The Trouble with Mining Activities over the Years
by
Robert Shoemaker, et al., 1996

TABLE OF CONTENTS--Robert Shoemaker

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. In its tenth year the series numbers thirty-five volumes completed and others in process.

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. Langan Swent delighted in referring to himself as "technical advisor" to the series. He abetted the project from the beginning, directly with his wise counsel and store of information, and indirectly by his patience as the oral histories took more and more of his wife's time and attention. He completed the review of his own oral history transcript when he was in the hospital just before his death in 1992. As some of the original advisors have died, others have been added to help in selecting interviewees, suggesting research topics, and securing funds.

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 of AIME 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. Later the National Mining Association became a sponsor. The project was significantly advanced by a generous bequest received in November 1997 upon the death of J. Ward Downey, UC Berkeley alumnus and early member of the mining series advisory committee. His own oral history was completed in 1992. Other individual and corporate donors are listed in the volumes. Sponsors to date include nineteen corporations, four foundations, and 113 individuals. The project is ongoing, and funds continue to be sought.

The first five interviewees were all born in 1904 or earlier. Horace Albright, mining lawyer and president of United States Potash Company, was ninety-six years old when interviewed. Although brief, this interview adds another dimension to 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. In 1990, he was inducted into the National Mining Hall of Fame, Leadville, Colorado.

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. His uncle, Frederick Worthen Bradley, who figures in the oral history, was in the first group inducted into the National Mining Hall of Fame in 1988.

Frank McQuiston, metallurgist for the Raw Materials Division of the Atomic Energy Commission and 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. After over thirty individual biographical oral histories were completed, a community oral history was undertaken, documenting the development of the McLaughlin gold mine in the Napa, Yolo, and Lake Counties of California (the historic Knoxville mercury mining district), and the resulting changes in the surrounding communities. This comprises forty-three interviews.

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. A list of completed and in process interviews for the mining series appears at the end of this volume.

The Regional Oral History Office is under the direction of Willa Baum, division head, and under the administrative direction 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

January 1998
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University of California, Berkeley

Western Mining in the Twentieth Century Oral History Series

Interviews Completed, March 2001

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

Samuel S. Arentz, Jr., *Mining Engineer, Consultant, and Entrepreneur in Nevada and Utah, 1934-1992*, 1993

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

William Clark, *Reporting on California's Gold Mines for the State Division of Mines and Geology, 1951-1979*, 1993

John Robert Clarkson, *Building the Clarkson Company, Making Reagent Feeders and Valves for the Mineral Industry, 1935 to 1998*, 1999

Norman Cleaveland, *Dredge Mining for Gold, Malaysian Tin, Diamonds, 1921-1966; Exposing the 1883 Murder of William Raymond Morley*, 1995

Harry M. Conger, *Mining Career with ASARCO, Kaiser Steel, Consolidation Coal, Homestake, 1955 to 1995: Junior Engineer to Chairman of the Board*, 2001

James T. Curry, Sr., *Metallurgist for Empire Star Mine and Newmont Exploration, 1932-1955; Plant Manager for Calaveras Cement Company, 1956-1975*, 1990

Donald Dickey, *The Oriental Mine, 1938-1991*, 1996

J. Ward Downey, *Mining and Construction Engineer, Industrial Management Consultant, 1936 to the 1990s*, 1992

Warren Fenzi, *Junior Engineer to President, Director of Phelps Dodge, 1937 to 1984*, 1996

The Knoxville Mining District, The McLaughlin Gold Mine, Northern California, Volume I, 1998

Anderson, James, "Homestake Vice President-Exploration"
Baker, Will, "Citizen Activist, Yolo County"
Birdsey, Norman, "Metallurgical Technician, McLaughlin Process Plant"
Bledsoe, Brice, "Director, Solano Irrigation District"

The Knoxville Mining District, The McLaughlin Gold Mine, Northern California, Volume II, 1998

Cerar, Anthony, "Mercury Miner, 1935-1995"
Ceteras, John, "Organic Farmer, Yolo County"
Conger, Harry, "President, Chairman, and CEO, Homestake Mining Company, 1977 to 1994"
Corley, John Jay, "Chairman, Napa County Planning Commission, 1981 to 1985"
Cornelison, William, "Superintendent of Schools, Lake County" (Includes an interview with John A. Drummond, Lake County Schools Attorney)

The Knoxville Mining District, The McLaughlin Gold Mine, Northern California, Volume III, 1998

Crouch, David, "Homestake Corporate Manager-Environmental Affairs"
Enderlin, Elmer, "Miner in Fifty-Eight Mines"
Fuller, Claire, "Fuller's Superette Market, Lower Lake"
Goldstein, Dennis, "Homestake Corporate Lawyer"
Guinivere, Rex, "Homestake Vice President-Engineering"

The Knoxville Mining District, The McLaughlin Gold Mine, Northern California, Volume IV, 1998

Gustafson, Donald, "Homestake Exploration Geologist, 1975-1990"
Hanchett, Bonny Jean, "Owner and Editor, Clearlake Observer, 1955-1986"
Hickey, James, "Director of Conservation, Development, and Planning for Napa County, 1970 to 1990"
Jago, Irene, "The Jagos of Jago Bay, Clear Lake"
Jonas, James, "Lake County Fuel Distributor"
Koontz, Dolora, "Environmental Engineer, McLaughlin Mine, 1988-1995"

The Knoxville Mining District, The McLaughlin Gold Mine, Northern California, Volume V, 1998

Kritikos, William, "Operator, Oat Hill Mine"
Landman, John, "Rancher, Morgan Valley"
Lyons, Roberta, "Journalist and Environmentalist"
Madsen, Roger, "Homestake Mechanical Engineer"
Magoon, Beverly, "Merchant and Craft Instructor, Lower Lake"
McGinnis, Edward, "Worker at the Reed Mine"

The Knoxville Mining District, The McLaughlin Gold Mine, Northern California, Volume VI, 1999
Robert McKenzie, "McKenzies in Monticello, Berryessa Valley
Harold Moskowite, "Napa County Supervisor"
Marion Onstad, "Neighbor and Employee of the McLaughlin Mine, 1980-1995"
Ronald Parker, "Resident Manager of the McLaughlin Mine, 1988-1994"
Richard Stoehr, "Homestake Engineer and Geologist to Senior Vice-President and Director"
Joseph Strapko, "Exploration Geologist, McLaughlin Mine Discovery, 1978"

The Knoxville Mining District, The McLaughlin Gold Mine, Northern California, Volume VII, 2000
Jack Thompson, "General Manager, McLaughlin Mine, 1981-1988"
Twyla Thompson, "County Supervisor, Yolo County, 1975-1985"
Avery Tindell, "Capay Valley Environmentalist"
John Turney, "McLaughlin Metallurgist: Pioneering Autoclaving for Gold"
Della Underwood, "Knoxville Rancher, McLaughlin Mine Surveyor"
Walter Wilcox, "County Supervisor, Lake County, 1979-1995"
Peter Scribner, "Boyhood at the Knoxville Mine, 1941-1944"

Marian Lane, *Mine Doctor's Wife in Mexico During the 1920s*, 1996

John Sealy Livermore, *Prospector, Geologist, Public Resource Advocate: Carlin Mine Discovery, 1961; Nevada Gold Rush, 1970s*, 2000

J. David Lowell, *Using Applied Geology to Discover Large Copper and Gold Mines in Arizona, Chile, and Peru*, 1999

Plato Malozemoff, *A Life in Mining: Siberia to Chairman of Newmont Mining Corporation, 1909-1985*, 1990

James and Malcolm McPherson, *Brothers in Mining*, 1992

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

James H. Orr, *An Entrepreneur in Mining in North and South America, 1930s to 1990s*, 1995

