to do?

McQuiston: No, I didn't. I knew I wanted to take engineering, but not any particular subject. I resigned from the Shell Oil Company and registered at Cal the same day I resigned because I had worked a graveyard shift and got off work at seven o'clock in the morning and drove to Cal for my initial registration.

An incident occurred when I was standing in line. Some big old boy who was obviously from a farming area was in tears because he was born and raised in the state of California and yet they had him down as a nonresident. And he didn't have the funds to register at that time, but I feel sure that it was eventually straightened out. I followed in line, and had no problem at all although I hadn't been in California for quite a year and was under age when I started working in California, but I sailed right through the inquiry and seemed to justify my statement that I was a resident, thereby saving considerable money.

Swent: I'd like to know more about your commuting.

McQuiston: I'll get into that.

Swent: I was wondering what kind of car you drove and how long it took you.

McQuiston: I had a Model T Ford coupe that I had had for many years, and the only reason I could afford it was because I could do all the repair work myself, which any half intelligent person could do on the old Model T Ford because it was so simple. I had it in San Diego when I went to high school there and later drove it back to Arizona and enjoyed the privilege of having a car to help me get around because I wasn't so agile.

Swent: And then you drove it from Arizona out here to California?

McQuiston: That's right. And used it to commute.

Swent: That must have been a long drive in a Model T.

McQuiston: Oh, it moved right along. Roads weren't good. As I've mentioned, my family moved to Torme, which was the village next to the smelter town of Selby. Again, this was a Guggenheim operation, one of the old smelters. All gold and silver reduction eventually had to go through the smelter in Selby as it was the only one of its kind in the state of California.

Swent: Were people aware of lead poisoning at that time?

McQuiston: We became aware of it.

Swent: When your father worked there, for instance.

McQuiston: No, we were not aware of it.

Swent: There wasn't any talk of danger from it?

McQuiston: I'll come back to that when I'm at work at Selby.

Engineering at Cal

McQuiston: At the University of California, the first two years in any form of engineering were practically identical because you took subjects giving you a sound base for your junior selection of what your major would be. So I looked at various majors such as civil engineering because I was possibly interested in building bridges, having seen the

McQuiston: Carquinez Bridge being erected as I lived right next door with my family at Torme.

And then there was mining and metallurgy, mining geology, and petroleum engineering. Not to mention some side issues such as meteorology and things like that. So the first two years of general courses in engineering prepared one well for the selection of his major interest at the junior level.

I was quite undecided at that time as to what kind of career I wanted to follow. Shell Oil Company offered me a scholarship if I would take chemical engineering and go to Cal with this scholarship. I didn't particularly favor chemical engineering. ASARCO, where I worked every Christmas holiday and every summer vacation while I was at Cal, offered me a scholarship if I would take nonferrous metallurgical engineering. I did not, at that time, think I wanted to work for the smelters as I had seen enough of them in the past.

Swent: Did you take either of those scholarships?

McQuiston: No.

Swent: You turned them both down.

McQuiston: They wanted me to take these certain courses, and I decided I didn't want those certain courses. And yet I ended up in metallurgy. But I never liked nonferrous metallurgy, that's smelting.

Swent: So you had a pretty good idea, even then, what you liked and wanted to do.

McQuiston: Generally speaking.

Swent: Had you studied chemistry in high school?

McQuiston: Oh, yes. While in high school, in preparation to going to the University of California, the coach, who knew something about mathematics, taught me algebra and geometry courses so that I would have those on my graduation record. The only thing I didn't have was mechanical drawing, and they had no one to teach mechanical drawing, so I went to Crockett High School three nights a week for a six-months term to study mechanical engineering.

Swent: This is while you were working at Martinez?

McQuiston: Yes. My father, at this time, worked for American Smelting and Refining Company at Selby.

Swent: So your family had moved out here.

McQuiston: They moved out after I had come out because they didn't think I ought to be, at that age, living alone. So I put aside a considerable, at that time, sum of money to carry me through the first six months or a year at college. And then my grades declined because I had to work and earn money to go to college. Worked my way through all the way, but with the great help of American Smelting and Refining Company because they had always had a job ready for me. The day after I finished school, winter vacation or summer vacation, I always went to work the next day, which is pretty good.

Swent: At Selby?

McQuiston: Yes.

Swent: That gave you some security, then, didn't it?

McQuiston: Yes, it did. But very little vacation time.

Swent: Who were some of the professors that you had at Cal that you particularly remember?

McQuiston: Dean Frank Probert, number one. Hersam, I don't remember his first name, he was professor of metallurgy. And because I was working at Selby, he thought I ought to be giving these lectures instead of him because I knew more about the practical aspects than he did, because I worked in practically all the departments out there; then after a period I had a couple of years of continuous experience. And then there was Carlton Hulin, who was a geologist. And Norman Hines, he used to give Geology 1A. And Andrew Lawson, and "Tucky" [Nicholas] Taliaferro.

Swent: Were any of these people particularly influential on you in your personal career decisions?

McQuiston: Oh, then there was Anderson. Anderson was. He taught mineralogy and I liked that very much. I was a little older, you know, and I didn't take so well to some of these things.

Swent: You did know a lot already.

McQuiston: Well, yes. And I was older and had a very unhappy youth because of my bad hip. But then, that's another story.

Swent: You were not too old to get involved in a few high jinx, though.

McQuiston: No, I had a lot of very close friends in college.

Extracurricular Activities

Working for ASARCO

Swent: Were you involved in extracurricular activities?

McQuiston: Yes. I worked that first summer between my freshman and sophomore year as a guard on the armored truck that commuted daily between Selby and the mint on Fifth Street in San Francisco. We transported the bullion bars of silver and gold and brought back impure bars of silver and gold for refining at Selby. We would leave the plant at eight o'clock in the morning, having locked the doors to the cab, which was equipped with bulletproof glass, and we were armed to the teeth with two shotguns, two rifles, and side arms.

We were timed along the route of driving to San Francisco. For example, the first station was a service station who telephoned in to the operator on duty at the switch that we had just passed at, say, 8:48 and then the next one would be something along the highway that was permanently occupied. And eventually we got to the bridge and to the mint.

Swent: How did you cross the Bay?

McQuiston: The Bay Bridge. And followed what is now I-80 into San Francisco and to the bridge entrance and then across and parked at the mint where we unloaded, with their help, the bullion that we brought. The interesting bullion we took back was from the Philippines because they were small bars about the size of a cake of Ivory soap, and they were shipped from the Philippines to the mint, or either direct to Selby but we would pick them up at the mint. Because Selby had an arrangement that the post office would deliver these gold bars, which were small but, of course, very heavy.

Swent: They had been mailed in the Philippines?

McQuiston: Yes. Sent by registered mail with a cardboard full of stamps on them. That was from the Benguet and Balatok mines principally. They were the main shippers. I would dream, while we were driving along, because we didn't have too much conversation.

Swent: How many of you were there?

McQuiston: Two. The driver and myself as the principal guard. But we didn't talk too much about any consequential matters because we were more or less alert to road blocks or something like that because it was nothing unusual to carry a million dollars worth of gold, which was a lot in those times. That lasted all summer for three months and was very interesting. It was not hard work. We would finish our run and get back to Selby by noon or shortly after noon and then would do some work in the ore sampling department, then go home early.

Swent: How did you happen to get this job?

McQuiston: Because I was always guaranteed a summer's job and a winter's job. We had three weeks vacation normally during the year at Cal for Christmas, so I worked during those times at Selby. I, as a pastime, would think, now if I were going to stop this vehicle and attempt to rob it, where would it be? Now, the cab was locked from the inside, and could only be unlocked from the inside. The body of the armored truck was locked with two sets of keys when we left Selby, and could not be unlocked because we had carried no keys with us, until we had reached the mint, where the second set of keys would unlock the body of the truck. So I conceived the idea that the mint was the only place we were really subjected to

McQuiston: a holdup, because every twenty or thirty minutes we were timed, and if we didn't pass that place for a check station, then the police and patrols and all would be out looking for us, which happened when we had a flat tire. Then we would be guarded by the highway patrol until we got the tire changed and on our way again. However, they were exceedingly heavy-duty tires and that only happened on one occasion, to my memory.

The place that I selected for the greatest care and personal attention was when we arrived at the mint. We backed down from the street through a very slight decline to an approach with cement walls on either side so that they could unlock the back doors and use their little dollies to take the gold bars. There was a guard for the mint, but he didn't pay too much attention to what was going on because we were checking out our load of bullion, and there was a checker-in for the mint, and then two workmen to unload the bars.

The bars were all in white canvas sacks and they had to stoop over this heavy weight--it wasn't so heavy, they were one-hundred-pound bars, approximately--but the mass weight was very difficult to handle. If it had been distributed over a larger object, it would have been much easier. And that was the one place where we were vulnerable to a successful holdup, because they could have surrounded that, although it was sort of a trench where we backed down. The alarms would have gone off, but it wouldn't have prohibited a very clever, organized theft. So I was always on the alert; I picked a certain place I could stand and I always took my shotgun with me, to the amusement of the mint people. But I was young and dedicated to my work.

Swent: Nobody ever really robbed you?

McQuiston: No.

Swent: Was it just the one summer that you had that job?

McQuiston: On that job. I worked in all the departments in the smelter.

Other Student Jobs

McQuiston: While attending the university I had various jobs through the student employment agency--they didn't call it an agency; it had some other name--student council or something. I cut lawns, I gave driving lessons, I attempted to survey a subdivision once which was, at that time, still occupied by an orchard. I was only taking surveying, so I didn't last over two days on that job because I didn't know enough about surveying, but I thought maybe I might learn. But the man didn't have the patience to teach me. He wanted somebody more senior that could really help him survey. And to go around all these trees was more than my knowledge and capacity.

Swent: Where was this?

McQuiston: In Oakland.

Swent: Probably it is all built up now.

McQuiston: Probably, yes. Then I had a job parking cars in the evening at a theater in Oakland which is no doubt long gone. That was a job that lasted from eight until about eleven. When I had all the cars parked and all the drivers of the cars were in attending the theater, then I could do a little studying in the booth.

Swent: Was it a movie theater?

McQuiston: Yes. I also had a job for a man, sleeping outside his door on a cot, because he was a sleepwalker. And I would have to set my alarm so I would wake up every hour to be sure he was all right because there was a window in his bedroom that he would never allow to be locked, as he said, "If there's a fire, I don't want it locked." We fastened the local lock on it but nothing very secure. He liked to wander around the house while my cot was outside his door. But that wasn't a very good job, in my estimation, although I worked there for a while.

I taught driving to several ladies who had cars and didn't know how to drive, and that was all right; I was a good driver.

McQuiston: Then at the end of my freshman year, the second semester, I joined a fraternity, Phi Sigma Kappa. If I had it to do over again, I would not join a fraternity. They are too demanding on their own affairs and not enough supportive of better students. But I did enjoy it very thoroughly.

And now we'll move to my sophomore year, where you're encouraged by the fraternity to go out for some activity. Not only encouraged, but told to do so. So I selected the Blue & Gold and was a sophomore manager as they called it. All that meant was your main function was to go around and visit all the class. I had the jump on most of the other sophomore managers because I knew where all the chemical laboratories were. And I would very kindly try to get permission from the professor to visit without disturbing what they were doing and I was quite successful in getting a large number of those students to sign up to buy the Blue & Gold when it was published six months later.

Swent: This was the annual yearbook?

McQuiston: Yes. So I served my sophomore year satisfying a fraternity requirement. I didn't get paid for this, but I attempted to work a night shift at Selby.

ASARCO; Hazards of Lead

McQuiston: I would finish my courses and drive to Selby and go to work at three o'clock in the afternoon and work until eleven. I was a guard, again, because I was a trusted employee. I was a guard in the silver-gold refinery, which was quite a responsibility, although the workmen were old hands at the job and had been there a long time and were considered quite trustworthy. I sat in a room, all glass enclosed, above all working areas, where I could look out, and my room was dark, look out over the workmen and see that nobody was filching a little gold or silver or something like that.

I finally went to my foreman and said, "Couldn't I have a little light up there?" And explained that my grades were suffering terribly because I had no chance to study at night. And he said, "Well, it's against all regulations and security and this and that, but we will fix up a small light that will

McQuiston: give you a bull's eye right on a book or something of that nature, and have it in an area where they can't see that you have a light from where they work. Because all of our security is based on being observed from above without being seen." So anyway, my grades picked up after that.

Swent: How did you drive from Berkeley to Selby? Was the tunnel there then?

McQuiston: No, no tunnel. It's I-80. You know, it's just at the entrance to Carquinez Bridge. So it was a very direct route. It took me about thirty minutes the way I drive.

Swent: You were a fast driver?

McQuiston: Yes, I was then. Thirty, forty minutes.

Swent: You were leading a very full life.

McQuiston: Too full.

Swent: Did you live at the fraternity house?

McQuiston: I did at the end of my sophomore year, yes. I also worked there waiting on tables. And I got my board and room for that.

Swent: Where did you work the summer between sophomore and junior year?

McQuiston: I worked again at Selby; I had a job waiting for me and my principal occupation was on the wharf.

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McQuiston: There was a long wharf for receiving the overseas ore carriers. My job was to boss a crew of mostly Mexicans and Yaqui Indians which we had four of, the best workers in the whole smelter, I believe. Because they were about six feet two, three, four; slender, but just all rawhide. So I worked on the wharf under the wharf superintendent.

Swent: Did these people speak English?

McQuiston: Oh, well, I taught them English and I learned some of their language. But it was a good job. I was outdoors all the time and became interested in the ships that would come in. The first thing they would do, they would throw over lines to the wharf where my men would put them over the--I don't remember the nautical terms anymore--put them over the pier piles and then they would immediately put down a shield which would slide down from the vessel because it was on the incline. Slide down with this attachment of string, so that it could be pulled back up, of about twelve, fourteen inches in diameter. And that was to keep the rats that we had on the wharf from getting on board the ship. You know, like this [motioning] and the rope going down and these things would slide down on the end of the string and then they would stop there. And the rats couldn't come up the hawser.

So that was a very interesting job. We received concentrates mainly from Peru, again a Guggenheim operation, Southern Peru Company. We also received concentrates from Cerro de Pasco in Peru. Ecuador and Paraguay had mines that were shipping to us. It was quite a busy place.

The precautions taken for lead poisoning were no doubt adequate around the lead smelters but they were not adequate for lead dust in the sampling department or the unloading department. Our men, the workmen, after they had finished their shift, would take high-pressure hoses, which were around for cleaning--air hoses. And they would blow the dust off their clothes, and in so doing they would blow the--it's quite unusual--blow the galena concentrate, with lead concentrate, into the pores of their skin, where it would eventually enter the bloodstream.

I lost a whole crew who had lead poisoning. This is one of the most horrible diseases I ever saw. I visited three of these men when they couldn't come to work, because of my fondness and their good loyalty to the Selby smelter. I visited them in Vallejo and they had lost their minds, but were not too bad off physically. But that was the end of them. Our doctor was the one that discovered this unusual type of lead poisoning. When we cut the use of the air hoses it stopped. But the harm had been done.

Selby, being a lead smelter, and gold and silver, were always associated together, such as I mentioned some time ago about the smelters in Leadville and in Pueblo. The lead ores

McQuiston: containing silver, principally, which is a main mineralogical association, and the lead and the smelting of the lead, gold, and silver were compatible with each other for a method of processing and also refining.

Swent: What were the concentrates that were coming from South America?

McQuiston: Lead ores, also from lead mines. With gold and silver content.

Swent: And bullion from the Philippines?

McQuiston: That came from cyanide plants in the Philippines.

Swent: That wouldn't have lead in it?

McQuiston: That had no lead. See, Selby was a lead smelter but a refinery for gold and silver.

Swent: Smelting and refining. That's what it says.

McQuiston: Yes. That's right.

Swent: And then they also, of course, got concentrates from all over the West; all over California, at least.

McQuiston: Yes.

Swent: Anything from Alaska?

McQuiston: Alaska Juneau [Mine] shipped there for quite a while.

Swent: So this would have been the summer of 1926, perhaps?

McQuiston: I entered school in August of '25 and then the working summer would be '26 and then you would go back to school again in '26 and the working summer would be '27.

Swent: So this is 1927.

McQuiston: Yes.

Swent: I was trying to think when the Bay Bridge was built.

McQuiston: That was the Carquinez Bridge.

Swent: The Carquinez Bridge was new then.

McQuiston: Well, I soon gave up any desire of being a civil engineer, because I wanted so badly to see the erection of the final span of the Carquinez Bridge. And I went to my professor who was teaching civil engineering and said that I lived out there and liked very much to see it, and could I be excused from class, which he wasn't attending; he was having one of his teaching fellows give the class. He says, "Yes, you'll get an F in the class." So I went out there anyway, and I did get an F in the class.

Swent: Did you really! In civil engineering?

McQuiston: Yes. I didn't attempt to hide from him, and I said, "I live right down there, you could see it. And I followed this construction ever since it was started." Oh, he was mean.

Swent: What was his name?

McQuiston: I don't remember. But he taught civil engineering.

Swent: But not in a very enlightened way. Nowadays they would take the whole class out there for a field trip to watch it. I hope.

McQuiston: Sure they would. Sure.

Work and Play as an Upperclassman

McQuiston: In my junior year at Cal my activities were quite numerous, because I had been elected one of the three juniors for the Blue & Gold manager staff. Which was quite an honor and only earned by hard work. I was very active in politics and other activities on the campus, such as being chairman of the junior ball and solo societies, which are things of the past and not to be revered anymore.

Swent: Do you remember the names of them?

McQuiston: Well, let's see, there was one in engineering. The society of engineering was Theta Tau, which all engineers of some prominence had to join.

Swent: That's the equivalent of Phi Beta Kappa, isn't it, for engineering?

McQuiston: No. It's more social than grades. And Phi Phi, they had a snake for an emblem. You know, stuff that doesn't mean much. And then there was a publisher society for the Daily Cal. and the Blue & Gold, and Raspberry staff. But between the fraternity, working, and trying to maintain some semblance of grades, it was quite an undertaking. I was made manager of the fraternity which awarded me the board and room, so that was very helpful.

Swent: It's interesting that everything you've done, you've always ended managing, haven't you? You had that gift right from the beginning, I guess. Plus hard work.

McQuiston: That's right. It was during the summer of 1928, all geological students had to attend a three weeks field trip under the supervision of "Tucky" Taliaferro. I don't remember his first name, but we called him "Tucky."

Swent: His name was Nicholas, but everyone just calls him "Tucky."

McQuiston: Which meant that we established a camp of tents where we slept, and a tent for a mess hall, and we had a cook, Joe Jackson. It was on the San Simeon Hearst ranch, which apparently had a lot of geological areas that the university considered worthwhile studying. This was a very interesting experience, as we were actually in the field doing the mapping, surveying, and everything as if we were full-fledged geologists, which we were not.

At this time I was more or less majoring in geology because I realized the importance of that in any mining operation. You had to find the ore before you could mill it and smelt it and refine it. My over-all grades were not very good, so this was a five-unit course and I worked very hard and got a B which pulled my grades together enough to hold me in line for another year.

Perhaps the most influential of the professors that I came in contact with was Dean Probert, who was a very strict person on the campus but let down his hair on a field trip, which I saw once in Grass Valley. Dean Probert, Carlton Hulin, and "Tucky" Taliaferro. Other professors of distinguished reputation were Andrew Lawson--about whom stories will last

McQuiston: forever--and Dr. Louderback. I've had courses from both of those. Lawson had a mean streak in him, more than was necessary. He would lock, at the ten-minute minute, at the ten-minute second after the hour, his assistant would lock the doors and you couldn't get in. And that was fatal, because so many of those and you received an F. Students would be late and they would rattle the door, and try desperately to get in through a window or something.

And one time his assistant wasn't there so he closed the door himself but he forgot to lock it. In came one of our students--you had small classes, probably twenty--came a student, tiptoed; unless you saw him, you wouldn't know he was there, he was so quiet. Tiptoed in and took his seat and opened his notebook and Andrew Lawson said, "That was very nicely done. You didn't disturb the class, you didn't disturb me, and I think you're probably very much a gentleman." But he says, "Nobody comes in my class late! Get the hell out of here!" He just shouted it. I know this for a fact: he threw one of the teaching fellows through the window.

I was taking a required course from Andrew Lawson in my junior year, so I signed up early for my junior year. It was twice a week on Tuesdays and Thursdays and he came for three weeks and we were very careful in recording our notes. Suddenly he didn't come. His little helper was always around locking doors and doing this and that for him--he was just a kind of a servant--but Lawson didn't come any more. So we inquired, we would go to his office, and the secretary would say, "I don't know, we haven't heard from him. We know he isn't ill, but we don't know where he is." Pretty soon the word came back he had gone to China, right in the middle of his class, to look at something he had become interested in.

The next year, after we had had our three weeks, or six lectures, he came, but he didn't come at the first of the year, he came after three weeks. Started in on a sequence of lectures, which was number seven, as if he hadn't been gone for a year. Started right in, and those new students had no notes on the three weeks of lectures that he had given. Some of the seniors had petitioned to get out of that course because he wasn't there. And that was your Andrew Lawson.

McQuiston: The legendary stories about him would take a half an hour to tell. He was in Canada on a geological meeting, and the head of the Canadian geological survey had a daughter, I think she was eighteen or nineteen. And Lawson was past retirement age, he must have been at least seventy, married her, and they had a youngster.

She moved to Silverado, and she became as ornery as he was. Any time you hit a golf ball that went in her yard, and it was not hard to do, she wouldn't let them come in and get it. My son hit a golf ball and it went into her yard and he said, "I'm going over to see if I can get that, I know just where it went, I can see the bush where it went in."

She came out, and she said, "You get out of my yard or I'll have you arrested." She apparently inherited that. She wasn't well, but. . . .

Swent: Well, that's kind of a problem, but when you live by a golf course you should expect that, shouldn't you? Taliaferro was good-natured though, wasn't he?

McQuiston: Oh, he was a great person. Very sympathetic and I could learn more from him. I knew Norman Hines very well, because I had a source of what we called lightning whisky.

Swent: Oh, this was prohibition time, wasn't it?

McQuiston: Yes. It was called lightning whisky out in Pinole, where they made it. And he was one of my customers. Somebody had told him, "Well, Mac gets a gallon of whisky once in a while and dispenses it around to his friends." He asked me if I could get him a gallon of whisky, and I said, "Sure."

Swent: Did you have to supply the bottles?

McQuiston: No, they came in a gallon jug. Nothing less than a gallon.

Swent: You mentioned Anderson the other day, also. Wasn't there a teacher named Anderson?

McQuiston: Yes, Andy Anderson. He was a mineralogist. He was a friend of mine; he went on to be quite a big person in the U.S. Geological Survey. He never went into actual mining operations or anything.

McQuiston: That's why we had such a high regard for Carl Hulin, because he was still a consultant to Potosi and Pachuca. And also Randsburg. So he had a lot of practical experience. He became quite a good friend; I saw him after I had left college. I would drop around to his office and talk with him and tell him what I was doing and some of the mines I knew. He was very interested.

Now we're in the junior year where we had to go to summer camp down at San Simeon. It was awfully hard. Then I came back and worked at Selby. At that time they hoped that I would stay with Selby or stay with ASARCO, so I never had the same job twice, although I had experience. The job as guard on the armored truck, I don't see that that was very much experience but it taught me to be careful. Then I had a job working a night shift running a reverberatory furnace. It was a very boring job because you just looked at the temperature and the fire control and then you had to unload the furnace just once a shift. So I could sit on the steps and I could go to sleep. As soon as there would be something wrong with the fire, because it had to be just right, the change would wake me up just in a minute.

Swent: You must have been awfully tired a lot of the time.

McQuiston: Well, yes, but when you're young, I was pretty strong at that time.

Swent: So then you started your senior year.

McQuiston: I took a broad outlook of what I was doing at the university so I decided that my choices would be either geology, which I wasn't equipped for because of my bad leg, or metallurgy. I wasn't interested in mining engineering because I realized that I would have to serve an apprenticeship underground, doing a lot of underground work. I was more interested in either geology or metallurgy, and they were of course entirely separated subjects. No relationship, none whatsoever. Mining and metallurgy there is, and mining and geology there is, but not those two. Now I had grown up in the mining area, so I knew many people who were dedicated to their work, but I thought, what about all these people that took mining and then went into real estate or brokerage houses, or something like that. So I gave considerable thought to those two specialties which covered the mining

McQuiston: field. I could go into any part of the mining field with those two backgrounds.

Swent: Was mining a very popular field at that time?

McQuiston: It was. Yes, everything was prosperous.

Swent: Were you aware of Hoover at that time? Was he any influence?

McQuiston: No. He was in Washington in '28.

Swent: That was when he was elected, but had you known of him as a mining person?

McQuiston: No. Lawson had a counterpart, Willis, at Stanford who was quite literary, wrote a lot of professional papers; he was a great specialist in earth tremors, earthquakes, and things like that. Lawson would say, "Any time a professor doesn't know anything, like a friend of mine at Stanford, he writes a book on it."

Swent: What about Plato Malozemoff; had you run into him at this time?

McQuiston: Just casually; he was a straight A student, and I was strapped, and he didn't work.

Swent: Did you overlap at Cal?

McQuiston: Yes. We were there.

Swent: But you weren't friends?

McQuiston: No. I was in geology more and he took straight mining engineering.

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I knew him, not well, because he was a chess player and I was a playboy to an extent. And I was with the athletes. We had quite a few of them in the College of Mining. I think it would be nice to mention that Andy Miller was the center on the football team; Fran Fredericks was in geology and was a crew member of the famous 1928 world championship crew. And there was Dusty Rhodes who was a big seed tennis player in an international competition. These were all very close friends of mine, because I was interested in sports. I couldn't

McQuiston: participate, but I could be friendly with those who did. A man named John Coke, who was in mining engineering, was a tackle on the football team. So we had a pretty good cross section of athletes.

So I guess that brings us up to the fall of 1928. I had not intended to go to my senior year; however, I was the only one who knew it. I had completely run out of funds, although I did have my Blue & Gold appointment. I was appointed manager of Blue & Gold, which paid \$120 a month, which would have taken me very nicely through my senior year. That was a paying job, you know, because there was a profit on publishing the Blue & Gold. And I thought, well, that is fine. I can now make up for some of the things because as a manager I've got three junior managers to do the leg work and all I have to do is make the management decisions.

Lo and behold, my present wife, the only one I've ever had, was elected vice president of the student body for 1929, her graduating year. I did not know her. She was a member of Delta Gamma sorority. I knew other DGs, but I didn't know her. And unbeknownst to me, she spearheaded a movement whereby they cut the salaries with the student council, cut the salaries of the Blue & Gold editor and manager, and the editor and manager of the Daily Cal. So that was cut to \$60. And that wasn't enough money for me to go to school because I was no longer manager of the fraternity; I was president then. I just didn't have the funds, and I didn't see how I could work because if I was going to stay, Blue & Gold took my attention away from work. I just couldn't do both, and I wouldn't do any job half way.

So I thought it all over very carefully. No one knew that I wasn't registered. Even my fraternity brothers, the closest ones to me, never knew it. I pledged the 1929 class of neophytes into the fraternity, and then I figured I had accomplished enough in getting them on their way and I left and went to Arizona to get work, where I knew I could get a job. I didn't want to go back to Selby; that was right in the neighborhood and I wanted a clean break.

So I went down and worked in the mill at Hayden, Arizona, for a while under the direction of the man who talked me into going to Cal, Walter Garmes. Then I went to work at the smelter. Although it was a different kind of smelting--this was a copper smelter--I had had lots of smelting experience so I went to work at the smelter in sort

McQuiston: of a fill-in job position because I could do most anything around the smelter, from running the big cranes overhead to doing anything.

Swent: Where did you live at this time? Did they have boarding houses?

McQuiston: I lived at the guest house at the smelter. My uncle happened to be the manager. So he allowed me to live at the senior men's dormitory.

Swent: Was his name McQuiston also?

McQuiston: His name was Kiser, Charles Kiser. My mother's brother.

Swent: Did you know at that time that Fran was responsible for cutting your pay?

McQuiston: No.

Swent: That came out later; you married her in spite of it.

McQuiston: To get even.

Swent: [Laughter] You'll never let her forget it? She thought she was being efficient, I suppose.

McQuiston: Well, she was. They didn't need that money. Then I stayed out of college that year. That would be '29 and I came back and reentered in 1930.

Swent: The Depression had hit by now?

McQuiston: Partially. The bad years of the Depression were '31 and '32.

Swent: But you were still okay?

McQuiston: I had had all my years's work in, most of a year's work. And I could live very cheaply and save a lot.

Swent: You drove your Model T back to California?

McQuiston: Oh, no. That was no Model T. That was a Model A then. I bought the first Model A coupe that came into Berkeley. I knew the fellow, he was an old fraternity brother, who owned the Golden Bear Ford Motor Company. So I used to visit with him, you know, looking to turn in my car. Well, it hadn't

McQuiston: come in yet, hadn't come in yet. So finally they did come in. I had to go down on a Saturday, and here it was on the floor. So I talked to some of the men and I drove it off the floor and I said to him, "I've got it now." So he let me keep it. Oh, that was a fine car.

Swent: Yes. Did it have a rumble seat?

McQuiston: Yes. That car--turn over on its side, get a couple or three men, we would ride it back up again. I always carried extra oil, would put oil in the thing and then drive off. It would do anything.

Swent: You see them still.

McQuiston: Yes, there's one here [Villa Marin, San Rafael, California].

Swent: They were wonderful cars. So that's what you were driving back and forth.

McQuiston: That's right.

That was a '29 model but I think I got it in '28, I'm not too sure. But it was the first one of its kind in Berkeley. Oh, I had it a long time, too. Drove it thousands of miles. So then I came back to school in 1929, registered for my classes and picked up where I had left off a year before.

Swent: Back to the fraternity?

McQuiston: Yes. I've forgotten how I paid my bills there, I guess I had enough. I wasn't the manager and I wasn't president. But anyway, yes, I had enough to pay my way.

Swent: Now you switched from geology?

McQuiston: No. I still had geology, and metallurgy, and all the engineering courses. But I met Fran [Frances Haseltine] and became somewhat interested and then more deeply interested; and maybe it was the intrigue of what she had done with me. She was taking a postgraduate course to get her teacher's certificate. This was in '29 and '30. And she had an apartment across the street from the DG house, which was just around the corner from the fraternity. So I started taking her out.

Swent: I don't know how you had time with all these other things.

McQuiston: I had a little more leisure at this time because of having worked for a year and saved.

We were still having field trips. We had a field weekend for geology and went to Mariposa. I was manager again; I should have opened a tour office, shouldn't I? I was manager of the group which comprised, oh, twelve or fourteen juniors and seniors in geology.

Swent: Were there any women in your geology classes?

McQuiston: All men. And Tucky Taliaferro was again our field professor. We were staying at the local hotel, boarding there, through arrangements that I had made for all of us. We arrived on Friday; most of them had some means of conveyances, it was up to them to get there. I didn't have to arrange a bus or anything like that. We met at the hotel to spend a day in the field at Mariposa, which had very interesting geological structure. We probably walked miles that day studying the outcrops and whatever Tucky wanted us to look at, and I, as manager, felt I ought to have some kind of entertainment for these boys at night. So I asked Andy Miller, Fran Fredericks, and a fellow named Ross if they would like to have a little libation. And they said, "Where would you get any in Mariposa?" And I said, "Well, I'll make it up."

So I took some lemon extract, some Virginia Dare wine, that was a cooking thing, I don't know whether you ever heard of it. It had a little alcohol content, and I mixed those together and something else, and so we had a little snort of this brew because there was no way I could get anything else. I did bring a bottle of wine with me, though, and that made this punch. And so we had enough to revive our spirits after a heavy day in the field.

There was a local circus in town. So we thought wouldn't it be fun to let that mangy old lion out. He probably has lived there so long that that's the only home he knows and he wouldn't go far and it would just really cause a lot of fun. And we stood there and looked at him; he didn't even get up off the floor and growl or anything, even if you poked a stick in at it. So we decided he didn't have any teeth, because we noted bowls like mush for him to eat. So

McQuiston: he didn't have any teeth. And it was just a two-bit side show, was really what it was. So we decided, why not let the lion out to run around a little bit, create a little excitement. About that time we were working on the hasp on the door, and one of the attendants of the circus saw us. They had a battle cry which has been with the circuses for a hundred years; they would call, "Hey Rube!" And that meant something was going on and they all assembled with their picket stakes ready to do harm to anyone that was doing harm to their circus.

These circus attendants came up and they saw Miller, who was about six foot three, and Fran Fredericks, who was six feet four, and I was around six feet then, and Ross--he wasn't big but he was husky. So they decided that they wouldn't have a fight with us but they would talk us into leaving. So we did; we decided there wasn't anything at the circus to interest us. We went by the courthouse, the famous Mariposa [County] Courthouse.

Swent: That's a very historic building.

McQuiston: There was our Blue & Gold stationery heading, see. [Shows stationery]. The '28 crew. That was the theme of the book. The clock tower two-story white frame building built in 1854. It's the oldest courthouse in California. So walking back to the hotel or just around town to see what Mariposa looked like, we walked by this courthouse. We decided my, that would be interesting to see what made the clock tick. So I being the lightest of the men that were there, climbed up, it was two stories, you see up here [shows photograph], climbed up to the second story here on the drainpipe. So I went up hand over hand on this drainpipe. You know, the drainpipe comes up like this, then it goes around over the eaves and then back again [motioning]. And just as I got out there to the eaves the drainpipe started pulling loose from the side of the building where it was anchored. So I thought, this is going to be a crash when I land, because I was two stories up--and here were the football player and the crewman down below dancing around, you know. And I never even hit the ground. They caught me. Because you see, it was kind of slow as each one pulled away. So they caught me; there was no problem.

Swent: You weren't hurt?

McQuiston: Not a bit. Then, in looking around, we found one of the lower windows open; it wasn't latched. So we all four entered this courthouse room, the chambers. And we decided to get up to the clock. The clock was our interest, not the chambers or anything. We weren't going to be destructive. So we finally found a ladder that led up to this area here and it was rafters like they have on any building or house; it wasn't floored. But they had planks that you could walk on.

So we walked from the back to the front and got up in the clock tower and were working to get some of the hands loose from the clock itself. Andy Miller had taken out a little piece of wedge steel about an inch by a half which held the bell clapper into the frame so that the bell would ring. Unthinkingly, he dropped that in his pocket. It had nothing to do with the hands but in attempting to get two of the hands off, why, we were fairly cumbersome and broke them, broke two hands.

So we decided we had enough. So we all went back to the hotel, but before we entered the hotel, we buried the hands in the yard. We were smart enough to do that because we knew that they would be missed. And who would they suspect but this field trip party?

So that ended that night and we went on the field trip again the next day. When we came in, there was the sheriff waiting. And he said, "Who has this room down here?" Andy Miller said, "Well, I'm there with Frank McQuiston." So he brought a pair of pants out and he says, "Are these yours, Mr. Miller?"

Mr. Miller says, "Yes."

He says, "What's this little thing from the bell clapper doing in your pocket?"

"Oh," he said, "I don't know how that could have gotten there."

He said, "Are you sure you fellows didn't put it there?"

Well, there was no use denying it. And he said, "We have all the evidence that there were several of you involved in this episode. You know, that clock is our pride and joy

McQuiston: for not only the little town of Mariposa, but for Mariposa County." And he says, "You have committed a very serious crime."

So Tucky Taliaferro, he was there too--they had all of us--and he didn't say a word. Oh, once in a while he would look over at us and shake his head and grin a little bit, you know; nothing bothered him too much. So the sheriff said, "You're going to come with me, Miller, but it would go easier if you would name the others that were with you."

And we had decided that I would take the blame because I turn my foot out due to the hip when I walk, and I said, if they're going to get anybody, they're going to get me because they can see my footprints on the dust, on this plank that we walked down where my foot is a little sideways. I said, "They'll pick that up right away." Well, they didn't. They didn't see that at all. So it was all agreed that I would take the blame and say, "Well, it was me." Because they had had the evidence. But they caught Andy with that bell clapper piece.

So Andy said, "I was the only one, I just couldn't sleep, and I got up and I got in through the back window."

And they said, "Why would you pull the drainpipe down?"

"Oh," he said, "I was just testing my strength; you know, I'm an athlete and I was just testing my strength."

And the sheriff said, "There had to be two of you because we know that that was pulled off from the top, started from the top down."

Andy said, "Maybe there was somebody, I don't know who it was, though. Didn't recognize him. Nobody was involved but me." They couldn't change his story.

So anyway, they put Andy in jail that night. So the students were leaving the next morning; this was Saturday night. We had had our two days of field trip, so Taliaferro said to me, "Frank, you've got to stay. You're the manager." And he said, "We're through as far as managing a field party goes but we're all going; no use us staying here."

McQuiston: So I phoned, this was Saturday, and I phoned Andy's brothers, two of them, and I phoned an ex-football player that we both knew down in Merced, trying to raise money. I said, "We might need a fine of as much as \$300 or \$400, and I haven't got any money." I took up a collection from students that were with us and raised \$100 from them on loan. So I had that, and I had maybe \$30 or \$40 of my own and I said, "We haven't got very much, Andy. How much have you got?" He said, "Five dollars." I was talking to him in the jail. I drove over to Merced the next day and his brothers came up and met me.

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They were kind of rough, tough characters like Andy. I said, "Don't you come up to Mariposa because you can't do any good for us. You give me your money." So then I went to see this great football player for Cal and a good friends of Miller's. By then I had about \$500 between Andy's brothers and our own and this and that.

Swent: He was in jail for several days then?

McQuiston: No, I did this on Saturday. Because I phoned and got everything arranged so that I could meet them. We got the money together, and I went back and talked to the sheriff. He was getting a little suspicious of me and he said, "Why are you so interested in this?" I said, "I'm the manager."

"Oh yes," he said, "I did hear your professor say that you would have to stay on and take care of anything."

And I said, "Yes, I'm the manager. That's why I'm here. Because he was one of the party and it's up to me to do anything I can to help him out."

"Oh," he said, "I understand that now." He was still suspicious of me for some reason or other. Every once in a while I knew too much about it, see.

McQuiston: Then the trial came up and on Sunday they started coming to town from all the outlying districts in wagons and on horseback, and some of them walking, and then old automobiles; there weren't too many new ones up around there. They came to witness this man in jail who had defaced their

McQuiston: loved clock. So I mingled around with them, they didn't know who I was, so I mingled around town and went and talked with some of them. Fortunately there were no saloons. Talked to them, and they said, "You know, I don't think hanging would be out of order here." Well, of course, that was talk; the sheriff would never have permitted that. But anyway, they talked; they said, "then we ought to demand--maybe a ten-year jail sentence would be about right. Penitentiary, no jail. Penitentiary. We don't want him here in our jail. I wish we could get him out and beat him up or something." Oh, it was a rough element there for a while. And his trial was the next day. And it had all gone very quickly.

So I found out who the judge was, this one right here, Judge Scott [shows picture]. And I went to see him, and the sheriff let me take Andy with me. I had won the sheriff over a little by then. I think he was suspicious of me; he said, "I hate to see this Miller get all the blame because I know there were more of you." And I said, "Well, there probably were, they're a rough lot, these students at the University of California."

So anyway, he said, "I'll let you take Miller to the judge's home; the judge isn't going to come up here because he doesn't like this mob any better than I do, so you can take Miller to the judge's home, and I'll see that you get there." So he drove us in an old Ford that he had.

And Miller had such an open face and nothing bothered him, you know. So he just exuded good fellowship and he talked to the judge. The judge said, "You know, I kind of like you, Miller. You tell the truth. You're not telling all the truth and I don't hold that against you because we know that there were more involved. But you're man enough to take the whole blame. Even if it's a jail sentence."

Andy says, "Yes, I'll never say that there was any more than myself involved, because then I would have to give names."

And the judge says, "That's quite a commitment."

McQuiston: I was talking a blue streak, whenever I got the chance, about what a fine character he was. He was anything but a fine character [laughter]. But I said what a fine character he was, and his mother was a widow and she had raised these three boys, and on down the line making it up, because I didn't know much about his history. Except we were very close friends.

So the judge said, "I'll tell you what I'll do, now. I don't want to make this into just a farce, so I am going to levy a reasonable fine, and I will sentence Miller as I see fit, and the fine will be \$150." Oh, boy, I almost fell on the floor because I had all this other money with me. I had about \$500 by then. And here's the receipt: [reads receipt] "Andy Miller, the defendant appearing on this charge pleads guilt," (because he was!) "therefrom he is fined in the sum of \$150. Fine paid. Justice of Peace, Mariposa County, W.A. Scott."

Swent: What was the date on that?

McQuiston: That was April 5, 1930. So he said, "I'm not going to put you back in jail now; there is no jail sentence," he says, "I've wavered that." But he says, "You know, I have to face these people. So you get the hell out of town."

So I had to go back to the hotel and check out and get his things and my things. The judge said, "He can wait here if you want." So the sheriff took me to my car and I went to the hotel. The sheriff was in on this then. He said he didn't want to be, but he couldn't help but be, because he didn't want Miller to escape. He didn't know too much about it. So anyway, we went to the hotel, and I got my things and I checked out, because I had slept there the night before, and went back. I put Miller in the rumble seat and he was big; he was six feet three or four, big man. Away we went. Never even turned around and looked back. I put Miller in the rumble seat so that nobody could recognize him.

The newspapers all had--here's the Oakland Tribune. They had a picture of Andy Miller in his football uniform bending over a clock with the face of the clock the end of the football. They just made a farce of it, and that's what made the Mariposa people so angry. See, here's a story of

McQuiston: "Mariposans Wait in Vain for Trial of the U.C. Gridder."
Because they stood out waiting on Monday morning, waiting for
the trial to take place.

Swent: And he was long gone.

McQuiston: We were just about in Berkeley then; we were to Berkeley.
Then this is the Oakland Tribune. I think this came out of
the Sacramento Bee. Because he was a noted football player.

Swent: Did they ever find the hands?

McQuiston: We showed them. I didn't; Andy did. He took the sheriff and
he says, "The hands are buried right here." They dug them up
and they were all right. They eventually repaired it. They
were broken off right there [shows picture]. They eventually
repaired them. Here's our summer camp [shows picture].

Swent: Oh, yes, your tent and everything.

McQuiston: Yes. There were twenty of us or something there.

Swent: As a result of that you didn't hang around Mariposa much?

McQuiston: Oh, no, because my name was as well known as Andy's because I
was the go-between between the culprit and the law, just like
an attorney. So my name was known. But the mayor and the
city council drafted a letter to Dean Probert demanding our
expulsion from the University of California. Of course, they
had my name. They all suspected that I was involved, but
they had no proof. So they didn't want to distract from
having the culprit right here.

So anyway, the word got out on the campus that they were
going to expel that field party. Of course, they couldn't do
it because they weren't involved, most of them. Dean Probert
called us in and he said, "I would like to talk to those
involved." So the four of us went because we were involved.
We admitted to him. He said, "Who were the real culprits?"

And Andy said, "Well, I was, Dean."

And I said, "That's not quite so, Dean Probert. I was
just as much involved as Andy was. He was the one who took

McQuiston: all the blame. And the other two were just along for the ride."

But he said, "This is pretty serious. They want me to take this up with the chancellor and see that you're expelled."

So I said, "That's pretty harsh treatment."

He says, "It sure as hell is, isn't it?" He said, "And I don't intend to have any two-bit mayor up in Mariposa tell me how to run my college." So he says, "You fellows get out of here and stay out of trouble from now on or I'm liable to lose my good judgment." But he says, "Nobody can tell me about my students, what to do with them." Oh, I remember his speech, he got up from behind his desk, and he was a little man, not very tall. And boy, he just--

Swent: He went to bat for you.

McQuiston: You bet he did.

Swent: It must have been a chastening experience though.

McQuiston: There were such funny elements; Andy, it didn't make any difference whether he was in jail or what, but he was such a funny person, kind of nonchalant. He was quite a boxer, too. Heavyweight champion boxer. I took him to Nevada once on his motorcycle; two of us went over. And I entered him in a boxing match. [laughter] It was a fly-by-night gold camp that they discovered called Weepah. We went up there and he was my challenger to this local heavyweight. Of course, he could have been kicked off the football team, but we both needed money.

So I took Andy up there and I was his manager [laughter] and I entered him in this contest. We got \$50 if we won, \$25 if we lost. So, I said, "Well, that \$25 has to be in advance; we spent money getting here."

"Where are you from?"

I said, "Southern California."

He said, "Who's this fellow you've got?"

McQuiston: I said, "Oh, he's just a big husky guy, pretty good fighter, just a big old husky country boy." So I said, "We have to have \$25 in advance and \$50 if we win." Money wasn't too plentiful in those days, but that sounded all right. Then I said, "There's \$10 expenses in coming over." And I almost gave it away, because "coming over" sounded like you know, from some place east or west. And then I said, "By that I mean coming from southern California up here."

So he said, "All right, I'll give you \$10. Because your boy is big and husky but he's sure going to get beat up well."

It lasted just a little over a round. Andy, of course, being the Pacific Coast heavyweight boxing champion, it wasn't any contest. The promoter came around looking for me, and he says, "I don't think you deserve that other \$25."

I said, "I'll settle for half." So I got \$37.50 plus \$10. We didn't make much money but we had fun.

Swent: What became of Andy Miller?

McQuiston: Something I would never ever dream of. He died of pneumonia. He had graduated from Cal and he had taken up flying lessons. He was going to fly with the Flying Tigers. He already had an assignment; he was on his way. His mother wasn't well; she lived up in some cold climate. I don't remember where it was. So he went to see her and he had on, of course, all light clothes for going on overseas. And he visited with her for three or four days, and then he got pneumonia, and died very quickly.

Swent: Right after graduation from college?

McQuiston: Yes. Within a year. Because he had to take flying lessons and qualify for the Flying Tigers.

Swent: But he didn't get involved in his career at all.

McQuiston: No. He wanted me to come with him. I said, "I can't fly, they won't take me." He says, "Oh well, we'll get you a job in the ground crew."

I mentioned I had become interested in Fran, who was studying for her teaching certificate. And lo and behold if

McQuiston: her first assignment wasn't in Mariposa where she spent a year teaching in the high school. She did not dare address a letter to me because I was always under suspicion in Mariposa as being one of the culprits. Which, of course, I was. And I never went to Mariposa to see her. She would come to see me. I was in Jackson for a year. Oh, that hasn't come up yet, has it?

That's when Phil Bradley, who had a mine near Mariposa, that he was attempting to reopen or do something with, he used to go and call on Fran. He used to tell me when I would see him, "Well, I'm beating you out." [laughter] So she taught for a year. God, what year would that be, '32 and '33?

It is hard to believe that with so many escapades that take place on these field trips, we still learned a great deal about field geology from Tucky Taliaferro.

[Interview 3: 30 June 1986] ##

Swent: You had come back from Mariposa, so is this the summer before your senior year?

McQuiston: It wasn't the summer, it was in mid-term, because it was only a long weekend that we had this field trip.

Swent: And you had already met Fran?

McQuiston: Yes.

Swent: But she wasn't teaching at Mariposa at that time?

McQuiston: No, not at that time.

Swent: It was just a coincidence that she went there later?

McQuiston: That's right. In fact, jobs were pretty scarce in that time.

Swent: Yes. This was the beginning of the Depression, then, wasn't it?

McQuiston: Right.

Swent: Did this affect the mining in California greatly?

McQuiston: No. Because mining in California was principally gold. And because it was gold mining it was after the price of gold was raised from \$20.67 to \$35 an ounce. Then the gold mines really were in boom time because of the higher price.

Swent: The price was raised in 1934. Did this affect your choice of career at all to go into gold?

McQuiston: No. Because gold in 1931 was still \$20.67 and all of the mines that I know of were operating but not too lucrative.

III VARIED WORK EXPERIENCE IN THE SIERRA

Assayer, the Spanish Mine

Swent: Perhaps you would like to tell a little bit about how you made your career decision when you finished college.

McQuiston: Knowing that graduation was coming up in May of 1931, I thought it prudent to look for a job. So I asked F.W. Bradley of Bradley Mining Company--

Swent: This is Fred?

McQuiston: Fred Bradley--for an interview which he kindly consented. He mentioned that they were just bringing into production a mine called the Spanish about thirty miles northeast of Nevada City.

Swent: How did you know about Fred Bradley?

McQuiston: I had met him due to the fact that I knew his sons, Worthen, who was out of college, and Jim Bradley, a very good friend. Phil Bradley and Hank Bradley, their two cousins, were the sons of Phil Bradley, who was a partner and brother to F.W. Bradley. So going to school with Jim, I had stayed at his home in San Francisco on an occasion or two when we had a night out during our school year. So I was able to get this interview with F.W. Bradley and he said, if I would like to go to the Spanish Mine, why, he could offer me a job, and Jim

McQuiston: was going as manager. Which surprised me somewhat because I never thought he had done any work at all in mining, although he was from a mining family.

I also had an interview with the Gould and Company who were quicksilver miners and knew the Gould--I don't know his first name. I did then, we were very good friends.

Swent: This was New Almaden?

McQuiston: Well, they were the top producers of quicksilver in the state of California. Mr. Gould, the senior of the Gould Company, offered me a job to go to work at New Almaden; however, I postponed a decision on that. And a third interview was with Benguet and Balatok of the Philippine Islands, who had a San Francisco office. They could not do any more for me than accept my application; however, in the Philippines were six or seven Cal mining engineers who had gone there in the late '20s to work in the Philippine gold mines. So I really had a choice of three positions: at the Spanish Mines with the Bradleys, with the Goulds, or going to the Philippines.

I selected, with a little pressure from Fred Bradley; perhaps he thought I would be of some help to Jim as manager because I did know quite a bit about mining, having grown up in that atmosphere and started working around the mills and smelters and mines at an early age. The Spanish Mine was located about five miles from a little village called Washington on the south fork of the Yuba River about twenty-five miles from Nevada City.

The Spanish Mine had barely started operating when we were in trouble with metal prices, as this was 1931 and the Depression was advancing very rapidly on all mining activities as well as other forms of industry.

Swent: What was your position, what was your title at this time?

McQuiston: I was employed as assayer and served in that capacity for two or three months. Now, I guess, it is time to mention that the Bradley Mining Company started a metallurgical laboratory in Berkeley and employed three or four metallurgists, each one of them assigned to an individual mine. The Spanish Mine was assigned to a young man named Church Holmes who was the metallurgist, and said, "What should be done about the milling?"

Swent: Was this at the university or in the town?

McQuiston: No, in the town, just in lower Berkeley. Dee [Dimitri] Vedensky was assigned, I believe, to Bodie, which was an old mining camp last operated by George Wingfield many years ago. But the Bradleys thought they could revive the operation and build a mill and develop the mine which was about ten thousand feet elevation in the high Sierras. Another mine that they assigned a metallurgist to was at Atolia, a tungsten operation in the Randsburg southern California district. This plan of hiring a metallurgist to work out the details and then become mill superintendent sounded good on paper but was not a practical approach.

Church Holmes, who was running the Spanish mill from Berkeley, would come up and spend long weekends and a week or two in Nevada City and commute to the Spanish Mine. And make mill changes, thinking nothing of shutting down the mill while a pipe line was changed, or a pump was installed, or the flotation cells hooked up in a different manner. He had no understanding of what this did to production, as he was strictly interested in the metallurgical aspects.

Swent: He had the authority, however, to do this?

McQuiston: He was in charge of the mill.

Swent: As assayer, did you have any input on this at all?

McQuiston: Yes. When the reports began reaching San Francisco about our low production and not very good metallurgy, Church Holmes was assigned to some other task and I was made mill superintendent. Because of my former experience in Hayden and knowing considerably about flotation from studying it at Cal and visiting plants whenever I had an occasion. The Spanish mine shut down just before Christmas. Our production of concentrates were from a very complex ore, containing copper, lead, zinc, some gold and silver and a high percentage of barite as a gangue.

Our objective was to make individual concentrates from these metals, except gold, which was jigged into a concentrate for shipment to Selby. Otherwise all other shipments went to El Paso American Smelting & Refining Company smelter. The last shipment we made was about the

McQuiston: first of December and the mine owed the smelter for treating the concentrates instead of getting paid for the metal contained. This was the final straw, and the mine was shut down.

I was asked to stay on and mothball the milling equipment and mining equipment. And then was offered a job at Yellow Pine in Idaho.

Swent: Would you mind saying, if you remember, how much you were paid at this time?

McQuiston: I don't know. I can tell that later.

Swent: I was also interested in what sort of living arrangements you had up at the mine.

McQuiston: Living arrangements were very primitive. I, being a college graduate, was a step above the others, except Jim, the manager. Jim had a small house which he lived in. I had a room over the general office, which was quite comfortable and large and suited me better than bunking with Jim. We all ate at the mine boardinghouse; we had about forty employees, as I recall.

Swent: How was communication with San Francisco? Did you go through Jim Bradley on these things?

McQuiston: Oh, I didn't communicate with San Francisco. You don't ever cut the manager out, no matter who he is.

Swent: But you somehow registered your discontent with this mill situation.

McQuiston: To Jim. I let him take it up. Oh, yes.

Swent: And it was not held against you, obviously.

McQuiston: Oh, no. I had two men helping me mothball the equipment. Which meant painting, greasing, be sure there was good drainage in all the floors and buildings, propping up some of the lean-tos, and just making it safe for winter.

Swent: You were hoping to reopen at a later time?

McQuiston: Yes. By then the snows had come and I was completely snowed in. We had one mule which I rode in from the mine to drag timbers around the yard, mine yard, and haul heavy loads that were necessary. And I rode him in to Washington, where I got in touch with the Forest Service and asked if there was any way they could get me out with my car. So they said, "We will give you a firm time in ten days and say when we're sending in the Caterpillar tractor." Because there was a two-thousand-foot drop between the highway, on top of the ridge leading from Nevada City, and the south fork of the Yuba River, where Washington was located. So with the mule available to haul my car, pull my car, from the Spanish Mine to Washington, I then waited for this phone call which came and, sure enough, the Caterpillar tractor was there to tow me up this long incline grade. And from there I was on my own.

I did not accept the job at Yellow Pine because I heard that they were also snowed in, and I didn't want to go through this experience of snow again. So I decided I would go to Jackson, California, and work on the Mother Lode for a while.

Timberman, the Argonaut Mine

Swent: Was this still with Bradley?

McQuiston: No. The Mother Lode in Jackson, there was the Kennedy Mine, I've forgotten the ownership, probably a stock company, and the big Argonaut Mine, which was owned as a stock company. I did know the manager whose name was Stent. And the metallurgy was done by contract to Hamilton, Beauchamp, and Woodworth, an outstanding metallurgical firm located in San Francisco. I became friendly with Hamilton and he put a word in for me with the general manager. And I was employed underground as a timberman's helper. I was not too fond of this particular assignment because the mine was what we call "heavy ground" and the timbers were sixteen inches in diameter. And they would snap like matchsticks after being under pressure with the swelling in the slate formation. I had accumulated money to buy assay office equipment.

Swent: Any time you care to say what you were being paid, this is of interest. Do you remember?

McQuiston: I was paid \$3.50 a day.

Swent: As a timberman's helper.

McQuiston: Yes.

Swent: And on that you were saving money?

McQuiston: No, I saved money working at the Spanish. I spent all the money I made at the Argonaut because of buying this assay office equipment. And opening up a custom assay office, which I thought would help me to get in line with some good prospects in the area.

Swent: What sort of equipment did you buy?

McQuiston: Complete assay office. It's too much detail.

Swent: All right.

McQuiston: I bought it at a mine outside of Grass Valley that I knew of and had it shipped and hauled it down by a friend's truck. Rented a space and set it up and did quite a bit of assaying at nights when I wasn't working, or on days when I was working nights. I finally decided there was something better for me to do at the Argonaut Mine than become a miner's helper or timberman's helper and gradually work my way up at a slow pace.

Custom Assayer

McQuiston: So I went directly, with the help of Hamilton, who was a Scot. He, although with the firm as previously mentioned, lived in Jackson and did the metallurgy at the Argonaut Mine, which was most complicated. Because they had some carbon in the ore which precipitated the gold from cyanide solution. So he devised a new method of tumbling the concentrates made by tabling or flotation with creosote oil which coated the particles of sulfides and inhibited the precipitation of the gold on the carbon. This was my first experience with carbonaceous material.

Swent: This was very important later in your career.

McQuiston: Oh, yes. I found a pretty good prospect on what was known as the West Belt of the Mother Lode near a little town called West Point. West Point was the furthest point west that Kit Carson came to during his exploratory visits to the western mountains.

Swent: That's out in Mokelumne, isn't it?

McQuiston: Yes. How did you know that?

Swent: Well, I just happen to know it. But I'm glad to know why West Point got its name.

Mine Leaser, The Golden Eagle Mine

McQuiston: I obtained a lease on the Golden Eagle Mine, which seemed to have some promise. And two friends and myself had this lease on the mine, and I had grubstake from working at the Argonaut. So I quit the Argonaut and we started opening up this adit. The formation was very hard and when we had funds we could use a jackhammer, but if we didn't have funds to run the compressor with--to buy fuel for the compressor--we did it by single jacking and double jacking.

So our progress was slow, but we did hit one small pocket and took out a nice specimen of gold, the only one we found in the whole mine, and we sent it to Sacramento for the state fair and won a small prize.

Swent: Would you care to mention who your partners were in this?

McQuiston: My two partners were the Irwin brothers. Homer graduated in mining geology and his brother didn't go to college. They were very husky and very interested in their work. But would fight, really fight with fists and anything handy unless I was there to separate them. They just didn't seem to get along.

Swent: Were they from that area?

McQuiston: No, they were from southern California. And their family sacrificed a great deal to send Homer on to college and the last I knew of him he died an alcoholic in South America at a mining camp. Not too many years after he left Berkeley and, particularly, the Golden Eagle Mine.

Swent: Was drinking a problem at that time with him?

McQuiston: Not as long as I was there to handle him.

We believed that the price of gold was going to advance because it was higher in Europe than it was in the United States. The price of \$20.67 had been established since the 1700s. However, we ran out of money completely and the only alternative was for me to borrow \$25 from a friend of mine in Lodi who was a fraternity brother, and go to Grass Valley and look for something new to do, look for a job.

Swent: Did you still have your assay office?

McQuiston: I sold it. And put it into the Golden Eagle.

Swent: How did you get news about the gold price in Europe? How were you aware of this sort of thing?

McQuiston: Because of talking with the Argonaut and Kennedy people.

Swent: This was, of course, something of great interest.

McQuiston: Sure. It was down there.

Swent: In most towns at that time, the gold price in Europe would not have been a thing that the man in the street would know.

McQuiston: No.

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McQuiston: On the north end of the town of Jackson was a division of the town called Jackson Gate which was the home of most of the miners working in the Argonaut and Kennedy. One would drive to Jackson Gate, or walk through Jackson Gate in the middle of the night, you could hear the little mills grinding away. Which was high grade stolen from the mine. I went to Mr. Stent, after I had the Argonaut, and said, "I would like the job of preventing the highgrading from going on in the mine,

McQuiston: of which I'm sure you are aware." He listened very carefully to my plan, and having worked in the mine, I had some idea of what was going on. However, he said, "Young man, you wouldn't live the week out if I gave you the job that you thought you wanted of stopping the highgrading in this mine." He said, "We all know it goes on and there's nothing we can do about it but put up with it and hope the ore is sufficiently good grade to tolerate the losses."

Swent: Did you work at all in the mill there?

McQuiston: No. But I used to visit a lot and knew, because of knowing Hamilton, and also I'd met Woodworth.

Swent: That was Selim Woodworth?

McQuiston: Yes. I'd met him.

Swent: So your career as a security officer was nipped in the bud.

McQuiston: Not then, I kept on until I put it to work.

Swent: This is, of course, a constant problem in mines and mills, isn't it? Or at least something you have to be aware of.

McQuiston: Yes. Except Carlin.

Swent: Well, we'll get to that later.

IV BEGINNING A CAREER AT NEWMONT, 1934

The Empire-Star Mine; Developing Flotation

Swent: What was your next step?

McQuiston: I decided that Grass Valley offered the best opportunity for a future to stay in the mining business. So on the \$25 I borrowed from my good friend Ralph Fitzsimmons I went to Grass Valley, talked the boardinghouse lady into giving me credit for room and board, and then started making the rounds. I had known Mr. Fred Nobs from my tenure at the

McQuiston: Spanish Mine, because Jim and I both would come to town Saturday nights and were a part of the younger members of the Nobs family and the family of Arthur Foote, who was one of the principal owners and the manager of the North Star Mine, and he had three lovely daughters. So there was partying going on most Saturday nights. The Nobs had three boys and one girl who were of course there in the summer when we were at the Spanish from May until they went away to school again.

So not wanting to use my social connections with Fred Nobs I went to see him in his office at the Empire Mine, waiting in line with what we called the "rustlers", who were men forming a line at 5:30 in the morning to see the underground boss. I stepped aside just before I got to the underground boss and went up the steps and asked if I could see Fred Nobs. This way I was not taking advantage of knowing him previously because I had waited throughout the line for thirty minutes for my turn to come to put in an application.

He said, "You're very fortunate, Frank, we need a man in the assay office and somebody with the experience in flotation that you have had at the Spanish Mine. I understand from Jim Bradley that you were a very good assayer at the Spanish. So we have an opening as assistant assayer and it'll give you a chance to learn cyanidation."

I said, "I accept the job without any qualifications or any reservations."

He said, "Your pay is \$5 a shift." Not \$150 a month but \$5 for the days I worked.

I said, "Thank you, that sounds like a lot of money, because I had to borrow money to get here."

It turned out to be a very fortunate arrangement. The assay office was located in the cyanide plant. I was working for a man named Jim Tritch, who was a Stanford metallurgical graduate and went to school with Fred Nobs at Stanford and was probably one of the foremost cyanidation experts in the United States. He could have gone on to much bigger things than being the head assayer and metallurgist of the cyanide plant; however, he had three daughters growing up and he would hit the bottle occasionally, which held him back because he was in no shape to come to work.

McQuiston: It didn't take too long for me to learn the fundamentals of cyanidation working with him and having at least an hour to two hours every day for discussion of what took place in a cyanide plant. And then with the assay office located in the same building, I could wander from the end of our assaying shift to the end of the day's work through the cyanide plant, talk to the shift foreman, and also to Arthur Dowdell, who was superintendent of the cyanide plant.

Having had flotation as my first insight into milling ores at Hayden, Arizona, where flotation for copper ores was one of the early developments, and the Spanish Mine, where we floated copper, lead, and zinc, I was anxious to apply flotation to the Empire mill. The flow sheet used was the stamps for crushing, amalgamation plates for the stamp mill discharge, and then shaking tables--Wilfley tables for the concentration of sulfides. The recovery of gold was about 65 percent to 70 percent free gold in the form of amalgam, and the balance, 25 percent, was in the form of concentrates which were piped to the cyanide plant. The table concentration was not too successful, but it was the best that they had conceived up until the time of flotation.

So I diligently worked with flotation; I even got the company to buy small flotation cells, and worked until I had developed a flow sheet which was the forerunner of that used up and down the Mother Lode country. And having developed a friendship with the American Cyanamid metallurgists who were foremost in the leading group of world-renowned metallurgists because they were the chemical company developing flotation reagents, I had considerable help and the loan of much equipment from them too, as they were trying to sell, at that time, the Fagergren flotation cell. However, we also had the Kraut flotation cell, which was developed by Pan American Laboratory.

Swent: So you were really doing research?

McQuiston: Yes, I was really doing research while I was working as assayer, and I soon became metallurgist for the Empire mill, which was gradually enlarged to the North Star mill. At the Empire we milled 400 tons per day and at the North Star we milled about 300 tons a day.

Swent: And they had similar ores?

McQuiston: Yes. Adjoining ores. Adjoining ore bodies or overlapping ore bodies. We soon went to flotation, bypassing tabling entirely. One small flotation unit in the stamp mill for treating half of the 400 tons per day occupied less than 5 percent of the area occupied by the tables and appropriate division of the cyanide plant.

Swent: Was there pressure from these companies that were selling equipment?

McQuiston: Oh, great competition.

Swent: Did they put pressure on you in any way that influenced your research?

McQuiston: No, they couldn't do enough for me. It was no pressure, it was just the opposite. Cooperation.

Swent: There was competition among the companies.

McQuiston: Yes, among the companies, but that meant they couldn't put pressure. No, there was no pressure whatsoever because the sales organization for the Kraut cells and the Denver Sub-A cells and the Fagergren cell, they were in competition. So they were trying to do favors for you, but not with pressure. And then there was Dow Chemical Company, American Cyanamid Company, and Dupont, developing flotation reagents. The Dow Chemical Company were the developers principally of the xanthates, which were the early reagents used in copper metallurgy in the 1915, 1920 period.

Swent: Wilfley must have been unhappy when you cut out their tables.

McQuiston: Well, that was just natural evolution. They take up huge space.

Swent: They didn't pressure you to continue using them?

McQuiston: No. They turned to development of a fine pump. Oh, no, I had good friends in Wilfley.

Swent: Were there things like conventions and meetings that you were attending?

McQuiston: No, I was too junior.

Swent: So you weren't getting wined and dined by these people?

McQuiston: No. I was made metallurgist for the Empire-Star Mines, but only those under Fred Nobs. There was a manager who was quite a rival named Robert Hendrix, rival to Fred Nobs. And he had his operation which I was called upon to assist, but did not have direct authority.

Because of the progress I made for developing a system of milling the gold ores of Empire and North Star and other neighboring mines of Newmont, I was given the job of developing a research laboratory for Newmont. This was independent of Empire-Star, but still we had their backing and cooperation. It was a very fine building at the North Star Mine which was taken over for the metallurgical laboratory, completely equipped. And ores started coming in from Canada, Mexico, South America, and different places for testing purposes. I had a small crew to assist me in doing this work and an assayer to do the assaying.

This later became Newmont's central laboratory located in Danbury, Connecticut, which now does all of the metallurgy for all of Newmont mines the world over. They have about twenty metallurgists and twenty supporting staff.

Swent: Where did the initiative come for this; was this a suggestion that you made?

McQuiston: [Smiles, points to himself] Always pushing.

Swent: You made this suggestion?

McQuiston: Oh, yes.

Swent: To whom?

McQuiston: Fred Searls.

Swent: Where was he at this time?

McQuiston: President of Newmont in New York.

Swent: He was in New York. And how did you see him? How did you communicate with him?

McQuiston: He came out and visited all the time.

Swent: And you had a chance to talk to him?

McQuiston: I would make a chance to talk to him. My pay during this period was \$5 a day during the early period. After I had been in the Empire cyanide plant and assay office for a reasonable period of time I went to see Fred Nobs to ask for a raise in pay, pointing out some of the achievements that I had accomplished. Nobs pulled out a folder from his desk about two inches thick, and said, "Frank, here are over a hundred applications from engineers all over the world that would all consider it a privilege to live in Grass Valley and work for the Empire Star." I replied, "Thank you, Mr. Nobs. I hope you don't dock me for the time I spent coming to see you."

Swent: [Laughter] Oh! Well, those were hard times, weren't they?

McQuiston: Oh, yes.

Swent: This is '34 now, '35?

McQuiston: Oh, '34, '35. During this early period of 1934 I married Frances Haseltine, because I had a job with not bad pay for that time of \$5 and had an opportunity of working weekends for which I was paid.

Swent: Overtime?

McQuiston: Yes. We came back from being married on a weekend in San Francisco, and Fred Nobs had heard from his sons and daughter that Frank McQuiston had gotten married. So he called me in and said, "I want you to take a week off with pay for a honeymoon." We had no money for a honeymoon, so we went visiting mines where I knew people well enough that we might stay with them or get a free meal. We went back to Jackson and visited with friends there, then we went to the Comstock Lode where Phil Bradley had an operation working over one of the old dumps by cyaniding the ores and tailings. Then we went to Nevada City and stayed with friends, which wasn't much of a honeymoon, because it was only four miles from where we were living.

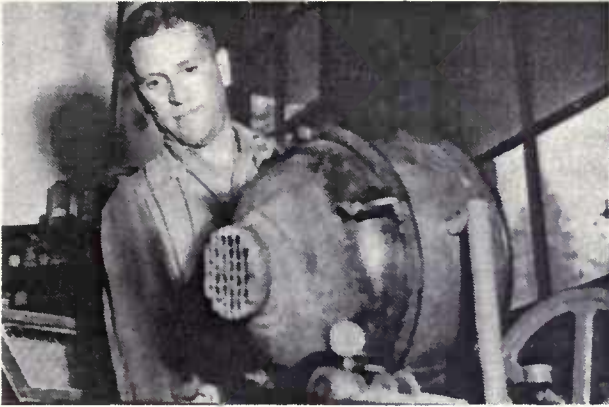
McQuiston: We lived in a rented room on the third floor of an old Victorian house and took our meals at the boardinghouse where I had boarded before getting married. And then Fran found a very nice little bungalow of five rooms in a nice court with wide open spaces around it for \$35 a month, which left us \$100 for living expenses.

All Grass Valley was full of engineers because the Idaho-Maryland, the Spring Hill, the Lavacap, the Empire, the North Star, and the Empress, and one or two smaller mines were all running full blast because of the increased price of gold from \$20 to \$35. Almost double the price. So it was a boom time for the gold mines.

Gee, I could go on forever, because I wrote this book on this chapter, here, but we can't do that, we'll refer them to the book. [Frank Woods McQuiston, Jr., Gold: The Saga of the Empire Mine 1850-1956, Nevada City, CA: Blue Dolphin Press, 1986]

During this time, let's see, it was in 1936, Noble Getchell, a state senator and mining entrepreneur and formerly a profitable operator of the Midas & Betty O'Neill mines in Nevada, grubstaked two prospectors who decided they would look for some kind of gold deposit northeast of Winnemucca. They took the grubstakes that Noble Getchell had given them and after doing a little wandering around bought two gallons of whiskey at Redhouse, Nevada, which was the railroad siding on the Western Pacific Railroad. After they drank the whiskey, they decided they had better go back to Reno but did not dare face Noble Getchell without some samples. So there was almost a cliff of outcrop with a reddish and orange coloring. So they knocked chunks of that, filled their sample sacks, and went back to Reno.

The assays showed a fair gold content and Noble Getchell went out himself and took other samples and found that the outcrops for quite a wide area were very good gold values. So a strike had definitely been made. Noble Getchell was a great friend of George Wingfield. Neither one of them had



Above: Frank W. McQuiston, Jr.
Grass Valley, California, 1938.

Below: Frank McQuiston (right) and
Earl Craig at their mine dump
leaching operation, Tuscarora,
Nevada, 1979.



Photograph by Elko Daily Free Press, November 21, 1979.

McQuiston: any money, however, because George Wingfield, who had owned twelve of the First National Banks of Nevada, had gone through bankruptcy during the bank failures and he had no money. However, his old friend "Barney" Bernard Baruch, whom he knew in Goldfield, had always told him, "I will give you a million dollars for any gold, for any mine you ever want to invest in. So just let me know of the time and the place." So George Wingfield telephoned Barney Baruch in New York, and Barney says, "I'll send you a check for a million dollars." George Wingfield said, "No, I will not accept it until you have an engineer examine this mine, this prospect that we have." Barney Baruch said, "All right, I'll send Fred Searls out."

Fred Searls was in Africa, and by the time he settled his business there and

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returned from Africa, George Wingfield had borrowed sufficient funds to start driving an adit into this large outcrop. The ore was getting better and better as it advanced. By the time Fred Searls arrived at the Getchell they realized they had a big mine, they had discovered a big mine. And Fred Searls and Barney Baruch between them could only get 38 percent of the Getchell mine.

Swent: What was the connection between Searls and Baruch?

McQuiston: Fred Searls was president of Newmont. I think Baruch's connection was just friendship. I guess he owned stock in Newmont, but I don't know how much.

There was no question in Fred's mind that a large deposit of good gold ore had been discovered. With the money that Barney Baruch and Newmont put up they built a one-thousand-ton-a-day cyanide plant designed by Western-Knapp Engineering Company.

Swent: Had Western-Knapp done any work for you up at Grass Valley?

McQuiston: No. Not Western-Knapp, Western Machinery--I bought a lot of equipment from them. Fred Searls requested, through Fred Nobs, that I make periodic trips from Grass Valley to the Getchell mine to serve as Newmont's representative and consulting metallurgist to the Getchell Mine. So I became a part of the Getchell organization and developed a keen friendship with Roy Hardy, the consulting general manager, and George Wingfield, the principal owner, and Nobel Getchell, the other owner.

Swent: Were these men trained in mining?

McQuiston: Oh, they all were.

Swent: As well as financiers they were also mining engineers?

McQuiston: Oh, not Barney Baruch.

Swent: But Wingfield and Getchell were?

McQuiston: I don't know about Getchell.

Swent: Was Wingfield a trained mining man?

McQuiston: He was a trained gunman with several notches in his gun.

Swent: From Goldfield?

McQuiston: Yes. The early ores at the Getchell cyanided very, very well with about a 95 percent extraction on a two-tenths ore grade. which was a seven-dollar ore and the costs were one dollar a ton mining and milling. So the profit was very substantial. And it pulled George Wingfield from the bankrupt condition he had been in, to a very wealthy man again in Nevada. After a few years the Getchell had worked out the oxide ores and encountered sulfide ores which were among the hardest metallurgical ores I have ever encountered in finding a solution to recovery of the gold in the ore. The ores were high in realgar, orpiment, some arsenopyrite, some pyrite, finely associated with the realgar and orpiment.

So we built a roasting plant with two large roasters, probably six feet in diameter and two hundred feet long. Had a Cottrell plant to save the arsenic from the fumes that were

McQuiston: exhausted from the roasters. However, the Cottrell plant was not sufficiently designed to extract all of the arsenic, and at times, when we would have an inversion of the atmosphere, the arsenic would precipitate out and fall like snow flakes killing all the dogs and cats in camp, and causing sores on the children. We had thirty nice houses built for the employees because of the remote location of the Getchell mine. Roasting was fairly successful but not too profitable because the extractions were low.

Swent: Were you still living at Grass Valley?

McQuiston: Oh, yes. But I was consultant, see. All metallurgical firms which I had knowledge of, such as Battelle [Memorial Institute], Colorado School of Mines Research Institute, American Cyanamid, Dupont, all worked on these Getchell ores without much success. We did a little experimental work with carbon and I made contact with Dr. Thomas Chapman of the University of Arizona, who at that time was acting president, but he was the head of the Arizona School of Mines. So he came as a consultant on three different summers to the Getchell, and he had been quite successful in developing carbon for a method of adsorption of gold from the pulp. His method was to use flotation. He would add very finely ground carbon to the pulp and then float it off the carbon, which was very readily floatable.

We developed, from there, the method of using coarse carbon, which we got as coconut shells from the gas masks after the war, which were made from peach pits. Very hard, very active. And we obtained those from the Union Oil Company laboratory in Los Angeles, who had tons of this shell product. We developed, with Mine Smelter and Supply in Denver, equipment for removing the coarse carbon into the drums which were submerged in the pulp, in the agitators and that way we could circulate the pulp through the screen drums and absorb the gold on the carbon.

We were quite successful with the recovery of gold onto the carbon but we never could devise a method of getting the gold off the carbon. We worked with many metallurgists and could not overcome this factor. Shipping the carbon to the smelter was a losing proposition because it couldn't be accurately sampled and would have various values. So on one of my trips I made contact with a man named Professor John Zadra, who was with the US Bureau of Mines. That's the one

McQuiston: that Homestake's using now, the Zadra process. He didn't get anything out of it. I, through the Newmont attorneys, wrote up a patent with Roy Hardy, the son of the general manager of the Getchell. For the adsorption of gold on carbon and the screening of the carbon from the pulp. But, unfortunately, I did not follow that because I went to Washington shortly thereafter. But I had all that in my hands. Let it go.

Swent: Who did patent it then?

McQuiston: No one.

Swent: It was never patented?

McQuiston: No.

Swent: And Zadra couldn't patent it because he worked for the Bureau of Mines.

McQuiston: Yes. A little side light of the famous George Wingfield was that when I would be visiting the Getchell mine and he would be there at the same time we would stay at the guest house, which was a very lovely accommodation, and then we ate in the boardinghouse, common boarding house; however, we had a reserved table for the staff. But I would get the small empty cans of condensed milk that we used on the table, take a stack of them back to the guest house, and fill them full of water to give them a little weight. Then I would throw them up in the air and he would pull his gun, which he always wore under his armpit, and shoot the cans out of the air. He would hit seven out of ten no matter where I threw them.

To finish the Getchell story, during the war we were allowed to operate, although L-208 [War Production Board order which closed gold mines] was still in effect, because we supplied arsenic to the government. And in order to dispose of the arsenic caught in the Cottrell plant, arsenic trioxide, we buried it in the ground in deep pits. The War Production Board asked us to reclaim as much as we could of this arsenic so we dug it all up. They, because we produced arsenic, allowed us to operate, and then also we put in a tungsten recovery plant, which was badly needed by the War Production Board. With our tungsten and arsenic production we were allowed to continue. This was just purely research

McQuiston: on treating the sulfide ores. But we were allowed to continue because of the arsenic production.

Swent: So you were producing gold as well?

McQuiston: That's right.

Swent: I don't know when you would like to talk about Fred Searls; would you like to talk about him now or later in your story? You knew him well.

McQuiston: I think it would be more appropriate later. Because I was still a young metallurgist at that time.

Swent: Had you met his brothers?

McQuiston: I knew Bob Searls, Carroll Searls--he's the one that drew up this patent for us in Grass Valley one Sunday afternoon; he had me cite all of the facts and he wrote it up. Too bad I didn't follow it up; I could have made lots of money. Well, I think we're through with Grass Valley.

Swent: All right. What was Fran doing all this time?

McQuiston: Trying to learn to cook.

Swent: Did she teach school at Grass Valley?

McQuiston: Just as a substitute.

Swent: Did you ever move to Redhouse?

McQuiston: No, there wasn't anything at Redhouse but a station.

Swent: That was just a postal station, I see.

McQuiston: But Winnemucca was the main town.

Swent: Did you get down to San Francisco?

McQuiston: Oh, yes. Not very often. She did with her family. But, yes, we came to San Francisco and Sacramento and various places.

Swent: I imagine the social life in Grass Valley was something, though.

McQuiston: Oh, these young engineers.

Swent: It must have been a very jolly town.

McQuiston: The Idaho-Maryland made a great fortune for Earl McBoyle, who later on had a huge ranch just on the edge of Grass Valley and Nevada City called the Loma Rica ranch, where he raised race horses, had an airport for his private plane to come in and pick him up, and he was, in prior years, an engineer for the state of California. In looking at the various gold producing areas, which was an assignment of his, he ran across the Idaho-Maryland, and eventually became the principal owner along with Oliver who developed the Oliver filter. I think we've finished Grass Valley.

Effects of War Production Board Order L-208

McQuiston: In 1942 the government issued order L-208 which closed all U.S. gold mines by decree. The object was to force the miners and other workers in the gold mines into the shipyards, and to conserve on steel used in the mines; for instance, hoisting cable in the deep shafts, and other mining equipment was just banned. So the gold mines up and down the Mother Lode, including the Empire and the North Star, were forced to close. But we were allowed to keep the mines dewatered and maintained.

After the war the Empire made an attempt to reopen but could not get the men. Gold was the same price, wages had increased very, very much, and they finally turned the mine over to leasers. Leasers were experienced miners, who would take a block of ground with agreement with the mining company, and work it on a fifty-fifty basis. The mine would furnish all the equipment and produce the gold and return half of it to the leasers. Some of the most beautiful specimens ever produced at the Empire-Star came out of these leasers' areas. In fact, there are two specimens now on display at Empire State Park in Grass Valley of one of the leaser's ores, who gave it to me as a present.

McQuiston: The Argonaut, the Kennedy, the Plymouth, the Hetty Green, the Eureka, the Mokelumne mines up and down the Mother Lode never reopened because they had what was referred to as heavy ground, and most of them went through caving. Empire Star Mine was invited by the Kennedy to send men to the Kennedy Mine, to go over the map before they let it cave, in case we ever wanted to reopen it. I knew the Mother Lode pretty well, and was interested if we could get one of the upper levels and approach what was known as the Hetty Green stope. Hetty Green was one of the principal owners of the Eureka Mine and the Hetty Green Mine and made millions out of it in the early days. But there was never a mine on the Mother Lode reopened. And the Empire made an effort.

Then in 1956, what few men we had went on strike so we just pulled the plug. But we built dams underground to protect certain areas from washing out with the flow of water. It will never reopen again, although there is considerable ore, and good grade. But you could not afford to reopen the mine under any foreseeable conditions.

Swent: Are the mines flooded now?

McQuiston: Yes. We had drainage tunnels, and they are flooded up to those drainage tunnels. But that's all good water, strange as it may seem. So the water could be used very profitably. So that was the end of gold mining, in 1942.

Swent: The L-208 order was February of 1942.

The Resurrection Mine

McQuiston: Yes. I, without any gold mines to do metallurgy on, I went to a new property, an old property but newly acquired by Newmont, called the Resurrection Mining Company in Leadville, Colorado. The Resurrection was an old mine dating back to the 1880s. It was a manto-type ore deposit, which means it's flat-lined and was a replacement deposit in the limestone country rock, dolomite. There was one section of the mine which had very fine ore, that was the manto-type ore which milled very well for lead, zinc, gold, silver value. However, the true Resurrection ore was massive sulfide and the zinc mineral was marmatite with a zinc mineral with 20 percent iron in it. So it behaved almost like a pyrite, and

McQuiston: could not be separated, therefore, from the pyrite which was very heavy in the ore.

We built an eight-hundred-ton mill out of mostly discarded mill equipment from the various mines in the Coeur d'Alenes and Grass Valley and different places like that. We had eight different kinds of flotation cells and I was expected to make a producing plant out of this junk pile. We revitalized the Yak tunnel for haulage, which was 19,600 feet long on a down slope. And the water draining

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in the ditch alongside of the tunnel was so impregnated with zinc that it assayed 2 percent and could not be used in the mill because of the high zinc content.

Swent: What was the product that you were getting that the government wanted so bad?

McQuiston: Lead and zinc.

Swent: Lead and zinc were critical minerals.

McQuiston: Critical minerals. Very critical minerals.

Swent: And, of course, Leadville is high, about 10,000?

McQuiston: Leadville was 10,200 feet.

Swent: You were working year round up there?

McQuiston: Yes, snow and what have you.

Swent: It's pretty hard country to do construction in.

McQuiston: Yes. There was considerable activity with heavy media plants in the Leadville area, reworking old mine dumps, and jig plants were also used. A man got a lease on the Little Johnny dump and with an old jig plant, rebuilt, made over a million dollars in six months by recovering the wasted lead and silver carbonates.

Swent: Was this because of improved modern recovery methods?

McQuiston: Yes. And then there was an HMS [heavy media separation] plant built that was fairly successful; but any way that lead and zinc and copper could be recovered in any place was in demand by the government.