Vincent D. Perry, *A Half Century as Mining and Exploration Geologist with the Anaconda Company*, 1991

Patrick Purtell, *Maintenance and Management at the McLaughlin Mine, 1985 to 1997*, 1999

Carl Randolph, *Research Manager to President, U.S. Borax & Chemical Corporation, 1957-1986*, 1992

John Reed, *Pioneer in Applied Rock Mechanics, Braden Mine, Chile, 1944-1950; St. Joseph Lead Company, 1955-1960; Colorado School of Mines, 1960-1972*, 1993

Joseph Rosenblatt, *EIMCO, Pioneer in Underground Mining Machinery and Process Equipment, 1926-1963*, 1992

Robert Shoemaker, *Metallurgical Engineer: Union Carbide, Bechtel, San Francisco Mining Associates; Metallurgical Consultant, 1953 to 2000*, 2001

Eugene David Smith, *Working on the Twenty-Mule Team: Laborer to Vice President, U.S. Borax & Chemical Corporation, 1941-1989*, 1993

Simon Strauss, *Market Analyst for Non-ferrous Metals and Non-metallic Minerals, Journalist, Mining Corporation Executive, 1927-1994*, 1995

Langan W. Swent, *Working for Safety and Health in Underground Mines: San Luis and Homestake Mining Companies, 1946-1988*, 1995

James V. Thompson, *Mining and Metallurgical Engineer: the Philippine Islands; Dorr, Humphreys, Kaiser Engineers Companies; 1940-1990s*, 1992

William Wilder, *Owner of One Shot Mining Company: Manhattan Mercury Mine, 1965-1981*, 1996

Alexander M. Wilson, *Leading a Changing Utah Construction and Mining Company: Utah International, GE-Utah, BHP-Utah, 1954 to 1987*, 2000

Interviews In Process

Frank Aplan, metallurgist
Dean Enderlin, "Mine Geologist, Reclamation Manager, McLaughlin Mine"
Douglas Fuerstenau, metallurgist
Guy Harris, metallurgist
Susan Harrison, "McLaughlin Natural Reserve"
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INTRODUCTION by John O. Marsden

It has been both a privilege and a great pleasure to know and have worked with Bob Shoemaker over the past fifteen years--a period that spans less than one third of his working years, but during which time he has accomplished more than most do in a lifetime. He has worked in twenty-two countries, on every continent except for Antarctica, and if someone had been brave enough to develop a major mining or metallurgical project there, I am certain he would have been involved. Throughout our association, Bob has often talked enthusiastically about his years with Union Carbide, and the invaluable experiences and opportunities he was exposed to in that environment. Bob joined Union Carbide after obtaining his master's degree in metallurgical engineering from the University of Wisconsin in 1953. It is clear that he brought new insights and a fresh outlook to an established industry that was badly in need of a new coat of paint.

From Union Carbide he moved to Bechtel where he rapidly advanced as a result of his metallurgical and engineering capabilities that were immediately apparent to all who came in contact with him. During his time with Bechtel, sixteen years in total, Bob's reputation grew as he worked on a vast array of impressive projects, including gold, silver, copper, iron ore, molybdenum, uranium, tungsten, vermiculite, and coal in a variety of far-flung countries ranging from the USA to South Africa, and from Chile to Papua New Guinea. He was involved in many of the premier copper projects of the day, including Bougainville and Ok Tedi in Papua New Guinea, Kennecott Bingham Canyon in Utah, Chuquicamata in Chile, Cananea in Mexico, Anaconda in Montana, and Similkameen in Canada. All of these names still strike a resonant chord in the copper metallurgist's ear. In the field of iron ore processing, he was instrumental in the metallurgical plant designs for Hanna Mining in the development of the iron ore range in Minnesota and Michigan.

But it is in the field of precious metals extraction that he has distinguished himself more than any other, and he is truly one of the all-time greats in this field. As chief metallurgical engineer for Bechtel in 1964 he was responsible for the metallurgical design of Newmont Mining's Carlin gold plant--the first gold plant to be constructed in the USA in thirty years. He pioneered the concept and use of recycling of low-grade pregnant solution at the Zortman-Landusky operation in Montana, a concept that is applied today very profitably at many heap leaching operations around the world. All in all, he has been actively involved in the metallurgical development of over eighty heap leaching and forty milling gold and silver operations, including many well-known "household" metallurgical names such as Alligator Ridge, Borealis (which today is a fine example of a reclaimed heap leach operation), Chimney Creek, Cortez, Lihir, Randfontein Estates, Rochester, Round Mountain, Mesquite, and Mount Leyshon, to name but a few.

He has been one of the primary influences leading the revolution in gold metallurgy that has occurred in the late 1970s, the 1980s, and extending into the 1990s. There have been three main components to this revolution. First, the introduction of heap leaching on a large scale. Next, the widespread use of carbon adsorption for gold recovery, either from slurry using the carbon-in-pulp (CIP) process or from solution using carbon in columns. Finally, the development of methods to effectively process refractory sulfidic ores, including chlorination (Emperor, Fiji), roasting (also at Emperor), pressure oxidation (Lihir), and biological oxidation. Bob is an innovator and implementer in all three areas.

Throughout his career he has been one of the few people involved in plant design to actually commit his successes and failures (few as there are) effectively to paper. This is a skill and level of dedication that is sadly lacking in today's engineering and metallurgical world. In 1979 and 1984, Bob authored two ground-breaking books with his great friend and business associate, Frank W. McQuiston [Frank Woods McQuiston, Jr., *Metallurgist for Newmont Mining Corporation and U.S. Atomic Energy Commission, 1934-1982*, Regional Oral History Office, 1989], of which no self-respecting gold metallurgist is without well-thumbed copies on his bookshelf. These books, *Gold and Silver Cyanidation Plant Practice*, Volumes I and II, contain a wealth of information about many of the prominent precious metals recovery plants around the world at the time they were published, and they are becoming an increasingly valuable resource since many of these plants are no longer in operation. He has also edited several books for the Society of Mining Engineers (SME) of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) as well as a plethora of papers on plant design and practice, all of which have helped to preserve and enhance the art of metallurgy, thereby providing a great service to the metallurgical industry. On a less formal scale, while Bob and the design team were working on the development of Gold Fields Mining Corporation's Chimney Creek project, we used to joke that all the best plant design work was done on cocktail napkins late in the evening. If this is true, and I believe it is, then Bob Shoemaker has used up a lot of cocktail napkins in his career.

More recently he has acted as expert witness for a number of litigation cases across the globe. He has the unusual, if not unprecedented, distinction of being on the winning side for fourteen out of fourteen cases. A remarkable record indeed, and one can only pity the poor metallurgist or engineer who must stand across from him in the witness stand in such situations.

Throughout his career, he has been a strong supporter of the AIME, serving as its director, vice president, and president, and continuing his interest and support of the society to the present day. He has also served as president of the Mining and Metallurgical Society of America, and has been active in a large number of other metallurgical organizations worldwide, including the Institution of Mining and Metallurgy (Great Britain) and the South African Institute of Mining and Metallurgy. Both of the latter organizations have elected him to the distinguished position of "Fellow" in their societies. He was the recipient of the prestigious Richards Award in 1974 and was the SME Krumb Lecturer in 1989.

Everyone who comes in contact with Bob immediately recognizes a number of attributes: a keen eye for detail, an uncanny ability to home in on any weak aspect or fatal flaw in a particular project or plan, an unwavering devotion to the practical application of appropriate theory, down-to-earth common sense, and a vast wealth of metallurgical knowledge derived from years of taking complex problems and reducing them down to the lowest common denominator before solving them efficiently and decisively. It is the application of these skills that has allowed Bob to thrive as one of the world's premier metallurgists during his years with Union Carbide, Bechtel, San Francisco Mining Associates, and subsequently with his own company, R. S. Shoemaker, Ltd.