Swent: Were you still working for Newmont?

McQuiston: Yes. This mine was sort of a half-breed. It was owned by Hecla. The Resurrection Mining Company was owned by Hecla of the Coeur d'Alene district, and by the U.S. Smelting Company in Salt Lake City, and Newmont. Each owning a third, and pooled engineers, management, and so forth for the staff required to operate.

Swent: Did you live at Leadville?

McQuiston: I camped out. Here's something. When I first went to Leadville there was the old Vendome Hotel which was a red brick structure, and I paid fifty cents the first night to sleep on the floor, the lobby floor, and then I was promoted to a chair for a dollar a night, and then eventually I got a room. The room was supplied, on the fourth floor, with a coil of rope tied to the radiator which you threw out the window in the event of a fire and slid down the rope to safety.

In 1942 Resurrection milled 75,000 tons of ore for a loss of \$30,000. However, some of that was spent for buying other properties. Leadville in 1942 approached being a reincarnation of the Leadville of 1878 previously mentioned, because of the Climax mine, a molybdenum producer, badly needed for the war effort, going full blast, and 25,000 ski troops in training at Camp Hale, both within a short driving distance. It was wide open, and the saloons, gambling joints, and old red light district were wide open.

During this period the army released to the Resurrection Mining Company forty volunteers to work in the mine. After two weeks ten of these men were in jail, twelve had gone AWOL [absent without leave], ten had been fired, and the remaining eight turned out to be good workers. I had the same experience down at Bagdad.

Swent: In Arizona?

McQuiston: Yes.

Swent: Did they release army personnel to work in Bagdad too?

McQuiston: Once. They released them but I didn't take them. I was running Bagdad then, and I didn't take it. But I have a story about Bagdad. I don't think there's any more to say about Leadville. It's still a going mine. Leadville, of course, we had had temperatures thirty, forty below in the winter. And we would get some snow, not too much, but some snow there, two and four feet. I stepped off the curb on ice and turned my knee and went to the St. Mary's Hospital in Leadville where they tapped from my knee and I had to be on crutches. I was doing some vital metallurgical work for the government and for Newmont on the Black Bear mines near Telluride. So the manager sent for my wife, Fran, who came to Leadville to take care of me because I just couldn't get around. They assigned a man to help me as much as possible, but you can't walk on crutches on sheets of ice. So we didn't have very good accommodations. In order to keep the mine running we bought an old building that was from the later 1800s and converted it into cold-water apartments which had no running water, no bath facilities, no toilet facilities, except on the end of the hall for some of the miners to live in.

They converted an old brewery into four apartments and we were given one because we had to live some place. And so we were given one that had one big room which was apparently a part of the brewery, and we put a divider in it with the bed in the back for a bedroom and shared the bath facilities with four Mexican families. Then the government built what they called the barracks for government workers in Climax. We were fortunate to get one of these apartments which had thin walls; you could hear everything anybody said within three apartments in any direction. That lasted a few months and then we did get a fairly nice apartment of about the size of a small camper. Eventually my knee got better and my wife returned happily to Grass Valley.

The Black Bear Mine

McQuiston: While I was in Leadville I was doing this work on a government project called the Black Bear, located near

McQuiston: Telluride, Colorado, which was under consideration for being reopened again, for war effort, because of the high content of lead, zinc and copper in the ores. The Black Bear Mine was up at 11,800 feet, where the portal of the tunnel was. So we sent a crew in on snowshoes, of experienced mountain men and one lone engineer to get samples of the ore which were then delivered to me to see whether or not, if the government drove this tunnel and opened up an ore body, it could be milled and separate the three metals. So I worked on the ores, still on crutches.

Swent: Did you have a research facility or laboratory there at Leadville?

McQuiston: I didn't need much. But, yes, we had built a laboratory. I finished testing the ores that were delivered by this one engineer on snowshoes back to Telluride and then he brought them personally to me so that there would be no mistake or mixup of samples, because it was a several-million-dollar project, and they couldn't afford to have something that wasn't representative.

Newmont had assigned one of their New York senior engineers to this project, so he told me, whenever I got the results from testing the Black Bear ores, if they were amenable for recovering the metals, to let him know immediately. I finished testing the ores and firmly believed that we could make a three-product separation by flotation with a reasonable recovery into separate concentrates of copper, lead, and zinc. I received the final assays about ten o'clock one night and made my metallurgical calculations, and they looked so favorable that then I phoned Phil Kraft, the engineer in New York at that time, which got him out of bed at two o'clock in the morning and I said, "Mr. Kraft, the ores are amenable to milling." He said, "Thank you very much, Frank, but next time you can call me in the morning."

Swent: So they did go ahead, then?

McQuiston: Yes. That's the next story. The next one is the Black Bear.

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[Interview 4: 2 July 1986]

Swent: We were just talking about the moving of the mining library from the Ferry Building. You don't think that's a good move.

McQuiston: The library was under the direction of a very charming, knowledgeable lady. They occupied the second floor of the Ferry Building, and had one of the finest mineral collections and displays in the state of California. Much better than the one at the California Historical Museum in Los Angeles, better than that at UCLA or University of California in Berkeley. For example, their gold collection, which was loaned by Empire-Star to them, had two specimens which were valued independently by the New York Historical Museum and by the Smithsonian Institution for \$250,000 each. There were many lesser specimens of gold, but the main feature of the library itself, which was a function of the mineral museum, was their great collection of books dating back to 1850. They had a vault in the building which contained the original copies of the Mining and Scientific Press which went back to the 1880s. Then they had, of course, a full collection of the volumes of the state mineralogical and mining engineers who visited all the gold mines from 1875, I believe, or 1880 until the present date. The information obtained from these very fine authentic volumes was the subject of my book on The Saga of the Empire Mine, 1850 to 1956.

I became interested in the library and decided that some time in the distant future I might write the Empire history. So I, on any opportunity, would visit the library and start researching the Empire and other mines; of course always in the back of this research was the possibility of finding a likely looking prospect.

Swent: You might just mention your other book at the same time now, the recently published book on gold.

McQuiston: We can bring that in later.

Swent: All right. But you were saying that you thought it was a mistake to move the library.

McQuiston: It was a serious mistake to move the library, and of all places, it landed in an empty building down in Mariposa, which is so far off the mining belt, it's the southernmost limit of what was known as the Mother Lode, which extended from Mariposa to about Placerville. Grass Valley and Nevada City deposits, the Alleghany mining camp and Downieville were not part of the Mother Lode in the true sense of the geological formations. It's in storage, and nobody can use it, and a great effort was made by the Mining Club and the Mining and Metallurgical Society of America to find a home for this famous collection of minerals and books. But nothing came to fruit.

Swent: So now when you want to look up something--

McQuiston: You can't do it.

The Resurrection operation in time reached the goals that we had set, and that was milling 800 tons per day of good grade zinc ore. However, we were never able to produce what we considered would be a suitable zinc concentrate. However, Corpus Christi smelter of American Smelting and Refining Company agreed to accept these concentrates because they had an electrolytic plant for zinc recovery. Due to the high iron content in the zinc mineral marmatite, the highest grade that could be made was about 42 percent, whereas sphalerite has a zinc content of over 60 percent.

The Bagdad Mine

McQuiston: Because of the Resurrection being on scheduled production, satisfactory with the Newmont partnership management, I was asked to go to Bagdad, Arizona, which was located near Hillside, about eighty miles southeast of Prescott. This was not a Newmont operation, but the copper production seemed to be vital to the War Production Board, so I was loaned from Newmont to the Bagdad management to assist in the separation of molybdenite, of which they had a reasonable quantity in the ore, from the copper concentrate. This was a remote location in the middle of the desert about forty miles east

McQuiston: of the Colorado River. Very hot desert type of climate. A mill had been erected for the open pit mine, with a capacity of 3,000 tons per day. It is strange that this mill was the exact duplicate of the 30,000-ton-a-day brand new Morenci concentrator.

Swent: Not owned by the same company?

McQuiston: No connection in the ownership. Bagdad did not have a major company backing. This itself is an interesting story because all of the copper porphyry deposits, such as Bingham Canyon, Morenci, Ajo, Ray, Chino, and others were well known and were profitable operations. Bagdad was a lone mine without any kind of prior reputation. There was a very comprehensive examination made by a group of engineers headed by a man named Monroe, which when finished was two volumes each about two inches thick describing the geology, the ore occurrence, the location, and everything that goes into a very fine mining report. However, although Phelps Dodge, Kennecott, Newmont, and all other major mining companies looked at the Bagdad, it was turned down completely.

The operation had been brought into being by a man named Jack Still, who had been there for a number of years and had great faith in the potential of the mine. He raised funds principally from a Mr. Lincoln in Cleveland, Ohio, who owned the Lincoln Welding Company, a very prosperous corporation. He put up the money to get the mines started on the basis of 3,000 tons per day. The manager was an ex-Newmont employee from Grass Valley, Canada, and other points. It was his request, sanctioned by the War Production Board, that I would attempt to make a salable molybdenite concentrate which was badly needed for the war effort.

Swent: What was his name?

McQuiston: This was Arthur Kendall.

Swent: Had you known him before?

McQuiston: He was general superintendent of the North Star Mine, where the Newmont laboratory was located. So we became close friends, and he was also manager of Resurrection, and requested my presence to work on the Black Bear ores from the San Juan district and from the Resurrection Mine.

Swent: When you went to Bagdad, then, he was no longer working for Newmont.

McQuiston: He came from the Canadian gold mines owned by Newmont which were, in turn, forced to shut down by L-208. This was a very interesting plant although there was one feature which, if it hadn't been serious, was rather amusing. On the real hot days, of which we had many, we would lose one or two flotation motors which were mounted on top of the flotation machine with a direct drive of the impeller in the cell. The motors would overheat, blow out the fuses, and then catch fire, just like a rocket going off. It would shoot flames thirty feet in the air. So we had a very good stand-by fire department to put out these motors. We would borrow motors wherever we could to continue operation, or bypass the cells and do the best we could with the remaining cells.

Swent: Were these out-of-doors or were they under a roof?

McQuiston: Under roof, because we had serious rains in the winter. As usual with the mines during the war, we were terribly short of labor. We needed unskilled labor to unload lime, which was used as a flotation modifier; other supplies, flotation reagents, grinding mill steel, crusher parts, and all sorts of equipment; even food stuffs for the boarding house. So I would go on Monday morning to the Prescott jail and pay the bail of those arrested over the weekend for misdemeanors, drunkenness and so forth, and take them, five or six at a time, back to Bagdad, where we got some work out of them. And particularly two or three turned out to be very able hands.

Another scheme was devised that we, the Bagdad, would bring in forty Navajo Indians to work in the mine, because we had a terrific shortage of ore to supply the mill. So these forty Indians were transported by truck from the Navajo Indian reservation in northern Arizona to Bagdad. When they arrived in a group I went out and looked them over and one man, or leader, or so-called chief stepped forward and said, "We no work underground. Evil spirits lurk there." So we had these forty Indians, which refused to work--and we had them on contract--for sixty days. They refused to go underground.

Bagdad did need a telephone line between the mine, Hillside, and Prescott. So we immediately got the poles

McQuiston: which were from northern Arizona, and copper wire, enough for a telephone line. And the Navajos went to work. They were terrific workers outside, using horses to snake the poles over the rough terrain and build this telephone line. Eventually it was completed and we still had about a month on their contract.

So one of the Indians came to me and said, "If you will buy the other Indians a horse apiece, they will go home." So there were several ranchers in the area, and I approached one rancher, and he said, yes, he would see that I had forty horses. Not good riding stock, but satisfactory for the Indians. And he herded up forty horses, delivered them to the mine, and I delivered thirty of them to the Navajos, because ten of them wanted to remain and work in other jobs on the surface.

Swent: So how did you get workers for underground, then? How did you manage?

McQuiston: Oh, from the jails and--it was an open pit mine, so we didn't require too many.

Swent: Would the Navajos work in an open pit mine?

McQuiston: Oh, no, because we had to go underground. We had what we call a coyote blasting system, and from the lower benches, we would drive in tunnels rather than blasting from the surface; we would blast from these tunnels upward.

The mine was in an area full of rattlesnakes, scorpions, tarantulas and the usual species of Arizona poisonous insects and reptiles. One day I was in the office, and two men came charging in unannounced, and said, "We quit."

And I said, "But you fellows are working in the crushing plant. Why would you quit? It's a good place to work."

He said, "A rattlesnake just came through the crushers."

And I said, "Wasn't he dead?"

And he said, "No. He surely wasn't dead. We don't want any part of working where the rattlesnakes are."

And this rattlesnake had come through from the open pit,

McQuiston: down the draws, up the conveyer belt, through the main big crusher, and was in the crushing plant still alive. He just survived all that.

I was bitten almost nightly by a scorpion because my guest house room, where I stayed, was infested with scorpions. We did not have the luxury of having sprays that would kill insects. So I put the four legs of my cot into cans of kerosene. I was a heavy smoker at that time but believe you me, I quit smoking in bed because the kerosene could have caught that bed on fire and it would have gone up like a rocket. But the scorpions soon outsmarted the kerosene, which they would not cross to crawl up the bed legs. They got on the ceiling and dropped from the ceiling onto me. Not very many--about one a week would get me. It was so hot, and we had no air-conditioning, that you would sleep in the raw. Then I decided that I had better have pajamas, that gave me some protection from the scorpions.

Swent: Did they give you anti-venom or anything for it?

McQuiston: No, we had a doctor there who would make a little slit; it was his method for treating them.

The separation of the molybdenite from the copper was practiced at quite a few of the Arizona plants and it was customary to float the molybdenum, which was very difficult to depress and very readily floatable. So the molybdenum would be in the copper concentrate and then you took the copper concentrate and tried to depress the copper because the molybdenum was not successfully depressed. Depress the copper and float the molybdenum. Cyanide was quite effective depressing the chalcopryite but was not effective at all on chalcocite, and most of those deposits contained an appreciable content of chalcocite.

I could not understand our very poor advancement in finding a solution to the separation of molybdenite and the copper minerals. They just seemed to be beyond us. I would always go when we had a change of shifts. I had two of my best men on afternoon shifts because the results were the worst. Better in daytime, better in midnight shift, but worse in the afternoon shift. So late one afternoon I was there studying those machines and trying different things. Finally I put my hand in the water, which we used for dilution purposes, and it was hot. Well, it's well known

McQuiston: that flotation reagents in some cases work better with warm solution, but for a separation, such as we were trying to practice, it was fatal to use warm water.

I traced the water. We had an eight-mile, eight-inch pipeline on the surface from the wells near the Colorado River to the mine. The pipeline would move as far as six feet from morning until night. Looked just like a snake moving because of the expansion of the pipeline. It would knock over trees or anything else with the power of the expansion. I found these pipelines so hot from being out in the sun that the water was just a few degrees below boiling. So we decided that was the reason of our poor separation. We therefore reversed the pumping procedure for filling the mill water tanks by pumping at midnight when we had cooler water, or early in the morning, at say, three o'clock, when the temperatures were the lowest. Our results immediately improved when we got this cooler water. We did have the right set of reagents and the right techniques for making this copper-moly separation. The temperature was the guilty factor.

Swent: There was no way of refrigerating out there, I suppose.

McQuiston: Oh, no. While in Bagdad, and in order to get all the ideas on the separation of copper-moly, I visited Miami Copper, which were just about the leaders in this form of metallurgy. I went to Cananea, Mexico, where they were also making the separation; I went to Ajo, Morenci, and Chino.

Swent: You might want to mention any people that you met at that time.

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Swent: Were you corresponding with other metallurgists and getting their ideas?

McQuiston: I would telephone them and say, "Can I come and visit your plant?"

"Of course you can."

Swent: And you were exchanging ideas?

McQuiston: Well, I was learning their methods.

Swent: Would they sort of guard them?

McQuiston: Oh, no. No, it was open.

Swent: Was there any resentment of your investigation?

McQuiston: No. But the foremost molybdenum metallurgist that I encountered was Charles Curtis at Miami Copper, who later went to Duval at their big operation in Tucson. His knowledge of molybdenite was the tops in all of Arizona and New Mexico and northern Mexico. I was very pleased when I visited Ajo to find an old friend from Hayden, Arizona, as general manager. His name was Lisle Barker. He was one of the foremost metallurgists in the United States and was with Kennecott for many years at Hayden. Then he joined Phelps Dodge where he became general manager of Ajo, a 30,000-ton-a-day operation.

One interesting feature about my visit to Ajo is that I went underground where they mined water. They did not have a sufficient aquifer for a steady supply to pump water. So they sank an 800-foot shaft and then from the shaft they drove, in the four points of the compass, long drifts out and the water would seep into these drifts in sizable quantities because the formation of the rock was porous enough to hold water but not porous enough to hold aquifers. So they had these huge pumping stations at each median point of the four lateral drifts, and that supplied the water for Ajo. As far as I know, it is the only known method of mining water.

Swent: Water, of course, is always a problem in that area, and mills do have to have water.

McQuiston: Oh yes. Bagdad was a very interesting experience. Again, trying to solve the labor problem.

Swent: Did you also have to house your workers?

McQuiston: Oh, we had towns. We had camps, boarding houses. That was already built. Yes, everything was there.

Swent: Did you have any organized labor?

McQuiston: No strikes, no.

Swent: Were they organized?

McQuiston: No. They weren't good enough to organize. While at Bagdad I received word from the New York office that I should immediately proceed to finish, to wrap up my duties at Bagdad, and then proceed to Ouray, Colorado. Most of our senior Newmont officers had gone to Washington with the Metals Reserve, War Production Board, or some other important function. Newmont was a very patriotic company and the war effort came before anything else. They did not harbor any resentment for shutting down, for instance, a very paying gold mine in California and opening up Gray Eagle in that happy camp on the Klamath river which was only a four-year-life mine. Or reviving production at Resurrection, Leadville from the Resurrection mine. Or shipping me off to Bagdad where I might contribute to the production of molybdenum.

More About the Black Bear

And now the call came that Newmont was interested in the Black Bear. Early in this story I mentioned working on the Black Bear ores, which were copper, lead, zinc, gold, and silver. I did that work at Leadville and it was documented and had received the blessing of the powers in Washington from the War Production Board and the Metals Reserve and whoever else might be involved. So they decided that the government, with Newmont's engineering assistance, would drive the Treasury Tunnel from the Ouray side, which was called Red Mountain, to intersect the Black Bear vein, which had formerly been mined at 11,800 feet in elevation. Which is the tunnel that they got the original sample from that I worked on in Leadville.

I went to the Idarado Mine, which was twelve miles over the Million Dollar Highway, and two thousand feet higher than Ouray at the mine site, the tunnel site. A man named "Long John" Austin, who was a noted tunnel superintendent, because of the rush of the job, was employed to work twenty-four hours a day. Three shifts around, or perhaps they worked two shifts a day at ten hours a day, I don't recall the detail. But while he was driving the tunnel I was planning a mill. They had planned a mill of 250 tons a day, it was just a

McQuiston: number picked, because of not knowing what the ore would be. But I was planning the mill without any thoughts of construction until this tunnel was completed.

"Long John" Austin completed the tunnel and intersected the Black Bear vein. The tunnel was 10,200 feet long, and he intersected the Black Bear vein, and it was really a jewelry store with the high content of lead, of galena, chalcopryrite, sphalerite, and gold, and silver. So I immediately started construction on this 250-ton-a-day mill. There was a small mill there that had mined the Barstow ores which was off a nearby tunnel at a shallow distance of a thousand feet.

I was loaned men from Sunshine Mining Company, because that was also shut down.

Swent: That's up in Idaho.

McQuiston: Yes. But I was sent engineers from there to assist me in building the mill, because silver was in abundant supply in the Treasury Department. So they did not need silver production. So I got these very able engineers to assist me in designing the small mill, which you could do on the back of an envelope. But the great help was a master mechanic and three of his best millwrights to set the equipment. We did have, as a mine superintendent, John Edgar, who was formerly the superintendent at Sunshine. With him as general superintendent as a mining engineer, he in turn saw that I was well staffed with help.

Swent: So you had people who came there from Arizona and from Idaho.

McQuiston: Yes. That was the war, you know; we weren't in uniform, but we did as we were told.

Swent: Who paid you?

McQuiston: I was paid, because all wages were frozen, I was paid \$450 a month, of course with all expenses. By Newmont. Then I could be reimbursed by the companies, like Bagdad, I had a very handsome bonus from them, and Resurrection, my check always came out of Grass Valley.

Swent: So the government was not paying you then.

McQuiston: No. I might mention at this time that my major earnings, starting at the Empire at \$5 per day on the days worked,

McQuiston: went, in not too long a time, to \$250 a month on a salary when I opened up the Newmont laboratory at the North Star Mine. Then when I became western metallurgist for Newmont I was paid \$450 a month.

Swent: That was top dollar in those days.

McQuiston: I think you mentioned you were interested in that. Because of the success of the interpreted long-range geology from the Black Bear Mine, in which the lower levels were filled with water and we only had the upper levels to judge the geology by, the projection of that vein for 1500 vertical feet was a real geological accomplishment. The ore looked so favorable on the intersection of the vein with the tunnel that Newmont, not wanting to be beholden to the government, paid for the driving of the tunnel by "Long John" Austin to get the government out of the picture.

Idarado Mining Company

We had as partners U.S. Smelting and Sunshine Mining. However, U.S. Smelting and Newmont bought out Sunshine Mining which were so firmly entrenched in silver mining in the Coeur d'Alene District of Idaho that they did not want to spread out into Colorado. John Edgar, a very able mine superintendent, was a Sunshine man. I was looking after all the surface work, a Newmont man. After a few years of bickering back and forth Fred Searls made one of his famous offers. He had his engineers with him. He, by some remote knowledge, arrived at \$2,000,000 for the value of what we call the Idarado Mining Company. Idarado was named from Idaho and Colorado. So he said, "You buy us out for a million dollars, or we'll buy you out for a million dollars. And it's your first move. We'll not show any favoritism. That way there's no blame whatsoever."

So they sent men over from Salt Lake City where their main office was. U.S. Smelting was quite a prominent mining company in Utah. A man named Mike Romney, and I've forgotten the other one, came over and spent two weeks there. I spent a lot of time with them, explaining the metallurgy. Because this type of metallurgy had never been done before--the separation of copper, lead, and zinc in these particular minerals. So finally they decided they would let Newmont pay

McQuiston: the million dollars and they would get out. John Edgar really kind of wanted to stay but we decided we should have a Newmont man.

Swent: Now, let me see, John Edgar was a Sunshine man, but Sunshine was not involved in this--

McQuiston: No, but he stayed on because of his knowledge.

Swent: Yes. But this time Sunshine Mining was out--

McQuiston: Out of it financially.

Swent: Had they bought them out too?

McQuiston: Yes. Two of them.

Swent: U.S. Smelting and Newmont bought out Sunshine. And then there was a tussle between U.S. Smelting and Newmont.

McQuiston: Yes. Each one of them telling the other one what to do. The same formula was used in Resurrection between-- I have to look that up.

Swent: Who were the Newmont-- Fred Searls was the Newmont--

McQuiston: No. He was in Washington. He set up the formula.

Swent: He didn't come out to the property itself.

McQuiston: Oh, yes. Oh, definitely he came out.

Swent: Were you aware of any animosity?

McQuiston: Yes. John Edgar, fortunately, was a fine man, and he was neutral at that time between the companies. But Fred Searls used to work for U.S. Smelting before he organized Newmont. So it was one of those things which was good for the company.

Swent: So Newmont came out on top then?

McQuiston: If you mean--yes, they never made a lot of money, it wasn't a big mine. One rather interesting feature--when John Edgar left, a man named Billy Plumb, who was an old friend of Fred Searls, came from a shut-down gold mine located on the American River. Billy Plumb was an optimist. Absolutely through and through. He might have been a good mining

McQuiston: engineer at one time, but everything can't be wrong, it has to be good. So we had opened up a new stope. But it was only one stope. Only one area of the mine, but it was a jewelry store. Lead, zinc, copper, and you could even see specks of gold in the face of this stope. So when Fred Searls visited Idarado, Billy Plumb, with his usual optimism, took Fred Searls underground and showed him this stope. Fred Searls was absolutely dumfounded, very elated, very enthused, and particularly when Billy Plumb told Fred that he had a whole mine of these stopes.

I did not know of this or I would have interceded. Because I visited the mine on regular intervals once every ten days or something, to keep abreast of what it looked like underground and how the ore might be coming out and I could tell from the stope whether we're going to have heavy lead or heavy zinc or heavy copper or an even distribution.

So they came out of the mine, the two of them, and said, "We want to enlarge the mine, enlarge the mill. Because we just have more ore underground than we know what to do with."

And I said, "Well, that's news to me. How did it happen?" Something to that effect.

Fred said, "Billy Plumb showed me this jewelry box of a stope full of ore," and he said, "he's got four or five other headings looking just like it. So we want to increase the mill."

And I said, "We can do 300 tons a day by pushing it."

He said, "No, we want to go to 1,500." I said, "How much?" And he said, "Fifteen hundred. Can you do it?"

And I said, "Sure, I'll put in three seven-by-seven ball mills. So we want them all the same, all the units the same. We'll keep running this one. It's very difficult terrain but we can build them."

And he said, "You order the ball mills, because those will be the slowest delivery. and I'll get an order from the War Production Board too. Where would you like to order them?"

McQuiston: And I said, "I'll get them from Mine Smelter & Supply--Marcy mills."

And he said, "How about the rest of the equipment?"

I said, "Don't worry about that, I can get that through the manufacturing concerns that I know and have a close relationship with."

So we ordered, the next day, three ball mills. Before their arrival we were fortunate to keep the three-hundred-ton mill going.

This was now going into, perhaps, months. But I had the mills on order and I had to take them. When they came due, of course there was a rush order on and I knew the Mine Smelter people very, very well. In fact, the president of the company was the one that put Fred onto the Idarado part of the Black Bear.

Swent: What was his name?

McQuiston: Oscar Johnson. He was president of Mine Smelter Supply and dabbled in mining. And then there was a man named Hillsdale who had an interest in the Idarado Mining Company. And, as I said, there was a part of a mill there, 150 tons a day that they milled from the Barstow ore mine. I felt very guilty but I didn't know what I could have, should have done. After all, Fred Searls made the decision, he listened to Bill Plumb. But here I knew these mills were coming in and we had nothing to feed them.

Swent: Was there a geologist on the job up there?

McQuiston: They didn't come in contact with Fred Searls. No, there was a very fine engineer named John Wise who later became general manager. He was one of the very few Columbia School of Mines graduates that I knew. But he was a very fine engineer. He and I used to sympathize with each other. He said, "I'll have to get the ore out and you'll have to mill it, Frank."

Swent: Even if it's not there.

McQuiston: But he knew it wasn't there. But Bill Plumb thought it was there. He just saw this one wonderful stope and he thought the whole mine's going to be like this. So eventually the mill kept operating. I finally put in another ball mill and

McQuiston: got it up to 600 tons a day, I guess.

Swent: Did you ever make anything like 1500?

McQuiston: No! Never made a thousand. No, nothing like that. But the three ball mills were delivered and we took them to Grass Valley, because we had no room at Idarado for them. There wasn't any area big enough. So we took them to Grass valley. We had a big yard there.

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They were shipped to Grass Valley.

Swent: I see. Instead of ever going to Idarado.

McQuiston: Because we had no area for them. And besides, they were never going to be used there. I had convinced everybody by then.

Swent: Where were they made? Where is Mine Smelter & Supply?

McQuiston: Denver, Colorado. They were the foremost ball mill manufacturer in the world at that time. Later Allis Chalmers became-- but at that time they were the foremost. I heard a rumor that the Copper Queen Mine at Bisbee, Arizona, one of the old copper camps in the state of Arizona, was about to enlarge their production. I called the manager and asked him if he would be interested in some extra ball mills which I had on delivery and would soon be located in Grass Valley.

He wanted to know the size, and the shape. And I said, "They're a great mill, they're absolutely the best mill you can get." So he said, "What are the motors?" And I told him they were oversized motors, direct drive. And he said, "We could use two of them."

So I said, "All right, I haven't the authority, but I will have two of them. I'll call Oscar Johnson, and have him hold any shipments until you're ready for them. Meantime I'll clear it with Newmont." That wasn't hard to do because nobody in the Newmont office believed that we had that kind of a mine at Idarado. So, anyway, two of the mills went down there.

The third mill stayed in Grass Valley for years. Finally it was shipped to what is now known as Namibia,

McQuiston: Southwest Africa. I was doing the metallurgy at a place called Kombat, Southwest Africa. We had ore for about a 500-ton unit. It was copper ore. So we shipped the remaining seven-by-seven mill, which is operating and paid for itself many times over. Down to southwest Africa. Ten thousand miles away.

Swent: That makes bookkeeping a little bit hard, I would imagine.

McQuiston: Yes. There's a lot about Idarado, but it's a different time schedule. The metallurgy was a challenge because we wanted a copper concentrate, a lead concentrate, and a zinc concentrate, which we were able to make with very high recovery and very excellent grades. It would be too technical to go into the grades and recoveries, but the copper mineral chalcopyrite was very allergic to cyanide. Lead wasn't. Zinc was. Not so much as we used only cyanide, but with some zinc sulfate, the zinc would disappear in the flotation cell. So we were fortunate in making these three outstanding concentrates; the zinc went to Amarillo, Texas; the lead went to El Paso, Texas; and the copper went to Hayden, Arizona to the copper smelter, and eventually to our own smelter in Magma. We had jigs in the circuit because we had--from the Black Bear Mine we had very good gold recovery. The only unfortunate feature about the separation was using cyanide, and that, in the flotation cells, dissolved the free gold, which was in the ore. And the solutions, then, were sent to waste.

So that was not a very good flow sheet. So I started adding carbon, very finely ground carbon, to the copper-lead pulp. First we made a bulk copper-lead concentrate, kept the zinc by itself, then we separated the copper and the lead with the cyanide solution. So the tailing solutions contained gold, but by adding your carbon at the right place, it adsorbed the gold and was a solid. So it went with the lead concentrates. We cut the gold losses down to a minimum. And it joined the lead concentrates for shipment to the lead smelter.

Swent: So you sent the gold with the lead?

McQuiston: Yes.

Swent: I've heard the expression char and pulp.

McQuiston: Oh, that's it. You add char to the pulp. Pulp is water-ore

McQuiston: mixture.

Swent: So the carbon was charcoal.

McQuiston: This was in the period of 1944, '45, and '46.

Swent: And you were living in Ouray with your family?

McQuiston: Yes. They were there for about a year.

Swent: Was it a nice place to live?

McQuiston: We had four hundred inches of snow a year up at the mine. And we had about two or three hundred inches in Ouray. Beautiful place though. But I finally got the best house in town when Bill Plumb left.

Swent: You outlasted him then?

McQuiston: Yes, I did.

Swent: Was Fred Searls an optimist by nature?

McQuiston: No. He just believed what he had been told. The triangle area between Silverton at ten thousand, Telluride at nine, Ouray at eight thousand, those are just rough elevations, not accurate, because there's a few hundred feet added or subtracted to each one of them. But those three towns made this triangle of the San Juan District, which was very, very rich. The Camp Bird Mine was in this triangle, which is a well-known, historical, interesting background, where the owner of the Camp Bird Mine, MacLean, bought the Hope diamond. So there's a long story about that.

Newmont acquired very substantial holdings on both sides of the mountain. We finally connected the underground operations from one side, from what we called the Red Mountain side, that's where the mine was, to the Telluride side, which was five miles underground. Sixty-five miles by road around. So it was a very interesting mine. Because of the fluctuation in the base metal prices, it needed gold and silver content to help out, and the Black Bear vein had that very fine quality.

There were many mines in the area. Many mines. The Tomboy, the Camp Bird, the Lucky Strike, the Treasury, the Liberty Bell, and on, and on, and on. It was a mining camp

McQuiston: of quite some prominence in the late 1800s.

There was a mill at Telluride which was one of the largest coverings of any mill I had ever seen. Because they put everything in--even the mine machine shops, and repair shops. The mine tunnel just came out there in the mill.

I was then sent there from New York in about 1953 to remodel, to rebuild the Telluride mill because it was then decided that the ore was more approachable from the Telluride tunnel portal than from the Red Mountain tunnel portal. The Red Mountain was called the Treasury tunnel, the Telluride tunnel was called the Pandora. It was one thousand feet lower in elevation than the Red Mountain.

So there was better drainage, there was less movement of the ore because we had worked out, more or less, the upper stopes. You always work from the bottom up in these types of mines. And they worked from the lower levels to the Black Bear level itself at 11,800 and found some good ore. But it was slightly oxidized and didn't mill so well. But the Telluride was then to become the principal mining and milling center, although we maintained the Treasury tunnel because we had housing; we had a lot of men living in Ouray and no accommodations in Telluride. So we kept those and fed them into the mines from both directions. And they were five miles apart, these two tunnel portals. I guess the operation was then up to five hundred tons at Idarado, and we were going to put in a thousand-ton unit at Telluride, so that we could still keep going and take our time and rebuild a Telluride mill. That was a very interesting project. We had a nice guesthouse to live in and I had one of my key mill superintendents working with me.

Swent: What was his name?

McQuiston: Kenneth Tatman. He had been a mill superintendent for Newmont at the Murchie Mine in Nevada City, at the Zeibright Mine on the Bear River, at the Browns Valley Mine in Browns Valley. Then he was moved, when the gold mine shut down, to become mill superintendent at Resurrection. So he was broadly experienced.

Swent: Had he been with you for quite a while?

McQuiston: Yes. Then I replaced the mill superintendent at Idarado with Ken Tatman, which was a very difficult thing to do, but he had lived too long at the elevation at some mines. This was a man named Dick Unger, who was a very able mill superintendent; I had him at the Empire in Grass Valley, and I had him at the Gray Eagle, he was mill superintendent. Then I had brought him into Telluride, and the elevation there began affecting him.

But we were very fortunate in having a good mill crew at Idarado, because it was just at the shutdown period where we worked out the ore in Gray Eagle. All these men went from Grass Valley to Gray Eagle when we shut down in Grass Valley and reopened this copper mine in Gray Eagle. So we had employees, mill men, who were with us from one job to the other. We would always move them and their families, and see that they had good housing. So I kept a good crew.

Swent: Did you have a responsibility in planning housing?

McQuiston: Oh, indirectly, yes.

Swent: Did you have to provide schools and hospital care and that sort of thing?

McQuiston: No. No hospital care because the mines were not big enough to support that. But housing, yes. Housing was always a problem. I was always opposed to a new mine having housing.

Swent: That is for a family.

McQuiston: A new small mine. Like at Carlin. Because then there was a call for schools, and then the next thing they wanted churches, and the next thing they wanted a store. So they never put that in at [first at] Carlin. And yet Carlin now has, but it's just as well because Carlin is spread out. We had about five hundred employees there but it never went in for towns or schools. We would commute.

Swent: You would just let them find their own housing arrangements.

McQuiston: We'll help them out in the town itself, where we don't get involved in schools or any of those things. That's your biggest headache of a mine.

Swent: So for the fellows at Idarado, then, what did you have?

McQuiston: We built some houses. Oh, we would provide some housing. We would buy up some. Never smart enough to go into a mining camp which was dormant, and we should have bought all the houses in the mining camp. I could never convince them of that. "We don't want to go into real estate business." But that's what they should have done. Then they ended up by building, you know, trailers. Which were about seven hundred square feet. Housing is a mess. But we did move some houses from over on the Silverton side, from the Mayflower Mill, up to the mine at Red Mountain, where we had selected men who would live in them. Like the chief electrician, the chief mechanic, and they would have to stay a week or two weeks in avalanches. We lost a lot of men one time in an avalanche. But, anyway, Telluride was a very interesting project.

Swent: Did you have any say in the mining part in the sense that there was a certain kind of ore to be coming in?

McQuiston: Oh, yes, that happens every place. You bet I did. Sure, the miners get awful. Even your mining engineers, they get a little careless and go for tonnage rather than grade. We ran into that at [inaudible] where I went in and shut down Telluride. Somebody at the New York office had put it on the basis of contract mining. Well, we had more strange things come in that contract mining, because it's all done by cubic feet. It didn't make any difference whether ore, waste, or old fill. But it has to be selective mining in any underground mine.

So we built this mill at Telluride, which is one of the most beautiful places there is. It was 1500 tons a day by then. But we had many more areas to draw on than the original Black Bear. We had about eight different vein systems. It operated until about seven years ago. I was no longer on the board. I was on the board of directors for many years, and I never could quite understand--I know some of the inside facts--why Homestake bought ten percent, or eleven percent. Because it wasn't that good a mine. No. We would make a profit of about one million dollars a year. That was the normal operating profit. Eight hundred to eight hundred thousand to one million. That's enough on Idarado.

End of the Getchell Mine

McQuiston: The next one I've got starts in on the atomic energy. During these intervening years I was still doing work on the Getchell Mine because of the most complicated ores that we encountered with the shaft that was sunk for the higher grade gold contents of the ores. The ore was in a geological gouge making mining and ore handling most difficult. Roasting was even a worse problem because the ores at two-inch size would be fed to the kilns and would be discharged at the other end in three- or four-inch balls completely unroasted in the core of the balls which accumulated during the rotation of the kilns. It was during this time of trying to solve the sulfide metallurgy that the New York office informed me that their very good associate, American Metal Climax, had developed a new method of roasting and were willing to disclose to us this process if we would come back to their plant in New Jersey.

Roy Hardy, who was the son of the general manager, the nephew of George Wingfield, and assistant to me, went to New York. We were not permitted to sign a nondisclosure agreement because it was not Newmont's custom to ever do that. However, they soon granted us permission to visit the Carteret, New Jersey, plant. They really had a deep security, because by the time you went through their normal plant security, you were out on a vacant slag dump, surrounded by barbed wire fences in a little old shack of a tin building. It was a cylinder standing on end, in which they fed the crushed ore through the top into a chamber; this is now known as the fluo-solids roasting method. We were quite amazed at the successful demonstration they performed on the ore samples we took with us. Then when we obtained the assays, we were thoroughly convinced that we had a process that could be applied to the refractory Getchell metallurgical ores. There was considerable work to be done to upgrade this process into a plant-size reactor. So there was a period, now, of waiting. While attending an AIME [American Institute of Mining, Metallurgical, and Petroleum Engineers] in Denver, I talked with the Dorr-Oliver representative, who is also a vice-president of Dorr-Oliver. He told me that they had developed a new roasting technique. And I said, "Would it involve a fluid bed roasting procedure?"

He looked so startled that I suspicioned that I might

McQuiston: have hit upon their method. He said, "Maybe we should talk about this. What is your knowledge?"

And I said, "Well, I can't talk too much because it is not Newmont's possession, it's another company."

So we agreed to get together and talk it over. I obtained permission from Fred Searls, who went then to the powers of AMAX and got their agreement, and without any disclosure of the details, I talked it over with Ted Counselman, and there was so much similarity between these developments, absolutely unknown to each other. They had hit upon the same procedure over a period of three or four years research, and about the same time. So this put us in a bind as to whether we should proceed with the Dorr Company or proceed with AMAX. I told my story as I saw it. Ted Counselman told his story. We compared notebook dates, recorded dates in notebooks. They disclosed recorded dates in their notebooks as to when these things happened, and there did not seem to be any doubt whatsoever that Dorr-Oliver were about a month ahead in this development. So Fred Searls, sort of a judge, said, "I don't think there's any doubt but what American Metal Climax is not in this picture." And they agreed. And here they had spent thousands of dollars on this research.

So the Dorr Company, later on, when we were no longer interested in the Getchell Mine, put in a fluo-solids roaster for a company called the Goldfields Consolidated Company. Which was a total failure. They made nothing but mistakes and didn't have the reactor, and it was a botched-up job from the word go. I might as well finish the Getchell. I still had complete faith in the Getchell Mine. Not particularly in the shaft area where it was the worst ore we had ever seen, but in the area itself.

Swent: When you say worst ore you mean worst from a metallurgic standpoint?

McQuiston: Worst physical type of ore to handle mechanically or metallurgically. Fred Searls gave me the assignment of going to the Getchell Mine for two months and working up from all of the information we had the complete metallurgical picture of the Getchell Mine for the last ten years. We then met at the mine with Newmont's geologist, Fred Searls, and descended on George Wingfield's home in Reno. And at that time I had convinced Fred Searls that the Getchell was a good

McQuiston: investment. He said, "How much of an investment?" I did not know. So, anyway, we went prepared to make an offer to buy the Getchell Mine out. See, we had dropped out of the picture at that time.

Swent: About when was this?

McQuiston: In 1947. He asked me if I could write out a report, a simplified report addressed to Barney Baruch, and he would write a report also addressed to Barney Baruch. He never invited me back to see him but I wrote this report. On the train that we took from Redhouse, Nevada to Denver he had a stateroom and we had arrangements whereby we could write. He did his writing. It's the first time I have ever been subjected to such a high-powered report. And the company that took it over made a miserable failure of it because they didn't have the know-how that we thought we did.

However, to conclude the story of the Getchell, and to confirm our faith in the Getchell, Goldfields Consolidated, as the American subsidiary of Goldfields of London and South Africa, have just made a tremendous discovery five miles north of where we were working this shaft. And they have good ore and are going to build a four-thousand-ton plant.

End of the Getchell.

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V THE ATOMIC ENERGY COMMISSION, 1948-1952

[Interview 5: 8 July 1986]

Swent: When did you go with the AEC?