Bob has always been a family man, and he and his wife Jean are enjoying watching their nine grandchildren grow up. I hope that they will enjoy reading this book one day, along with numerous metallurgists around the world who will marvel at the achievements described within these pages. Bob is one of those rare metallurgists who brings a sparkle to the industry and makes life more interesting and enjoyable as he goes about his work. His enthusiasm for metallurgy and his dedication to the art have made Bob Shoemaker what he is today--a statesman of supreme stature in his field and a great role model for young metallurgists of today.

John O. Marsden, P.E.
Vice President of Technology and Development
Phelps Dodge Mining Company

July 31, 2000
Phoenix, Arizona

INTERVIEW HISTORY--Robert Shoemaker

Robert Shoemaker is a past president of the Mining and Metallurgical Society of America [MMSA] and received the Richards Award, the top award for metallurgists, of the American Institute of Mining, Metallurgical, and Petroleum Engineers [AIME]. In August 1987, he was interviewed in order to complete the oral history of Frank McQuiston, one of the first five volumes in the oral history series on Western Mining in the Twentieth Century. McQuiston was selected as the pre-eminent metallurgist to represent that branch of the mining industry in the series. Regrettably, he died before we could finish interviewing him, but we documented his work on the Carlin Mine processing plant through the Shoemaker interview which recalled their collaboration there and with Tuscarora Associates and AgAuExploration companies. The books which McQuiston and Shoemaker co-authored on metallurgical processing, *Gold and Silver Cyanidation Plant Practice*, volumes 1 and 2, and *Primary Crushing Plant Design*, were published by the Society for Mining and Exploration [SME] and for a quarter of a century have been best sellers in their field.

Instead of studying for a Ph.D., Robert Shoemaker chose what he considered the more practical route of obtaining two master's degrees, one in chemistry at Oregon State College where he did his undergraduate work, and the second in metallurgical engineering from the University of Wisconsin. He has worked for major corporations, Union Carbide and Bechtel Engineers, as well as independently as a trouble-shooter, consultant, and expert witness; he has worked in nearly every country and in a wide variety of mining operations. His breadth of experience and his very practical outlook are evident in all of his intimate and often amusing recollections. The unifying theme, as he says, is that people continue to make the same mistakes over and over.

Robert Shoemaker was Bechtel Corporation's first chief metallurgical engineer. While working out of their San Francisco office, he served as president of the MMSA and established the San Francicso section of MMSA. He also instituted the MMSA looseleaf roster, an invaluable biographical resource. After leaving Bechtel to work independently with San Francisco Associates, he built a home in Grass Valley and moved there. Living near the Loma Rica airport, he has the best of all possible worlds: a woodland acreage, a beautiful house with an indoor solar-heated swimming pool, air transportation within half a mile, Highway 80 a few miles away, electronic access to worldwide enterprises. He has his own well for domestic water, and for other use buys from the Nevada County Irrigation District half a miner's inch. A miner's inch, 11.25 gallons per minute, is a historic measurement still in use there. He travels widely, recently to Australia as an expert witness, but he also generously contributes his expertise locally to the county and the Empire Mine Historic Park. The hospitality of the

Shoemakers made these interviews a special pleasure for me. Bob's wife Jean is an honorary member of the Woman's Auxiliary of AIME, a tribute given for her many years of service to that organization, and she has been in effect office manager and secretary for her husband's independent consulting work.

In the fall of 1998, we received the donation of the Shoemaker memoirs, begun soon after his seventieth birthday, primarily as a gift for his family. I took the train to Colfax, and visited the Shoemakers at their home in Grass Valley, where Bob and I went over the memoir and made plans for expanding it with more technical information in order to include it in the mining oral history series. Four supplementary interviews were conducted: on 6 February 1999, at my home in Piedmont, California; on 26 May 1999, at the Shoemaker home in Grass Valley, California; on 8 December 1999 and 9 June 2000, in conference rooms at The Bancroft Library.

Bob Shoemaker in his late seventies seems as vigorous as ever, with good hearing and eyesight, a remarkable memory, and undiminished enthusiasm for his work. Clearing acres of forest underbrush for several years has kept him slim and strong. During the course of completion of the oral history, however, he and Jean moved across the road to a somewhat smaller and less demanding home.

Funding for the oral history was partially provided by MMSA and the introduction was supplied by friend and associate John Marsden, Vice President of Phelps Dodge. The photographs of the Brazilian gold rush miners are from the Serra Pelado Project Report of the Compania Vale do Rio Dolce.

The tapes of the interviews were transcribed in our offices and the lightly edited transcript was sent to Mr. Shoemaker in sections, beginning in September 1999. He reviewed the transcript promptly, and returned each section within two months or even sooner, with a very few changes made for clarity. A few brief sentences were added, neatly and clearly indicated on the transcript. The interview manuscript was corrected and indexed at our office. The memoir was indexed by Mr. Shoemaker. The interview tapes are deposited in The Bancroft Library and are available for study.

The Regional Oral History Office was established in 1954 to record the lives of persons who have contributed significantly to the history of California and the West. The office is a division of The Bancroft Library and is under the interim direction of Ann Lage.

Eleanor Swent, Project Director, Research Interviewer/Editor

March 2001
Regional Oral History Office
The Bancroft Library

Regional Oral History Office
Room 486 The Bancroft Library

University of California
Berkeley, California 94720

BIOGRAPHICAL INFORMATION

(Please write clearly. Use black ink.)

Your full name ROBERT S. SHOEMAKER

Date of birth 7-3-25 Birthplace ROSEBURG, OR.

Father's full name SAMUEL J. SHOEMAKER

Occupation BOOK & STATIONERY STORE Birthplace NAPOLEON, OH

Mother's full name LESTA E. SHOEMAKER

Occupation HOMEMAKER Birthplace HUMBOLT, KANSAS

Your spouse JEAN B. SHOEMAKER

Occupation HOMEMAKER Birthplace SENECA IL

Your children STEVEN, JAN, MOLLY, SCOTT

Where did you grow up? ROSEBURG, OR.

Present community GRASS VALLEY, CA

Education BS & MS, INORGANIC CHEMISTRY, OREGON STATE COLLEGE 1950 & 195.
M.S. U. OF WISCONSIN, METALLURGICAL ENGINEERING 1953

Occupation(s) METALLURGICAL ENGINEER - CONSULTANT

Areas of expertise EXTRACTIVE METALLURGY RESEARCH -
METALLURGICAL PLANT DESIGN - PLANT OPERATION

Other interests or activities VOLUNTEER WORK FOR COUNTY & CITY
CARPENTRY, FISHING

Organizations in which you are active SME, MMSA

INTERVIEW WITH ROBERT SHOEMAKER

I EDUCATION AFTER WORLD WAR II

[Interview 1: February 6, 1999] ##[1]
[Piedmont, California]

Chemistry Major, Oregon State University, 1946 to 1951

Swent: Let me just say first that you have already written an extensive memoir, which we're going to augment with this interview, and we already have an interview that you did in completion of the McQuiston volume, so this is a supplementary interview that we're doing now.

Shoemaker: I thought I would talk a little bit about how I really got interested in the mining industry. This was after World War II, in the fall of 1946, when I went to college at what was then called Oregon State College, which is now Oregon State University.

Swent: I think you covered a good deal of this in your memoir.

Shoemaker: Yes. Well, I thought maybe I'd just give a little bit of it.