McQuiston: In 1947 I wrote a personal letter to Fred Searls in New York asking if I could see him on his next western visit. He replied that he would be in Salt Lake City at the Hotel Utah at a certain date. So I joined him for breakfast, having come from the Getchell Mine for this meeting. Also there was Fred Wise, who was manager of the Getchell and a close personal friend of mine and also of Fred Searls.

McQuiston: At the opportune time I said to Fred Searls that I felt that I had accomplished as much as I could do for the western mining operations of Newmont with the Empire-North Star group of mines closed, the metallurgy in hand at Resurrection, and the Black Bear-Ouray operation going smoothly, and Getchell coming to the shutdown period; that I was prepared to take on more work and responsibility. Fred Searls looked at me and said, "Well, Frank, that's a very ambitious itinerary you've set forth, and don't let me stand in the way of your looking for another job, if that's what you have in mind. And you can put me down for a reference." With that Fred Wise broke out into loud laughter and said, "I guess I would ask for that comment by Fred Searls." But he did say, "We'll see what turns up." And that was the end of my interview for my future career.

Swent: Was Fred Searls chairman at that time?

McQuiston: He was chairman and president--chief executive officer of Newmont Mining Corporation in New York City.

Swent: Was Wise an officer of the company also?

McQuiston: Wise worked for Getchell, which was an independent organization.

Swent: What was your official title at this point?

McQuiston: I was chief metallurgist of Western Newmont Operations.

Swent: Did this take courage to do this or was it just a little presumptuous?

McQuiston: It was a little presumptuous and took a lot of courage, but I felt that that's the only way, to not wait for something to turn up, but see if I couldn't force it.

Swent: Were you on first-name terms with Fred Searls?

McQuiston: Yes.

Swent: You had known him quite a long time?

McQuiston: Well, in recent years I came in contact with him concerning the Getchell more and more. Because we knew we had to do something with it and he felt responsible for Barney Baruch's 19 percent and Newmont's 19 percent. I believe I mentioned

McQuiston: that we made an offer of \$250,000 for the mining property, which was turned down. So the Getchell was not on our favored list any more for potential exploration or development. In due course I received a telephone call from Fred Searls, saying that he would like to have me come to New York and meet with John Gustafson, who was stationed as chief geologist of the Utah area in Salt Lake City.

Swent: Was John Gustafson working for Newmont at that time?

McQuiston: Yes. We both arrived in New York in early January, and Fred Searls, at quite an expense of his time, told us that he had been asked to supply, to recruit, some men for the Washington, D.C. operation of the U.S. Atomic Energy Commission. The reason was that the Manhattan Project under General Groves developed the atomic bombs that bombed Hiroshima and Nagasaki, and the division of the army that General [Leslie R.] Groves supervised was the White Sands area in New Mexico, where the bomb was developed. Now it was decided by the powers in Washington that the development of future atomic energy should be under the civilians rather than the army. So this was the preparation of the takeover of the Manhattan Project, to be developed into a civilian project.

Swent: This was in early 1948?

McQuiston: This was the end of 1947 that we were in Washington. The Manhattan Project was to be turned over to the civilians in January, 1948, when John Gustafson and I had agreed to go to Washington for a period of two years to help in the organization of the raw materials division, which meant seeking uranium for the project. The only other known source of uranium was the Shinkolobwe Mine in the Belgian Congo, which is now Zaire. And then there was a small pitchblende vein at the Great Bear Lake in northern Canada.

The team of civilians being organized for the take-over of the Manhattan Project was under the leadership of James Lilienthal, who had been moved from TVA, the large government power development, to Washington, D.C. as the commissioner of the U.S. Atomic Energy Commission. Our division was known as the Raw Materials Division, U.S. Atomic Energy Commission. The old Treasury Building on Constitution Avenue was assigned to this new group of civilians. John K. Gustafson was the manager, and directly under him was Jesse C. Johnson, deputy manager. I was consulting metallurgist. This rather obscure

McQuiston: title was devised because Fred Searls did not want me to leave Newmont entirely. So I could serve both the U.S. Atomic Energy Commission and Newmont by agreement with the government.

Swent: Was this still the time of the dollar-a-year people?

McQuiston: No, this was '48. This was the very critical time when we were getting ready for war with North Korea.

The Search for Uranium

Swent: Were you aware of that?

McQuiston: Oh, yes. Our big worldwide search in the free world was for the recovery of uranium of which we didn't have a source of supply.

Swent: That was Jesse Johnson's field of expertise?

McQuiston: John Gustafson was a very distinguished geologist and Jesse Johnson was a mining engineer who had served in Washington in the Metals Reserve division of procurement during the World War II. He was of great assistance and was selected by John because of his knowledge of how to do things in Washington, where the rest of us did not have any inclination of the functions in Washington.

Swent: Had you known either of these men very well before?

McQuiston: I knew John Gustafson but not Jesse Johnson.

Swent: John had also been with Metals Reserve, hadn't he?

McQuiston: I don't remember.

Swent: I think so. But you were a greenhorn in Washington.

McQuiston: Absolutely.

Swent: Did you know any congressmen?

McQuiston: Oh, yes. That'll come in a little later. Before we went to Washington we had to have a full FBI investigation, which was

McQuiston: done without my knowledge by Fred Searls, who had made up his mind to send me to Washington. In late 1947 a thorough investigation by the FBI took at least three months. It was during this period of investigation that the word came to me of inquiries being made at the corner grocery store, and where I worked at different places in Colorado, and Arizona, and Utah. That I was being investigated. That disturbed me at first because I wondered what I could have done that would require these men to be asking about my habits.

Swent: I would think that would be quite unsettling.

McQuiston: Quite so. My first assignment with AEC was to look at all of the reports done on the metallurgy of uranium-bearing ores, of which there were many. The General Groves organization did a very thorough job of examining all museums containing mineral collections. For instance, such as the New York Natural History Museum, Smithsonian Institution, and others. And it was during this inspection of some of these specimens that the geologist recognized pitchblende and uraninite in the South African gold ores. This was stored away for future reference.

Metallurgical work had been done by Battelle Memorial Institute in Columbus, Ohio, and by Massachusetts Institute of Technology, which, I believe I mentioned previously, had done the metallurgical research in the Watertown Arsenal under Anthony Gaudin, who was a world-renowned metallurgist.

Shinkolobwe, Belgian Congo

McQuiston: Under the direction of Manhattan Project a mill had been started at Shinkolobwe in the Belgian Congo, and also at the Great Bear Lake in northern Canada. These were a well-recognized type of uranium ores: the pitchblende, which was very high grade in uranium. The Shinkolobwe milling plant was about ready to come on stream, so my function was to immediately go to the Belgian Congo and assist in the startup of this plant. It was interesting that the type of metallurgy for the extraction of uranium from the ores was very similar to the extraction of gold from its ores by cyanidation. However, in the case of uranium ores, it was extracted by sulfuric acid and then precipitated out into a low-grade type of precipitate. These were the two flow

McQuiston: sheets employed at Great Bear Lake and Shinkolobwe.

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From my experience at the Empire-Star and helping other mills get started in the cyanidation practice in California, and also the Getchell Mine, using cyanidation, I was quite familiar with leaching of ores, and it did not take long to pick up the metallurgy of the development to date, which was pretty crude.

Swent: Excuse me, I think that we lost a little bit when I changed tapes. You were just saying that this metallurgy was similar to that of gold ore, except that the crushing was different?

McQuiston: No. Except that the gold ores used cyanide for a dissolving agent and the uranium ores used sulfuric acid.

Swent: Who had designed these mills? You were taking over something that someone else had already begun, weren't you?

McQuiston: Well, the Belgians had a very astute metallurgical staff and MIT had a very well-trained group of metallurgists and engineers, and the Canadians, who knew cyanidation as well as the Americans or South Africans, soon developed the flow sheet for the Great Bear Lake plant.

Swent: Did you meet with all of these people who had done the initial work?

McQuiston: Oh, yes. I visited, spent considerable time at MIT with the men, because we were going to continue to use that Watertown Arsenal, which was well equipped for uranium metallurgical research and development.

Swent: Was there any friction because of the changeover?

McQuiston: No, they just went from a very strict, military type of supervision to a civilian type. No, there was no friction.

Swent: Were you replacing any particular person?

McQuiston: No. I was adding to them because we were enlarging, and I hired seven different metallurgists to work on projects. I recall Sheldon Wimpfen being engaged to work on the extraction of uranium from phosphate ores in Florida because we had determined that the ocean-laid phosphate deposits

McQuiston: contained minute amounts of uranium, but with the huge tonnage of phosphate rock mined and processed each year, the amount of uranium in those ores was considerable. Through John Gustafson's associations and Jesse Johnson and myself, we decided we should have the best talent available advising our geological efforts in finding uranium. So the advisory committee selected comprised Fred Searls, Jr.; world-renowned geologist Ira Joralemon of San Francisco; Donald McLaughlin, a regent of the University of California, and I guess he was with Homestake.

Swent: He was with Homestake by then. Fred Searls, Jr. is the same Fred Searls of Newmont?

McQuiston: Yes. And Henry Carlisle.

Swent: This was very distinguished company.

McQuiston: It was an advisory board. It is interesting to note that the Colorado plateau had produced, in 1911 and '12 and '13, uranium ores containing radium, which was used by the Pasteur Institute by Mme. Curie. However, our esteemed collection of outstanding world-renowned geologists held very little hope of developing uranium sources on the Colorado Plateau from the carnotite type of uranium ores.

Swent: So they ruled that out?

McQuiston: Fortunately we had the courage to launch one of the largest exploration programs ever undertaken for a single mineral, for a single element. And it turned out most successful because we found all the uranium that could possibly be used as time went on, on the Colorado Plateau.

Swent: But there was doubt, you say?

McQuiston: The advisory committee doubted very much that we could develop sufficient mines to have any justification for large exploration.

Swent: Who made the decision to go ahead anyway?

McQuiston: John Gustafson, myself, and Jesse Johnson. Because we three were running the Raw Materials Division. John Gustafson was the geological expert in our division. Jesse Johnson, a mining engineer, but knew his way around Washington so well that he was a great help, and then I was in charge of all the

McQuiston: metallurgy for all of the uranium plants which were to be built in the very near future.

Swent: Had you run into uranium before in Colorado? Had you worked on the Colorado Plateau at all?

McQuiston: Oh, no. No one had. There was no activity. They had produced some vanadium. The Rifle plant and the Uravan plant and the Grand Junction plant all produced some vanadium during World War II, because it was greatly needed for the hardening of steel.

Swent: Were you aware of that?

McQuiston: No, I wasn't involved in that; they were different areas.

The MIT reports on the metallurgy of the Shinkolobwe Mine were needed for the startup of the plant. I was assigned the task of delivering these very secret reports to the Belgian Congo. I had three passports: one personal; one issued by the State Department for diplomatic purposes; and one called a special passport, which gave me a wide range of access to our U.S. government in different locations around the world without going through the State Department.

For this trip the Belgians were extremely careful, not wanting to raise the ire of the Russians. So they cautioned us to use extreme precautions about my visit down there. Hence I used my own passport.

Swent: How did you get there?

McQuiston: I flew. My itinerary was to fly on Pan American to a destination in Elizabethville. We landed in Gander.

Swent: This was before jets, wasn't it?

McQuiston: Yes. We landed in Gander, the Azores, Lisbon, and then Elizabethville, which was the capital of the Belgian Congo. The Belgian general was there to meet me at the plane and to swish me through the customs so I wouldn't be observed too freely.

Swent: What was the date on this, approximately?

McQuiston: Oh, approximately March of '48.

Swent: This is fairly soon after you went with AEC, then, wasn't it?

McQuiston: Oh, yes.

Swent: Were you travelling alone?

McQuiston: Yes. An interesting occurrence was that I had all these reports in a briefcase which was chained to my wrist, and in Lisbon we had quite a layover of two or three hours to have dinner in the airport. To get to the dining room one had to go through a customs inspection. Of course, that was something I would not do because of the documents that I had with me. So I was served my dinner in the waiting room outside. I said I was traveling for a bank and I asked for one of the policemen to kind of keep an eye on things for me. They were quite suspicious of what I had in the briefcase, but they did not have any authority to look into it, and I volunteered nothing. The Belgian Congo was under the Belgians, the government, and their military, such as it was. But the police were strictly under the Belgian control. I spent three days in Elizabethville, more or less to take a lot of quinine tablets, because they didn't want me to get back in the interior, where this uranium mine was, and come down with malaria. They had a very lovely guesthouse and charming host and hostess, so I stayed there for three days and went on by a smaller plane and then by a paddle ship for a few miles, and then again by a plane into Jadotville.

Swent: Approximately how far was this into the interior, do you know?

McQuiston: Pretty near two thousand miles. Over a thousand miles, we'll say.

Swent: What kind of planes were those?

McQuiston: DC3s. I had very fine quarters and the Belgians, of course, all spoke English from childhood on up, and they spoke English as well as I did. There was one German who became quite a good friend of mine, although he was a Belgian citizen. They had these huge mines of copper cobalt in this area, which I enjoyed seeing. Then from Jadotville to Shinkolobwe was about twenty-five miles of dirt road that we traveled in a jeep. The plant was completed and because of the heavy atomic weight of pitchblende ores, there was a jig plant which had been designed for both Great Slave Lake and for this one, for the Shinkolobwe Mine.

Swent: Was this mine developed only for this?

McQuiston: Only for uranium.

Swent: So it was not a pre-existing mine.

McQuiston: No. It was developed during the war for the sole purpose of producing uranium, which was sealed in lead drums because of the radiation exposure. Sealed in lead drums and shipped, labeled "copper ores," to the United States, where it was then transported to Chicago, and Dr. Enrico Fermi did his original work on the fission of uranium. The processing of these ores was sort of a Rube Goldberg hand operation, because they were so rich in pitchblende, it did not take much ore to produce pounds of uranium required for the bombs, to the plutonium eventually. The residue, which contained sufficient radium and uranium for a real health hazard on the outskirts of Chicago, was finally dug up, transported to Hoboken, New Jersey, and hauled out to sea and dumped overboard. There wasn't much of it, but it was very, very radioactive.

Swent: Had the Africans been aware of this at all?

McQuiston: The Africans?

Swent: I mean in the Congo.

McQuiston: You mean the Belgians?

Swent: Well, all right, the Belgians in Africa.

McQuiston: The Africans are black.

Swent: I wondered if they had been aware of the radiation.

McQuiston: Oh, they didn't know anything. They were very primitive. They didn't know anything.

Swent: They hadn't noticed this.

McQuiston: No. They would just do whatever they were told. The first thing I suggested was put into effect within twenty-four hours and that is aprons for the men who were on the jig plant and on the sorting belt where they picked off large chunks of pitchblende ore so they wouldn't have to be crushed and processed. They quickly designed lead-lined gloves and

McQuiston: thick aprons about a quarter of an inch thick of lead to shield themselves from the radiation of the ores going by that they were working on.

Swent: There had been no concern for this before that?

McQuiston: Very little. Among the literature I took down was quite a bit of information on the hazards of radiation. I did not know any more than the natives who were working with these ores, myself, never having been in contact with them. I visited Shinkolobwe Mine, I went underground, and I wondered at that time about radiation exposure, because you could see a vein of pitchblende ores fourteen inches wide and the radium exposure must have been terrific to the workmen, and the radon gas that was emitted was a serious handicap. Although it was against our production goal to shut the mine down, in contacting New York AEC office where the experts were from the Manhattan Project, they advised immediately shutting the mine down until huge fans could be installed and exhaust the radon gases forming constantly.

But we had enough ores that we operated the plant and it was in very good shape and the Belgians were probably the greatest group of metallurgists outside of South Africa. The head office of the Union Miniere Company was in Brussels, and then they had a large plant in Hoboken and other installations in Belgium. Of course all these were shut down during the war because they had no ore supply from the Congo, except what came to the United States.

They were very pro-American and willing to take great risks to supply the United States with uranium, but on a secret basis because they were under surveillance by the Russians, who suspected that Shinkolobwe existed, but they had no way of knowing it for sure. No one was allowed in except their own Belgian supervisors, and then, of course, myself.

Swent: Were all of the miners African natives?

McQuiston: Yes. I might add that I made many close friends with the Belgians, who were fine engineers, and this association continued for the next twenty years because I, through Newmont, had lots of business with the Union Miniere officers of the company in Brussels and Hoboken.

Perhaps now would be the time to mention, not in

McQuiston: sequence of time of discovery, the sources of uranium developed by the raw materials division within the next two years, or by 1950. Of course the carnotites were on the Colorado Plateau, which included parts of Wyoming, Colorado, and Utah.

Swent: Does that extend out into the Four Corners area?

McQuiston: It wasn't called the Plateau down there, but there was a lot of production down there. The pitchblende was found at the Great Bear Lake in Canada; Marysvale, Utah, which was on the Plateau; Shinkolobwe, Belgian Congo; Urgericia, Portugal; and some at Dawn, Washington.

We also found uranium in shales. Sweden produced at a later date, of course, a method for extracting uranium from the shales, oil shales that they had in Sweden. The phosphates, only in the ocean phosphate deposits, as for example, those large phosphate deposits in--

Swent: Florida?

McQuiston: Those are all ocean-laid. What's the next state over from Florida?

Swent: Georgia?

McQuiston: No. there's another state in there.

Swent: Alabama?

McQuiston: Alabama, I guess.

Swent: Tennessee?

McQuiston: No. Tennessee was too far north.

Swent: Didn't New Mexico have phosphates?

McQuiston: No.

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Swent: So the phosphates were in Florida and neighboring places?

McQuiston: No, the ocean-laid phosphates were only in Florida. And, of course, in North Africa, and they had a fair content of

McQuiston: uranium.

Swent: So you were working with geologists at this point?

McQuiston: Oh, yes. We had the U.S. Geological Survey. They loaned us many outstanding geologists in the wide search for uranium.

Swent: You were given a mandate by Congress?

McQuiston: Oh, yes.

Swent: How did that work?

McQuiston: A good example of the mandate we received to kind of do as we pleased was that the Great Bear Lake plant burned down, which is not unusual for mills of that nature, to burn in the winter time in the cold area when they need so much heat. We needed the production badly from the Great Bear area. So I approached the general of the air force, with proper introductions of course, from the congressmen and military, and so forth. And he listened very carefully and he said, "How much do you have to move up there?" So I gave him the tonnage of steel and the type of equipment that was required, and he said, "You get it ready" and told me what field it should be delivered to, and he said, "I'll take it in, in a week." And he put the transports on, I've forgotten which, the numbers of them, the names of them now. But the air force transports. And he put those into service and he hauled this whole mill in, in a week and we had it running in a month. Because the Canadians went in and did a tremendous job of flying in Canadian engineers to rebuild it.

But then no one knew what was going to take place. With the war going on in Korea, and the Russians just lurking on the edge, we didn't know but what we were going to be at war with Russia. I'm sure it was all false belief because they didn't want war any more than we did, but still we had to be prepared and as long as we had the know-how of the atomic bomb, they would not move in our direction in an offensive manner.

Swent: Did you go up to Canada?

McQuiston: Just on one trip, I made a visit there to see how the plant was running.

Swent: What province is this in?

McQuiston: Northwest Territories. Another potential source never exploited was thorium, which is radioactive. These potential sources of thorium were Idaho, small quantities from one of the rivers; India, large quantities; and Brazil, large quantities. It was interesting to visit Brazil and talk with two of the generals who seemed to be in charge of radioactive materials. However, I went as a Newmont engineer at that time, as we did not want to have any dealings whatsoever with any foreign government through our government.

Swent: Did you visit India also?

McQuiston: I visited India, and it was amazing to see this huge pit with a spiralling walkway and the women did all the work. The women carried these baskets of the sands which they used to produce thorium, for which the biggest usage was gas mantles.

Swent: Oh, for gas lamps?

McQuiston: Yes. Thorium mantles burned forever--well, not forever, but a long time. We never exploited any of these sources for thorium because we found enough uranium that we didn't need to go into thorium. It was a very complicated metallurgical chemical process to extract the thorium and get the uranium out of the thorium.

Swent: Did you visit the mines in Brazil also?

McQuiston: No, I only talked to these pompous generals. [chuckles]

Swent: Did you speak through an interpreter?

McQuiston: No, they spoke English.

Swent: So you went to Shinkolobwe--

McQuiston: One time. And I went to Urgericia one time; that was in Portugal. That plant was under the jurisdiction and design operation of the British. The British were part--maybe now is the time to bring that out--the British and the Americans were equal in all uranium know-how and, theoretically, they had half of all uranium that was developed. This was from the Roosevelt-Churchill Casablanca meeting at which time they decided that they would share all atomic energy secrets. Although they tried to take an active part they were really not interested. They wanted no uranium delivered to them and they didn't want to know any of the real know-how, although

McQuiston: they did have, by law between the countries, full access to most of our information.

Swent: Canada at that time was still a colony, wasn't it?

McQuiston: No.

Swent: So the Canadian effort was independent of British control?

McQuiston: They were very friendly with us developing everything, yes.

Swent: I have some clippings here that I brought from the New York Times that might be pertinent. Here's one from November 2, 1951, that tells about your visit to Pretoria. "U.S. Atom Group in Pretoria."

McQuiston: Wow.

Swent: "Three United States and four British representatives have arrived in the Union of South Africa to discuss with authorities here the production of uranium--the basic atomic research element--from gold bearing ores in the Transvaal. United States representatives are J.C. Johnson, F.W. McQuiston, and A.A. Wells." [Reads aloud]

McQuiston: Yes, I was going to give you those names--

Swent: That was later. Or are we up to that?

McQuiston: No. That was--when was that?

Swent: This is November, 1951.

McQuiston: Let me see that. I can't quite place it.

Swent: Right here in the middle. [Shows article]

McQuiston: Yes, I guess that's it. I thought it was 1950.

Swent: Can't argue with the New York Times, I guess.

McQuiston: I should say not. No, I thought it was 1950. That's a good date to remember.

Swent: And then I have another one here also from 1951. This first one was November, this is October 3, one month earlier. You were sort of commuting to Africa, it appears.

McQuiston: What does it say I did then?

Swent: This is just a news article that says that "Colonel Pommerie, director of industrial production at Rabat, reported today that uranium had been discovered in the South Atlas Mountains at Bouazzer and Azegour."

McQuiston: I did that.

Swent: I thought so; that's why I copied this.

McQuiston: Yes, I did.

Swent: He said the mineral at Bouazzer was in complex form that would make exploitation difficult but at Azegour it was in the form of pitchblende.

McQuiston: In minute quantities. Yes, I went in there. I have it down here.

Swent: Okay. Well, let's talk about it.

McQuiston: Let me see now, we better keep these things in order.

Swent: When did you go to India?

McQuiston: Oh, that was just a passing--it must have been 1950.

Swent: Okay. So the Korean War was a fact.

McQuiston: Yes, but India wasn't. [chuckles]

Swent: Where were the mines in India, these thorium mines?

McQuiston: You know, I don't remember.

Swent: Hot, anyway.

McQuiston: Oh, yes. And I was so--I didn't want anything to do with them. Never went back and never want to go.

Swent: Were you traveling alone?

McQuiston: No. I went with Al Wells, who was our attorney, and on this trip John Gustafson went. Must be about time to talk about South Africa.

- Swent: Before we leave Shinkolobwe maybe I should mention another clipping from the New York Times, February, 1952. "Dispatches from the Belgian Congo said today that the uranium mines at Shinkolobwe had been declared a military zone as a result of recent breaches of security. The mines are being guarded by colonial troops under Belgian officers." So there had been some security problems in February, 1952. That was after you had been.
- McQuiston: Yes. Oh, yes. I went there in '48.
- Swent: Well, security's always a problem.
- McQuiston: Oh! I'm writing a story on a \$650,000 gold theft at Carlin. I'm writing it up. I have all the facts and figures and everything.

Morocco and Algeria

- McQuiston: To talk of South Africa I have to bring in first Zellidja. Now is probably the logical time to discuss the very interesting project known as Zellidja, the Zellidja Mining Company. Fred Searls had a look at Zellidja in 1946 and liked the general geology of the district. His liking of the area brought him in contact with Jean Walter and with Mrs. Biddle. Mrs. Biddle was the daughter of Colonel Thompson, the founder of Newmont. She lived in Paris and was a great friend of the Prince of Wales.

Mrs. Biddle became quite good friends with Mr. and Mrs. Walter and Jean Lacaze. I'm bringing this story of Zellidja at this time because it was the sole reason that I was given the liberty of working for the government on secret missions and also doing work for Newmont. This was a very unusual occurrence in Washington, D.C. However, I apparently had some qualifications that AEC needed, and others that I knew that Newmont was interested in.

- Swent: Were you being paid by both Newmont and AEC at this point?
- McQuiston: Oh, it's too long after the fact; they can't do anything now; yes, I had a consulting check from Newmont deposited to my account in New York.

Swent: Were you still a consultant at AEC or were you an employee, by now, of AEC?

McQuiston: At first I was a consultant and then I became deputy manager. So I was an official of a government agency and receiving a consulting fee from Newmont. And it started because of Zellidja. St. Joe Lead Company also had tracked down some information on this quite fabulous ore body in North Africa, in Morocco, which was very close to the border between Morocco and Algeria. So they became partners with us. Their duties were to furnish the mining know-how and our duties from Newmont were to have the mechanical know-how, through a Newmont employee and myself, to do the metallurgy and to build the mill.

Swent: This is still uranium?

McQuiston: No. This was one of the largest lead-zinc ore bodies known in any foreign country at that time. So we were anxious to bring it into production. It made a convenient stopping-off place for me on my way to South Africa because I could fly in to any of the European capitals where the airlines originated and then go to Casablanca or to Oran by either ship or airplane. And then from there I would go to Roberts Field and pick up Pan American for South Africa. My connections with Zellidja gave AEC the inside road with the French government, the Moroccan government. Because we were quite sure there was some uranium in Morocco. Again through the research by our mineralogist and geologist we focused on the BouBeker Mine.

Swent: Were there restrictions on a government employee?

McQuiston: Oh, yes. Because I was an officer, a deputy manager of the Raw Materials Division and outside consultant carrying this top secret information around. But I was extremely careful. I never went near an Iron Curtain country except Sweden, and then it was always on a mission that was in no way connected with the State Department. So they couldn't pick up my tracks from that. Because, you know, the State had leaks and everything. They would get very annoyed at me but it didn't do them any good, because I wasn't any fan of the State Department.

The negotiations for Zellidja led to a new company: Nord Africaine du Plomb or NAP for short. This was the mine just over the border in Algeria. Very fine high-grade zinc

McQuiston: mine.

The first mill that I saw when I visited Zellidja in 1948 was something that it's hard to believe unless you can see it. The tailings, the rejects, were shoveled out of a back window by an Arab as they formed in piles. They did not have the knowledge of using pipe lines. It was just fantastic that things could be as bad as they were. Although they were producing lead because they had some jigs and they even bought an HMS [heavy media separation] plant which was never installed or used but they read some place that that was one way to recover lead zinc ores.

My duties, then, were to become Newmont's representative with the French and to decide upon the size of mill we would need to treat the ores. My companion was Kramer Bain from the St. Joe [St. Joseph Lead] Company in Missouri. He was a mining expert. After considerable discussion over there we arrived at a figure for the mine production from two shafts of two thousand tons a day each, or four thousand total. And we would have a four-thousand-ton-a-day mill.

Swent: So this was two American companies--

McQuiston: Owning 49 percent.

Swent: And the French the rest?

McQuiston: The French owned 51 percent.

Swent: On your wall over here you have an award from the Moroccan government.

McQuiston: Yes, at the inauguration of this mill, which was built in rather record time by a Canadian construction company. We used them because many of their foremen were French Canadians and spoke a bastard French, hardly understandable by the French people, but nevertheless it helped out. [chuckles] At the big inauguration which the French dearly loved, and the Moroccans also, there were Newmont and St. Joe, Zellidja executives, Moroccan and French government officials, a sprinkling of royalty including the Duke and Duchess of Windsor, General Juin (the only five-star general in the French army except General DeGaulle), who was governor general of Morocco for the French government. Then they had the crack Moroccan cavalry, who could put on more antics on a horse than most clowns do in the circus.

Swent: It must have been very exciting.

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Swent: Was it at the inauguration that you were given the award?

McQuiston: At the inauguration I was presented, by General Juin, with the order of Ouissam Alaouite-Cheritien for outstanding service to the Moroccan government. And I was kissed on both cheeks by General Juin.

Swent: That was sort of a novelty in those days, wasn't it?

McQuiston: It was to me.

Swent: Was Frances there with you?

McQuiston: Not for the inauguration but she was there for a month-- stayed there while I went on to South Africa and came back. Just lovely. In 1964 Newmont and St. Joe, they had given up on North Africa. For one thing, the Moroccan government had obtained a substantial ownership of Zellidja by buying stock inherited by the son of Jean Walter. Also the French-controlled government in Algeria had been given their independence and immediately after that they expropriated the Alzi mining properties. My last trip to Morocco was in 1964 when we bailed out, when it was my duty to bail out Newmont and get as much as we could.

During one of the trips to Morocco, during this period of 1948 to '52, I had a personal audience with General Juin in Rabat. We were doing considerable research work on the possibility of extracting uranium from the huge phosphate deposits in Florida, but were not making much progress. There were three research companies doing this work, and although there was little possibility we would have any production out of Morocco, we never knew what other countries might be doing, such as France or even the Russians. So we wanted to get an assurance that any uranium produced from Moroccan phosphates would come to the United States. I had to compromise with the general that any uranium produced from phosphate ores in Morocco would be sent not to the United States but would be stored on the island of Martinique under the jurisdiction of the French military.

Swent: Let me be sure that I've got this straight. There were two things that you were working on there; you were interested in

Swent: this lead prospect--

McQuiston: That was Newmont. This is AEC.

Swent: Right. Yes. At the same time there were uranium mines--were there mines yet?

McQuiston: No.

Swent: Just deposits of uranium in Morocco.

McQuiston: We didn't even know that. I'm going there next.

Swent: Okay. So this is just before the fact that you're talking to him about something that might come in the future.

McQuiston: That's right. Through Mrs. Margaret Biddle and Jean Walter, arrangements were made for me to meet with the Prime Minister of France, Rene Pleven, in Paris, to obtain permission to discuss uranium phosphate and other uranium deposits in Morocco. When arrangements were made you don't make them with him himself but with his staff. I was cautioned, not once but several times, of the jeopardy of involving the prime minister in some kind of uranium negotiations with the United States. I pointed out that this need not be considered an official arrangement at that time, because I was doing this work for the French associates at Zellidja.

After receiving instructions from his staff of how to get to his place, to his home, at midnight on a certain date, I took two separate taxi cabs and two subways and then walked a short distance to his home.

Swent: Were you consulting at all with the State Department about this?

McQuiston: No. The last thing we wanted involved was the U.S. State Department. And also with the French, they agreed that that would open up a can of worms. So we spent perhaps half an hour together, and he was very interested in what we were doing in uranium. I could explain truthfully that the extraction of uranium for the manufacture of bombs was not in my department. But I told him about the Colorado Plateau; I did not tell him about Shinkolobwe, I did not tell him about Urgericia. But I enlarged the story of the huge amount of uranium in the Florida phosphates on which we were working. And in great detail, for a sidetrack conversation, described



Frank W. McQuiston, Jr. receiving the order of Ouissam Alaouite-Cheritien in Morocco from General Juin, 1951.

McQuiston: the Colorado Plateau, which was public knowledge anyhow. We had a friendly discussion and he said that I would be told if it would be possible to meet with General Juin in Rabat.

So in due course I got word back through Jean Walter that to disassociate me with the prime minister he would see me on my next trip to Morocco if I would give him a day or two notice. Which I did through Jean Lacaze, who knew the general fairly well. He listened very carefully and we made sort of an arrangement, without being in writing, that they would not dispose of any uranium, except if they did produce uranium it would be stored on the island of Martinique under the control of the French military, which was satisfactory with me. And at the same time I brought up Bouazzer, which he had never heard of. But he said, yes, I had his permission to visit if I wanted to. But perhaps arrangements should be made through the mining companies involved.

So Jean Lacaze again made the arrangements for me to visit Bouazzer, which was a godawful trip down in the northern part of the Sahara desert. They had a makeshift guesthouse full of flies, and the temperature was a hundred and ten. But I enjoyed the visit there because it was a mine producing cobalt ores. I had never known of an association of uranium and cobalt until Bouazzer. Nor had our geologist or mineralogist. But I took sufficient samples, and after analysis of these samples by our technicians we decided that there wasn't anything there of interest to us. But we determined that it wasn't of interest to us and it was not of interest to the French either.

We were very careful and had many demands from the French for an exchange of information. They were so anxious to know geological occurrences of all uranium deposits that we knew of that it was hard to discourage them from the pressure they had put on us. But then we did not ever exchange, during my time in AEC, any information with the French government regarding uranium except my one meeting with the prime minister. Which was known to only a few of us in raw materials; Jesse Johnson knew it, John Gustafson knew it, and two of our attorneys knew it, but no one else.

Swent: I was wondering whether you had met General Juin before?

McQuiston: I think I did, and that's why it wasn't hard to get an audience with him. Yes, it was after the inauguration.

Swent: It must have been a very exciting time for you.

McQuiston: We believed there could be uranium in Ghana, Tanganyika, and Uganda, and three or four others of the more or less northern North African countries. Many of them I visited as a Newmont engineer only. Never discussing uranium but visiting their mines. There was a fine copper-cobalt mine in Uganda which I visited. There was a big gold mine in Ghana operated by the British, whom I got access to through the British Atomic Energy Commission, and had considerable conversation. Again, as a Newmont engineer only. And Ghana, I negotiated that on my own through the mining engineers. Our search was not particularly for production as much as it was for knowledge of uranium occurrences and to know if the Russians were down there looking around. Well, that brings us up to the very important production from South Africa.

[Interview 6: 9 July 1986]

Swent: Yesterday we had just ended with your North African experience. Is there more that you wanted to say about Bouazzer or Zellidja?

McQuiston: Oh, yes. Zellidja, by the way, was about thirty-five miles south of the town of Oujda, which was very close to the western border of Algeria. It was a town of approximately 35,000 population and was a railroad terminal. It was the eastern major city for Morocco. We often took the railroad at night from Oujda and had a very comfortable sleeping car to Casablanca, where we would do whatever business we went for. They had some paved roads, and of course the Atlas Mines were a ski resort in the winter because they were high enough, up around ten thousand feet, where they had lots of snow. The forest that was growing on the mountain was patrolled daily by guards because the Arabs were great for cutting trees down to make charcoal for their fuel, as they had no other means of cooking or heating their tents. I much preferred the Bedouins to the Arabs. They seemed more straightforward people and were of course fierce tribesmen.

We made one interesting trip from Zellidja to the mountains nearby where we got our water for domestic purposes. About thirty-five miles north and east in the high mountains. We went for a visit to this remote village and

McQuiston: the citizens, or the people living there, were quite different than any of the Arabs I had seen all through North Africa. They were very handsome people, quite clean, and industrious because they had small garden plots and, of course, the usual goat herd and were most friendly to the French. I've often thought it would make a good research problem--project--to investigate their background.

To finish up with Zellidja, we had built, at the expense of many millions of dollars, quite a town for French workmen. Nice accommodations, and there were approximately five thousand people living at the town of BouBeker. The medina was the home of the Arab workmen, their wives and families, and they had a system of building the medina which was started by the French contractors and then taken over by the Arabs themselves, of never leaving an unfinished wall. The walls were for some three thousand people or so who lived in this medina. The wall was a continuous connection. We also built, with St. Joe Lead's assistance, a lead smelter about twenty miles from BouBeker and the mills at BouBeker where we hauled the lead concentrates for smelting to the smelter. Which was also on a spare railroad connecting to the main line going into Oujda.

Swent: The workmen were all French, you said?

McQuiston: Arabs and French.

Swent: And they lived together?

McQuiston: No, they didn't live together. The medina was a separate city, really. That's where the Arabs lived. The French, then, had nice bungalows built for them, dormitories for the single French, and nice bungalows. It was a very first-class mining camp.

Swent: Schools and hospitals?

McQuiston: No, the hospital was in Oujda. They had no doctors in BouBeker because it was a paved road and only less than an hour of good driving to Oujda.

Swent: And your water was no problem?

McQuiston: Water was a problem. The water was turned off at nine o'clock in the morning and not turned on until five in the afternoon. That is, the drinking water. Domestic water.

Swent: What about power? What did you use for power?

McQuiston: We brought power in with a high-tension line built by the mine from Oujda, where they had an oil-fired generation plant. We had plenty of power. Plenty of labor, although the Algerian government were far removed. Our mine in Algeria, just across the line from Morocco, was in the southern part of Algeria and there were no roads connecting to the Algerian cities to the north, such as Oran.

Swent: So you were dealing with two governments; the project extended across a national border.

McQuiston: Yes. I mentioned previously that they expropriated the Alzi.

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This was in the 1960s, after Algeria got their independence from France. They had their own ideas of how things should be done and got along very well with the French. Many French had been there for two or three generations, born and raised in Algeria.

Swent: It must have been a more difficult thing for you, then, to be dealing with two--actually three governments--the French, the Moroccan, and the Algerian.

McQuiston: It was. That's right. But actually, the Americans did very little political negotiation because the French were so adept at that type of business. I had all my negotiations with the French mining authorities, such as Jean Walter; Jean Walter, his father; Jean Lacaze; and then the mine staff, who were very fine engineers, but had no previous practical experience; they had to be taught by Americans.

They had fine college educations but did not know how to use their hands and had no previous experience, or working in the summers like the American boys do when they're going to college. During this period of visiting Zellidja at frequent periods, I would then move on south into other parts of Africa, making connections with the government or with the geological surveys or mining departments, whatever they had, looking always for sources of uranium. So I would take these trips to Zellidja for Newmont but continue on with AEC work of searching the surrounding countries. I visited in all about twelve or fifteen African countries.

McQuiston: There was one mine in Mauritania in the country of Mauritania called Akjoujt which was reported to be a sizable copper deposit. Because we had no knowledge of uranium associated with copper ores it was not a normal circumstance. So Fred Searls asked me if I would visit Akjoujt to see whether or not the mine itself had any merit as a possible producer of copper and also, perhaps, uranium. This was a long, hard trip. First a hundred miles by jeep over a trail rather than a road; then we mounted camels and rode for another fifty miles in two days on a camel to Akjoujt, where there were some buildings from the old, old working days. And I didn't take long to know that it was a huge oxide copper deposit. And at that time there was no method of recovering copper from oxides.

So I reported back to New York and Fred Searls unfavorably on the mine. Strangely, it was later taken over by Anglo-American, a leading mining company of South Africa, with a method developed by a friend of mine, Maurice Ray, for recovering copper metal from copper oxide ores. It was never a success as a copper producer, and my judgment was correct in thinking that it would never be a producer because, one, the severe location right on the edge of the Sahara desert was against it. I could question a water supply making the community livable for the kind of workmen that we would need to put it into production, so it was just a big copper deposit, but unprofitable.

Swent: So your judgment was the right one, then.

McQuiston: That was the right one.

Swent: You must have a lot better understanding of African geography today than most of us, when you read the papers.

McQuiston: Except they've changed.

Swent: The countries' names have all changed.

McQuiston: But they've all changed and their boundaries seem to have changed. I don't know how they could do that but they did. To some extent, but not much. This dissertation takes us up pretty well into the year of 1950.

South Africa

- Swent: Let me see. The uranium was reported in Morocco, in the papers, that is, in 1951, October '51. The trip to Pretoria--the New York Times for November 2, 1951, says that you arrived and the date line is November from Pretoria.
- McQuiston: That doesn't mean that was the initial trip.
- Swent: No, it doesn't.
- McQuiston: Because I know we were there before that.
- Swent: You made several trips there?
- McQuiston: Oh, fifty. About fifty.
- Swent: Oh, my!
- McQuiston: Knowing of the occurrence of uranium in the gold ores of the Witwatersrand in Orange Free State of South Africa, a visit to Johannesburg was of high priority. Approximately in 1949 we made the first trip to South Africa.
- Swent: This might be a good place for you to explain why you have no confirmation of these dates, that you couldn't keep notes.
- McQuiston: Oh, I can dig them all out, because I have my passport.
- Swent: But you were not allowed to keep notes.
- McQuiston: We did not keep personal notes on any of our atomic energy business either in the Colorado Plateau; Washington, D.C.; or South Africa; or any other place. After all, it was some thirty-five years ago, so I'm just a little vague on the first date of South Africa, although I believe it was 1949.

Through prior arrangements made from the Atomic Energy Commission and the State Department to the government of South Africa in Pretoria, we set up the first meeting to take place in Johannesburg. Our team comprised Jesse Johnson, deputy manager of the Raw Materials Division, myself as chief metallurgist of the Atomic Energy Commission Raw Materials Division, and Al Wells, who was an attorney steeped in bureaucratic know-how about how to conform with government regulations, and more particularly the State Department

McQuiston: regulations.

We would not permit a State Department representative to accompany us. It was a showdown with the State Department. But the Raw Materials Division had the important function of searching out uranium sources, and we were the fair-haired group of this new civilian organization called the U.S. Atomic Energy Commission. We were welcomed by the Pretoria government, who in turn then called in the leaders of the mining industry in South Africa, whose companies and men were all members of the Chamber of Mines, which was a powerful organization representing all mining in South Africa. It can be compared with the CIO mine union or something of that in the United States, because they represented all mining companies. For labor negotiations, purchasing of many supplies, particularly from overseas, and just all business where all mining companies had something to gain by this.

Swent: Was it a labor union?