Swent: Okay.

Shoemaker: I was a chemistry major. My professor there was William Caldwell, who had had a degree as a mining engineer before he got his Ph.D. in chemistry, and he was still a miner at heart. He had a small mine up on an island in Puget Sound. It was a mine that contained celestite (strontium sulfate) and strontianite (strontium carbonate). But he and a friend of his by the name of Kenneth Watkins, who was a logger and a miner, got interested in the Champion Mine, which had been worked in the 1920s quite extensively. It was in the Cascade Mountains

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[1]## This symbol indicates that a tape or tape segment has begun or ended. A guide to the tapes follows the transcript.

of Oregon, east of Cottage Grove, Oregon, at an altitude of 6,000 or 7,000 feet.

They had gotten ahold of a logging company that wanted to expand their timber holdings in the Cascade Mountains. It was called Bohemia Lumber Company, and it eventually became a very, very large company. In fact, they had a mill at Grass Valley. But the Bohemia Lumber Company would put up the money to help Watkins and Bill Caldwell try to rehabilitate this Champion Mine, in exchange for them filing more mining claims in that area so that the lumber company could harvest the timber. At that time, it was perfectly legal.

I was hired during the first summer vacation after I was a freshman by Bill Caldwell, who kind of took a shine to me. I was twenty-two years old at that time. I was put to work underground, along with a mining engineering student at Oregon State, which at that time had a mining engineering program. His name was Bob Tonneson. We had to clean out the main haulage way, which was the 1,200-foot level, in the bottom of the mine. That was the entrance to the mine.

Swent: This was a mine that had been abandoned?

Shoemaker: It was copper with some gold. During the Depression, it was shut down and never reopened. It was quite an extensive operation at one time. They had a hundred-ton mill, a hundred tons-per-day--or per-shift mill, so it would be a three-hundred-ton-a-day mill. There was a bunkhouse there, a three-story bunkhouse that was held on the side of the mountain with cables going across the road, above the bunkhouse and anchoring it to the trees, because in the wintertime the snow was so deep that the snow would have pushed the bunkhouse off of the mountain.

One of the other people there was Gordon Card, who was a miner and a logger. His grandfather had owned the Card Iron Works in Denver. They made mine cars and sheave wheels for hoists in mines. They had a foundry, and they served the mining industry. The mine actually had come into the possession of a man named Bill Bartels. Bill looked a lot like and acted a lot like Major Hoople. He was bald-headed.

Swent: Major Hoople was a comic-strip character in the thirties and forties.

Shoemaker: That's right. A great talker and a great drinker. He did his own assaying. He used what was called an iron nail assay, and he used a track spike for the iron nail. This is a fire assay. He did a fairly good job as an assayer, but he and his--I would call him a second banana, whose name was Joe Thompson, and he was known as Little Joe--were working a winze off of the 600 level of the Champion Mine, which had an entrance on the other side of this mountain.

Little Joe [chuckles] only weighed about 125 pounds. He claimed he had been over the Chilkoot Pass [to the Yukon] in 1898. We don't know whether that was true or not, but any time he would have a drink, which was often, he would recite great stories about his experiences over the Chilkoot Pass. Obviously, it seemed like they were exaggerated.

He would also recite poetry when he had quite a bit of liquor in him. One of them that we took down over a number of evenings was a parody on a Robert Service poem. It was called "The Hermit of Shark Tooth Shoals." I have that whole parody, which is very funny.

As I say, they were working the 600-foot level, along with Gordon Card. Gordon Card was a young fellow about my age. Very athletic and very strong. This 600-foot level went not too far into the side of the hill. The three of them had developed a winze that went down about fifty feet, and they were mining down there this copper-gold ore, primarily for the gold. They would ship the ore to the Asarco Tacoma smelter.

During the time I was there, I would go up and see how they were doing because I was interested in the way they were mining. Gordon [chuckles], besides helping Little Joe down in the winze, was loading the skip that was pulled up by an air tugger by Bill Bartels. Bartels never really did much of the work. He was the boss. But Gordon would have to run out to the portal and pour water down into this air compressor that was as old as the hills.

It was called a Gardner-Rix compressor that was a gasoline-driven engine, a gasoline-driven compressor. The engine and the compressor shared the same crankcase, which was very, very unusual. It had iron wheels, and it had a bottomless pit as far as water in the radiator was concerned. Gordon would run out to the portal and pour water down that radiator at least every twenty, thirty minutes. If he didn't, it would freeze up and stop. The air tugger was just a three-cylinder air-driven hoist.

Doc Caldwell was writing a book on general chemistry for freshman students, along with a friend of his by the name of King, who was also a professor of chemistry but from Washington State University. They were writing on this book in the evenings. It eventually sold more copies than the book that Linus Pauling wrote. Both of them became multimillionaires from that book, which was the source of great envy to the rest of the faculty at Oregon State.

The rest of the faculty didn't like Caldwell very well anyway because all of his graduate students had to work on something for their thesis that was practical and that had a possibility of making some money for someone, whereas the rest of these professors, like most of them today, had their grad students work on research projects that are so esoteric that they might eventually end up as two or three figures in a reference book that no one reads. He was also a consultant to the lawyers that at that time were representing the fruit growers up in Oregon and Washington, and were suing the aluminum companies because of the fluorides that were being discharged into the air from the aluminum pots, electrolytic cells, in aluminum smelters, of which there were several up in that area using Bonneville [Dam] power.

In fact, when I became a graduate student under Caldwell, he took me along with him to visit a couple of these smelters and then had me do my research on the recovery of cryolite, which is the sodium-aluminum fluoride mineral, that at that time was mined mostly in Greenland and was used as the electrical conductor in the electrolytic aluminum pots. Each plant had tremendous numbers of these pots. They called them a pot, but they were more the shape of a coffin except much, much larger.

They had a carbon or graphite liner in these pots that was about eight inches thick, and then there were graphite electrodes in the pots, sticking down into the molten bath. Eventually, these electrodes--both the cathode and the anode--would crack from the heat, and the molten cryolite would seep into them. Eventually, they had to be removed from the pots and thrown away. Well, they didn't throw them away. They put them in huge piles alongside of the Columbia River. There were fluorides from that draining into the Columbia River.

A Practical Master's Thesis on Recovery of Cryolite from Aluminum Smelters

Shoemaker: Anyway, as part of his, Caldwell's, expert witness testimony, he got interested in these aluminum pot liners and had me work on a system for recovering the cryolite from these waste aluminum pot liners. That was the subject of my master's thesis. That process which I developed under his direction was the basis for all of the recovery plants that were put in by all of the aluminum companies to recover this cryolite, which was quite valuable. Every aluminum company has one of these recovery plants and has had them for many years.

Swent: Did you get any credit for it?

Shoemaker: I didn't get any money out of it, no. Oregon State didn't get patents on things like that. I'm sure they would nowadays. But it was in the literature, and all the aluminum companies came and got copies of my thesis.

Swent: Did you have any contact directly with the aluminum companies?

Shoemaker: Only when I was up there visiting with a plant at Longview, Washington, and one in Troutdale, Oregon.

Swent: As a result of your thesis.

Shoemaker: Yes.

Swent: They didn't try to hire you as vice president or something?

Shoemaker: No, I wasn't ready to go to work yet. I wanted to have a Ph.D. and be a chemist, although I was still very much interested in mining, or metallurgy. But anyway, King and Caldwell, although they were writing this book, which went through many editions. in the evening--King was in charge of the survey crew that was surveying all of these new claims for Bohemia Lumber. There was about six young fellows on the survey crew, and King was the surveyor.

They went out one day, and they were surveying downhill in the mountains in western Oregon. The Cascade Mountains are very steep, and they found that coming uphill was a lot longer than going downhill, and they miscalculated their time to return back to the bunkhouse, and it got dark. King had a son who was about sixteen years old, and he was about six feet tall. He had an enormous appetite, although he was as thin as a rail. He could out-eat anybody on the whole crew up there.

Anyway, one of these fellows remembered that he had a carbide lamp in his pack that he was carrying, and some carbide. That seemed to have saved the day, but coming back up the mountain, it was so warm they had drunk up all of their water. King had the idea that each of those young fellows you might say carried their own water supply which he could use as a reagent to make acetylene with the calcium carbide. But it was so hot that not one of the six people could come up with the necessary reagent of water. So they were pretty desperate because they were going to be there all night until King's son remembered that he had an orange left over from his lunch, which was an absolute miracle because he ate not only his lunch but half of everybody else's.

So King squeezed that orange into the carbide lamp and was able to make enough light so that they got finally back up to the road. We were so worried we sent out a rescue party, and we were walking down the road and met them on the road and brought them back up the hill.

I thought that invention of orange juice and carbide to make acetylene probably was one of the greatest inventions in the world and probably compared very well with Newton's discovery of gravity. I have a formula here that I made up for the calcium carbide [looking through papers] reacting with the urine and how it would produce acetylene, but unfortunately, they weren't able to give it a try because they were all too dry. $CaC_2 + Pee \rightarrow CaPee + C_2H_2 \uparrow$ [calcium carbide plus pee gives calcium pee plus acetylene]. And it has an arrow here at the end that goes upward, and that is acetylene, and that arrow means that it's a gas.

Swent: And that gives you your light.

Shoemaker: Yes. [laughter]

Swent: Okay. So that was one summer up there, right?

Shoemaker: Well, it wasn't all of it. When I first went up there, I went up on my motorcycle. Even though Caldwell wanted to hire me, Watkins, being the miner, had to approve of me. I went up to see Watkins, and it was raining that day. I was wearing my--what we used to call a tin suit, which was two layers of canvas with oilcloth in between. It was waterproof, and it was the usual attire for anyone who was working outdoors, like loggers and laborers of any type.

The pants on these were held up with--I had a pair of red suspenders. I found out later that the red suspenders were the reason that Watkins hired me because he had a policy of never hiring anyone who didn't wear suspenders [chuckles].

Anyway, Tonnesson and I were put to work cleaning up this long 1,200-foot drift into the mountain, the main haulage way, cleaning all the iron hydroxide that had precipitated in the ditch alongside of the track. It was a very wet mine, and it was raining all the time in there. The water was highly acid. It would eat into a pipeline like the air pipeline or a water pipeline in a matter of a day or two. Actually, the copper in the water would replace the iron in the pipeline, and it would just cause a hole in the pipe.

And then we had to install a bucket--it was about three by five feet--in the shaft that went up to both the 1,050- and the 900-foot level. We were working on the 1,050-foot level, Tonneson and I, and we got it cleaned up and we got it timbered, and when it would rain occasionally up there, Watkins' son--he was on the survey crew, but he would beg off the survey crew and come into the mine and work so he wouldn't get so wet.

Anyway, we had to get everything cleaned up. Watkins came up--well, he would watch the job, but he wouldn't be there all day long. And we started mining the stope; it was a vertical vein, probably sixteen to eighteen inches wide. We were using a stoper, which is drill for drilling overhead. It had an air-operated--what was called a stinger, a rod that had a sharp point on the end of it--come out the back end of the drill so that it would push the drill upward; you didn't have to hold the drill itself. These were quite old-fashioned ones, and they weighed ninety pounds apiece.

Watkins was showing us how to use this drill, and we would put stulls--what you might call braces but they were called stulls--between the walls of the vein. We had to mine thirty inches wide to get the eighteen-inch vein rock out. Thirty inches just about gave you room to turn around in.

Watkins was standing on this stull--actually, on a two-by-ten timber that reached between a couple of stulls. He weighed about 250 pounds, and that board was sagging, along with the weight of the stoper.

He was saying, "Now, you have to be very careful because when you grip the throttle to start the drill and if the drill catches in the hole, then if you don't let go of the throttle instantly, you'll be wrapped around the stoper." The drill would turn itself. So he started the stoper, and he drilled about six inches, and the drill caught in the hole, and it happened so quickly that he went around that stoper three times, wrapped up in the air hose.

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Shoemaker: Pretty poor example! Anyway, we mined out quite a bit of that ore and shipped it to the Tacoma smelter.

Swent: What was the year?

Shoemaker: This was 1947.

Oh, I wanted to go back to [Bill] Bartels. I would go over and watch him run these iron nail assays in this little assay office. He had a coal-fired assay furnace. But also I would go up and watch Little Joe and Bartels and Gordon Card. I was standing at the top of the winze where Bill was operating the air tugger, pulling up the ore that Gordon loaded into the skip. Bill spent most of his time with the carbide lamp, which he would take his whole hat off to use and examine the ore to see how good it was.

While I was there, one of the skip loads had some pretty good-looking ore, and some visible gold in it, and so he called down to Little Joe to come up and take a look at this ore that he was mining. So Little Joe climbed the ladder about fifty feet, and we were looking into this ore car, and they both bent over, and Bill had his hard hat off, so he could shine the lamp directly on this piece of ore. And Little Joe leaned over to look at it, and his carbide lamp, the flame of it hit Bill Bartels right in the middle of his bald head.

There was an absolute scream. It just sounded like a wounded panther. He jumped around and swore and yelled and screamed. They finally decided that that was enough for that day, and they went back down to the cook house or the bunkhouse. Bill had this great big--looked like a robin's egg blister right in the middle of his bald head.

So they decided to go to town, go to get some medicine for that. Of course, that was the type of medicine that was applied internally rather than externally. They had an old Studebaker ex-Army six-by-six truck. It had vacuum brakes, and every time you hit the brakes hard, the engine would die. They got down the hill all right. This was very steep. It was nine miles down a very steep, winding road. They--

[tape interruption]

Shoemaker: Well, they didn't get back to the bunkhouse, and we were finally getting worried about them because we knew they would both be drinking. Finally, Little Joe came staggering up the road and came into the bunkhouse. He was kind of scratched up and absolutely worn out. He was still considerably inebriated. He told us that somehow the truck had leaped off of the road down into the canyon. That's about all he could tell us!

We asked him about Bill, and he said, "Well, he's still down there." So we all got into another truck we had, and we went down the hill a couple of miles. This truck had gone off the road and fell over between two great big fir trees. The front bumper hit one of them, and the tailgate of the truck had fallen open and caught on this other fir tree, and the truck was lying on its side on this very steep mountain. If it hadn't been for the trees, both of those fellows would have been killed.

When we got there, Bartels was sitting on the truck. He was too big and fat to--he was sitting on the door. He had climbed out the window. He had the bottle in his hand, which miraculously hadn't gotten broken. And just as drunk as a skunk. [laughter]

But really, even with those incidents, I learned an awful lot and learned to do a lot of mining, particularly metallurgy. That's where I got my interest in eventually getting a second master's degree in metallurgy. [See the Shoemaker memoir, University of Wisconsin, 1951-1953]

II UNION CARBIDE COMPANY, 1953 TO 1962

Supervisor of Research in Mineral Processing and Recovery

Shoemaker: I think we should go now to when I got out of college, after the University of Wisconsin, and I went to work for Union Carbide Research Laboratories in Niagara Falls. That was in 1953.