McQuiston: Oh, no. It was the highest type of organization that one can imagine. It can be compared to a labor union because of their great authority, only they represented the opposite from a mining union; they represented mining industry. This was over quite a period of time because sometimes we would be there a week or ten days or two weeks, and had regular scheduled meetings. Anglo-American Mining Company was represented by R.B. Haggart; General Mining--by McLean; Goldfields by Lawrence; Anglovaal by West.

These were the prime movers of our uranium program, although sitting in the executive meetings were the senior mining men which we would label as president, CEOs, and chairmen. These men were known as the chairmen and managing directors of their various companies. There were seven picked to attend these meetings, seven of the managing directors, to attend these meetings. Other meetings were broken down as more detail was required into the mechanical design consulting. They called all their top people consulting engineers because they had more than one mine. Instead of saying he was the mechanical engineer for Western Reefs, for example, they would say he's the consulting mechanical engineer for this company. So eventually it boiled down to having four mechanical design engineers representing the four mines we finally selected. Of course with the South Africans' mining companies and the South African government, we boiled all the mining operations down

McQuiston: to four, who had the highest grade uranium content in their current milling ores and on the tailing dumps of past milling ores.

There was also a very strong group of metallurgical engineers, consulting engineers, again representing each of the mining companies. There were one or two very outstanding metallurgical engineers from other mining companies invited to attend these particular meetings when we discussed metallurgy, because of their very capable know-how. The executive meetings were on a very high level of we three from the United States, the managing directors, two senior men from the Pretoria Mining Company, two men from their mining division of the government, and three representatives from Great Britain's Atomic Energy Commission. I mentioned previously that the Churchill-Roosevelt agreement made in Casablanca included Great Britain as a partner in all atomic energy developments. So they sent three men down who knew nothing of mining and were, at times, so obnoxious to the South Africans, whom they looked down upon. Probably an aftermath of the Boer-British war, but it was very annoying at times because they were the guests of the government of South Africa, who paid all their hotel and other expenses and even advanced them funds for trinkets or whatever they wished to buy. We Americans were on U.S. government subsidy and would allow no expenditures whatsoever to be paid for by the South African government. But the British were eager to have this very fine arrangement.

After we negotiated--principally with the mining companies--that we should start uranium production at the earliest possible date, we agreed on a price of eight dollars a pound, which was a very low price, even though it was a by-product production from the gold ores, as compared with prices paid at a later date in the United States on the Colorado Plateau of from twelve to sixteen dollars a pound.

Swent: I thought eight dollars was the Circular 5 price. [Atomic Energy Commission, Domestic Uranium Program Circular 5]

McQuiston: We had side deals where we would include amortization. Anaconda was one of them; we paid them twelve dollars a pound to bring in that big mine in Shiprock.

Swent: So it was eight dollars plus?

McQuiston: Yes.

Swent: Did you go on out to Africa with a price that you thought you would want to get?

McQuiston: No. That came fundamentally out of discussion with them and visits to their plants, which was my duty, and my estimate with their metallurgist as to what the cost might be. I had never dealt or expected again to deal with more outstanding mining men than the seven men we met who were managing directors of the mining companies. Their integrity was beyond question; they were fair; they knew we needed uranium so badly; they had the uranium to produce and could come in production long before any real amount of uranium could be produced on the Colorado Plateau.

Swent: They didn't take advantage of their position?

McQuiston: They did not take advantage of us in any sense of the word, and we all developed friendships with these men which lasted practically the rest of our lives. I still correspond with some of them. Outstanding men.

Swent: Maybe the British helped bring you together by being so difficult?

McQuiston: No. The British contributed nothing. Absolutely nothing. They were not mining people; they wanted to be a part but had nothing to contribute. Until a later date when we got some good technical men from Great Britain who were a big help in running the pilot plants. But they were from the chemical engineering divisions of American Cyanamid and the large chemical company in Great Britain. Then we got some contribution when we got technical men; the others were political.

The main objectives, then, were negotiation of price and the selection of the four mines out of some fifteen who would come into production, and that was on mutual agreement, with us sort of sitting on the side line because they were the ones that could say "Anglo-American will produce, Goldfields will produce," and this and that, and we more or less had to listen. But to be sure that we had them spread around, we didn't want to have four of the plants together.

But we had to guarantee the equipment for these plants because South Africa at that time was in a stage of development. They had a steel mill, but it was swamped with orders for structural steel. They had no stainless steel

McQuiston: industry to speak of, and the rubber industry was not developed to any great extent. So that was why I made so many more trips than any other American from the Atomic Energy Commission to South Africa, because it was construction of which I had considerable knowledge, and the supplying of the equipment. So it fell to me to send all the needed structural steel; the Oliver stainless steel filters needed badly for the recovery of the yellowcake from the solution; the pumps, rubberlined because of the acid condition in the pulps; and acid plants, the manufacture of complete acid plants of which they had none in South Africa.

Swent: So you were ordering supplies from the States--

McQuiston: We were furnishing them then with the materials for the building of these plants. After I had investigated what was needed and agreed with their mechanical metallurgical group of men sanctioned by the managing directors, I returned to the United States and, of course, this was during the time of the conflict of the Korean War, so we had a shortage of some supplies and equipment. I managed through Fred Searls to get several thousand tons of structural steel, different sizes and shapes required for the plants. I knew the Oliver Company from my days in Grass Valley, so I negotiated the shipment of twenty-two sixteen-foot-diameter Oliver filters, built of stainless steel. And then stainless parts for other purposes in the plant, I got from a very good friend of mine.

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McQuiston: One of the most important items was a complete acid plant required for each of the four uranium plants to be built.

Swent: It was a brand new process, of course, too, which you were developing at the same time.

McQuiston: Yes, we had a lot of research going on down there and here. Chemical Construction Company seemed to be the foremost acid plant builders, so with the proper introduction I went to see the president and chief executive officer of chemical construction--a General somebody.

Swent: This is a South African?

McQuiston: No, this was the U.S. The South Africans didn't know how to build acid plants. This was in New York. Finally, after waiting a half an hour, I was admitted into his office and

McQuiston: not asked to sit down and he said, well, what did I want. So I pointed to an American flag on his desk and I said, "We need to wave the American flag over South Africa and we have selected your company the foremost candidate to undertake this very serious job." And before he could say, "Well, we're not interested," or anything like that I broke into a dissertation of the importance of South Africa to produce uranium to hold the Russians in abeyance and on down the line and kept on talking and talking, because he was more of a talker than a technician. So I stayed in his field, and finally he said, "Yes. We will build these acid plants for you. We will ship them down. I will send men to erect them because we want them to work, and I will send operators to start them up and teach the men down there how to run them." I said, "That's a very fair deal. Now how about the price?" And he says, "What's your idea of a price?" And I said, "The cost of the plants plus a fee which we will agree upon. Cost plus a fixed fee."

Knowing the high standards set by Chemical Construction, I was dealing in very safe ground by using this formula of their plant cost and that we would have paid the shipping cost. Then we bid on a fixed fee basis. The fixed fee was a very low percentage; it was under 10 percent. So we got the acid plants that way.

At this time we were not sure how to extract the uranium after we got it in solution with the sulfuric acid. We could always precipitate it out but it was so inefficient because we ended up with such a low-grade product, precipitating with lime or soda ash, usually lime, that it was a low-grade, undesirable product. With the success I had had at the Getchell mine on recovering gold from cyanide solutions on charcoal or carbon, I got the Merrill Company, who manufactured the zinc dust used for precipitation of gold from solution in the normal plant, to do research work using carbon. It was an idea that didn't go very far because carbon did not adsorb uranium from solution; it adsorbed too many other impurities.

I had discussion with a Dr. Hirschkind, who was the director of research for Dow Chemical Company at the Pittsburg Plant in California. He was a very brilliant man and was very keen to be a part of this project in South Africa. I might add, anybody that was approached, or any company approached, was willing to do whatever they could, usually at their own cost, helping on this enormous project.

Swent: Were you still trying to be secret about all this, also?

McQuiston: Oh, anybody who worked on it had to be.

Swent: Did you have to go through clearance to talk to these people about supplies?

McQuiston: Oh, no. I just told them we wanted to build the plants. They didn't know what kind. But I said they're very vital to the U.S. government. But, no, we didn't. But we had certain men in certain companies--now like Hirschkind, he finally got his clearance. Many of his men did. We already had clearance for the MIT people at Watertown Arsenal. We had clearance for those at Battelle.

Swent: I was wondering if it was an extra delay to have to get these commercial contacts cleared.

McQuiston: I was fortunate enough to foresee that we would need this, need some clearances, so I went to Dow Chemical Company, oh, almost months before. I went to Dow Chemical Company and Rohm and Haas Company who were leaders in the development of ion exchange and of resins used in ion exchange. Because I had the feeling that if we couldn't work carbon in, then we would use ion exchange pellets. And they had no pellets that they had ever made.

So they were working on the development of pellets and I had started clearance on many of these chemical people a year before they were called upon to contribute to the project. The breakthrough of using ion exchange is a little controversial. Tony Gaudin, I believe, takes credit for it, and Frank McQuiston, I believe also takes credit for it. But anyway, it worked. The Dow research people at Pittsburg, California, finally made the breakthrough. And we erected a small plant, made uranium solutions by using uranium chemicals in--that was a secret plant, very, very secret.

Swent: Out here at Pittsburg?

McQuiston: Yes. And Dr. Hirschkind devoted, I would say, 95 percent of his time, he practically took retirement to devote full-time to this project and to train some three different young men whom I wanted to send to Africa to inaugurate the usage of ion exchange. So as time went on we did develop a flow sheet where we could dissolve the uranium, pass the filtered solutions off the stainless steel Oliver filters through ion

McQuiston: exchange plants, big columns filled full of resins which kept breaking down but they were improving and improving. Rohm and Haas made a very great breakthrough because their knowledge of the structure of the ion exchange pellets was superior to that of Dow. Dow were more scientific in the approach and contributed in that respect.

We built two pilot plants. The South Africans were wonders in construction. There were two able construction companies: E.L. Bateman and Company and Frazier Chalmers Company, who built most of the cyanide plants used in South Africa. So to erect two pilot plants at two of the selected producers was a very short period of time; in something on the order of three months we had these plants running. I had the men lined up to produce acid. We had no source of sulfur in South Africa except pyrite, which was in the gold ores. So we would make a flotation concentrate of the pyrite and then roast that and convert it into sulfuric acid. So the Chemical Construction sent their pilot plant for this purpose down to South Africa on loan to us, because it was so much quicker than building them.

We had two Dow men, one Rohm and Haas man, two from MIT who were very strong technically, and then the consulting chief metallurgist of the four different mines in South Africa spearheaded the building and the erection of and the operation of these plants. With the help of the six men I sent down from the United States. Then the process proved entirely successful after, of course, some mishaps. As you would expect in a new process using ion exchange.

After the pilot plants were started and we projected the results and success into the future, we then started on the major plants. The steel had been ordered, the filters had been ordered, the acid plants had been ordered, all the rubber parts had been ordered, and then it was just a matter of--and, oh, electrical gear I got from England. They could supply it from England, and besides, it brought them a little bit into the picture. Also by this time the English pompous men who were originally in the picture were now out of the picture and we got fine technical experts from Great Britain. Three of them came down to help out on these pilot plants. Absolutely tops. It was a big chemical company in England and they have holdings here and in Canada. So the South African project was well on its way.

To digress a moment, on one of my frequent trips down

McQuiston: there, which was about every two to three months for a period of two to three weeks, because there were details always coming up of shipment of the yellowcake to the United States and the hush-hush that we had to go through; they had their own form of security. Until finally it was well-known that plants were guarded and the method was secret, the world soon knew we were building plants down there. The South Africans didn't seem to care whether the Russians knew it or not.

They were the third group that gave us full and complete cooperation. First was the Belgians, second the Canadians at the Great Bear Lake plant, and third the South Africans. Of course, we got excellent cooperation here in the United States from anyone that could contribute to these plants in Africa. I remember once coming back from a rather long stay in South Africa to start up one of the big plants and was called upon to come to a meeting where Admiral Rickover, Robert Oppenheimer, Gordon Dean the commissioner, two senators (one of them Henry Jackson; I've forgotten the other one), Smyth who wrote the Smyth report, and others started asking me questions about progress in South Africa and to give a complete report. I started in by saying I had just finished negotiating a \$250-million-dollar deal and it cost me out of my pocket \$1,480 because of the per diem I was on. And I did have to occasionally hold up my end, couldn't accept charity from the South African government. That brought down a laugh, and Gordon Dean said, "Frank, I'll see that some way you get an extra check." [laughter] But that was true, it cost us money, because we had to hold up our end, occasionally entertain or something like that.

Swent: What was the basis for the resentment of the State Department?

McQuiston: Because they were not involved. They would have liked to have been a part of this; in other words, had the discussion take place, one at the Chamber of Mines, and the second time at the embassy, and things like that. We had no contact at all with the embassy.

Swent: Why did you avoid it so?

McQuiston: Didn't trust them.

Swent: Why was this?

McQuiston: Well, there were leaks. They were always causing trouble

McQuiston: with the South African government. I knew that at a later date from our operations of Tsumeb, Palabora, and O'okiep mines that they were--maybe they were right, but at that time we just--we were an independent organization. We were not under the government, under the State Department. We reported to a Senate Atomic Committee and we reported to the technical people like Oppenheimer and Smyth and people like that. But we did not ever report to the State Department. And I don't think I ever used--only on two occasions--used my diplomatic passport. I used my special passport or my own passport. It was an expeditious way of travel and not having somebody meet you at the airport; I was sufficiently well travelled and I could handle my own affairs.

Still, we had always Al Wells, who was steeped in government official recognitions that could take care of things for us. But we didn't bother, we would drive him crazy with our shortcuts. When I received that medal of Moroccan honor at BouBeker in Morocco, of course, I was a government employee and that is strictly against the laws of the United States to be decorated by a foreign government. So the AEC chief counsel, I still have the letter, wrote to Dean Acheson who was Secretary of State and he explained to him in this letter that if this medal was returned to General Juin in Morocco it would be a very unfavorable situation for the United States to be in. Because he was a general himself in the army and he would take it as a personal insult if we returned it to him. So they said, "Well, we understand" and then they went on to explain that I was doing work for Newmont and as such opened the doors to the foreign countries, and particularly the mines in those foreign countries where we could look and see whether or not the uranium resources had any merit. By returning that medal, why, we would break this chain that we had been two years in building up. So they said, "Well, we'll take custody of it and return it to him when he leaves." So they did.

Swent: You had to turn it in to the State Department and get it back?

McQuiston: I got to know Acheson later, because he was employed by Newmont to do a job. This is after he retired from secretary of state to do a job in the world court. He was a very great international lawyer and represented us at the Hague in a case where our Tsumeb mine in Southwest Africa was being questioned. You don't have lawsuits, but it was being questioned as to whether or not we officially owned the

McQuiston: mine. And what was the connection of the American government with the German government, because it was formerly a German colony. I liked him.

Swent: Did you get involved at all in the investigation of Oppenheimer later?

McQuiston: No. I felt really badly over that. He was so impractical. Robert Oppenheimer was interested in raw materials, he was interested in anything pertaining to uranium, but particularly interested in raw materials and was quite anxious to know about the sources. When I told him of these huge piles of tailings containing minute quantities of uranium that could be extracted at a low cost, he asked, "Why don't we ship them back here to the United States and do it?" And I said, "Not enough ships in the Atlantic Pacific Ocean to haul those." And I said, "The cost would be one hundred times what we're paying them." He said, "That's a good answer." But I liked him; I came in contact with him on several occasions and I never believed that he was guilty of any disloyalty to the United States. His wife and his brother were communists. He was not. He entertained communists, but I'm sure he disclosed no state secrets to the Communist party. And to strip him of all he had done for the United States, I think was like kicking a sick dog, and it was just very unfortunate that they picked on him. Because he was, in my regard, a loyal American with some liberal ideas, but he was not disloyal. There were two movies on him; did you see those?

Swent: No, I didn't.

McQuiston: Oh, they were good. Very good.

Speaking now of disloyalty and particularly of someone who's known to both of us, I had some metallurgical work done by the U.S. Bureau of Mines in Salt Lake City.

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McQuiston: So to conclude this work I felt we should have these men investigated and cleared for what we called a Q clearance, which would allow them to see secret material and label material as secret, but not top secret. There were two of their senior employees that I asked to be investigated by the FBI. Well, the FBI did not issue clearances when they investigated someone. They returned their investigation

McQuiston: summary to the person who had requested it, of authority, not just any clerk or something like that. So in due time came back the FBI report. They telephoned me in Washington and asked if they could come and see me. So they came and brought these two FBI agents and brought their report with them on these two men, whose names I will not mention. They said, "They're attending communistic meetings in Salt Lake City." And I said, "My God! Are they Mormons?" "Yes, they're Mormons." And I said, "It can't be then, a good dedicated Mormon is not going--" He said, "Well, they don't know whether they're communist but we're just reporting to you that they attend these communistic meetings and we know that they're communistic because we have a rundown on four of the men, and they're pretty strong communists."

One of these men, a very astute metallurgical engineer, was slated to go to the University of California and be a professor of metallurgy. So that disturbed me a great deal to think that this man, who could have communistic tendencies, would be in a position of influencing young metallurgical or mining students.

So I called Donald McLaughlin who was on the Board of Regents, and I told him this story. I had known Donald for quite a number of years, and he says, "Frank, why do you find these problems for me? Because," he said, "this is a very serious thing to do. He's already been appointed to the job."

And I said, "Well, he isn't in the job yet." So he said, "Well, you've told me, and it's my responsibility from now on." The man went to work at the University of California. But I was told by Don later that he had given up his more or less wild activities because they had enough influence so that he could be supervised well. But it worried me to have a man like that. I was on the spot too, in Salt Lake City, before he left, and his associate. So I was very careful about what information he saw. And I changed the program entirely, so that I decided I should shift it to the Colorado School of Mines.

I seem to have run out of South Africa. The plants were a great success. These four plants came on stream in about a year, which is remarkable in that we had to ship so many of the building materials and equipment from the United States. They're very capable engineers; the best of all mining engineers I have met throughout the world are in South

McQuiston: Africa.

Swent: And of course the acid leaching process--

McQuiston: Was a total success because the whole plant was delivered.

Swent: And was adopted in many other places, later, too, wasn't it?

McQuiston: Oh, yes. But then they got them from Great Britain. Most of the senior executives of the gold mining companies were British; I don't remember any of them that were Afrikaners. The government people all were, the mining engineers and the metallurgical engineers that they had, they were Boers of Boerish descent.

During the time of my many trips and the burden of getting these plants going in South Africa, I still had time between trips to South Africa to look over the Colorado Plateau activities. We established an office in Grand Junction which was a western office. That was the only one we had outside of our own office in Washington, D.C. The development of the Colorado Plateau was moving in high gear. We had very fine geological advice from the U.S. Geological Survey.

We, Jesse Johnson and John Gustafson and myself, all went to visit mining companies with which we had close contact. I did not have to visit Newmont, naturally. But we approached Anaconda, Kennecott, American Smelting & Refining Company, as examples. In fact, we made American Smelting & Refining Company agree to do the sampling for the custom uranium plants because that was their strong forte, of sampling materials that was coming into smelters. So it was natural for them. And they did it at a hundred-dollar-a-year fee, or something like that. And we paid part of the expenses of the men who operated for them. Although that was only, usually, one man, and they paid his expenses. So we got excellent cooperation from the mining companies. And any time our geologists would make a discovery, we would get out a letter to the mining companies and tell them that we had a potential uranium mine and why didn't they send their geologists in to look at it.

Swent: It's also my understanding that this "Circular 5" pricing structure greatly benefited the little independent miner. Did you have anything to do with that?

McQuiston: Oh, yes. I remember when we wrote it. It was really put out from Grand Junction, but we did it in Washington. Oh, yes.

Swent: Was this a consideration?

McQuiston: That was for what we call leasers. I had leasers in Empire and the North Star Mines, and this was similar to that because they could take a small mine and produce ore and have a home for it without being involved in the milling. And ASARCO would sample it at the mill and then it would go through that mill. Monticello, Rifle, Uravan, Grand Junction, the Riverton plant, the Atlas plant, all received custom ores. In fact, that was one of the qualifications when we gave a contract.

Swent: For the mill?

McQuiston: Yes. That they would accept--oh, Durango also had a plant.

Swent: This was a policy decision that somebody made somewhere.

McQuiston: Yes.

Swent: Not to just exclude the little mines.

McQuiston: Oh, no. Because we were still not sure how many big mines we might find. So all the mills were custom mills. Meaning they would accept outside ore. That was the stipulation.

Swent: This was a pretty important decision.

McQuiston: Yes, it was. Marysvale, well, we must have had fifteen mills going at one time out there. Or more. But some of the mining companies, like United States Vanadium, had operated out there before. And Union Carbide, they had operated before.

Swent: Did they pressure you in any way to have the inside track?

McQuiston: They always did. But I had dealt with them in Nevada on tungsten, so I knew their people pretty well. We wanted it spread around, which we did. After I left AEC I was involved in a mine that Newmont had found up on an Indian Reservation thirty-five miles west of Spokane. It was a good mine. We made a lot of money up there. Because it operated for fifteen years.

Swent: Was this the Dawn?

McQuiston: Dawn. Just shut down. I negotiated the contract with the Grand Junction manager, which I decided later was a little unfair because with all my--although it had been three or four years since I was in AEC--I knew all the ins and outs and I beat him down so much on the--or beat him up so much on the price, that after we were in operation we reduced the price at our own will, because I had done the same with Anaconda once. We gave them a big price to get involved of some fifteen dollars, and then when they were in operation their costs were around eight, so we settled on ten. We did the same at Dawn; I couldn't face that twelve-dollar-a-pound price that we had when our costs were around seven or eight dollars. So we reduced the price.

We built the mill; it was a small one. But high-grade ore. The mine was on an Indian Reservation. I had had one experience of building a plant that was down in the Shiprock area of taking an old helium plant--they had helium plants, the government built them during the war, for extraction of helium that they used in the aircraft. So there was good building there. I was a little trepiditious because it was on Indian ground and that meant you had to hire 85 percent Indians. We were pressured by the U.S. Bureau of Mines who had the plant to use this plant, make some good out of it, because it was shut down--the building--good buildings there. Well, we got involved in a Navajo Indian tribe and that was a disaster.

So when it came to building this Dawn plant, the mine was on the reservation where we were locked in with Indian miners. But I built the plant two hundred feet away from the line of the reservation. I ran into a lot of static from the Bureau of Indian Affairs, but anyway, I wasn't going to have a lot of Indians not working and on the payroll. So.

Swent: But you did have to use Indian miners.

McQuiston: Yes.

Swent: Did they work out all right?

McQuiston: Well, it was an open pit mine, and didn't take so many--yes, they did. They did.

Swent: I wondered if you would be interested in commenting on

Swent: Searls' resignation from the AEC. He was on your advisory board, but then later he was hired as deputy director of the Defense Mobilization Board, and soon resigned under fire. Do you want to comment on that? Charles Wilson said he had not resigned under fire. But Representative Clair Engle of California demanded that Mr. Searls either resign or be dismissed.

McQuiston: Oh, I remember that Clair Engle. He didn't like me any better than he did Fred Searls. That was the worst experience I had in Washington, was attending these senate hearings. We would have what we called a dry run the day before the meeting and we would have more attorneys than Jesse Johnson or John Gustafson, and myself. We had to go up and maybe it was the officer in charge of disbursements or something like that, but oh, they would just try to be nasty and try to get you upset.

Jesse Johnson's very good friend, whom he knew when he was in the state of Washington, where he practiced mining, was Henry Jackson. You know, one of the outstanding senators, Scoop Jackson. We developed a friendship through Jesse Johnson. And if it wasn't for Scoop Jackson getting him off my back in some of these hearings because I had somewhat of a short fuse when they would question my integrity or why did I do this, why did I do that. So we were taught to say, "At the time of this thoughtful decision it was the considered opinion of myself that that was the course to follow." Then that would stop them. See, you couldn't say anything more. You didn't hide behind the fifth amendment, but that would always stop them.

Swent: What led to the resignation of Searls?

McQuiston: Oh, he was the most patriotic man I ever knew of in my life.

Swent: Did he continue on the AEC advisory board?

McQuiston: Well, that sort of disbanded because we were finding so much uranium on the Colorado Plateau, where the board said there wouldn't be any. We had all kinds of uranium.

Swent: So they did themselves out of their advisory board?

McQuiston: We kept them anyway. Fred Searls, probably the most patriotic man I have ever known, always served in some official capacity in Washington, D.C. if it was to the

McQuiston: advantage of the government. During the Korean conflict what was he?

Swent: He was assistant to the Defense Mobilization Director, Charles Wilson.

McQuiston: Oh, that was Wilson from General Motors. Charles Wilson of General Motors, who was a friend of Fred Searls, asked him to go to Washington whenever he could and serve on this general mobilization board. It was Charlie Wilson, as he was known to his friends. Some of the commentators and some of the men that he had not bowed to at certain occasions in the government were anti-Fred Searls, because he did not tolerate a lot of small and petty happenings but was always trying to solve the big problems and get on with what was best for the United States in war time. He seemed to have a falling out with Clair Engle, a congressman from California, who seemed to have it in for Fred Searls. As so often happens in Washington, the jealousies are rather unfortunate. So Fred Searls decided he did not want to go through an investigation, if such was in the minds of some of his opponents. So he resigned in about April, 1951.

In early 1952 he called me to New York and told me all this experience, and sort of threatening exposure to something that didn't necessarily happen to be true, but that was the way Washington did business. Bobby Kennedy was one of those who mentioned Fred Searls, how could he be a loyal government employee and still run Newmont Mining Corporation. And how much of an overlap there was of an advantage to his company that he helped form. And they did not believe that he should be serving two masters.

Fred Searls told me that he had resigned but the affairs had not been settled, and he said, "They're going to eventually find out that you're deputy director of a government agency and still have Newmont connections." So he said, "You should either make up your mind within the next few weeks to stay with AEC or to return to Newmont. I would like to have you come to Newmont and we have the slot picked for you, and that is to take a very active part in the African operation because of your extremely fine information on South Africa. You would be reporting to Henry Dewitt Smith."

So this was a decision that I had to make. John Gustafson served his two years that he and I both went to

McQuiston: Washington to do, and then he left Washington, but did not return to Newmont, but went to M.A. Hanna in a very fine position. From M.A. Hanna he later went to Homestake where he became chairman, chief executive officer, and, I guess, president.

Swent: Later chairman of the board.

McQuiston: Yes, chairman of the board. After John Gustafson left, Jesse Johnson, with the commissioner, had me appointed deputy director of the Raw Materials Division, the job that he had been in under the administration of John Gustafson. I was very pleased to be recognized as such, and decided that I would stay for another two years, because I was so interested in the South African venture that I wanted to see these plants come to fruition. After talking with Fred Searls, my decision was made to return to Newmont and not stay within a government agency, as I felt that I had contributed as much as I could do in that length of time.

Swent: So you moved, then, up to New York with Newmont?

McQuiston: Yes.

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McQuiston: It was agreed that I would return to Newmont and the New York office, which, by the way, at that time, was located at 14 Wall Street. I was told that I would report to Henry Dewitt Smith, one of the foremost mining engineers in the world. Henry was in charge of all African operations and he assured me that he wanted me to continue with the mines that Newmont had at O'okiep Copper Company and Tsumeb Corporation in Southwest Africa.

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VI NEWMONT IN AFRICA

Swent: In 1952, I believe, you left AEC and decided to go back with Newmont.

McQuiston: Yes. Before leaving South Africa, in connection with the Atomic Energy Commission a state dinner was held for the

McQuiston: three negotiators from the United States and the three British counterparts. I was seated next to Sir Ernest Oppenheimer who, in making table conversation, asked what my profession was outside of the Atomic Energy Commission work. I said I was formerly employed by Newmont Mining Corporation of New York City and intended to go back to Newmont. "Well," he said, "that's very interesting. Because you probably do not know it, but Anglo-American and Newmont were partners in Northern Rhodesia on what we thought was a good enterprise." This was in the middle 1920s and Dewitt Smith and Fred Searls got intensely interested in the Northern Rhodesian copper mines, and it seemed there was a good possibility for an international cooperation between Anglo and Newmont. In 1925 a company was formed called Rhodesian-Anglo-American. It did not amount to too much, because there was a conflict of interest between the American mining manager who was sent down to assist in operations, and such a scheme very seldom works out. There has to be one man in charge and in this case there was cooperative management.

Swent: Who was the American that was sent?

McQuiston: George Monroe, who was a noted mining engineer in the United States, but it just didn't work out. Also, one of the mines they picked was the Bwana Makuba, which was an oxide copper deposit, very rich, but in oxide. It is strange that the man mentioned previously in connection with Akjoujt, who developed a method of recovering copper or other metals from base metals by a roasting procedure he had developed--he was called in. Although he was a Frenchman, he was stationed in Elizabethville doing research work on the Belgian Congo Mine. So he did some research on the Bwana Makuba, but it was decided it was not a viable mining venture.

Sir Ernest Oppenheimer said to me, "We had some good associations with Newmont and we respect them as an international mining company, but it seemed to be a good thing for two big companies to split up, and we have done very well without the assistance of Newmont." Very pointedly he said that.

Swent: Were you replaced on the AEC? Or was that sort of the end of the venture?

McQuiston: No, the Raw Materials Division continued as an entity of the Atomic Energy Commission for several years.

Swent: Of course, by then there was plenty of material, wasn't there?

McQuiston: We had many places to look; particularly here in the United States, we had really some tremendous potential uranium reserves in rather large mines. So there was no great problem about the source of supply.

Swent: So it appears you were in on the really exciting period.

McQuiston: I was granted clearance for a Newmont safe where I could still receive certain documents from Washington by courier and would make my comments and return the secret material, or top secret, whatever the classification was. So I maintained this connection for a year after leaving Washington, D.C., because I could not just abruptly depart the part I was playing in the Raw Materials Division.

During my last visit to South Africa in the capacity of deputy director of the Division of Raw Materials, Henry Dewitt Smith, who was to be my superior when I returned to Newmont, was in charge of all African operations. And he suggested that while I was there, if I could take a leave of absence from AEC, he would have a plane at my disposal to visit O'okiep Copper Company and Tsumeb Corporation. The two companies mentioned had a Beechcraft plane stationed in Cape Town, where they had their own pilot and maintenance facilities. The Beechcraft called for me at the Jan Smuts airport in Johannesburg and I started on a very interesting trip to view the two Newmont operations, with which I presumed I would be closely associated for many years.

O'Okiep

McQuiston: Our first visit was to O'okiep. O'okiep Copper Company started mining in 1852. It was located 500 miles due north of Cape Town and forty miles south of the Orange River. The mine had--when discovered--enormously rich copper ore running 10, 20, and as high as 30 percent copper. At that early date there was no way of recovering the copper from the ores so they were shipped by boat from a little village on the Atlantic Ocean eighty miles from O'okiep called Port Nolloth. O'okiep had built a thirty-inch railroad to haul the copper ores to the seaside, where they were shipped then to Swansea,

McQuiston: Wales, an old copper smelter of two or three hundred years of age.

Swent: They didn't concentrate them at all in Africa?

McQuiston: No.

Swent: Just shipped the raw ore?

McQuiston: Yes.

Swent: They were not oxides?

McQuiston: Some of it, yes. Oxide smelted better than the sulfide. But the high grade ore shipped averaged about 25 percent copper. In the more modern years of the 1920s Augustus Locke, the author of Leached Outcrops, a reference book found in all mining engineers' libraries, had examined the area and was convinced that there could be a worthwhile copper mine in this area. He interested American Metal Company, who in turn interested Newmont, and between the two, in 1928, formed the South Africa Copper Company. In 1937, O'okiep Copper Company was formed with Henry Dewitt Smith as the president. At an early date they sank two shafts, one at NababEEP and the other one at O'okiep. These were separate towns about five to six miles apart.

In the middle 1940s Newmont, who had then acquired fifty-seven and a half percent of the O'okiep stock, decided that it would be a very viable, fairly large scale mining operation. There were numerous ore deposits within a radius of twenty miles, but no one large one. A thousand-foot shaft seemed to be as deep as most of the ore bodies were worked and two mills were built, one at O'okiep and the other at NababEEP. There was a smelter also built to smelt the concentrates and extremely high-grade ore from small deposits. For the production of blister copper, which in turn was sent by this makeshift railroad to Carteret, New Jersey, which was the smelter of their companion company, American Metal Company.

Swent: Did they continue mining through the war in Africa?

McQuiston: Yes. The staff at O'okiep comprised the managing director Marcus Banghart; general manager David Smith, who was a Rhodesian by birth, educated at Witwatersrand Mining University; the mine superintendent was a Britisher from the

- McQuiston: Royal School of Mines; the mill superintendent was a Canadian; the chief metallurgist was a New Zealander; the superintendent of mechanical division was a South African; the chief geologist was originally from Rhodesia but had South African citizenship.
- Swent: International group! What was Banghart?
- McQuiston: American. This inaugural trip afforded me an opportunity to get to know the operating staff, as well as to become familiar with the mines, mills, and the smelter.
- Swent: Was there a road there also? You mentioned a plane and the boat and the train.
- McQuiston: A road five hundred miles north from Cape Town.
- Swent: So there was a highway connecting also.
- McQuiston: Yes. South of O'okiep was a national railroad operated by the South African government, and as trucks were developed for the haulage of the blister copper to this railroad terminal about forty miles south of O'okiep, the thirty-inch-gauge railroad to Port Nolloth was dismantled.
- Swent: Tell us some of your personal feelings about it.
- McQuiston: My next visits to O'okiep were in the capacity of the chief metallurgist of Newmont Mining Corporation. My function was to not directly manage, but to assist the manager in his direction of the metallurgical aspects of the mine such as the smelter and the two mills. During this period a third mine was developed called Carolusberg, which was a large ore body, but deep underground. We built a two-thousand-ton mill, which was larger than either the O'okiep or NababEEP mills. All housing was at NababEEP and O'okiep, because we established immediately a good road system of paved roads connecting the various operations. We had several other ore bodies being worked at the time: a small open pit mine and another one that was operated, strangely as it may seem, by a tunnel. The chief geologist on the property was a very able man. He was assisted by E.N. Pennebaker, a noted American geologist, who graduated from the University of California, and had taught me mineralogy when I was a freshman. He was a world-renowned geologist and served for many years as a consultant to O'okiep and later to Tsumeb.

Swent: Was there also a mining person who came--your counterpart, say, in mining?

McQuiston: No. Because Banghart was a mining engineer, Dave Pearce was a mining engineer. Then we had this Britisher from Royal School of Mines, so it was not necessary; they had lots of mining talent. But the metallurgical talent seemed to be somewhat missing. Mainly because of the mill superintendent who had been there a long time, a Canadian, but was sort of on the ornery side, and combined with heavy drinking, why, he desperately needed help. But he was very capable when sober and in the right mood. Younger men we brought from American universities, who were originally South African born, and graduate students from Witwatersrand or Pretoria or Stellenbosch Universities. And sent them to the University of Arizona on scholarships whereby they would have two years of intense metallurgical studies. If the occasion justified we even sent their wives with them.

Swent: How did you happen to select the University of Arizona?

McQuiston: Because of its noted metallurgical department.

Swent: Who was teaching metallurgy there at that time?

McQuiston: Dr. Thomas Chapman.

Swent: Of course, copper was the thing there, wasn't it?

McQuiston: Right. They had a very fine School of Mines at the University of Arizona, because it was supported with large gifts from the Phelps Dodge Corporation. It was almost called the Phelps Dodge School of Mines.

Swent: Was drinking a problem in these places?

McQuiston: Yes, I would say it was. I might add at this point that O'okiep was located in the heartland of the Namaqualand Desert, which was very arid and water was a continuous source of problems. At the mines, if they made any water at all, it was very carefully saved, accumulated, and sent to the mill, which mostly needed a supply of water. The tailings that were discharged with the water--it was amazing the scheme developed by the mill superintendent for having a very small pool area because of the high evaporation. With the small pool area, although the water was a little slimy at times, it sufficed for milling operations.

Swent: Did you recycle the water?

McQuiston: We would recycle the water, except what was lost by evaporation. Our main water supply was from the Spectacle River, twenty miles away, and a thousand feet lower in elevation.

Swent: Oh! What a problem!

McQuiston: So a pipeline was built and water was pumped in stages for the main water supply for the mills. A very interesting feature developed by bringing in the Forest Service Department, men of the South African government; they recommended the cutting of all these beautiful trees lining the river banks. Then it was a dry river, meaning that the water flowed underground, where we could pump from. Except in flood stages there was no water on the surface.

Each tree--we never cut any less than a foot, and some of them up to two feet in diameter--was proved to evaporate five gallons of water per tree each day. So we cut these trees, using the timber for barbecues, and a little for the natives to use for heating in the winter. Nothing was ever discarded, because we were too isolated for bringing in materials. The water supply increased five gallons per tree, and we cut two hundred trees, so that gave us a very good additional water supply.

Swent: Was this water supply also for your town site?

McQuiston: Oh, yes. Very restricted.

Swent: This beautiful table, is this from O'okiep?

McQuiston: That's Tsumeb. The facilities developed by the company at the O'okiep and Nababeep Mines were quite sufficient. We had a good hospital, with a good doctor, and a superior superintendent, and then, of course, the regular staff. But he was quite capable of tending to minor operations, and most illnesses which occurred. We had clubhouses at either place. We had a golf course, nine-hole golf course. Of course, without any water, we had sand-oiled greens, which was quite an experience to putt on.

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McQuiston: We had four thousand to five thousand employees--or people living in these two villages, not all of them employees. The Namaqualand Desert was the home of the Cape Colored. They were a race within themselves. They had mingled, like the Cajun Coloreds in Louisiana. They were light skinned, not dark skinned, not Negro, and some of them were quite handsome people. But they were very unhealthy; tuberculosis was rampant in this area. They did not inherit stamina. But they were a very intelligent race; many of them went on to hold good positions in machine shops and truck repair shops, most functions by a mechanic--speaking in terms of a mechanic being like a carpenter, we call them all mechanics--well, they were very, very adept at their work. And good citizens.

Our black African labor came from Basutoland, and, at their own free will, would make the trek of two hundred miles to O'okiep, looking for work, as we have customarily done in the United States. They never caused trouble, except an occasional fight, which you would expect. But they were very able workmen, and we did not have any racial problems, because they were not mixed with other tribes who have a natural hatred for each other.

My function was to assist on the design of the new Carolusberg Mill, try to improve the metallurgy on the operating mills, and reconstruct the smelter, which had been built by a man named George Kervin, who came from Mason Valley, Nevada, to build this smelter. He did a fine job with very little money in building the facilities. We converted the smelter to powdered coal, and made many, many improvements, and increased the capacity to one hundred tons of blister copper per day. It might be mentioned that O'okiep Copper Company had the lowest cost copper production in the world for many years.

Swent: A credit to its metallurgist.

McQuiston: Well--mostly others. Oh, as a sort of a sideline we had a concession on a diamond field down near the mouth of the Spectacle River where it entered the Atlantic Ocean. We produced a few diamonds but were not skilled in the finding of the diamonds and recovery. It became a burden rather than a profitable operation, so we re-leased this diamond field--in which many diamonds were produced by those who were familiar with the art of finding and producing. We made other attempts to enter diamond mining, but unsuccessfully.

McQuiston: One rather interesting aspect was that the west coast of South Africa is probably one of the roughest seashores in existence. It was not unusual to have thirty-foot waves. It was a sandy beach, and it is along this beach where the fabulous diamond field of De Beers is located, at the mouth of the Orange River. That is their most stable production of gem diamonds in the world.

Some glib person talked Newmont--meaning O'okiep and our South African venture--into building a type of vessel that they believed would withstand the thirty-foot waves and could dredge along the shore where we knew the diamonds had to be located, because they were within a few hundred yards of there, the great diamond fields of Namaqualand and the Orange River mouth. So this vessel was built in Cape Town, sturdy as all engineering could conceive, and could dredge to a hundred feet in depth. The first trial run of this vessel made us quite optimistic. On the actual test run, the vessel was sunk trying to get it into place for mining, and all hands were lost, fourteen men. A very good friend of mine, who volunteered to be the mechanical engineer of this vessel, from Tsumeb, was one of those lost. That ended our diamond search along the coast.

Swent: Was it wrecked by the heavy seas?

McQuiston: Yes. The seas came up, and that ended the vessel. But there is no question that's one of the greatest diamond sources in the world. A submarine type or underwater type will not achieve what is required because of the undertow and the extreme thirty-foot waves. When I say thirty-foot, they're from twenty feet to forty feet high, averaging thirty feet.

I continued going to O'okiep from this first visit in 1952 to 1967. I visited the operations down there at least twice a year.

Swent: That's a lot of travelling back and forth.

McQuiston: It was interesting to see the type of operations that I saw in 1952 improved to where they were modern and low-cost producers in 1967, and '68 and '69.

One afterthought which I would rather forget, is that one of the officers of Newmont who used to visit Grass Valley when I was a young engineer there, and whom I got to know when I was associated with the New York office, although

McQuiston: living in Washington, D.C., promised to let me know when the O'okiep stock came on the market. It came on the market in 1943 at \$5 per share. Within a few years it was \$154 a share.

Unfortunately I had no funds available at that time to invest in O'okiep Copper Company. It's back down now to about \$5. You know, I could have gone to the bank and borrowed a thousand dollars, but I just didn't do it at that time.

Swent: You didn't think about it.