We were doing research on mineral processing and recovery of minerals from ores. They had established a research laboratory the year before, under the direction of Rush Spedden, who they hired from MIT. He was an instructor at MIT when they hired him. He had hired one physical metallurgist and had ordered some equipment, but the laboratory wasn't nearly set up. That was my job, to set up the laboratory and get it in shape to do research on samples that Union Carbide Ore Company's geologists had sent in.

Swent: So this was a new enterprise on the part of Union Carbide?

Shoemaker: Yes. They had a number of mines worldwide, but this was the first time they had got into mineral research. We worked on a great number of ore samples.

Swent: Was this a new concept? Were other corporations doing this at the same time?

Shoemaker: Oh, yes. Kennecott had a very expensive laboratory in Salt Lake City. Anaconda had a laboratory first in Anaconda, Montana, and then they moved it to Tucson, where they built quite a palace down there. It was the kind of the thing to do for mining companies at that time, particularly the larger ones. It seemed like most of them had research laboratories.

Swent: Was the Bureau of Mines also doing research?

Shoemaker: Oh, yes. They had research laboratories on minerals--Albany, Oregon; Salt Lake City, Reno, Denver, one in Missouri, one in Minnesota.

Swent: These were all independent of universities?

Shoemaker: That's right.

Swent: That's interesting.

Shoemaker: But they've gotten away from that now. I think the only mining company that has a laboratory now is Newmont. Newmont established a laboratory first up in Connecticut. Now that they've moved to Denver, they have a laboratory that's on the land that is occupied by Denver Research Institute, which is a kind of quasi-governmental, state governmental entity that does research on all kinds of things, trying to develop business.

This laboratory that we had was in an old building that had been there at the laboratory site in Niagara Falls. The main laboratory was really a physical metallurgy laboratory for the development of different alloys that Union Carbide made in their electric furnace. Anything to do with metals. They were big in the welding rod business and developing different welding rods for different materials. That was quite a nice building. There was, oh, a couple of hundred people working there.

But our minerals laboratory was the first that they had. This building had been built during the war. It had two vacuum furnaces. They were electric arc furnaces that were operated in a high vacuum. Those furnaces made the uranium metal for the first atomic bombs. They made it out of uranyl nitrate, which was shipped to them. It was made in Oak Ridge and shipped up there.

It was reduced in these electric furnaces to uranium metal. This was enriched, U-235. The floor was a concrete floor there, and the floor was radioactive. The furnaces were radioactive. They left the furnaces there because they were too radioactive, they thought, to move. But my desk was right alongside of one of these furnaces. These furnaces were probably seven or eight feet in diameter and altogether ten or twelve feet high, something like that.

They found out later, when they tore the building down, that there was this uranyl nitrate--they call it green salt because it had a green color--it was dust up in the ceiling, in between the studs in the walls--the whole thing was--today you wouldn't be allowed to even come near the place. But in those days, you didn't pay attention, really.

Swent: You didn't take any precautions whatsoever personally?

Shoemaker: No. They finally put down some battleship linoleum on the floor, which didn't help at all. When I was working there in the laboratory, there was a cupboard in there, and I found a gallon can of what were called fins. They had made--when they made the uranium metal, it was molten, and then they poured it into molds and made castings that were later taken to some other place and machined into the parts that went into the bomb. They made the rough castings. Any of the metal that overflowed the molds was called fins. It was either remelted or--well, it was always remelted.

But anyway, I found a gallon can and it had some of these fins in it, and there were seventeen pounds of this material, which I didn't know what it was. I sent it up to the laboratory, the X-ray laboratory, and it came back that it was U235; it was bomb-grade metal. They were supposed to have accounted for every pound of this uranium that came in there, but their accounting wasn't very good.

So they finally decided--about that time, they decided to take those furnaces out of there, which they did, and took them out to our slag dump because they also had a very large ferroalloy plant there that employed about 1,500 people and made calcium carbide as well as all different types of ferroalloys. They took those furnaces out and buried them in the slag dump. That's also where that bomb-grade metal is today. As far as I know, it is. But it's not hurting anybody.

In fact, we lived right at the edge of Love Canal in a house I had bought for $17,000 with a G.I. loan. And that house, after I left there, was sold to somebody else. But then, when all the business about Love Canal came along, they closed up the house and boarded it up completely--all the houses around us. They didn't tear it down. But in the last few years they've opened up all those houses and have sold them because it turns out that, as usual, no one ever got sick from the Love Canal or from anything from the Love Canal.

Swent: Did any of the people who worked with you at that laboratory have any ill effects from it?

Shoemaker: No, no.

Swent: I'm trying to think. Frank Aplan was working with you, wasn't he?

Shoemaker: No, he came afterwards.

Swent: Who was there with you?

Shoemaker: Well, I was supervisor of the laboratory. That was for about two and a half years. They began--the Union Carbide development department over in the plant began borrowing me. Finally, they called me in and told me they would like to move me over there and move me out of the laboratory. That is when Rush Spedden hired Doug Fuerstenau. Doug came in and took my place.

Swent: He's still very healthy, too.

Shoemaker: Oh, yes. Well, he was there for I guess a couple of years, and then he went to work for Kaiser. Frank Aplan then came.[1] He had got his Ph.D. there at MIT, where Fuerstenau had gotten his Ph.D. Spedden never got a Ph.D. I don't know why. Anyway, Aplan worked there for a while, and then they moved the mineral processing laboratory down to Tuxedo, New York, which was up on the Hudson River, north of New York City.

I went over to development because they had been borrowing me to look into materials handling problems at their various ferroalloy plants. All the people in the ferroalloy plants were furnace type metallurgists. I was an extractive metallurgist. Extractive metallurgy is 60 or 70 percent materials handling--crushing, grinding, conveying, pumping, handling materials. Almost anyplace I would go in any of these plants, I could find places that I could save the company a lot of money on the materials handling--like screening and crushing and so on.

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[1]See interview with Frank Aplan, in process, 2000.

I worked in plants in--not only the Niagara Falls plant but I worked at Marietta, Ohio; Ashtabula, Ohio; and Alloy, West Virginia; and Portland, Oregon.

Alloy, West Virginia, was on the river that went through Charleston. It was about thirty-five miles southeast of Charleston.

I put in a number of jig plants at these different alloy plants to separate the alloys from the slag. They would pour the alloys from the furnaces, and they would always get some of the alloys, like ferrochrome or ferromanganese, mixed with the slag, and we had to crush it. Before I got there, they threw all this stuff back into the furnace, and it cost them a lot of money. I was able to install jig plants that would separate the metal from the slag, and the metal could be sold directly, without remelting, and then the slag was discarded.

I traveled just constantly for the last two and a half years that I was in Niagara Falls, to these various plants. I wasn't home but, oh, probably 25 percent of the time, at the most. And then the Union Carbide Ore Company began borrowing me. The first thing that they had me do was run a beach sand pilot plant north of Jacksonville, Florida, go down and set it up and run it. They were after titanium at the time. These beach sands down there contained rutile and ilmenite, which are both titanium minerals, and monazite, which is a rare earth mineral, and zircon, which is a zirconium oxide mineral.

I was gone all week, and the Ore Company insisted that I fly back to Niagara Falls every weekend, and so for five months I commuted from Jacksonville to Newark and then took the helicopter over to La Guardia [Airport] and then went from there to Buffalo and arrived home about two or three in the morning on Saturday, and left again about two in the afternoon on Sunday and went back to Jacksonville.

Swent: And Jean is patiently sitting there with how many children? Four children then?

Shoemaker: Four by that time.

Swent: Oh! She deserves a little credit in that.

Shoemaker: She certainly does. I don't know what I would have done without her.

When I was with the Ore Company, they established a government-bonded warehouse in Newport News, Virginia, and brought in ores from all over the world--manganese and chromium ores. This bonded warehouse was nothing more than a huge open field with railroad tracks running through it, and a fence around the whole thing. They kept about a half a million tons of both chromium and manganese ores there and would ship them out to the various plants that Union Carbide Metals owned. I called it--it was a government-bonded warehouse, and I called it--I've always said that I worked in the biggest government-bonded orehouse in the world!

During the Cold War with Russia, it was a kind of interesting time because the United States put an embargo on importing ores from Russia. For many years--

Swent: Let's get a date in there. When was this?

Shoemaker: Oh, this was along about the latter part of the Korean War. I went to the Ore Company in 1957, and that's when they built this government-bonded warehouse or orehouse. They had been buying chromium ore, even during World War II, from Russia. The ships that went up to Murmansk during the war--many of them came back loaded with chromium ore, chromite. But anyway, we had to stop importing Russian chrome ore. We suddenly found another deposit of chrome ore which was located in Montreal, within the city limits of Montreal.

Swent: Good heavens!

Shoemaker: It was called chrome ore X. Well, actually, the Russians would send this Russian chrome ore to a broker in Montreal, and then they would transship--they would unload the Russian boat and load the chrome ore onto other--maybe Canadian or American or any type of boat--and bring it down to Newport News. It was called chrome ore X. The United States government never knew that that was the way of getting around this embargo. But we were quite proud of this chrome mine that was in the middle of Montreal.

We had chrome mines in New Caledonia, South Africa, one in the Philippines--

Swent: These were actually Union Carbide-owned?

Shoemaker: They owned these mines. And then we had the largest manganese mine in the world by far in Ghana. It furnished 48 percent manganese ore, which was the standard in the industry, and all other manganese ores were compared with this ore that we produced over there, which contained 48 percent manganese. And it also furnished 80 percent of the free world's supply of dry-cell-battery manganese, which ran 53, 54 percent manganese. The thing is now shut down. It was nationalized and then shut down.

The Ore Company also owned a very fine ore boat. It was called the *Vindafjord*. It was painted white. It was a beautiful boat. It held about--I think it was 18,000 tons. It made eleven trips a year from our plant in Norway--the Ore Company owned three ferro alloy plants--two in Norway and one in England. This *Vindafjord* made eleven trips a year between Norway and Ghana, and it had accommodations--it had twelve staterooms, and our Norwegian subsidiary up there would let their workers take their vacations on this boat. It would go from Sauda in Norway to the Canary Islands, where it would refuel, and then let these people off, and then it would go on to Ghana and load up the manganese ore, and then stop back for refueling at the Canaries.

It was only the workers in the plant that got to do this. None of the managers were--

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Swent: You were saying that this was only for the workers, not for the managers.

Shoemaker: Not for the managers. In these plants and mines overseas, we had no Americans involved except geologists that might visit once in a while, and then I would visit and work actually at those plants, but I reported to my boss in New York. For instance, I spent four six-week periods each year in Norway for almost five years that I was with Union Carbide Ore Company, plus going to some of these other places.

The *Vindafjord* was owned partly by Norwegian-American Lines and was operated by Norwegian-American Lines. The *Vindafjord*--it was beautiful. It was painted snow white, and when they loaded manganese ore on it, the whole thing would be black, but within a day it would be polished and washed so that it looked like a liner, a passenger boat, rather than an ore-carrying vessel.

The Ore Company bought this other boat called the *Tontine*. It was brand new. It was owned 40 percent by the Ore Company and 40 percent by Norwegian-American Lines and 20 percent by a Norwegian company which was owned by officers of Union Carbide, as their private investment. They were allowed to buy pieces of this boat. As soon as they took delivery on this boat, the bottom fell out of the shipping market. It fluctuates, you know, wildly. And they found that they could lease other boats cheaper than they could run the *Tontine*.

Avoiding Questions of Legality in International Business

Shoemaker: This was also during the Cold War, which China was a part of, Red China. So they leased this ship--which was about 20,000 tons capacity--they leased it to the Red Chinese, which was strictly against United States government policies. But this 20 percent that was owned by the officers of Carbide--this was just a dummy company. It was a Norwegian company, and the owners didn't show up as directors of the company, so the Norwegian-American Lines had 40 percent, and they combined with this 20 percent ownership to make 60 percent, and therefore they could outvote the 40 percent that the Ore Company owned.

And so they leased--with that 60 percent ownership, they were the ones that could lease the boat to the Red Chinese. The Ore Company, naturally, wrote a very, very strong letter to both the Norwegian-American Lines and the 20 percent-owned company, protesting the leasing of this ship to the Red Chinese, and that got them off the hook, you see.

Actually, it was interesting. When I would go to Norway, I kept my paperwork to an absolute minimum because this was a Norwegian company and it was run by Norwegians, and yet we owned it.

Swent: This is the company that ran the ferro alloy plant, not the shipping company.

Shoemaker: The company in Norway was called Electric Furnace Products Company, and then we had another one called Meraker Smelteverk.

Theoretically, we couldn't tell the Norwegians what to do. We wanted to keep it arm's length. Once a year, Carbide lawyers would come into our offices. There were only about twenty-five of us in this company, including the mail boy, in New York. They would go through our files, and anything that they didn't like, they would just throw into a big box and take it away and burn it. They didn't want the government to come in prowling around and seeing that we were actually doing any directing of these companies. It had something to do with taxes, and I don't know what it was, but they would come in and just--the word "decimate" today is misused badly because it means only 10 percent. But they "decimated" my files by about 30 percent every year, maybe even 50 percent!

Getting back to that *Tontine*, it was very funny because the first voyage of the *Tontine*, the front end of the ship was loaded with wheat and the back end was loaded with automobiles.

Swent: This is going from Norway to Ghana?

Shoemaker: No, this was the one we leased to the Chinese.

It went down through the Suez Canal and on into the Red Sea. It ran onto a rock that was in the middle of the Red Sea that no one knew about. This thing was right in the shipping lanes, and it had been there for a hundred years, and no one had ever run onto it before. It was stuck on the rock for over three months. They dumped all the wheat overboard, and all the automobiles were dumped overboard, and they finally got the thing free, but they were afraid that the whole thing would sink in a big storm. They later went in and put some divers down there and blasted that rock out of the way.

Swent: For heaven's sakes. It really was a rock, then.

Shoemaker: It was quite a good-sized rock. Actually--I said three months --it took them four months to get that thing off the rock.

But it's strange how big companies work. They weren't doing anything that was strictly illegal, but they didn't want it to appear being anywhere near illegal. That's why the lawyers would come in, and I suppose they did the same to Union Carbide International, which owned a lot of chemical plants and other types of plants in other countries, including the one in Bhopal, India, that killed so many people. I think that was a horrible mistake.

I wouldn't trust the Indians to run a plant like that. I wouldn't trust a lot of countries to run a plant like that all by themselves. I think it's a terrible thing.

Swent: It turned out to be a mistake.

Shoemaker: I wanted to tell a little bit about--we put in a manganese nodulizing kiln, which was my idea. I converted an old lime kiln over in Norway to nodulize manganese ore fines. Manganese ore is very soft, and it makes a lot of dust in the furnace, and this dust will cave in into the electric furnace after it builds up on the sides and creates explosions. I had the idea of putting these fines into a rotary kiln and getting them hot enough so they stuck together and made nodules the size of baseballs. This had only been done at three other places in the world.

Swent: Is this similar to pelletizing?

Shoemaker: In a way, but the pellets are generally five-eighths of an inch, and they are made in a different type of furnace. But anyway, the one in Norway worked so well, then we put the one in Newport News in.

We got a man by the name of Homer Hutchinson, who had been a master mechanic in a mine in the Philippines and was captured and was in the Santo Tomas prison camp during the war.