Tsumeb

McQuiston: This is the story of the Tsumeb Mine, one of the great base metal producers the world has ever known. Tsumeb is located about nine hundred miles north of O'okiep by an awful road which would place it fifteen hundred miles north and somewhat east of Cape Town. It is bounded on the east by the Kalahari desert, on the south by the Namibia desert, and then, from there to the Atlantic Ocean, by the Nabeep desert. The natives in the area are principally Herrero and Ovambo. The Ovambo Reservation is about forty miles north of Tsumeb on the international line with Angola. So the Angolan border was about fifty miles north of Tsumeb.

Swent: So on the west coast?

McQuiston: On the west area. The country of Germany annexed Southwest Africa in 1884, and it was under German rule from this date until General Jan Smuts was mandated, through the League of Nations, custodian of Southwest Africa. The word Tsumeb means, in native dialect, a green slope. The green slope had nothing to do with grass, or trees, or any shrubs, but was the outcrop of this fabulous ore deposit, which was green from the copper present in the outcrop. The outcrop was described as a huge fifty-foot-diameter copper silicate protrusion, very rich in silicates and also in sulfides. Cutting through this outcrop of copper was a four-foot-wide band of solid galena.

Swent: It must have been awfully pretty.

McQuiston: Oh! The mining of this deposit dates back two or three hundred years, when the local natives would heat the copper with charcoal and make spearheads, or pots, or pans, or whatever there was needed. In 1885 a trader and an elephant hunter were awarded a concession on this outcrop. However, shortly after that, the Germans came in and waived the concession as not being valid and took over the mine themselves. In 1906 a German company built a railroad from Tsumeb to Swakopmund, which was on the Atlantic coast. They did not build a railroad to Walvis Bay, where the Tsumeb now has large shipping terminals. Because the British were noted for their astuteness when occupying a new land, they immediately selected a place with a harbor for the landing of their troops and for the use of their naval ships. So they had located an enclave at Walvis Bay, which to this day remains under the British flag. See, they're smart.

Swent: They are, to protect their shipping.

McQuiston: Yes. The original way of treating these ores was with gravity jigs and shaking tables, and blast furnaces, of which they had three. This method of treatment was very inefficient, but the ore was of such high grade that it was still a very profitable operation. In 1927, Arthur Storke, who was a famed mining engineer working for Selection Trust of England, visited the property. Because of the word leaking of such high-grade ores, he became quite enamored with this Tsumeb location.

Arthur Storke was one of the foremost mining engineers in the United States, having had the foresight to pick Climax Molybdenum as a famous potential mine. Secondly, he was very interested in the large open pit mines of Kennecott and became chairman of the board of Kennecott. It was unfortunate in the 1950s that Arthur Storke, B.C. Standard, and several other executives of the Kennecott Copper Company were killed in a plane crash.

Swent: It was up in Canada, wasn't it?

McQuiston: Yes.

Swent: It was a lesson to a lot of other companies.

McQuiston: Yes, it was. Storke was outstanding, and so was B.C. Standard, whom I knew fairly well. Arthur Storke suggested to Selection Trust that they invite Newmont to send a man down.

McQuiston: Duggleby, a geologist for Newmont, was available, and he was sent to Africa and to the Tsumeb Mine, and came back with glowing stories. Did I mention Duggleby being murdered in the Philippines?

Swent: No. Please tell me about him.

McQuiston: Duggleby was a devoted Newmont employee, and to enlarge upon his career, he enlisted in the army with Fred Searls and Billy Simkins in the First World War. They served together in the Engineers Corps overseas. Duggleby left Newmont and went to the Philippine Islands after the war. Then in 1942 he became a prisoner of war of the Japanese and was interned in Santo Tomas, which was the big university in Manila that they converted into a prison camp. In order to save a friend of his who had been selected for execution, Duggleby took the blame of smuggling food into the camp for the starving Americans and was caught and was told to dig a trench in which he was shot into the trench and executed that way. But he had reported very favorably on the Tsumeb mine.

Shortly after that Dewitt Smith, Marcus Banghart, E.N. Pennebaker, and two other engineers drove the nine hundred miles from O'okiep to Tsumeb to personally look over the property, which had been closed because of German ownership and their exodus from the government of Southwest Africa. With them was an outstanding South African German geologist Sohnge. They spent several days on the Tsumeb property and became aware that the method of concentrating the ores was so inefficient, only the high-grade copper ores were smelted in two blast furnaces. The high-grade lead ores were smelted in one blast furnace, which was an old known method of recovering metals.

Swent: It's really ancient, isn't it?

McQuiston: Yes. The investigation showed that there was as much as 500,000 tons of ore which had been sorted by the German management and discarded, as there was no feasible way of treating these ores. Five hundred thousand tons which had a content of 2 percent copper, 7 percent lead, and 9 percent zinc.

These dumps had been there for years. And they then uncovered, after moving the vegetation, a second dump of 670,000 tons.

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Swent: So these were dumps already mined and there.

McQuiston: Dumps with a content of over 25 percent metal, richer than most ores being mined at this time.

Because the country of Southwest Africa was called alien holdings confiscated by the South African government, and reassigned to the South African government as a mandate through the League of Nations, the South African government, representing the League of Nations, put the Tsumeb property up for bid, for sale. On the first bid, Newmont came in with a million pounds, and five other bidders were lower. The government was so disappointed that they threw all bids out and said, "We'll have a second bid."

The second bid by Newmont was for 1,010,000 pounds, which was \$4,040,000. Anglo-American and other South African companies could not understand this high bid for a mine for which they had no source of information of what was underground. But the astute farsightedness of Henry Dewitt Smith and Banghart moved in some engineers from Newmont, from New York, and built a small jig plant to jig the fines. The coarse ore was hand-sorted by many Ovambo women, who did a better job than the men. Hand-sorted by the Ovambos that they had working there, and some Herreros.

The shipment of these sorted and jigged ores netted \$7 million which was \$3 million more than they paid for the property. They hadn't even attempted mine production.

The next step was to use the \$7 million--\$4 million paid back the original amount put up, and the next \$3 million was used to build a small mill. It was during the end of the wartime and South Africa was not adept at making large-diameter mills so they had to use several small mills. And put in a flotation plant--without a building, and they put in a few crushers and these small ball mills and moved in a crew of capable engineers. The shipments in the first year netted over \$10 million.

Swent: That was really remarkable in the history of mining.

McQuiston: So that everything was paid for except the original advancement, which was later returned.

- Swent: Were they shipping the concentrates back to New Jersey all the time?
- McQuiston: No, the zinc was shipped to Amarillo, Texas; the copper to Carteret, New Jersey; and the lead to Hoboken, Belgium.
- Swent: So when you came on the scene were the mills already going?
- McQuiston: There was this makeshift mill there, yes. They sank the shaft and the mine was being reconditioned. Of course, the upper levels had been worked at a very unsatisfactory method in the old days. So the new mine was developed and the new mill was in the offing. I participated in the design and engineering, after I returned to Newmont. The profits from Tsumeb were the greatest--as far as records go--the greatest out of any mine in existence at that time. I believe, at a later date, the ore produced in the Mt. Isa Mine in Australia would have been higher grade. But these ores were just fabulous, you couldn't believe the metal content in the ore. Tsumeb Mine is operating today, whereas the O'okiep Mine is practically shut down.

But the metallurgy of the Tsumeb ores was probably the most difficult in the world because of the intergrowth of the copper, lead, and zinc, and the extent of the mineralization where there were 128 different minerals identified, of which some forty-five were from the copper-lead-zinc-germanium family. The separation into individual metals, such as copper, lead, and zinc, was of vital importance to get the maximum return. The zinc in the lead concentrate could be charged against the smelting rate as an undesirable element. You got paid a small amount for lead in copper, and copper in lead, but not very much, so the object was to make a good separation if possible.

We built two pilot plants; one to speed up the development of the metallurgy. These two pilot plants operated twenty-four hours a day, where we could try different reagents without upsetting the two-thousand-ton or three-thousand-ton plant. We had a very fine test laboratory, research laboratory, with a capable crew. Then we had the two pilot plants, and then we had the operating mill. As soon as we had something that looked feasible and profitable, we would put that from the pilot plant into one of the circuits of the two-thousand-ton unit or the three-thousand-ton unit.

McQuiston: Another interesting aspect, we had a mineralogist with two helpers; one was his daughter, by the way, who was a very fine mineralogist doing microscopic work. They came up with an unknown mineral which they could not identify. They suspected that it was a new mineral. So they sent samples to me in New York, and I sent them on to UCLA [University of California at Los Angeles] where they had a good mineralogist to identify certain types of minerals. He said, "It's a rare mineral, all right, but not unknown." It was renierite, which was a mineral of germanium. He was broken hearted because I had agreed to name the mineral after him, as "geigerite"; his name was Geiger. But he took it good-naturedly.

The content of germanium increased as the ores were mined deeper. At that time the discovery of transistors came forth. This was about the 1950s. The first development of transistors by the Bell Laboratory of the American Tel & Tel [Telephone and Telegraph]. So with a sufficient quantity of renierite, we had the ore, and we developed a method of recovering it. Because one form of the renierite was magnetic, we developed a magnetic method of recovery. I, through the influence of Newmont, got an appointment with Dr. William Shockley, who developed the transistor. At that time the transistors were made out of germanium. So I wanted to know the potential of germanium, because we were willing to spend several million dollars on a plant for the recovery of germanium.

Also, I soon uncovered that my friends the Belgians, some of whom I had known down at the Shinkolobwe Mine, were also at the Lubimbashe smelter in the eastern part of the Congo, and were developing quite a plant for the recovery of germanium. So I thought it would be better to cooperate than to compete. I went to Belgium and talked to my friends; some of those that I had met in the Belgian Congo were now senior executives in Brussels. So I soon made very fine contacts. They agreed that if we could produce a germanium concentrate, which had never been done before in history, they could refine it for us. They would sell it, and then we would share the profits. The only other source of germanium was from Eagle-Picher Mining Company in Missouri, where a little bit of germanium occurred in the zinc concentrates. But that was their source of germanium, not of any concern to us.

We went ahead and built a plant after agreement with the Belgians in that we had a full, complete method of sending

McQuiston: them a concentrate which went, I believe, 20 percent germanium. We had an agreement drawn up whereby we would be partners in the treatments of these concentrates, the refining, and the sales. So this plant operated at a very profitable margin for, probably, four or five years. Then as research developed on the transistor, they finally switched to silicon. It was a more stable element than germanium. So eventually this very fine plant of which we were so greatly proud was dismantled and shut down.

Swent: Do they use germanium for anything at all now?

McQuiston: Yes. It's coming back a little bit. But we would never go into it again.

Swent: Were you living in New York all of this time?

McQuiston: Yes. But I was gone 65 percent of my time.

Swent: Jet planes must have been a boon to you.

McQuiston: Oh, I should say they were!

Swent: Traveling back and forth to Africa must have been very arduous.

McQuiston: Oh, I would usually break it by staying in Amsterdam or Brussels, although I didn't like the Belgian airline too well. I would sometimes stop over on my trips--many times not. But I was pretty hardy then.

Swent: How did you get to Tsumeb?

McQuiston: Well, that's a good question.

We in management decided that a plane stationed in Cape Town was not the most convenient location. So we moved the eight-place Beechcraft to Tsumeb and also a Cessna 260, we moved that to Tsumeb, because Tsumeb was really more isolated--by far--than O'okiep. O'okiep was available on the mail plane every day. Or driving, there's a paved road only five hundred miles. Tsumeb was just--there was no mail plane, except their own, or come in by train.

Swent: There was a train?

McQuiston: Oh, yes. I mentioned the Germans built a railroad from

McQuiston: Tsumeb to Swakopmund. Then the South African government extended that railroad from the very lovely town of Windhoek, which has an international airport, takes the flights from Europe into there, and is a lovely town. The railroad goes through there. See, our railroad from Tsumeb went to Walvis Bay, not to Swakopmund. Walvis Bay, where we had good port facilities.

Swent: So you would fly to Windhoek and then--

McQuiston: So we based the two planes at Tsumeb where we had a very experienced pilot who was from the Dutch air force of Indonesia, and his wife and child. They lived in Tsumeb. We had a first-class mechanic to do our own repair work. In the meantime we had opened up a second mine which was about thirty miles or a good hour's drive from Tsumeb. We could go over there in fifteen minutes in the Cessna.

Swent: So you took commercial planes into Windhoek?

McQuiston: Yes. At the last you could fly direct there from London or Madrid, or any place like that. Tsumeb developed into such a fabulous profitable mine, except for the high smelting rates of the copper and lead. So it was decided to build our own smelters. Having had experience with American Smelting & Refining Company, where I worked all during my college period, I was given the task of building these smelters, which cost several millions of dollars at Tsumeb. I was given the task of designing and operating smelting facilities at Tsumeb.

First, we had high arsenic, which had to be eliminated. Then we built a lead smelter, because lead was the predominant mineral. The deeper the mine went, the lower the copper went and the higher the zinc. We could do nothing with the zinc but ship it. But we could make a very fine high-grade product. This was a very interesting experience occupying the better part of a year in designing the equipment and getting the design of equipment. I got the know-how of a sinter plant, which was necessary for treatment of all lead ores before the blast furnace. I got the sinter plant design from a new type of updraft operation from Australia. They furnished the design--it was RTZ [Rio Tinto Zinc] which had taken over a company who had developed this new process. They sent engineers to the United States to work with a manufacturing company in Pittsburgh to build this machine, which was then shipped down in parts to Tsumeb and

McQuiston: reassembled.

We had a copper smelter at Tsumeb, built after the O'okiep design which was very cheap and simple to operate. But we had so much lead at Tsumeb at that time, that was the main function. So we built a lead plant and a very fine silver refinery to accompany the lead plant. I was disappointed to find, on one of my trips, that they had shut down the silver plant because of theft of the silver by the natives working there. There was just no way--we couldn't have guards that were honest; they would steal with the workmen, and so they finally shut it down. We put the copper in the lead. Well, we got a good pay, but not as good as if we had sold it as silver.

Swent: You kept the silver in together with the--

McQuiston: With the copper. And just shipped it that way. They couldn't get to it then. But the staffing of this very intricate smelting operation was quite a chore. I went to all the main areas in France, Belgium, Sweden, England. I didn't go to Australia because they promised to send men who would start the sinter plant. But when we finally assembled a final crew, we had eight nationalities of workmen. Some of them didn't get along well together, but we had excellent housing. Tsumeb was a beautiful camp; it was high enough in elevation. We had lots and lots of water, so the gardens could be maintained and beautiful.

It was quite a sufficient camp in that, although it was a horrible mistake, we planted ten thousand eucalyptus trees to use small eucalyptus trees, seedlings, for mine props underground. They were the wrong kind of eucalyptus. They grew well, but when we put them underground they snapped just like matches. So we had to dig them all up, dig these ten thousand trees up, and replant them with expert advice, instead of the mine manager deciding what kind of trees to plant. We got the forest service of South Africa to advise us. They suggested that we plant the type of the eucalyptus that were growing in Tsumeb which were indigenous to the climate and the rainfall and the country.

Oh, we had a cattle ranch of seven thousand cattle, we raised vegetables; and no fruits, but vegetables we supplied the whole community. It's quite self-sufficient. Beautiful area. And a lovely guesthouse to stay in. So I didn't mind my trips there.

Swent: You personally recruited these people?

McQuiston: Yes, I personally recruited these people. I ran ads for one month in the London newspapers.

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McQuiston: Then I went to London and had an interview per man per day. I finally selected eight from London, who were young, very young men. Then we would send them around for training. But they did have a background in either pyro-metallurgy or had worked at--there were several big smelting plants in England that we could send them to and draw upon there. Then I, of course, had several Americans.

Swent: Did they have their families with them?

McQuiston: Oh, yes. The pay included complete transportation of the families and a nice home ready for them, furnished.

Swent: Was this a critical decision?

McQuiston: Oh, yes. But it worked out very well. The smelters are still operating; Tsumeb is still operating. O'okiep isn't. Just on sort of a partial basis.

Swent: That must have been a lovely time. What was the next step then?

McQuiston: Yes, I enjoyed Tsumeb as much as I have any place I've ever been. We had a very fine operating staff, most cooperative.

Swent: You were also overseeing other Newmont properties though, at the same time, weren't you?

McQuiston: Oh, yes.

Swent: In the States?

McQuiston: Yes.

Swent: When did the South American venture begin? That was later, I guess. You became vice president of Newmont in '64.

McQuiston: I guess I did, yes.

Swent: That's what it says, anyway. So that changed your route

Swent: a little bit?

McQuiston: No, it just made me a little more potent in issuing decisions.

Swent: Now Fred Searls died in '62, I think.

McQuiston: I have to look it up.

Swent: Was he still chief executive when he died, or had he retired before that?

McQuiston: He was still chief executive.

Swent: He was replaced by--

McQuiston: Plato Malozemoff.

Swent: You haven't mentioned him. Did you have much contact with him through the years?

McQuiston: I went to school with him. Yes. But, see, Newmont has always been classified--you know how a personnel chart goes horizontally from the chief executive officer and chairman of the board on down to the president, unless he's that too. Then you have your vice presidents, and then you have your managers, and then you have your consultants, and on down the line. Newmont was always recognized as a vertical organized company. Because when Colonel Thompson organized Newmont he got the finest talent that was available. Such as Henry Dewitt Smith, Henry McNab, Fred Searls, Henry Krumb, and all these men were capable of being the president of any company, any mining company in the United States. So you couldn't select one man from the other. Fred Searls seemed to be there first. And he was so agreeable that he was made president. But the rest of the men, although they were vice presidents, they would take a company and run it. They didn't report to Fred Searls or anybody; they had to keep me informed, they didn't tell Colonel Thompson, they would keep me informed. But that was their division.

McNab had Magma Copper Company; he ran that lock, stock and barrel. Henry Dewitt Smith had the African properties. Phil Kraft, another man, had the domestic properties, but see, they were vertical.

Swent: Oh, I see. So did you have anything to do with Magma?

McQuiston: No, I had too many other irons in the fire. Although we've enlarged upon O'okiep and Tsumeb, during this same period of fifteen years, I designed and built the Dawn Uranium Camp on the Spokane Indian Reservation.

Swent: You mentioned that last time, yes.

McQuiston: Yes. Then there was the Telluride plant that came in, that I had to go out there and spend my time and design. The plant was there, but we needed new equipment in certain areas, and rearrangements. It's a beautiful big building, but we had to have a complete revision to make it efficient.

Swent: You had enormous responsibilities then.

McQuiston: Zellidja, I still looked after. Dawn. Then there was one called Western Nickel. That was where I moved the Granby Mill, one of the earliest efficient mills in Canada. I moved that mill to Western Nickel because Western Nickel was given to me, unfortunately, because it wasn't a mine that we could do much with.

Palabora

McQuiston: Also during this period was the Palabora Mining Company, one of the great mines of the world. It is now the lowest-cost copper producer in the world. It wasn't a porphyry copper, such as our big coppers here, such as Kennecott, Phelps Dodge, and Newmont have. It was carbonatite. There are carbonatite deposits in Sweden, and not many, but they have a high phosphate content. The South African government was producing a fertilizer from the apotite, which is high in phosphate. So there was an operation there.

Swent: Where was this?

McQuiston: This was about eighty miles northeast of Johannesburg. So that would place it a thousand miles with direct air flight from any of the other operations. A thousand to two thousand miles. But the Newmont geologists, particularly from O'okiep, recognized this type of deposit having a content of copper which could go to great depths. After three years of drilling, it was decided that we could make a mine out of this Palabora deposit. Our partners were Rio Tinto Zinc, RTZ

McQuiston: again, and not within my understanding is the reason why we gave them the management of this plant. Because we even furnished the men. But we made them the managers. Perhaps there was some political reason that I don't know of.

Swent: This decision was not one that you made?

McQuiston: That I had nothing to do with. So I was assigned the task of milling and smelting these ores. For the mine, of course, we brought in open-pit technicians from the United States. They ran the mine, and I designed the mill and the smelter. It was a thirty-thousand-ton-a-day mill, and the smelter to smelt the copper concentrates. It was an unusual type of ore; being in the carbonatite formation, there was a mineral called vallerite which was very soft and not readily floatable. So our metallurgical recoveries were not good. But before ever approaching a design of the final copper smelter we built a hundred-ton-a-day pilot plant that had the complete type of equipment that we would use, only on a smaller scale. I sent down a crew from the United States to run this pilot mill. That is, a senior crew, the shift bosses and all. We operated that pilot mill for about a year and decided we knew the metallurgy. In the ores was a high content of magnetite which could be recovered very readily. We worked up a deal with Japan to take these magnetite concentrates for their iron content. Very high in iron. We got the South African government to build a thirty-mile railroad to connect with the other railroad that was already in, and from there to Mozambique.

Swent: That's a port, isn't it?

McQuiston: Yes. Where we shipped the magnetite.

Swent: From there to Japan?

McQuiston: Yes. To build and design the mill and the smelter with the Canadian who was to be the managing director, because he had lived in South Africa a long time and knew the country well. We interviewed most of the large construction companies and selected Western Knapp Engineering for the design and construction of the smelter. We selected Bechtel Company for the design and construction of the thirty-thousand-ton-a-day mill. They were both in San Francisco, which made my overseeing of these plans very convenient. We invited them to the New York office and said what we had in mind was a joint venture between the two, that neither one of them were

McQuiston: capable of doing the job alone. Pointed out that clearly, in our estimation, they were not. As a joint venture, we took the best of each and we gave them half an hour to meet together to make their decision, which came in ten minutes, that they agreed to form a joint venture and undertake this operation. They did a fabulous job.

The Palabora plant only went about six-tenths of a percent copper, which was low grade, but labor costs are also a great advantage to the operations in South Africa. We built a nice township, with a hospital, nice living quarters, entertainment, golf course, tennis courts, everything to make a very convenient place to live.

It's interesting to take in the area that we felt we should have for the tailing pond particularly, which was enormous; naturally, to store several hundred million tons, we had to exchange some of our ground, the Palabora concession, with the Kruger National Park authorities, because our ground overlapped on the south. It was very essential that we have this ground, and they were very pleased to take it over. They gave them two acres for every acre. They were very pleased to take over that. So that is now the northern gate to the finest-managed game reserve and park in Africa, Kruger Park. So they join right there, we have elephants and everything wandering through every now and then. They built a big fence, but--. Palabora has turned out to be one of the great successes of copper mine development.

Swent: You had started to mention Plato Malozemoff, too, and I was just curious, he was on another branch of the company, was he?

McQuiston: No. Next time I think we can get into Carlin, Granduc, and Similkameen.

##

[Mr. McQuiston died March 17, 1987. His work at Carlin, Granduc, and Similkameen is discussed by colleagues Robert Shoemaker and J. Harvey Parliament in the following pages.]

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Western Mining in the Twentieth Century
Oral History Series

Robert S. Shoemaker

RECOLLECTIONS OF FRANK WOODS MCQUISTON, JR.

Interview Conducted by
Eleanor Swent
in 1987

Since 1954 the Regional Oral History Office has been interviewing leading participants in or well-placed witnesses to major events in the development of Northern California, the West, and the nation. Oral history is a modern research technique involving an interviewee and an informed interviewer in spontaneous conversation. The taped record is transcribed, lightly edited for continuity and clarity, and reviewed by the interviewee. The resulting manuscript is typed in final form, indexed, bound with photographs and illustrative materials, and placed in The Bancroft Library at the University of California, Berkeley, and other research collections for scholarly use. Because it is primary material, oral history is not intended to present the final, verified, or complete narrative of events. It is a spoken account, offered by the interviewee in response to questioning, and as such it is reflective, partisan, deeply involved, and irreplaceable.

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ROBERT S. SHOEMAKER

INTERVIEW HISTORY

Robert Shoemaker is a renowned metallurgist, past president of the Mining and Metallurgical Society of America, and, like Frank McQuiston, recipient of the Richards Award of AIME [American Institute of Mining, Metallurgical, and Petroleum Engineers]. After receiving B.S. and M.S. degrees at Oregon State University and an M.S. in metallurgical engineering at the University of Wisconsin, he went to work for Union Carbide Corporation. In his second year of employment, he was awarded a bonus of a year's salary for his accomplishment with the jig plant at Niagara Falls.

When he met Frank McQuiston in New York City in 1958, although they worked for different companies and were not the same age, the common interests and abilities which they shared led to the development of a bond which lasted for the rest of McQuiston's life. Shoemaker left New York to become manager of the Division of Metallurgy for Bechtel Corporation, and was in charge of constructing the mill at Carlin, Nevada for Newmont, working closely with McQuiston. Subsequently they co-authored publications for the Society of Mining Engineers and also collaborated in mining ventures as partners in AgAu Exploration, Inc. and the Tuscarora Associates. These activities are the subject of the Shoemaker interview.

I had known Jean Shoemaker through the Woman's Auxiliary of the AIME and had met Bob, her husband. When Mr. McQuiston died, I turned to Bob Shoemaker for help in completing the documentation of Frank McQuiston's career. I wrote on July 17, 1987, and the interviews took place on August 5, 1987. An unexpected bonanza was the invitation to spend the night at their beautiful home near Grass Valley, California where he now maintains his office. From a tranquil forest beside a pond, they are connected by computer, modem, and fax machine to the centers of business. Photos from around the world and a large collection of miners' lamps attest to a wide-ranging career. The house was designed for ample accomodation of their family of four children as well as grandchildren and many friends. A special feature is the solar-heated indoor swimming pool.

Bob was a relaxed and forthright narrator, and promptly reviewed the transcript when it was sent to him. He also advised on spellings in the McQuiston transcript. He supplied some photos with the notation, "Mac never liked to have his picture taken." We are extremely grateful to both Jean and Bob Shoemaker for their generous hospitality and valuable assistance with the series on Western Mining in the Twentieth Century, and particularly with the McQuiston oral history.

Eleanor Swent, Project Director

March 1989
Berkeley, California

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1953 MS Metallurgical Engineering, University of Wisconsin

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1981-1984 San Francisco Mining Associates, San Francisco, CA, V.P.
1962-1981 Bechtel Corp., San Francisco, CA, Mgr. of Div. Metallurgy
1957-1962 Union Carbide Ore Co., New York, NY, Metallurgical Engineer
1953-1957 Union Carbide Metals Co., Niagara Falls, NY, Metallurgical Engineer

Member: SME of AIME; CIM; IMM; SAIMM; Sigma Xi; Mining Club of NY; Engineers Club of San Francisco; Registered Metallurgical Engineer CA, AZ, NV; Registered Professional Engineer MT; Professional Metallurgical Engineer MT College of Mineral Science & Technology; Past Pres. MMSA

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BIOGRAPHICAL INFORMATION

(Please write clearly. Use black ink.)

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VII THE NEW YORK YEARS, 1958-1962

[Interview 1: 5 August, 1987]

Swent: Suppose you tell first in what connection you knew Frank McQuiston and how you came to work with him.

Shoemaker: I first met Frank, or "Mac" as we called him, in New York when I was working for Union Carbide. I had been transferred from Niagara Falls down to New York and worked for the Union Carbide Ore Company.

Swent: In what capacity were you working for Union Carbide?

Shoemaker: I was a metallurgical engineer. The Union Carbide Ore Company was a very small company in terms of people. We had maybe twenty people in our head office, but it was run like, you might say, a little kingdom. We had mines throughout the world. Carbide was a major mining company at one time. This was operated--they were all operated--by nationals; there were no Americans overseas.

The Mining Club

Shoemaker: I got introduced to Frank by a fellow by the name of Bill Blocher, who worked for American Cyanamid at the time. They both sponsored me into the Mining Club in New York. Frank

Shoemaker: and I would have lunch together every now and then.

Swent: What year was this?

Shoemaker: From 1958 until I left Carbide in March of '62. Being metallurgists, we seemed to kind of hit it off together. So I left Union Carbide in February, I guess it was; I went with Bechtel [Corporation] the first of March 1962. In April we started the Palabora, South Africa copper project in which Newmont had a one-third interest. Mac spent a lot of time with us all during the ensuing year when we designed that project. Then in 1964 Newmont [Mining Corporation] came to Bechtel and said they wanted to build Carlin. This was the first mining metallurgical job that Bechtel had done for Newmont.

The Union Carbide Ore Company

Swent: What metals were you working with for Union Carbide?

Shoemaker: Manganese and chromium primarily, but we had mines, as I said, all over the world. We had one in Afghanistan; that was a chromium mine. We had chromium mines in Rhodesia, and South Africa, New Caledonia--

Swent: And were you doing any metallurgy for these?

Shoemaker: Yes. We had manganese mines in Ghana, the largest manganese mine in the world. And one in British Guyana, and we bought manganese and chrome ores from other mines. And we had two ferroalloy plants in Norway and one in England. And then, of course, we furnished the manganese and chromium to all the ferroalloy plants in the United States; I think there were five that were run by Union Carbide Metals Company. So that time was in New York. I spent half my time in Norway for almost five years. Then I was in Australia and South Africa and Ghana and almost every place they wanted to send me, so I wasn't home very much.

Swent: Then you went to Bechtel, and moved to California?

Shoemaker: Yes, we moved to Millbrae. Bechtel was just getting into the mining and metal business in a fairly large way at the time. They had built their first metallurgical plant in Riddle, Oregon for Hanna Nickel, M.A. Hanna Company, that was in 1954. Then they built a couple of iron ore plants and a

Shoemaker: couple of aluminum plants, about one plant at a time. Then they decided they wanted to expand their mining and metallurgical business. I was the second metallurgist that they hired. Before that they had been, you might say, almost a drafting service and construction service to Hanna Company and Reynolds Metals. So they decided to hire metallurgists; eventually I had thirty-five working for me.

Swent: You were their manager?

Shoemaker: After a couple of years, I became chief metallurgical engineer. I was the first one they had.

Swent: Who was the first one they hired?

Shoemaker: Allan Taylor. You probably know Ruth Taylor. He and I had worked together in a mine up in Oregon, back in 1947; that's where I first met him. Then I lost track of him. He stayed out of school. I went back to school, and he stayed out about ten years and eventually went back to Minnesota and became a metallurgist. That was his first job at Bechtel after he got out of school.

Swent: Did he recruit you?

Shoemaker: No, no, he didn't know anything about that, that they were even attempting to recruit me. Here I arrived and found that he was working there; I didn't know.

Swent: How did you get the job with Bechtel?

Shoemaker: I had a friend that was the president of Allen Shermanhoff Pump Company, and he was a good friend of a fellow in Bechtel. This fellow had been given the job of recruiting metallurgists; he was semi-retired. I had never even heard of Bechtel at this time. This man called me up one day and told me that this friend of mine had told him that I might possibly be available for the right price. So he came and interviewed me, or I interviewed him, one of the two. I wanted to get back to the West. We had been back East for twelve years at that time. I could see that Union Carbide Ore Company was going to be absorbed by one of the other divisions of the corporation and wouldn't be like it was. One of the founders of Union Carbide, back in 1889, was also founder of Union Carbide Ore Company. It was his. He still owned three percent of Carbide stock and he could pretty well do what he pleased. He was in his nineties.

Swent: What was his name?

Shoemaker: William Sneath. His grandson later became chairman of the board. He came into the office a couple of times a week. He was ninety at the time, and he died when he was ninety-three. We had an office separate from Union Carbide offices, down on 42nd Street; we were up on Madison Avenue. We had one floor of a four-or five-story building. As they say, it was run just like he had run it when he founded the company. We had Persian or Turkish rugs on the floor. I had the most beautiful mahogany desk you've ever seen in your life. They would send a man in once a month to rub it down with rottenstone and oil. And a lady would come in and polish and disinfect the telephones once a week. A guy came in every morning and shined our shoes. It was just like they had done it in the old days.

Swent: But you didn't think it was going to last forever?

Shoemaker: It lasted for about three years, and then they built a new Carbide Building and they moved us all into that and then everything was regimented. They even took away all our furniture and gave it to the government for a tax write-off. Then they bought new furniture and got it delivered free so they didn't have to move the old stuff. But they were just great people. It was nothing like working for the big part of Union Carbide. They would send Jean [Mrs. Shoemaker] to Norway with me and pay the babysitter every year, on one of my trips. I made four trips there a year. So even though I was gone a lot of the time, it was very nice on Long Island.

Swent: But you still wanted to go back West?

Shoemaker: Yes, and it was a good thing because the old man died about six months after I left. They were immediately absorbed by the Union Carbide Metals Company, and then it was just entirely changed. So I am glad that I left at that time.

VIII BECHTEL'S MINING AND METALLURGICAL DIVISION

Swent: So Bechtel came hunting for you?

Shoemaker: I went out to San Francisco. I didn't know anything about Bechtel, but I thought I'd try engineering for a year and if

Shoemaker: I didn't like it then at least I'd had a free ride out to the West. I would try it for a year, and if I didn't like it, I would go looking for a job with a mining company.

Swent: But you stayed for twenty years.

Shoemaker: Nineteen years, yes. The engineering business kind of gets in your blood. And Bechtel was a fine company to work for, very fine.

The Newmont Gold Project at Carlin, Nevada

Shoemaker: But anyway, Newmont--Frank McQuiston, Dave Christie--at that time had made arrangements to come and see us. They wanted to build a gold plant, which was the first gold plant of any size at all that had been put in in the United States in thirty years. They had found this ore body at Carlin [Nevada]. Actually the USGS [United States Geological Survey] had been doing some exploration work there under their heavy metals program at that time.

Swent: When was this?

Shoemaker: Sixty-four.

Swent: Was there any connection with the Korean war in the fifties?

Shoemaker: Yes, the heavy metals program was (they were looking for tungsten, gold, or any type of metal really) as a result of the Korean war. So the USGS found indications of gold.

Swent: Was this a new kind of gold?

Shoemaker: Well, there's only one kind [laughter], but it was the first of the microscopic gold deposits, and relatively low grade.

Swent: Was this discovery possible because of new technology?

Shoemaker: No. They just did some geochemical work and some surface sampling and assayed and found gold there. There had been a little bit of alluvial gold mining in the old days in the creek just below Carlin, but it was virtually nothing. And during the fifties there was a gold mine a few miles away, called the Bootstrap Mine. This was owned and operated by

Shoemaker: three men; one of them was Harry Treweek. He had been the manager of a plant called Little Gold Acres, which is over in Crescent Valley, south of Beowawe and east of the town of Carlin. It was a small plant but it was very successful. It was put in in the 1930s, probably the late 1930s. It ran all during the war, because it was a Canadian-owned company, or partly Canadian-owned, so they were able to get around this L-208 order [War Production Board order which closed gold mines during World War II]. Then it became exhausted and another company started a mine called Consolidated Gold Acres, right next door on another piece of ground. It ran up into the mid-fifties. But they were both small plants.

Swent: They had mills as well as mines?

Shoemaker: The Little Gold Acres plant was crushing and vat leaching. The Consolidated Gold Acres was crushing, grinding, and a typical cyanidation flow sheet. Those were Carlin-type ores; you couldn't see the gold in them. Later, they have been mined again by Cortez Gold Mines, which is owned by Placer Amex. They are just nine miles across the valley from Cortez Gold Mines.

Consolidated Gold Acres is interesting because the plant was built by Western Machinery Company out of Sacramento, which was owned by Jack Howe, if you've ever heard of him. He is quite a famous character in the mining industry. Howe later started Western Knapp Engineering, which was bought out by McKee and then Davy bought out McKee.

But he had built this gold plant in northern California, and I don't recall just where, and people there couldn't pay for it. So he tore down the mill or removed the mill from up in northern California and made a deal with Consolidated Gold Acres and moved the mill to Consolidated Gold Acres. He made a deal that he would get twice the value of the mill for putting it up on credit, and he also would operate it and have control of it. Then the mill made money, and he made an enormous amount of money, and then he turned it back to Consolidated Gold Acres. Harry Treweek was the manager.

When that mine was worked out Harry went over to the Bootstrap. Three people, he and his two partners, operated the Bootstrap as a vat leach operation, again just merely crushing and vat leaching. They made an awful lot of money for those days. One of their people started a fire,

accidentally, that burned a lot of acreage on the T-Lazy S Ranch which was owned by Tex Thornton and Roy Ashe. Thornton and Ashe sued the Bootstrap operation. They didn't have the money to pay off the judgment that was brought against them for burning up the range land out there. So Newmont came to their rescue and made a settlement and took over the property. I think that is where Newmont got interested, because that was the middle fifties.

Swent: They must have had someone out there that was aware of what was going on.

Shoemaker: Yes. Bob Fulton was out there. They were exploring about that time, or starting to explore. Anyway, Harry came out as a millionaire with the money he made. But you could never tell it; he was just a nice little Cornishman and the finest assayer in the world.

Newmont was exploring then, the Carlin deposit, and they hired Harry to do their assaying for them. They wanted to keep it secret that they had a gold deposit there. So Harry was using the assay office at Consolidated Gold Acres, which had been abandoned for some time. But he somehow made arrangements to use that assay office. He and his wife worked there at night. This was sixty miles from the town of Carlin. The geologist would bring the samples down at night to Consolidated Gold Acres. Harry and his wife Clemmie did the assaying there at night to keep it a secret. That assaying confirmed the presence of the Carlin ore body. One day in 1964 McQuiston and two or three other Newmont people showed up at Bechtel's doorstep and said, "We've got to have a gold plant built and we've got to have it built right now!"

Swent: The secret was out by then?

Shoemaker: Yes.

Swent: Do you have any idea how Bechtel happened to be selected for that?

Shoemaker: No. They had obviously heard about our work in iron ore and were pleased with our work at Palabora. There was no business development effort or anything; they just called up, said they were coming to see us, and when they walked into the office they said, "We've got to have a gold plant and we've got to have it in a hurry."

Swent: Was this Bechtel's first venture into gold?

Shoemaker: Yes.

Swent: Had Newmont been in gold before?

Shoemaker: Well, they had been here in gold, at the Empire- Star. They had one in Colorado up near Ouray. Then they had a small one up in Canada. They called that one the Northern Empire Mine. But they had been a mining investment house, primarily. Of course, they were in the copper business, too. The Empire-Star here was their first venture outside of being an investment house. They were a mining investment house, under Colonel Boyce Thompson. Fred Searls saw an opportunity out here and bought, or took options on, both the Empire and the North Star, and convinced Mr. Thompson to buy the mines for Newmont. And so they operated them; this was 1929.

Swent: Right. But they really hadn't done gold mining for a long time.

Shoemaker: The Empire-Star finally shut down in 1956, or maybe it was '55; I think it was early '56. In the last few years they had run the mill but had just leased out portions of the mine.

Swent: And Mac's connection here was a long one.

Shoemaker: Yes. He ended up as chief metallurgist, and then chief metallurgist for the western United States for Newmont.

Building the Carlin Mill

Swent: When he came back to Bechtel, were you aware that he was a pioneer in flotation work?

Shoemaker: No. That I found out later, that he had installed the first flotation circuit on the Mother Lode.

Swent: You had known him as a copper metallurgist.

Shoemaker: Copper from Palabora and San Manuel [Arizona], and gold, yes, from Carlin. They were in such a hurry that--

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Shoemaker: --we had equipment out there three days after they walked in the office, leveling off the top of the hill. We finished the plant in, I think it was, ten and a half months. We did the engineering and the construction simultaneously.

Swent: Did Bechtel do the construction also?

Shoemaker: Yes.

Swent: Ten and a half months!

Shoemaker: And that was through a winter time, too. Oh, the conditions out there were horrible! It was seventeen miles from the town of Carlin, which was on what is now Highway 80, and it was a gravel and dirt road.

Swent: Were you spending a lot of time out there on the site?

Shoemaker: I made a number of trips out there. I had my metallurgist working on the thing, and I worked on it. I remember making one trip out in the winter. I was going up to Oregon and I left the family at Winnemucca and then drove over to Carlin, and then started north up to the Carlin mill, which was seventeen miles. I had chains on all seventeen miles because of the mud. It was quite a trip [laughs] but anyway the mill worked very fine.

Swent: What is the relationship, when you have a company like Newmont that wants to build a mill and has a metallurgist who is well known and competent, and then they hire Bechtel who has a metallurgist who is well known and competent?

Shoemaker: I had no gold experience, so they didn't hire Bechtel because of me, but for our electrical, mechanical, and civil engineering design people, and also our construction ability, and good construction people that knew how to get a job done. They had their flowsheet already worked out when they walked in the door.

Swent: Were you doing it to their specifications?

Shoemaker: Yes. We had layout people who were able to help out. We had to fit the plant to the site. Actually, a gold plant like that is fairly simple. It's a series of unit operations that you have to put together. It doesn't make any difference

whether these unit operations are all in one line or in a square or inside of any particular type of building; they have to be connected together in the most efficient manner.

Swent: Was there anything new or different about this metallurgy because of the nature of the ore?

Shoemaker: No. It was very simple metallurgy. It was much simpler than, say, Homestake's at Lead. Because the gold was microscopic it was evenly distributed throughout the ore. The only problem they had was with the chert which was in the ore and was hard to grind. But most of the ore was a siltstone with clay. The other problem they had was they thought the ore would be fairly dry. That's something that all the people who have put in mines in Nevada have come to realize is not true.

Swent: It is a surprise, because everything there is dry.

Shoemaker: They had put down a decline shaft. I'm not sure whether it was a decline or just a tunnel. And they had mined out enough ore to do test work on a fairly large scale back in their Danbury laboratories. They thought the ore was going to be dry and it was the stickiest stuff in the world. It was just terrible. The crushing plant wasn't really suited for crushing that style of ore. They had to fight that crushing plant all the time.

Swent: Was this an underground mine?

Shoemaker: No. They only drove that tunnel just to get a sample. Then the ore hung up in the fine ore bins because it was so wet and sticky. They used only a single ball mill and the chert that was in the ore; there was more of that than they had thought. The chert chips would come out of the ball mill, and they'd just have mountains of them piled up outside the mill, because they just couldn't grind the chert. But eventually they overcame these problems.

Swent: Who was it, when you say "they"?

Shoemaker: Carlin people did. Mac, and the mill superintendent, and the mine superintendent. Otherwise the mill ran very well. These were, I guess, relatively minor problems. We know today how to design around this wet sticky ore. At that time autogenous and semiautogenous grinding had been used in the iron ore country, up in Minnesota and Michigan, and up in

Canada. We had installed a number of these semiautogenous mills. But at that time everyone thought that only iron ore would grind autogenously. There wasn't time to test it on the Carlin ore.

Swent: What was the rush?

Shoemaker: They just wanted a gold mine and they figured it would be very profitable, which it was, so they wanted it in a hurry. And they got it in a hurry.

Swent: At a premium, no doubt.

Shoemaker: Actually, it didn't cost very much. It was a fair amount for those days.

Swent: You have to pay more to get a rush job, though, don't you?

Shoemaker: Well, that's true. It was a union job, and we had to pull electricians out of Reno. The good electricians didn't want to go out to Carlin, so we got the poor ones, the wire benders in effect. At one time, we had 120 electricians on the job. I think half of them were doing the work over that the other half had done in the first place. So it did cost more money. But the whole plant cost about \$8 million, which for 1962 or 1964 was not an enormous amount of money.

Swent: Did you hire most of your people relatively locally? Reno is a long way from Carlin.

Shoemaker: Yes. Well, Carlin was a pretty small town at that time.

Swent: How far east of Reno is it?

Shoemaker: It's over two hundred miles. Elko was the nearest large town, thirty-five miles away; that had a population of only about four or five thousand at that time.

Swent: So you had to bring most of your workers in?

Shoemaker: Yes.

Swent: Did you provide housing for them?

Shoemaker: A lot of them lived in trailers.

Swent: Did you provide the housing site, too? Was this part of the

designing?

Shoemaker: I don't know. We didn't have a camp there. But people brought in trailers and lived in Carlin and Elko.

Swent: Did Newmont provide a camp for their workers?

Shoemaker: No. There were a few houses available at Elko. And they built the manager's house, but they didn't build anybody else's house. Today the mining companies do build, at least for their staff or give them loans.

Swent: What were your relations in this with Mac? Were you collaborating with him at all?

Shoemaker: Yes, I had two metallurgists on the job that were really more mechanical engineers, doing the piping and all the necessary pump and piping calculations. And I worked with the project engineer, whose name was Rod Hunt. He was kind of an old-timer at engineering and construction, and had been with Utah Construction before.

Swent: He was at Bechtel?

Shoemaker: Yes. Anyway, the plant worked very well, considering the sticky ore. It was up to full production, I think, in a matter of two weeks after it started.

Swent: It was a sensation at the time, of course, wasn't it?

Shoemaker: Oh, yes, and it made them an enormous amount of money, even at thirty-five-dollar gold.

Swent: Which it still was, for a while.

Shoemaker: It went to thirty-seven shortly after that, then eventually started on up. But it made a lot of money for them. They later expanded it. It was 2,000 tons a day and they expanded it by another 500 tons a day to treat carbonaceous ores by chlorination.

Swent: What was its first circuit?

Shoemaker: Just straight grinding, cyanidation in agitated tanks and countercurrent decantation with five thickeners and zinc precipitation. It was a very standard flow.

Swent: Then you added, or they added, the carbonaceous chlorination.

Shoemaker: They added. This was a matter of just putting in a ball mill, a few tanks and agitators and adding chlorine and begin treating carbonaceous ore.

Swent: They were getting into a different kind of ore, then?

Shoemaker: Yes.

Relations with the T-Lazy S Ranch

Swent: Were there environmentalists?

Shoemaker: No, thank goodness.

Swent: Did you have to consider those things at that time?

Shoemaker: No, not at all. The only thing they had to consider was the T-Lazy S Ranch, which was a cattle ranch of extremely large size.

Swent: Newmont had settled with them about the fire.

Shoemaker: Well, Newmont bought the Bootstrap operation from Treweek and his partners and bailed them out of their obligation to the T-Lazy S. Later, Newmont put in a heap leach on the low-grade ore that was still left at the Bootstrap. In fact they trucked a lot of the ore from the Bootstrap to the Carlin mill, about nine or ten miles. When Treweek was running the Bootstrap they could only take the highest grade ore, because it was a small operation.

Harry, as I say, lived very modestly, but he has left a million dollars to the Colorado School of Mines.

Swent: Was this his alma mater?

Shoemaker: Yes. He was a great friend of Mac's. They were the finest of friends.

Swent: From a long time back?

Shoemaker: No. From when they first met there at the Carlin operation.

Swent: This is when they first met?

Shoemaker: Yes. Harry later retired and then was a consultant on assaying, both to Carlin and to other plants around. You asked me about environmental problems, and I said the only problem they had was the T-Lazy S. I can't tell you what percentage, but part of their mine, the Carlin Mine, was on T-Lazy S ground and they had to pay a royalty. Also, T-Lazy S refused to lease or sell land to Newmont for a tailings pond. The Carlin Mine is up on the top of this hill and there are beautiful tailings sites down below, but T-Lazy S wouldn't sell them. So they had to put in a very expensive tailings dam which was included in the \$8 million, as well as piped water for fourteen miles. And they had to bring in a power line that was forty miles long. That was all in that \$8 million. But this tailings dam will eventually be three hundred feet high, one of the highest tailings dams in the United States.

Swent: Why was this necessary?

Shoemaker: Because they couldn't get permission from the T-Lazy S to use a few acres of this couple hundred thousand acres the T-Lazy S had. They had a lot more trouble with T-Lazy S because they would want to do some exploration, sometimes on T-Lazy S grounds, sometimes on BLM [Bureau of Land Management] ground, but they would have to go through T-Lazy S property. So every time they wanted anything T-Lazy S would have to have new water tanks or new gates or new fences. The way they described it to me was just constant harassment by T-Lazy S. I guess they killed two or three T-Lazy S cows that broke through the fence and drank water out of the tailings pond. Of course, those were horribly expensive cows. [laughter] Mac told me that he tried to convince Newmont to purchase the T-Lazy S Ranch. At that time, they could have purchased it for \$5 million, which would have been an enormous bargain. But Plato [Malozemoff] didn't want to be in the ranching business. It is interesting now, since they have bought the T-Lazy S, (for many, many millions of dollars, and I can't tell you how much, but an enormous amount of money); all the Newmont people I know are wearing T-Lazy S tie-clasps.

Swent: They love it now!

Shoemaker: Yes.

Swent: So Newmont eventually did have to buy the ranch.

Shoemaker: They eventually did. It had what is now called the Gold Quarry deposit on it. Of which they have, I believe, brought ten percent.

Swent: Newmont?

Shoemaker: Yes, they own the ranch, but they only own ten percent, I think, of Gold Quarry. So Roy Ashe gets his royalty on ninety percent of the Gold Quarry ore.

Swent: So McQuiston was rather farsighted in that, wasn't he?

Shoemaker: Yes, but he was frustrated because they wouldn't buy. Mac would occasionally get pretty frustrated with Plato. As I mentioned to you last night, Plato has only visited the Carlin plant twice that Mac told me about. The first time was at the dedication of the Carlin mine. Plato was supposed to be there for two days. They put him up at the Stockman's Hotel in the suite right along the railroad tracks, and he didn't get any sleep. So he asked Steve Bechtel to fly him to San Francisco in Steve's airplane the next morning, and he didn't attend the second part of the dedication. Then he came out one more time in the last few years before he retired, even though it made such an enormous amount of money for Newmont.

Swent: You mentioned that it really carried the company.

Shoemaker: It certainly did. When the copper business started to go downhill Newmont maintained its dividends with Carlin gold money. They had a lot of ore stockpiled ahead of the plant, some of it quite high grade. I have been at the Carlin plant many, many times over the years and I can recall them mining small pockets of ore with a one-ton truck, and a very small front-end loader. They would take this ore; it would run as much as one to even three ounces [of gold per ton]. They would put that through the mill.

Swent: Are these decisions generally made at that level, the grade of ore running through the mill?

Shoemaker: Yes. They would set up a budget in gold for each year. It was constantly being reviewed by the New York office and if they would all of a sudden want more money, they would just tell them to put the high grade through the mill. It was a quite remarkable operation in that case. They never sold gold forward; they may possibly do it today, but for many,

Shoemaker: many years they never sold gold forward, even when the price had gone up. They sold it strictly on a spot basis.

Swent: Does this complicate your mill design to have that sort of thing?

Shoemaker: No, not at all.

Theft from the Mill

Shoemaker: One of the interesting things that happened that Mac was involved in was a theft out there at Carlin. It was strange how it was discovered. This was in the days when you still had to have a gold license to possess gold, and when gold was still thirty-five, thirty-seven dollars an ounce.

Mac told me that the Treasury Department (who had charge of issuing these licenses) had been suspicious of a gold refiner in Chicago who they seemed to think had more gold than he should. He refined gold and sold it to jewelers and jewelry manufacturers. So they started following this man, or one of his people, and found he was flying to Reno. They followed him to Reno and saw that he had meetings with a couple of people in Reno who were known to be gold buyers that would buy gold from dentists and jewelry companies and scrap gold. They started following these two people and found that they were having meetings with people from Carlin. It was obvious that the gold was coming from Carlin.

Then they brought in the Secret Service who, I guess, was the enforcement agency. They went to Newmont and said, "You are losing gold." Newmont says, "No, we're not losing gold. What gave you that idea?"

So they started an investigation and found the chief chemist and his assistant were in cahoots with the three men in the refinery. The chief chemist was the one that was in charge of the assaying. So he was "cooking" his assay books; the assay of the ore that went into the mill (what we call the "heads"), and he was then cooking the tails, also (the assays of the tails). Anyway the amount of gold produced would match what they would predict from the assays.

These people in the furnace room were stealing

precipitate, zinc precipitate. So it didn't show up on the books. They stole the stuff and sold it. This had gone on for, I guess, about a year. Only one of them, the chief chemist, went to jail, and he was in jail for about four months. Of course, Carlin had insurance, but the problem was to prove how much gold had been stolen. These people that stole it, they weren't admitting anything.

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Mac went over there and spent months going through the records of the drill-hole and blast-hole assays and the tonnages that went through the mill.

Swent: Those hadn't been doctored?

Shoemaker: Those had not been doctored. There were just too many of them. So he was able to calculate how much gold was stolen.

Swent: Mac himself did that?

Shoemaker: Yes, he himself did that. He was able to calculate that they had stolen, as I recall, about a million dollars, and was able to get that back from the insurance company.

Swent: That was a very painstaking thing for him to do.

Shoemaker: Yes.

Swent: Why did he do it himself rather than bring somebody else out to do it?

Shoemaker: I think that if they had just an engineer do it rather than a vice president of the corporation an engineer just wouldn't have had the credibility. And, of course, Mac was a very famous man and everybody knew him and admired him and knew he was completely honest. So the insurance company just didn't question his figures.

Swent: I suspect this touched a personal nerve with him, too.

Shoemaker: Yes, because he knew these people, all of them. To have them steal gold from his plant (and he always considered it really his plant) was kind of an insult. I later got to know the ringleader --well, I had known him at that time--I had met him but I later got to know him very well. He had gotten on as chief chemist at a small gold operation over near Eureka,

Nevada. Pete Galli was the vice president of the outfit.

Swent: This was after the theft?

Shoemaker: Yes. Pete said this fellow was probably the most honest guy in the whole plant; he had learned his lesson. I liked the fellow. I was working out here at the mine called the Windfall Mine, doing consulting. I would take this fellow down to the bar and we would have a beer or a coke or two or more after work. He told me that what they did, these five fellows, they just spent the money just like water. If one of them were to have a birthday, the other four would go down to one of the local houses of ill repute in Elko and hire three or four girls for a whole weekend, for the fellow who had the birthday; and they'd stock the rooms with all the liquor and the food they could get, the fanciest they could buy, and just give him a high old time. They said they spent it just like water.

Swent: But their careers weren't affected?

Shoemaker: Well, yes they were in effect. This chief chemist was working in this very small operation and I know after that, when it closed down, he was out of a job. I've heard that a couple of the others are back in the gold business; but exactly what they're doing I don't know.

Swent: It's hard to tell if crime pays or not. But I imagine that Mac was very hurt by this.

Shoemaker: He was.

Swent: He must have known this man. Did he have anything to do with his hiring?

Shoemaker: I don't know; but I know that he knew him very well, because he knew so many people in that mill. Even after he retired from Newmont (that is from New York) he was still a director of Carlin Gold, and would go over there once a month. He was the liaison between New York and the Carlin Mine. Even though he was living out in Napa he had charge of that mine.

Swent: Even after he retired?

Shoemaker: Yes, and for a number of years after that. Let's see, is there anything else about that?

- Swent: You mentioned tailings problems. There really were no technological innovations then in the Carlin mine?
- Shoemaker: No, not at all. It was very, very simple.
- Swent: It was such a sensational thing, that I thought it was also new technologically.
- Shoemaker: That's why it was such a money maker. It was an ore with which you could do nothing wrong. Except the carbonaceous ore which came along later; but they made money at that. It was more expensive to treat; but they were only treating 500 tons a day versus 2,000 tons a day of the oxide ore. They are now expanding that mill. It is treating forty-five hundred tons a day. And, of course, they have the new Gold Quarry Mine at 8,000 tons a day; and then they have heap leaches going at Maggie Creek and at Gold Quarry, and I guess they're still occasionally doing some leaching up at Bootstrap. They're going to build a new mine at what they call Rain, which is south of the town of Carlin, a new mill. Within eighteen months (I was talking to a friend of mine yesterday) they will be mining 97,000 tons of ore a day in that whole Carlin operation there. The heap leaching and the milling together will be 97,000 tons a day.

Heap Leaching

- Swent: The heap leaching is something new, isn't it?
- Shoemaker: That's new.
- Swent: Do they end up with a concentrate from that?
- Shoemaker: Heap leaching produces a pregnant solution so that you can either recover the gold from the zinc precipitate in the traditional manner or by carbon adsorption.
- Swent: Do you tie that in then with this mill?
- Shoemaker: They started heap leaching there about 1971, just about the same time that the first heap leach was put in at Cortez.
- Swent: Did McQuiston have anything to do with that?

Shoemaker: Yes, he did. They first started having test heaps laid out right there at Carlin mill, using ore from the Bootstrap and a carbon recovery plant; and then they hauled the carbon to the Carlin mill and extracted the gold from the carbon there.

Swent: This is the same as char-and-pulp?

Shoemaker: Carbon-and-pulp, yes. A variation which has made possible the treating of low-grade ores, heap leaching, carbon adsorption and also carbon-and-pulp. In carbon-and-pulp you grind the ore and then agitate the cyanide solution and ore and carbon all together. Then you screen out the carbon that has adsorbed the gold and then strip the gold off the carbon; whereas, for the heap leach you heap the ore on an impermeable pad and spray cyanide over it. The solution that comes out from underneath the heap is then passed through carbon.

Swent: These are possible now partly because of plastic liners you can put under them, aren't they?

Shoemaker: Yes. But there are some operations going on that are still using a clay pad underneath the heap. Most of them use plastic now. The original ones-Bootstrap used a clay pad; and at Gold Quarry, they have an enormous heap leaching operation; it's all plastic.

Swent: McQuiston did come, you say often, to the plant to visit it?

Shoemaker: Yes.

Swent: Did he stay on the site for a long time?

Shoemaker: He would go over there and stay for two or three days a month.

Swent: He was a very meticulous type, I would guess?

Shoemaker: Yes. I attended a lot of those meetings. When I was with Bechtel he would ask me to come along with him.

IX BUSINESS PARTNERS, AGAU EXPLORATION

Shoemaker: And then later, when we were involved in Tuscarora, Mac and

Shoemaker: Ed Hewitt and I, in our own heap leach, Mac would ask me to go over to Carlin with him and have meetings with the metallurgists. We would just sit and talk about various problems and try and solve them--figure out why something was happening in the mill. Tuscarora is virtually due north of the Carlin Mine, but you have to go north from Elko.

Swent: It's also in Nevada?

Shoemaker: Fifty-seven miles north and west of Elko.

Swent: Was this a Newmont operation?

Shoemaker: No, this was just Mac and Ed Hewitt and I.

Swent: Gold, was it?

Shoemaker: Silver. Ed lived back in New York. He and Mac had been friends since they first met up here in Grass Valley. Ed worked for ESCO International, which is a big steel castings company. Electric Steel Company, I guess, was the original name for it, out of Portland. They sold a lot of things like crusher liners and chute liners, and made all kinds of steel castings. Ed was the salesman. He frequently came up here and they became the best of friends. He is the perfect salesman; he is the kind that loves everybody. If you ever knew Larry Burmester in San Francisco, he was the same way. Ed makes friends with everybody. He eventually became president of ESCO International. He traveled all over the world, because they had licenses all over the world for their casting processes.

Tuscarora Associates

Shoemaker: Mac got the idea of getting into business for ourselves. A geologist, and I can't remember his name now, but at the time he was working for Newmont, he was the chief geologist for Newmont exploration in the Carlin area. He had told Mac about a silver prospect up on Rock Creek called the Falcon Mine. It had never really been a mine; there had been a little bit of high-grade ore taken out of it, but this geologist thought this could be another Carlin.

So Mac and I went up there. You had to go to it from

Shoemaker: Tuscarora, this was west of Tuscarora. So we thought if we could raise some money that we would like to take a shot at it. At Tuscarora there were all these dumps. Mac had never been to Tuscarora before. Tuscarora was just a little bitty town. It had been a great mining town in the early days and it had 6,000 people, half of whom were Chinese.

And there were about half a million tons of dumps there of waste rock. We thought, "Why not heap leach these?" We took some ore samples, in fact, that day on the way back from the Falcon. They leached pretty well and we got interested. We did some more test work and then got Ed Hewitt interested in putting up some money. Then we needed a lot more money than any of the three of us could afford; we got Jim Frank [President, San Luis Mining Company] interested in it and San Luis Mining Company. Of course, San Luis was sold about that time.

Swent: It became Mexicanized.

Shoemaker: Yes. Actually it had been Mexicanized, but then they sold the remaining forty-nine percent to the Mexicans. So they were out of business and they had a lot of money. Wasn't Langan [Swent] the director?

Swent: No, he never was a director. He was assistant manager at one time.

Shoemaker: Anyway, Jim Frank--and I can't remember offhand the names of the others; there were a couple of other directors of San Luis--put together a company called Navajo Mining Company. They took the name from the Navajo claim at Tuscarora.

Swent: Did you have to get rights to this in the first place?

Shoemaker: Yes. Ed was kind of the chief negotiator. There were so many people to negotiate with. I think we had five or six, six I believe, different claim owners. One of the groups had twenty-seven people that owned little bitty pieces of the thing. Each one of them had to be contacted and gotten to sign an agreement. It was a long and involved process.

Fortunately, the biggest, or perhaps the richest of the dumps was owned by one woman up near Wenatchee, Washington. I went up and negotiated that lease; she was awful tough to deal with. She wanted a fifty percent royalty on all the sales of silver and gold; there was a little bit of gold in

it. And of course we had to put up all the money for the plant and then she wanted fifty percent of it. It ended up, finally, I got her down to seven percent; I was trying for five, but I couldn't make it.

Swent: Was Mac good at this?

Shoemaker: He didn't do much of that. It was up to Ed and I. Not because Mac wouldn't have been good at it, but because he was doing other things. The three of us went out there and did sampling. Then we hired a fellow to come in with a backhoe. We hired a fellow to sink shafts through this dump, this Navajo dump. We had a D-8 [bull] dozer that dug fifteen hundred feet of trench through the dump. I had an enormous amount of vacation time accrued, and I was taking a lot of it to fly out on weekends.

Swent: What was your title with Navajo Mining Company?

Shoemaker: It was Tuscarora Associates; Navajo Mining was Jim Frank and his friends who were the backers of us. This was in the seventies, along about '78 or '79 we started in.

Swent: Was it a good deal?

Shoemaker: We had a lot of fun. I think Ed and I went into it, primarily, to keep Mac busy. Mac's health was, of course, very poor. He would get spells where for three days he couldn't eat a single thing and throw up everything he had. It would leave him terribly weak. This was from the stomach cancer he had back in the fifties. He was written up in medical journals as taking more x-radiation than any other human being and still living. I know that because our daughter's father-in-law was a radiologist at U.C. and he'd read about his case. Mac wouldn't talk about those things.

But we were out there sampling those dumps. We finally did enough test work that we decided that we would go in and put in a heap leach operation. For a while there we were renting a four-wheel-drive, which was almost impossible for Mac to get into, because the step was so high. So Ed and I carried around a big concrete block and every time we would stop, either Ed or I would hop out with this concrete block and put it down on the ground so Mac could step on that.

Swent: He didn't like to make any concessions for that hip either, I
Swent: imagine.

Shoemaker: No, he didn't. He was touchy about it. When we first got the idea of this concrete block, he said, "Get out of here." We refused and said, "Step on the block or else!" So then he got used to it. But he would have a struggle to get up high enough to get into that four-wheel-drive. We had an awful lot of fun together, the three of us out there.

Finally, we put together this operation and we hired a manager. He lasted about two months. I had to fire him, because he just couldn't control--. We were building the plant at the time. So I fired him and took the rest of my vacation, went over and managed the construction myself.

By that time, we had hired Earl Craig, who had been mill superintendent at Carlin, then had been moved up to Washington to their uranium operation, the Dawn Mining Company. He had been retired.

He was mad at Newmont, because Newmont replaced him with Jack Thompson's son (JT was vice president of Newmont), young Jack. I guess they retired Earl a little bit early; Earl didn't want to be retired. When I heard that he was available, or at least out of a job up there, I called him up.

I said, "Mac and I are putting together a heap leach operation; would you like to come to work for us?" He said, "Where is it and how soon do you want me there?" He didn't even know where it was. So he came down and was manager, and was very successful. As I say, he didn't really like Newmont, because they had replaced him with Jack's son.

Swent: Had you offered this prospect to Newmont at all?

Shoemaker: Oh no. It was too small for them; they wouldn't fool around with half a million tons of dumps. So we operated that for a couple of years before we had to shut it down because the price of silver went down. We got in on some of that real high silver price. Actually, we started the plant up when the silver was just starting down from its peak. It hit fifty dollars one day. We sold the first shipment, I think, for thirty-eight dollars an ounce. Eventually it got down where we couldn't make a profit, so we shut it down after a couple of years.

Swent: Do you still have it?

Shoemaker: No, then we sold it to a fellow. We had a very difficult time getting our money out of him, but we finally did. But, anyway, we don't own it. We own nothing there anymore. We sure had a lot of fun. We kept Frank interested. He had to be doing something all the time, otherwise he'd just get terribly bored. He had so much energy.

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Swent: Did Tuscarora Associates do anything else together?

Shoemaker: No. Well, we eventually did go ahead with this Falcon Mine, to some extent; we put in five or six hundred feet of drift to investigate the thing and found there wasn't any silver there, so we abandoned the thing.

X COPPER PROJECTS

Palabora

Shoemaker: When Mac first came to Bechtel, he came there in 1962, when I was there. Bechtel had just got the Palabora project and Mac was very much involved in that. That is when I first met him in San Francisco after I left New York. I worked on the Palabora job with Mac also. It's in South Africa, in the Transvaal. I was a metallurgical group supervisor on that job for Bechtel, and worked with Mac very closely until we finished the Palabora job. So that was actually the first job.

Swent: What metal was that?

Shoemaker: That was copper. Carlin was the second. Similkameen was the third one. Similkameen was also copper.

Similkameen

Swent: This was in Canada?

Shoemaker: Yes, southern British Columbia. There were two ore deposits, one on the north side of the river and one on the south side. This was the old Granby Mining Company. They had mined copper there for a number of years and then shut it down. Newmont put in the Similkameen project.

Shoemaker: It was a conventional copper mill. It used autogenous grinding. We pipelined the tailings across the river, because there was no place for tailings disposal on the north side of the river.

Swent: Similkameen, as I remember, is the name of the river?

Shoemaker: I believe it is. That was a very successful operation. They expanded it later. I've forgotten what the initial tonnage was, twenty-odd thousand tons a day, I believe it was. It made them a lot of money. I don't know how big it became.

Swent: You had problems with the climate, though, didn't you?

Shoemaker: It wasn't too bad. Southern British Columbia is fairly mild; there is a lot of snow, but not terribly cold and not an awfully long winter.

Granduc

Swent: This was not the place that was taken out by the avalanche?

Shoemaker: That was Granduc.

Swent: Which was before.

Shoemaker: That's right. The only thing I know about Granduc is we did a study on it. In fact, I went up there. We took the Bechtel plane and flew into Stewart, British Columbia, where you're flying up this fjord. I remember the Bechtel pilot had never been in there before. We got about half way up the fjord and he made a circle just to see how wide the fjord was. Then as we got farther into the fjord there was

Shoemaker: absolutely no way of circling at all; you went right in at the base of the fjord. We had what they call a Learstar, which is a Lear adaptation of the old Lockheed Lodestar--two engines--held about nine people, propeller type plane. You had to land. There was no way of taking off again, because there was just a cliff right at the end of the runway, a mountain. And there was no way to circle because the mountains were on either side. The runway was so narrow that the bushes were almost brushing the wing tip, and you couldn't turn around in the middle of the runway. Once you got landed, you had to go to the end of the runway. They had a clear spot there you could turn around in and then come back up.

Swent: I think I'd rather go in there with a pilot who had done it before.

Shoemaker: Oh, this pilot was a great pilot.

Swent: He must have been; you're here to tell about it.

Shoemaker: I've flown with him an awful lot. But we went in and then we got picked up by an Otter.

Swent: That's an airplane, not an animal.

Shoemaker: Yes, the DeHaviland Otter. We flew on up near there, where we could land on a lake. A dry lake (it was actually a muddy lake; there wasn't any water). In the springtime it would have been full of water, but it was muddy. I remember when we took off, the pilot couldn't turn the Otter around, and so we had to all get out and he had a rope that he tied to the tail of the plane. While he revved up the engine we (nine of us) pulled on the rope to pull the tail around so he could take off. Then we got back in the airplane. He was headed in the right direction so he could take off. We were supposed to be met by a helicopter to take us on up to where the Granduc mill would be, but it didn't show up. Some of us started walking. We got about half way up there and ran into a grizzly bear.

Fortunately, the grizzly bear either didn't see us or didn't want to pay any attention to us. So we backed off and went back down to a clearing. By that time the helicopter saw us and we waved and he picked us up.

That mill was at the foot of that glacier, which was

Shoemaker: Fran thought that was a pretty good idea, although she didn't think it would work, but she was willing to try anything.

Orselli was very happy to do it. I arranged with him to call Mac up and say he was going to be up in that area one day and he might drop in and see him up in Napa. Sure enough, he mentioned it and Mac got interested. A week later he made arrangements to get this hip replaced. Neither Fran nor I told him that for several years afterwards. He was quite chagrined that we'd conspired together to get him to get this new hip joint in.

Swent: Was it satisfactory?

Shoemaker: Yes, it worked very fine; it kept him walking. Of course, he broke his back later on, or I guess it kind of fell apart. He had a heart attack. He had one of these hiatal hernia operations. And, of course, he was continually sick from problems with his stomach. Eventually the cancer came back, just a couple of years ago.

Swent: He was a valiant man.

Shoemaker: Oh, he certainly was.

The Gyratory Crusher at Similkameen

Swent: You were talking about the fact that this gyratory crusher was designed without a crane. Whose idea was this?

Shoemaker: Both our ideas. We sat down and tried to figure out how we could build an inexpensive gyratory crusher that would work. Then we also figured that we could put a rubber belt feeder underneath the crusher after the ore had been crushed. So we worked and worked on that. Both of us had to argue against the Bechtel people, who thought they knew better, and against Newmont people who knew better. We saved three-quarters of a million dollars, or something like that, which was big money; and it worked.

Everyone was afraid of this belt feeder, which was eight feet in width. They figured that the belt might last nine months. So we bought a spare belt. The last I heard the belt had lasted much longer; in fact, it was ten or eleven

Shoemaker: years before they moved to the southern ore body. That original belt was still under the crusher. They said they hoped nothing would ever happen to it because the spare belt they had was rolled up in this box, and they knew they wouldn't be able to unroll it after ten years [laughter]. The last I had heard it had had a hundred million tons of ore go over it, and they put much more over it after that.

Swent: Where was this fabulous belt made?

Shoemaker: We designed it at Bechtel and bought the pieces; it never cost them an hour's worth of down time for repairs. Oh, it had a bunch of nicks and cuts in it, and it was getting pretty thin by the time they finally shut it down. But it saved them an enormous amount of money.

Anyway, it's in our book that we published on primary crushers.

XI PUBLICATIONS

Swent: What is this book?

Shoemaker: Mac and I published three books together. [gets book from bookshelf] Our writing started when Mac was asked to write the section on precious metals for the new Mineral Processing Handbook that the Society of Mining Engineers was going to publish. This was about 1970. He was living in Napa; he didn't have the facilities there for doing the necessary drafting and all the typing. So he asked me to be his co-author of this section.

That was just about the same time that Bechtel had the job of doing the preliminary engineering for the Cortez gold plant, which was the second gold plant to be put in, in the United States. Carlin was the first one in '64 and then Cortez was '69 or '70. Anyway I was involved very much with the Society of Mining Engineers.

We got to work right away and wrote this section on precious metals. I think we were the first ones to finish our section. The thing kept getting delayed and delayed and delayed. It was supposed to have been published in '74. I was on the board of directors of SME at that time, and I

Shoemaker: realized that that book was not going to be published for a long time. And all this information that Mac and I had gathered from all over the world was going to be way out of date. We had been limited in the number of pages that we could have, so there was a lot of information that we couldn't put in that handbook.

Gold and Silver Cyanidation Plant Practice

Shoemaker: So I talked the Society of Mining Engineers into letting us publish, in book form, all of this material on gold and silver. And Mac was agreeable. This was the first book. The Society of Mining Engineers hadn't really been in the book publishing business for very long.

Swent: [reading title from first book] Gold and Silver Cyanidation Plant Practice, 1975.

Shoemaker: Well, in 1970 and 1971 when we were gathering this information, there were only the two gold plants: Carlin and Cortez. This book had information on plants throughout the world in it. When we agreed to write this book we went to all the contributors that we had gotten information from and got updated information.

Swent: Well, now, when you say there were only two gold plants--?

Shoemaker: In the United States.

Swent: What about Homestake?

Shoemaker: I'm thinking of new gold plants. [laughter]

Swent: Be careful now!

Shoemaker: So that really made three, you see.

Swent: There were plants that were producing gold as by-products?

Shoemaker: Yes, but of the some five thousand gold mines that were in the United States just before the war, there were only a half a dozen that were started up after the war; some of those were here and of course Homestake, at Lead, was one of them. But new gold plants--Carlin was the first one in thirty years.

Shoemaker: So we figured we would sell 300 copies of this book, and we hoped we would sell 500. This was the book publishing committee of the Society of Engineers. So we printed 750. This came out at the annual meeting of the AIME in 1975. Those 750 books were sold out at the meeting. They immediately reprinted; it's gone through, I think, three printings. There have been, last I heard, over 7,500 copies of this book sold.

The reason this book is in soft cover is because they didn't think they could sell very many of them. They wanted to print it cheap. So SME has made an enormous amount off of this. It is one of the few old books that they are still not discounting. They have actually increased the price; I think it originally sold for twenty dollars and now it is selling for thirty.

Primary Crushing Plant Design

Shoemaker: After Similkameen, Frank and I were expanding Palabora. We put in a similar type of primary crusher down at Palabora (similar to Similkameen). We got interested in primary crushers; we were always interested in them for that matter. We went to the Society of Mining Engineers and said, "Why don't you let us write a book on primary crushers?"

Swent: [reading from the second book] This is Primary Crushing Plant Design.

Shoemaker: We had a lot of fun writing that. They trusted us a little more. I don't know how many of those were sold, not nearly as many as this (pointing to the first book), but something like three or four thousand of these.

Swent: That must have been tremendously gratifying!

Shoemaker: Yes, it was.

Shoemaker: So then after this Homestake put in the first carbon-and-pulp plant at Lead in 1974, which we had in the first book. But then other carbon-and-pulp plants came along, and then heap leaching came along. This yellow book--we had it yellow because of gold.

Swent: The first one was yellow, too, wasn't it?

Shoemaker: The first one was yellow; it was supposed to be the color of gold. It has kind of changed--it's kind of faded on the end.

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Gold and Silver Cyanidation Plant Practice, Volume II

Shoemaker: So by 1978 we realized that our 1975 book on gold and silver was getting out of date, although they are still selling it today on a steady basis. So we put out the second volume, and we had the cover of that printed in silver, and, of course, it's hard-cover.

Swent: What did this one cost?

Shoemaker: I think this one was thirty-five dollars.

Swent: And it's called?

Shoemaker: It's called just: Gold and Silver Cyanidation Plant Practice, Volume II. This [gestures] AuAgAuAg on the top of the book are the symbols for gold and silver. And that is how we got the name of our company, actually over at Tuscarora. The company that Frank and Ed and I owned was called "AgAu Exploration"; Ag Au, the symbols for silver and gold. You could pronounce it better than you could pronounce AuAg. So we got the name of our company from the name of the book.

Shoemaker: And then AgAu went together with Navajo Minerals, who were our backers, and formed Tuscarora Associates.

Swent: So your work led to a publishing career.

Shoemaker: Yes. And this one sold about 5,000 copies so far, the last I heard, and this was about three or four years ago.

Swent: Well, SME should be very grateful to you then, too.

Shoemaker: Yes. They are among the best selling books that they have, except say the Mining Engineer's Handbook and the Mineral Processing Handbook, of which they sell a large number of

Shoemaker: copies. For a specialized book, this has sold exceptionally well.

Swent: The only other thing that I think we should mention, speaking of gratitude--I gather that Newmont wasn't always appreciative of what Frank McQuiston did for them. Do you want to talk about the Murchie Mine? It sounds as if there were many instances where he saved them a tremendous amount of money.

Shoemaker: Yes, of course, they made him a vice president. But they didn't always agree with him; well, naturally; people don't always agree with me either. [laughs] After he retired from Newmont and moved to Napa, he was still consulting for Newmont and given the job of disposing of Newmont's properties here in Grass Valley. They had a lot of property. He arranged for the sale of the Empire-Star properties to the State of California for the Empire-Star Park. He put in an enormous number of hours up here working on property titles--talking with people and getting all of this stuff up for sale. During the time he was chief metallurgist for the Empire-Star, he put in an enormous amount of time investigating the Murchie; he believed that Newmont could make a mine out of that.

Swent: This was fairly recently?

Shoemaker: Yes, this was along about 1980, I'm not really sure of the date. So he did an enormous amount of research on the maps and all the metallurgical information and geological information and put together a proposal to Newmont that they (Newmont) should develop the Murchie as a mine. But if they didn't want to develop the Murchie as a mine, Frank would like to get a couple of partners, who he had already talked with--people here in Grass Valley--and put up the money and lease the Murchie from Newmont, and make a mine out of it themselves. He took all this to Plato Malozemoff. Plato Malozemoff took it and said, "Thank you for the information," and that was the last that Frank heard about it. Malozemoff did not do anything about it and was not willing to let Frank and his partners lease the Murchie. This hurt Frank a lot. He didn't ever talk about it. But it hurt him very badly that after all the years of service that Frank had given Newmont that if Newmont didn't want to take the opportunity of putting the Murchie into operation, the least they could do would be to lease it to Frank and his friends.

- Swent: Has anything been done with it?
- Shoemaker: Not a thing. They have done absolutely nothing.
- Swent: That is too bad, to work for a company that long and end with a bad taste in your mouth.
- Shoemaker: Frank accepted it. Of course, it was Plato's prerogative to do that, but he felt very badly about it.
- Swent: What sort of person was Frank to work for?
- Shoemaker: He was a great man to work with and work for. I'd describe him as kind of crusty. If he didn't agree with you he said so. But he was willing to listen to your argument. I have had many an argument with Frank, quite strong arguments. Sometimes I'd win and sometimes I'd lose, but it never came to blows, as you might call it.
- Swent: Did he nurse grievances?
- Shoemaker: No. If he did he never said anything about it. He was a great man to work with and he was a great teacher. I've learned an awful lot from him, particularly about gold and silver. I thought more of him, I think, than any other man I've ever known. And yet we had arguments, but whenever we settled one, no matter which way it was, we were always the best of friends.
- Swent: They were probably technical arguments more than anything else?
- Shoemaker: Yes, they were technical arguments. He was very short with people who would put forth ideas that they hadn't thoroughly thought through. He would tell them, "That was a bunch of rubbish; don't talk unless you know what you are talking about." He was crusty in that way, but everybody loved him. Whenever he said anything he really meant it and had put some thought behind it. He was a great man.
- Swent: Who was his assistant? Did he have an assistant, a successor that he groomed for his position?
- Shoemaker: Dave Christie took over his job. He thought quite a bit of Dave. Dave retired after a few years.
- Swent: Was Mac the sort of person who had proteges?

Shoemaker: No. I don't know, I think probably if he had anyone that could have been called a protege it was me.

Swent: And you were not in the same company?

Shoemaker: Not in the same company, no. He was the one that nominated me for the Richards award that's hanging over there on the wall.

Swent: That's SME-AIME?

Shoemaker: Well, AIME really, but it is an SME nomination. And, of course, I was the one that nominated him for the Richards award, but he never knew it; I never told him and he never found out. And then I did not know that he had nominated me until after they had given me the award.

Swent: Well, that covers all the things that I was aware of and we've gotten to a few things I wasn't aware of, which I am very grateful for.

Is there anything else that you want to add?

Shoemaker: I can't think of anything. I'll probably think of something.

Swent: This has been a real pleasure, a bonanza!

Shoemaker: Well, I enjoyed Mac so much; he was kind of a second father to me, almost. As I say, I've known him now since 1957.

Swent: Thirty years.

Shoemaker: Thirty years, yes.

Swent: I'm sure you miss him greatly.

Transcriber: Elizabeth Shelton

Final typist: Noreen Yamada and Eileen Grampp

E & M J Salute for Outstanding Service



FRANK W. McQUISTON, JR.

IF YOU WERE TO ASK anyone who knows him what Frank McQuiston's outstanding characteristics are, ten out of ten replies would mention Frank's unfailing cheerfulness and his tremendous capacity for hard work. We're sure of this forecast because these two traits are so evident in everything Frank does.

He has a smile for you, and a polite deference for your opinion, even when he disagrees with you. But don't think you've put him off, or convinced him against his better judgment, just because he's pleasant. Frank has a mind, and a will, of his own. He just has a knack of getting things done smoothly, and he needs all that talent in his present job.

As Deputy Manager of Raw Materials Operations for the Atomic Energy Commission, Frank has to be constantly on the move, getting people to do things, usually things they don't particularly want to do. A dictatorial, or even a hard-driving, impatient man in this job could do infinite harm to this country's atomic energy program. Frank's friendly way of getting the job done smoothly is doing it infinite good.

Born in Pueblo, Colo., Frank followed his family's tradition of mining. Although he graduated from the College of Mines in Berkeley, Calif., in 1931 (of all years to graduate in!), he promptly got a job, with F. W. Bradley at the Spanish mine in California. A year

later he went with Empire Star at Grass Valley, Calif., the nicest mining country in the world.

Newmont Mining Co., Empire Star's parent company, didn't leave Frank in peace to enjoy it, however. Until the U. S. entered World War II, Frank was sent everywhere from his Grass Valley base, tackling Newmont's metallurgical problems, usually in flotation and cyanidation.

He pioneered new flowsheets involving recovery of free gold by jigs and amalgamators, or by flotation and cyanidation of concentrates as a means of replacing all-cyanidation techniques. Many of these developments are now standard practice in gold mines.

During the war, McQuiston turned his attention to base metal problems, notably at Resurrection in Colorado, Gray Eagle in California, Bagdad in Arizona, and Idarado in Colorado. The flowsheet he worked out at Idarado for this complex gold, silver, copper, lead and zinc ore is a noteworthy accomplishment of this period.

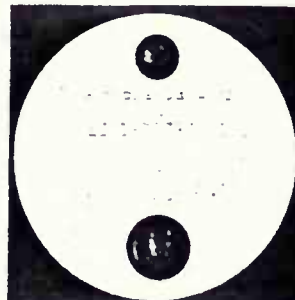
After the war, Frank returned to gold milling, putting much time in on developing a low-cost method of using activated carbon to recover gold from cyanide solutions. He stayed with the Newmont organization until January, 1948, when he was loaned to the AEC to help organize the Raw Materials Division. Although now doing a full-time job for the AEC, Frank still finds time for other things, for example, several trips to French Morocco as consultant to Soc. des Mines De Zellidja, the large new lead-zinc property in which Newmont has an interest.

That's the only trouble with Frank, after all. He gives too much of himself to his work, and to his industry. He's active in AIME affairs, and he has written numerous papers and articles. He seems always willing to take on another job, if it's worth doing. But for his own sake, and for the sake of the job he does so capably for the atomic energy program, we wish he'd slow down. Knowing Frank, we expect him to smile at this remark, agree that he'll "certainly try to," and keep right on going.

ROBERT H. RICHARDS AWARD



FRANK WOODS McQUISTON, JR.



CITATION: *Honoring his leadership and innovations in the fields of extractive metallurgical flowsheets and plant designs, especially for uranium, gold and copper and other sulfide minerals*

Frank Woods McQuiston was born in Pueblo, Colorado and spent his youth in and around the mining camps of Colorado, Utah and Arizona. He received his B.S. degree from the University of Southern California, Berkeley, in 1931.

In 1938, Mr. McQuiston organized the metallurgical research and development division of Newmont Exploration Limited. From 1941 to 1948 he worked as a metallurgist for Newmont and other western mining operations where he developed several flotation techniques now used in base metal mineral separations in the United States and Africa.

During a leave of absence from Newmont, while serving with the Atomic Energy Commission, Mr. McQuiston spearheaded the use of ion exchange in the South African uranium production program which was later used successfully in the United States and Canada. Earlier he was decorated by the French-Moroccan Government for his role in mill design and metallurgical development of the Zellidja lead-zinc mines.

Mr. McQuiston became a Newmont vice-president in 1964. He holds directorships in O'okiep Copper Company and Tsumeb Corporation Ltd., and is a director and vice-president of Carlin Gold Mining Company, Granduc Operating Company and Newmont Exploration Ltd.

The Robert H. Richards Award was established in 1947 to recognize "achievement in any form which unmistakably further the art of mineral beneficiation in any of its branches." The award is a silver vanning plaque engraved with the name of the recipient and the citation prepared in his honor.

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Robert H. Richards Award - 1968.

American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME)

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FRANK WOODS MCQUISTON, JR.
AN APPRECIATION BY R. S. SHOEMAKER

Frank W. McQuiiston, Jr. passed away at his home in San Rafael, California on March 17, 1987. Mac, the son of a mining engineer, was born on August 18, 1904 in Pueblo, Colorado and spent his youth in mining camps in Colorado, Utah and Arizona. He received his Bachelors Degree in Mining Engineering from the University of California in 1931, and employment being scarce in those days, he established an assay office in Jackson, California while rustling jobs in the mines there. He then became an assayer at the Spanish Mine for the Bradley brothers in Washington, California

In 1934, Mac went to work for Newmont's Empire Star Mines, Ltd. in Grass Valley, California where he became mill foreman and then research supervisor. The laboratory he established there was the foundation of Newmont's research facilities which still exist today in Danbury, Connecticut. During the period 1942-48, Mac was Newmont's Consulting Metallurgist for the Western United States. At that time he worked with T. G. Chapman of the University of Arizona and installed one of the first carbon-in-pulp plants at the Getchell Mine in Nevada. This work resulted in the first patent for a screen to separate carbon from pulp. Also, in that period he was awarded a French Order Alaouite-Cheritien Morocco for outstanding services for his contribution in making a success of a lead-zinc plant in Morocco.

From 1948 to 1952 Mac served with the U. S. Atomic Energy Commission, first as Consulting Metallurgist and then as Deputy Director, Raw Materials in Washington, D.C. During that time he and Robert Porter made major contributions to the use of ion exchange resins for the recovery of uranium from South African gold ores.

Returning to Newmont in New York in 1952, Mac made Chief Metallurgist and then Vice President of Newmont. In 1969 he retired to Napa, California but served as a Consultant to Newmont until 1982. Some of the plants for which he was in charge of the design in those years were Palabora in South Africa, Similkameen Copper in British Columbia and Carlin Gold in Nevada. Gold was always Mac's favorite metal, and he took an active part in consulting at Carlin until his retirement in 1982. His last venture in precious metals was AgAu Exploration, a successful silver heap leaching operation at Tuscarora, Nevada that he founded and operated with two friends

Mac was a prolific writer on the practical side of extractive metallurgy, and besides authoring several technical papers he was a contributor to the Mining Engineering Handbook and Surface Mining Volume. He was also co-author of the monographs Gold and Silver Cyanidation Plant Practices Volumes I and II, and Primary Chrusching Plant Design. Shortly before his death he authored Gold, the Saga of the Empire Mine which was published by the Empire Mine Association.

He was made a Distinguished Member of the Society of Mining Engineers in 1975, and an Honorary Member of AIME and received the AIME Richards Award in 1968. The Richards Award citation read, "Honoring his leadership and innovation in the field of extractive metallurgical flowsheets and plant designs, especially for uranium, gold, and copper and other sulfide minerals.

Mac is survived by his wife Fran of San Rafael, California and their son Michael. He will be remembered also by his many friends in the mining and metallurgical industries as a person who would always gladly give straight-forward and sage advice to all those who asked for it. We will all miss him.

1845 Palmerston Ave.
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V7V 2V3
August 11, 1987

Ms. Eleanor Swent
Research Interviewer
Californians in 20th Century Mining
Regional Oral History Office
The Bancroft Library
University of California
Berkeley, California 94720
U. S. A.

Dear Ms. Swent:

I have your letter requesting information about Frank McQuiston, for whom I had a great regard and respect. I am sorry I will not be in San Francisco in the near future but I am pleased to give you what information I have on the Similkameen property under your suggested headings.

1. The ore occurred in two main zones, the "Ingerbelle" deposit on the west slope of the Similkameen valley and the "Similkameen" deposit on the east slope, adjacent to the old Copper Mountain mine, previously operated by the Granby Mining Company. These two areas were separated by the deep canyon of the Similkameen River.

Ore mineralization was chiefly chalcopyrite with minor but important amounts of gold and silver. Some bornite also occurred in certain parts of the Copper Mountain deposits. In general the ore minerals were finally disseminated in bedded andesitic host rock which was very "tough" and difficult to grind. This toughness together with the fine grinding required for reasonable recovery resulted in a very high power consumption per ton and for this reason autogenous grinding mills were installed. Because of rock friability in the upper parts of the mine it was necessary to add large balls to the grinding mills, but this eventuality had been allowed for in the design. Several years after start-up, two large ball mills were added to the circuit to increase throughput from 15,000 to 22,000 tons per day.

2. Mill location and design was complicated by the very steep and rugged terrain and the fact that the two widely separated orebodies must be considered as a whole. Also the only suitable area for tailings storage was a valley about two miles north of the orebodies and east of the river. After a great deal of investigation and study the concentrator was located on the east side of the river, about one mile north of the Ingerbelle deposit, which was to be mined first. Tailings were transported by pipeline across the Similkameen canyon on the suspension bridge and reclaimed water pumped back over the same bridge for reuse. Later, when the Ingerbelle deposit was mined out, a separate crushing plant was installed at Copper Mountain and the crushed ore transported by conveyor across the canyon on the second suspension bridge to the existing concentrator.

Preproduction mining and construction of the concentrator and related facilities were started in 1970 and the mine was in full production by September 1972. Despite summer temperatures of 90° F and winter temperatures of -30 to -40° F, with several feet of snow, the project went very smoothly. Design and supervision of construction of the plant was by Bechtel, overseen by Newmont staff, including Frank McQuiston. Construction was carried out by B.C. construction companies well experienced in local conditions.

Water required for the plant and domestic use, in addition to that reclaimed from the tailings, was pumped by a high-head system from the Similkameen River. Concentrates were dried and stored at the mine for shipment by truck to storage in Vancouver and subsequent shipment to Japanese smelters.

All mining was done by Newmont Mines crews under the mine staff. A townsite adjacent to the town of Princeton was built for the employees. Because of the favorable location of the mine, it was possible to obtain and train good employees, many of them local people, well before full production started.

3. Storage of tailings for the Similkameen project in rugged terrain and with the main river a part of the international water system was a serious problem. The only practical solution was, as mentioned, to transport the tailings across the canyon to a valley occupied by a "dead" lake. Permission was obtained from the B.C. government to use this area under strict environmental controls. Starter dams designed by Bechtel were built of carefully selected local material at each end of the valley with the future dams raised by cycloned and compacted tailings. This system was later changed to building by depositing cycloned sands inboard of

the dam crests. The dams are presently several hundred feet high. Reclaimed water is pumped from stations on barges midway between the dams via a pipeline across the suspension bridge to the concentrator. Another pumping system outside the dams picks up any sub-surface seepage by means of wells and returns the water to the settling pond inside the dams.

4. The main technological differences at Similkameen, other than problem of logistics and topography, was in the grinding circuits. Autogenous grinding, while well known elsewhere, was new in B.C. The mills were very large (32 ft diameter by 14 ft single stage) and were each powered by two 4000 hp motors. Oversized material was to be crushed in 4 ft cone crushers, but when it became necessary to add steel balls to the mills these crushers had to be removed from the circuit.

Power for the property was supplied by B.C. Hydro over a new 68 mile transmission line financed by Similkameen. Design of the electrical system, particularly in regard to starting the very large mill motors, presented a number of difficult problems.

To speed the start-up of the mills the very large gears, which could only be cut in England, were flown in four 11 ton segments per gear in large transport planes to Vancouver and trucked to the mine. This saved almost two months per mill over shipment by sea and rail.

The suspension bridge and the relocation of the main highway also presented interesting design and construction problems. (See "The Similkameen Project".)

5. There were no special considerations or problems because Newmont, a U.S. company, was operating in Canada. Newmont had operated here for many years and had purchased most of the property, including water rights and the tailings area from the Granby Mining Company, an old established Canadian company. Also the fact I was a British Columbian and a Canadian and knew many of the Provincial and Federal officials may have helped.

Granby had shipped copper concentrates to Japan for many years, and as executive vice-president for Granby prior to joining Newmont I was very familiar with this practice. Details of the smelting contracts were finalized by Newmont's New York head office mainly by J.E. Thompson, President of Newmont Mining Corporation.

6. Frank McQuiston was an extraordinary man. He had very wide experience in metallurgical installations, both design and operating, of various sizes from small to large and in many countries. He had a good theoretical mind but was extremely practical. He was a very good "company" man in the best sense of the word. He did not allow any "gold-plating" or waste of money on any project he was involved with but on the other hand did not skimp or cut back on equipment or features that would really make for an efficient operation.

He had good relations with his supervisors. He was not a "yes man" but told things as they were in a non-abrasive way and he always had a good reason for his opinion.

He also got on well with his peers. He was courteous and friendly and was always willing to discuss a problem and offer good advice. He was generally well liked by his assistants and was considered a good man to work for and learn from. However he could be rather impatient and caustic with anyone he considered stupid.

He liked challenges and often came up with an original solution to a difficult problem. He would argue strongly for something he believed in but usually tried to keep the discussion from becoming heated. If he did not agree with something he would say so in positive terms. I can remember a good many arguments, particularly with some of our consultants, when we did not agree with their suggestions or recommendations but these differences were resolved to the benefit of the project. In all our sessions with Bechtel, Frank was in control of the meetings and kept the pace brisk.

I am sorry that Frank was unable to complete his story before his death and hope that I have been able to fill in some of the gaps. I am enclosing a copy of a paper I presented on Similkameen in April 1973, which may give you a fuller picture of the project.

Regarding Granduc, I took over the property a few years after it started and was not involved in the design and construction. Dave Christie worked closely with Frank McQuiston on it and I am sure he could give you whatever information you needed.

Yours very truly,

J. H. Parliament

*per
en* J. H. Parliament

JHP/em
encl.

The Similkameen Project

J. H. PARLIAMENT, Executive Vice-President,
Similkameen Mining Company Limited,
Vancouver, B.C.

ABSTRACT

The 15,000-tpd Similkameen open-pit copper mine, 10 miles south of Princeton, B.C., started production during 1972. The two main ore zones are separated by the deep canyon of the Similkameen River, with the Ingerbelle or western deposit being mined first. The location, design and construction of the plant were complicated by the steep terrain and the situation of the orebodies.

Mining, utilizing 10-cu.yd electric shovels and 100-ton electric-wheel trucks, is conventional. Closely integrated with the preproduction mining was the construction of a 4-mile section of main highway to bypass the Ingerbelle pit. This entailed a very large fill, placed with mine equipment.

Ore is crushed to minus 9 inches, stockpiled and reclaimed for direct delivery to three 32-ft-diameter by 14-ft single-stage autogenous grinding mills, each driven by two 4000-hp motors. Because of the friable ore in the upper part of the mine, 4-inch balls are added, with higher than design throughput attained. Classification is by 96-inch spiral classifiers and cyclones. The flotation section comprises three parallel lines of ten 400-cu.ft rougher-scavenger cells and a single line of 100-cu.ft cleaner and recleaner cells. Concentrate is transported in end-dump, closed trucks to Vancouver for dockside storage prior to shipment to the smelter.

Tailings are piped across the canyon on a suspension bridge and through a tunnel to an empoundment area. Water is reclaimed and returned to the concentrator, forming a closed system. Dams are raised with cycloned sands, with the downstream section compacted.



J. HARVEY PARLIAMENT, executive vice-president, Similkameen Mining Company Limited, and vice-president and general manager, Granduc Operating Company, is a native of British Columbia. After a number of years in practical mining and milling, he entered the University of British Columbia and graduated with a B.A.Sc. in geological engineering in 1945.

After graduation he worked for the B.C. Department of Mines, B.R.X. Mines and Polaris-Taku Mines. In 1949, he joined the Granby Mining Company at Copper Mountain and was a mine geologist and then chief engineer. He became manager of Phoenix Copper Company in 1955, general manager of Granby Mining Company in 1962 and executive vice-president of Granby in 1966. In 1968 he joined Newmont Mining Corporation as executive vice-president of Similkameen Mining Company, and in February, 1973 was also made vice-president and general manager of Granduc Operating Company.

Mr. Parliament has served as Chairman of the Vancouver Branch and as vice-president, District 6, of the CIM. He is also a member of the Professional Engineers of British Columbia.

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INTRODUCTION

THE SIMILKAMEEN PROJECT would have involved a fairly routine low-grade open-pit copper mine and treatment plant except that the two main ore deposits are separated by a deep canyon, the concentrator and tailings impoundment areas are on opposite sides of the canyon and a highway traversed one of the orebodies. Also, the concentrator was designed for fully autogenous grinding with very large mills.

These factors, together with the steep, rugged topography, presented some interesting problems in design, construction and logistics. This paper will mainly describe these problems and how they were handled, with only a brief description of mining and milling practice.

LOCATION AND HISTORY

The operation of Similkameen Mining Company Limited, a wholly owned subsidiary of Newmont Mining Corporation, is located in southern British Columbia about 170 miles east of Vancouver. It is 10 miles south of the town of Princeton and about 20 miles north of the U.S. border.

The Princeton area has a long history of mining and many of the claims now owned by Similkameen were staked around 1900. The Granby Mining Company operated the Copper Mountain mine from 1923 until its closure in 1957. In 1966 Newmont acquired the Ingerbelle property on the west side of the Similkameen River and in 1967 purchased all of Granby's assets in the Princeton area and formed Similkameen Mining Company Limited. After an extensive program of surface and underground drilling, metallurgical test-work and engineering studies, a decision was made in June, 1970 to place the property in production. Preproduction mining and construction of a concentrator and related facilities to treat 15,000 tons of ore per day were started. In April, 1972 the first of the three grinding units was run in and by September, 1972 the mine was in full production.

DESCRIPTION OF PROPERTY

The Similkameen property consists of two main ore zones, the "Ingerbelle" deposit on the west slope of the Similkameen valley and the "Similkameen" deposits on the east slope, adjacent to the old Copper Mountain mine. These two areas are separated by the deep canyon of the Similkameen River. Ore reserves developed to date total 76 million tons mineable by open-pit methods, with a grade of 0.53% copper and an average ratio of 2.2 tons of waste to 1 ton of ore. In addition, an appreciable tonnage of ore of similar grade will likely be recoverable by open-pit operations from the caved area of the old Copper Mountain mine. Ore mineralization is chiefly chalcopyrite, with minor but important amounts of gold and silver.

The topography in the vicinity of the ore deposits varies from fairly steep on the upper slopes of the

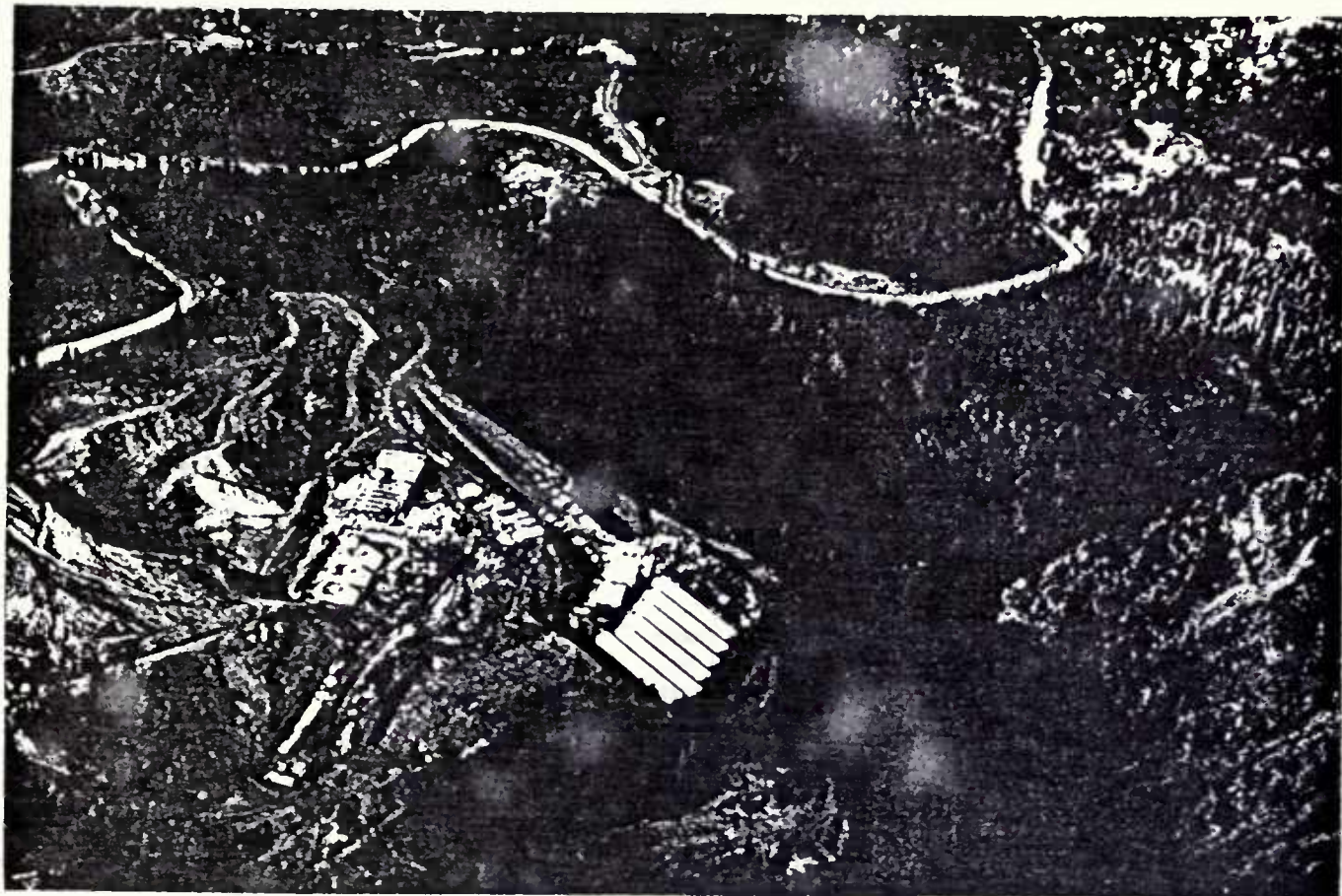


FIGURE 2 — Similkameen plant under construction, showing the river canyon, the old road in the upper part of the picture and the new road under construction at the top of the picture

The Southern Transprovincial highway, a heavily travelled route across British Columbia, crossed almost over the center of the Ingerbelle orebody. In order to mine this area, it was necessary to relocate a 4-mile section of highway west of the pit limits. Designing and constructing this road, which was built at Similkameen's expense and largely by company forces, was an important part of the preproduction program.

Design of the plant electrical system presented a number of difficult problems, particularly in regard to starting the very large mill motors. Power for the plant is supplied by B.C. Hydro over a new 68-mile 138-kv transmission line financed by Similkameen.

MINING

Mining to prepare the Ingerbelle pit for production was started in December, 1970 and about 23.5 million tons of waste rock and alluvium were removed during preproduction operations. Mining is currently proceeding at the rate of 85,000 tons of ore and waste per day on a three-shift schedule, five days per week, to supply the concentrator, which operates on a continuous basis.

The Ingerbelle pit has a bench height of 40 feet. Drilling is on a 22- by 22-ft pattern using three electrically powered, 60-R rotary drills. Hole size is 9 7/8 inches and the holes are drilled 9 feet below grade. Blasting is mainly done with ANFO, with plastic sleeves used in wet holes.

Four 10-cu.yd electric shovels are provided for loading, with three normally used at one time. Pit cleanup is done with three rubber-tired bulldozers. A 15-cu.yd front-end loader is used to supplement the shovels and for loading jobs outside the pit area. The hauling fleet consists of fifteen 100-ton-capacity, electric-wheel trucks powered with 1,000-hp engines.

Mining during the early stages of development was complicated by the proximity of the old highway, which was very heavily travelled, particularly during tourist season. Traffic was stopped daily during blasting operations, but by careful co-ordination and the use of radio communication this delay was eventually reduced to less than five minutes per day.

HIGHWAY CONSTRUCTION

As previously mentioned, a new section of main highway a little over 4 miles in length was constructed west of the pit to replace the existing highway which traversed the Ingerbelle orebody. It was necessary to complete this new road, including paving it, by September, 1971 in order that the old road could be removed before the concentrator start-up early in 1972. Because of late delivery of equipment this resulted in a very tight schedule.

To obtain the grades and alignment specified by the B.C. Department of Highways the route required several large fills. As it was decided to build these with mine equipment, using waste material removed while stripping the orebody, the road construction was closely integrated with the mining program.

The right-of-way was cleared and the road grade was constructed, except for the fills, by a contractor. Access roads were then built from the pit to the fill areas and construction of the fills started by mine personnel.

The fill material, composed of well-graded blasted rock and alluvium, was placed in 10-foot-thick layers. Continual travel of the single-axle mine trucks, with a gross weight of about 165 tons, over the surface of the layers produced excellent compaction. The first two fills were relatively small, containing 250,000 tons and 800,000 tons respectively, and were fairly easy to build.

The third fill, however, was in the form of a curve which crossed and partially followed a deep ravine. This fill, believed to be one of the largest ever built for highway purposes, was 300 feet deep at its deepest part and, when finished, contained almost 7 million tons of compacted material. Constructing access roads and placing this amount of material in 10-foot layers was a major job.

A haul road at minus-10% grade was built down the sides and along the bottom of the ravine. The material was then placed in layers to the required limits, retreating successively up the haul road to the final elevation. As each layer was put down it was capped with alluvium to help prevent tire wear. Trucks were routed over the entire surface of each layer to obtain uniform compaction.

After completion of the new highway, a safety berm built of mine waste rock was constructed on the lower side of the road. This berm, about 100 feet wide and 15 feet higher than the road surface, parallels the highway for about 4,000 feet. The slope facing the highway has been planted with grass and the surface planted with grass and trees. This forms a "green belt" and an effective screen between the highway and the mining operation.

PROCESS DESCRIPTION

Pit-run ore is delivered by 100-ton-capacity trucks to a 54- by 74-inch gyratory primary crusher with an open-side setting of 9 inches. The crushing plant is designed for one-man operation and has no superstructure except the operator's control cab. Servicing of the crusher is done with an 85-ton mobile crane, also used for servicing mine equipment. A hydraulic grapple is used to dislodge oversize feed.

Crushed ore is fed from the crusher surge pocket by a 96-inch-wide belt feeder onto a 48-inch discharge conveyor and then to a stacking conveyor. The stacker, designed to swing 45 degrees in either direction as well as to be raised or lowered to minimize dust, delivers the ore onto a kidney-shaped stockpile with a design capacity of 45,000 live tons.

Ore is recovered from the coarse-ore stockpile by three reclaim tunnels, each containing a 42-inch conveyor fed by two reciprocating plate feeders. Each reclaim conveyor delivers ore directly to a 32-foot-diameter by 14-foot autogenous mill powered by two 4,000-hp electric motors. Each mill is designed to grind 5,000 tons per day and yield a product of 65 per cent minus 200 mesh.

Discharge from the mill passes through an 8-foot-diameter by 22-foot trommel with $\frac{3}{4}$ -inch square perforations. Trommel oversize returns to the mill and the undersize goes to a 96-inch-diameter, single spiral

classifier. Sands from the classifier return to the mill, with the classifier overflow pumped to a bank of seven 20-inch primary cyclones. Cyclone overflow goes to the flotation circuit and the underflow returns to the mill.

The mills were designed to be fully autogenous, but most of the ore from the upper part of the mine proved to be too friable to act as grinding media and it was necessary to add 4-inch steel balls to obtain a satisfactory grinding rate. Originally, 3-inch trommel oversize was fed to a 4-foot short-head cone crusher, which reduced it to minus $\frac{3}{4}$ -inch and returned it to the mill. However, since the use of balls, the crushers are not used and have been locked out of the circuit. It is expected that as the pit becomes deeper the characteristics of the ore will change and fully autogenous grinding will be possible. Ball consumption is about 1.5 pounds per ton of ore and grinding rates in excess of design capacity are being consistently attained.

The flotation section is comprised of three parallel banks of ten 400-cu.ft rougher-scavenger cells, one bank of eight 100-cu.ft cleaner and three 100-cu.ft recleaner cells, and one bank of five 400-cu.ft cleaner-scavenger cells.

The rougher-scavenger concentrate is delivered to a regrind mill which reduces it to about 90 per cent minus 325 mesh. This regrind mill was originally designed to use 3-inch pebbles from the autogenous mills as grinding media, but at present $1\frac{1}{2}$ -inch steel balls are being used.

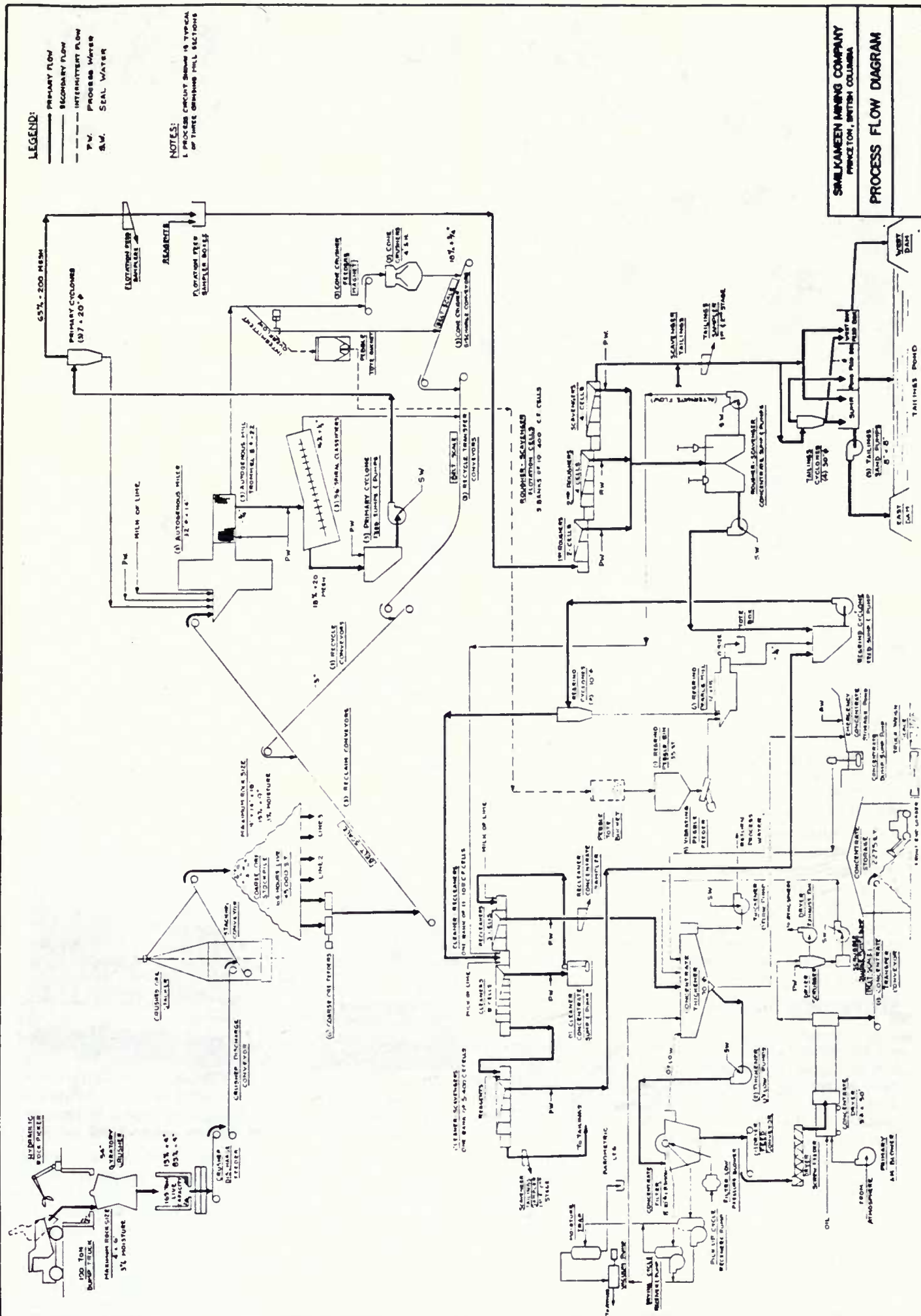
Concentrate is thickened to about 60 per cent solids in a 70-foot-diameter thickener located outside the concentrator building. Thickened concentrate is pumped to a disc-type vacuum filter which discharges it at about 15 per cent moisture to a rotary dryer. Dried concentrate at about $7\frac{1}{2}$ per cent moisture is stored, then shipped by truck to Vancouver, where it is again stored prior to loading aboard ship for delivery to overseas smelters.

CONSTRUCTION OF THE CONCENTRATOR

Location of a suitable site for the concentrator and related facilities, as previously mentioned, required a great deal of investigation and study. The site finally selected was on a sloping hillside, just above the break-off into the canyon. Bedrock suitable for crusher foundations was exposed at the top of the slope, but the remainder of the site was overlain by up to 200 feet of glacially compacted sand and gravel. Careful drilling indicated that the bedrock, although too deep for mill foundations, was cup-shaped and that the site would afford stable support for the large mills.

The hillside was excavated to provide a level site for the concentrator and the office-shop-warehouse complex, with the removed material used to build a flat area at a slightly lower elevation for the construction campsite. This area was later used for the concentrate storage and loadout. The site was relatively small, with restricted room for material laydown, and very careful scheduling was necessary.

The mills were founded on widespread reinforced concrete mats below floor level, each containing 1,200 cu. yds of concrete. The piers and above-ground foundations required an additional 1,300 cu. yds for each mill. Local gravel sources were not suitable and con-



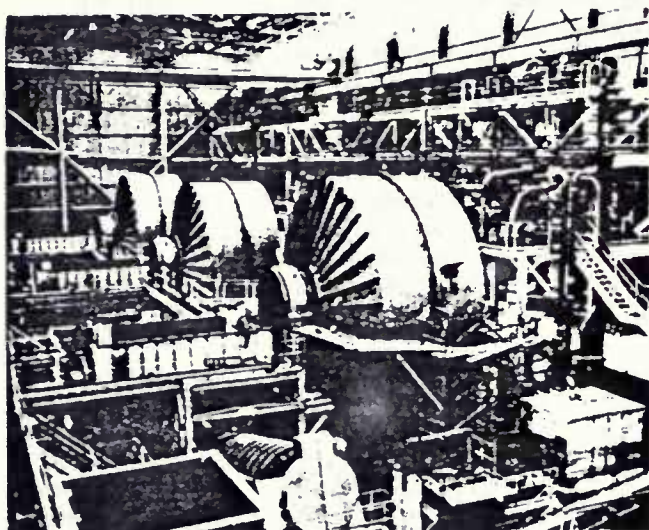


FIGURE 4—Interior of the Similkameen concentrator, showing the three autogenous mills prior to installation of trommels and main gears.

crete aggregate was trucked about 40 miles to a batching plant at the site. Concrete work was continued through the winter months with little difficulty.

Much of the structural steel was supplied from Vancouver by truck, with the shipments arranged to arrive to suit the erection schedule. Heavy equipment was brought to Princeton by rail and was then trucked to the mine site.

The 38-foot-diameter main drive gears for the autogenous mills, the largest cut to date, were made in England. The production schedule provided for completion of the gears at approximately two-month intervals, and this became the critical factor controlling the start-up date. It was decided to place the grinding circuits in production one at a time, as soon as each unit could be completed. To advance the starting dates, the gears were flown from England to Vancouver, and then trucked directly to the mine site. Each gear was made up of four 11-ton bolted segments and two segments were carried by one airplane.

Construction of the plant went quite smoothly, with practically no labour trouble. Because of the location of the project it was possible to work a five-day week for most of the job, with the construction crews driving home to Vancouver or interior towns for the weekends. A major problem presented by this arrangement was in providing sufficient parking space at the site for the construction workers' automobiles.

SUSPENSION BRIDGE

The design and construction of the suspension bridge to carry the tailings and reclaim water pipelines across the Similkameen canyon was an integral part of the project. This was particularly difficult because of the very steep terrain, the limited access and working areas, and the severe climatic conditions.

The bridge deck is 600 feet above the river and is supported by cables from two towers 950 feet apart. The north tower is 136 feet and the south tower 122 feet in height. The two main support cables each consist of four 2-inch-diameter strands clamped together at 25-foot intervals, with $\frac{3}{4}$ -inch suspender cables also attached at these points. Lateral guying is provided by upstream and downstream wind cables, each made up of four $1\frac{3}{4}$ -inch strands.

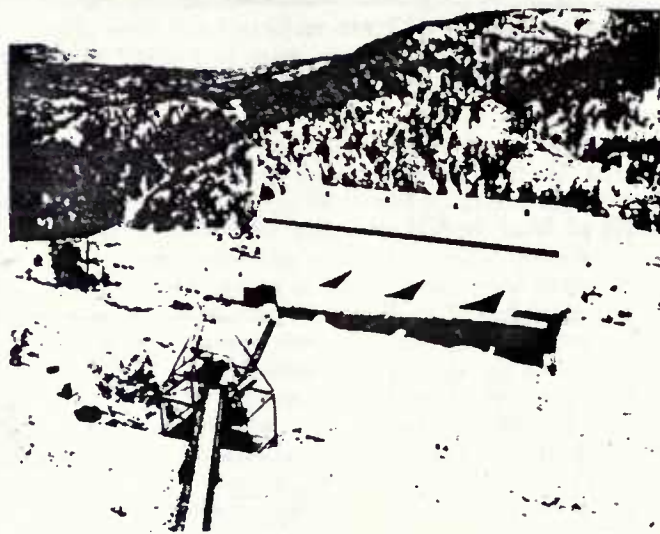


FIGURE 5—The Similkameen concentrator during construction. The office and shops are to the left of the main building and the coarse ore stacker is in the foreground.

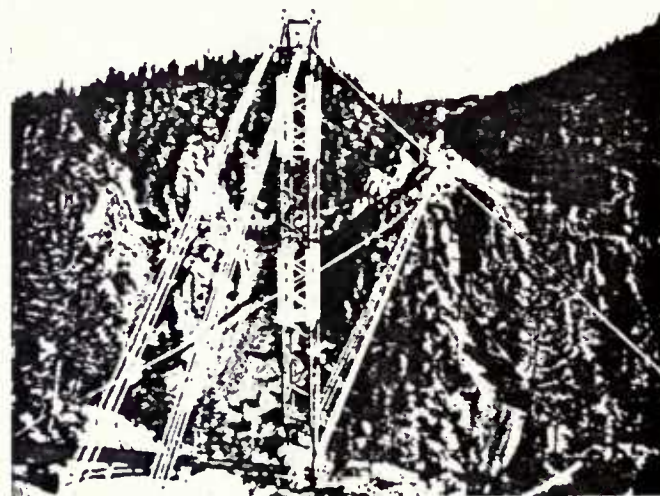


FIGURE 6—Pipeline bridge across the Similkameen canyon.

The towers, comprised of four 12-WF120 columns, are 8 feet square and are attached by pin connections to concrete foundations. The main bridge cables are attached to connectors at the top of the towers. The towers are tied back at 45 degrees by a separate set of cables, similar to the main cables but made up of four 2-3/16-inch strands, and are guyed laterally by two $1\frac{3}{4}$ -inch cables from each side of each tower.

The tower support cables and wind cables are anchored to monolithic concrete blocks tied into bedrock by post-tensioned cables. Each anchorage consists of 12 cables made up of eight 0.6-inch-diameter spaced strands, grouted into 4-inch holes drilled 74 feet deep into bedrock. The anchor foundations were located on very steep rock faces and required over 5,000 cu. yds of rock excavation to obtain access and solid footings.

The north tower was erected first, using a 40-ton crane. A 1-inch nylon line was then carried across the canyon from the south side by helicopter and this line was used to pull wire ropes across for temporary tower guys and for the "high-line". The "high line", attached to the north tower and a temporary tower on the south side, was the cable-way from which the bridge was built. The main cables and wind cables were made up on the north side and pulled across to

the south side with the suspenders and wind support cables attached. The bridge deck was installed in 25-foot sections starting from the south side and using a travelling carriage hung from the high-line. The tailings lines were made up into 120-foot sections and installed in a similar manner. The 18-inch-diameter reclaim water line, suspended under the bridge, was butt-welded and pulled across from north to south, sliding on teflon pads.

The bridge carries three pipe lines and a 5-kv power cable. The main tailings line, 20 inches in diameter and made of rubber-lined abrasion-resistant steel, rests on supports at deck level. Under it is a spare 20-inch line, also of AR steel, but without rubber lining. Below the bridge deck, on tubular supports, is the 18-inch reclaim water line. All the lines rest on teflon pads to allow for thermal expansion. On each side of the pipe lines is a 2-foot walkway with a hand-rail and safety fence.

The bridge is designed to withstand wind gust velocities to 90 mph and to carry an ice load based on a 1-inch-thick ice coating on all surfaces. The range of temperature used in the design was from -45° to 107°F , although actual temperatures usually range from -30° to 100°F . Because of the difficulty in siting anchor points, the wind cables are not symmetrical in plan, which further complicated the design.

TAILINGS AND WATER SYSTEMS

Tailings are piped by gravity from the concentrator across the bridge, along a narrow, steep-walled gully and through a 900-foot-long tunnel to the west end of the Smelter Lake valley. This valley is an old channel of the Similkameen River, filled during glacial times. It has steep, rocky sides and its bottom was mainly occupied by a shallow eutrophic lake. Dams erected at each end of the valley form an effective impoundment area well out of general view.



FIGURE 7—Part of the housing development in Princeton for Similkameen employees.

Prior to commencement of operations, earth-fill starter dams about 60 feet high were constructed of selected local material. These dams will be progressively raised over the life of the mine, using the sand portion of the cycloned tailings. A central cyclone station, equipped with four 30-inch-diameter cyclones and located just below the north portal of the tunnel, processes the required quantity of sands, with the balance of the tailings discharged some 1,000 feet farther east. Sands flow by gravity to the west dam and are pumped through an 8-inch line about 8,000 feet to the east dam.

The sands are deposited on the upstream side of the dams throughout most of the year. During the summer months the dams will be raised by transporting sands to the downstream side of the dams and placing them in thin layers with a self-elevating scraper and then compacting the layers with a vibrating-wheel compactor.

Decanted water is returned to the concentrator for re-use through a buried 18-inch pipe line by means of barge-mounted pumps. Two barges are located near the east end of the impoundment area, each mounting two 1360-USgpm vertical turbine pumps powered by 300-hp motors and one 430-USgpm pump powered by a 125-hp motor. The reclaim process water is stored in a head tank, with a capacity of 200,000 U.S. gallons, located on the hillside above the concentrator. This closed system reclaims approximately 70% of the water used, with the balance chiefly retained in the tailings or lost through evaporation, and practically precludes any escape of effluent into the surrounding drainage systems.

Make-up process water, as well as water for domestic, gland sealing and cooling purposes, is obtained from the Similkameen River. Water is drawn through horizontal perforated pipes extending from the pump station into the river bed. Four 12-stage vertical turbine pumps, each rated at 850 USgpm and powered by a 300-hp motor, are provided, with two normally in use. River water is pumped through a 12-inch line against a total dynamic head of approximately 900 feet to a storage tank with a capacity of 545,000 U.S. gallons. This tank also provides fire protection for the concentrator complex. Water for mine use and fire protection is pumped from this tank to a 100,000-gallon tank located near the mine repair shop.

HOUSING

All Similkameen employees live in the town of Princeton, about 10 miles by excellent paved road from the mine. A subdivision was developed by the company and 55 housing units were built for sale to employees, with provision for further houses as required. The area was laid out to take the best advantage of the site, with the trees left undisturbed as much as possible. This, combined with the curving paved streets, makes an attractive setting for the houses.

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Eleanor Herz Swent

Born in Lead, South Dakota, where her father became chief metallurgist for the Homestake Mining Company. Her mother was a high school geology teacher before marriage.

Attended schools in Lead, South Dakota. Dana Hall School, and Wellesley College, Wellesley, Massachusetts. Phi Beta Kappa. M.A. in English, University of Denver. Assistant to the President, Elmira College, New York. Married to Langan Waterman Swent, mining engineer.

Since marriage has lived in Tayoltita, Durango, Mexico; Lead, South Dakota; Grants, New Mexico; Piedmont, California.

Teacher of English as a Second Language to adults in the Oakland, California public schools. Author of an independent oral history project, Newcomers to the East Bay, interviews with Asian refugees and immigrants. Oral historian for the Oakland Neighborhood History Project.

Interviewer, Regional Oral History Office since 1985, specializing in mining history.