He was a mechanical genius. He built a radio by himself in that prison camp and was able to listen to American broadcasts. He was so valuable, they wanted to keep him, and the Japanese kept trying to send him to Japan. Finally, they told him he had to go the next day. There was a doctor there that operated on Hutch without any anesthetic and took his appendix out, so they couldn't take him. That was a ship that got sunk by the Americans.

Anyway, after the war, he went to work in New Caledonia at our chrome mine down there and then was brought back to the

United States and worked in Rifle, Colorado, in the uranium mines, and then came and worked at Newport News. He became a very close friend of mine. He invented more innovations in materials handling equipment than you can almost think of. I had first met him when I was over in Australia for Union Carbide Ore Company, which I've related in my memoirs.

When I was ready to leave Australia, my boss at Union Carbide Ore Company asked me to go to our mine in New Caledonia and take a look at it. It was run by an Englishman, but New Caledonia at that time was still controlled by the French. It seemed like they did an awful lot of drilling over there, but they never found any more ore, and the reserves were getting quite small. So they finally decided that since I was over in Australia, they would send me over there to stop by and make a visit.

It was quite labor intensive, but that wasn't the whole problem. If they had invested money in labor-saving devices, they could have made more money. But anyway, I met the manager, who was an Englishman. He was saying that he was going to locate a new exploration hole the next day and asked if I'd like to go along with him, so I said, "Sure."

So I went out the next morning with him, and he got out of the Land Rover that he was driving and I was riding in. He had a couple of welding rods that he had bent in the form of an L-shape, right angle. He started walking around with these welding rods--

Swent: Like a dowser?

Shoemaker: Like a dowser! Actually, after half an hour, he said, "This is the spot where our new drill hole is going to be." Well, he had been doing this all this time. He had never had a geologist on the staff. He had never hired a geologist. He did his own dowsing, but he never found any more ore. I went back to New York, and I told my boss, Tom Meek, about that, so they removed him and got a new manager for the mine.

Swent: Did they find more ore then?

Shoemaker: Yes, they did.

Swent: With a different method.

Shoemaker: Yes. [laughter]

Swent: Oh, dear.

Shoemaker: Hutchison--I have this one about Hutchison. He's dead now. But when he was working in Rifle, he liked to drink a lot--not on the job, but he would drink it up at night. He went to a party one night, and a few days later this man came to the door and he says, "I've got your organ outside." He says, "Where do you want it?" Hutch said, "What organ?" And he said, "Well, the one you ordered from me the other night at the party." Well, Hutch didn't remember it at all, but he had always wanted to play an organ, so he told the man to bring it in. And his wife, who could play the piano--she taught Hutch how to play the organ.

Down in Newport News, he had it hooked up to twelve different speakers in his house. He would play the organ, and the plant superintendent and I would go down there and we would drink Kentucky Gentleman [bourbon] out of jelly glasses because that's the only kind of glasses they had. They were very casual in their housekeeping! And he would play the organ, and you could hear it all over the place. People didn't mind because he played so well.

Swent: Well, that was good.

Common Sense Solves a Viscosity Problem and Spoils a Research Paper

Shoemaker: Another mine we had was in South Africa. It was a chromite mine. Spedden, who was my boss in Niagara Falls, had gone to South Africa, and he visited this mine. They had just installed a heavy media plant for separation of the waste from the ore. A heavy media plant--they were using very finely ground ferro-silicon mixed with water to give a slurry of specific gravity of around, oh, 2.8 to 3, which means 2.8 to 3 times the specific gravity of water.

The chrome ore would sink in this slurry. The slurry was kept agitated all the time. Most of the waste material was composed of a kaolin clay, which was extremely light. It had a specific gravity of, say, maybe 2.0, so it was a very, very simple separation job. The plant wasn't working because the kaolin, being so very soft, would grind up, and the slurry would become extremely viscous. Well, this would happen with most any ore, but it happened particularly with this one because the kaolin was so soft.

The chrome ore would sink, but part of it would sink and a lot of the kaolin would sink with it and a lot of the chrome ore would float, along with the kaolin. It was a mess.

So Spedden had the idea that he could decrease the viscosity of this slurry and make the plant work, and so he came back--he brought samples with him, and he came back to Niagara Falls. This was when--I don't think we should mention his name, but we have mentioned it before. He was working there, taking my place. They experimented with trisodium phosphate, which is a dispersing agent. It lowered the viscosity of this slurry so that the heavy media plant would work properly.

I was in South Africa shortly after this, and I went out to the plant, this chrome plant.

Swent: Where was it?

Shoemaker: It was in the Transvaal, north of Johannesburg, a hundred and fifty miles or so. At the heavy media plant--the sink product mixed with ferro-silicon and the float product mixed with ferro-silicon flow out of this drum that the separation is made in. The two products go onto screens. The first part of the screen--the ferro-silicon goes through and drains. They call that the drain section of the screen, and it is pumped directly back to the separation drum.

But then the ferro-silicone has to be washed off of both the sink and float, the chromite and the gangue mineral. And so the second part of the screen is called the wash screen, and they spray water on it, on the ore that goes across the screen, and the ore and waste is washed clean of ferro-silicon, and then this dilute slurry goes to first a magnetic separator, which removes the non-magnetic gangue material from the magnetic ferro-silicon. And then the ferro-silicon goes into what we call a spiral classifier, which is used as a densifier. It removes enough water to bring the specific gravity of the slurry back up to what is required in the separation drum.

Underneath the screens there is a launder that can be moved along underneath the screen to either increase or decrease the amount of ferro-silicon going directly back to the drum from the drain section, or increase or decrease the amount of ferro-silicon that goes to the wash section of the screen. This launder is on rails, and you crank it along with a crank to get the right ratio of drain and wash.

Well, this manager was telling me how great this idea was that Spedden had of using trisodium phosphate to decrease the viscosity of the ferro-silicon slurry. He had just bought a very large tonnage. The way he explained it, it was about a quarter of a shipload. The plant was working quite well.

But I noticed that these launders had been moved all the way forward, so there was very little of this slurry of ferro-silicon and kaolin that was getting into the wash section and going to the magnetic separator and the densifier. I asked him why he operated this thing with these launders so far forward.

He said, "What do you mean?"

And I said, "Well, you see this crank here. It moves this launder back and forth and puts more of the ferro-silicon into the wash section, which gets rid of the kaolin in the magnetic separator and it prevents a build-up of the fine kaolin." And I said, "This thing is clear forward, and you have nothing going through the cleaning circuit and virtually everything going back to the drum. Why don't we move this launder back to where it should be?"

He says, "Oh, that's what it's for." [laughter]

So I moved these two launders back to about the midpoint there, and then I asked him to cut off the feed of the trisodium phosphate. The plant ran without any trisodium phosphate. It ran perfectly.

He said, "What am I going to do with all this trisodium phosphate?" He said, "I've got a quarter of a shipload of it."

I said, "Well, that's not my worry. That's yours. But you certainly don't need it."

Well, Spedden and his assistant were writing a paper on this use of trisodium phosphate to reduce the viscosity of the media in the heavy media plant. I didn't say anything about it, but Spedden at that time--he was down in New York, too. We had moved to New York at the same time to go to work for the Ore Company. He heard about it from my boss, and they had to cancel the publication of the paper. Spedden wasn't very happy with me.

Swent: I'm sure not!

Shoemaker: I was continually doing things that got me into trouble. But my boss always got me out of it.

Swent: Who was your boss?

Shoemaker: Tom Meek, a wonderful man. He let me do anything I wanted to do because he knew I always made money for the company.

After being with the Ore Company for almost five years, I could see that we were going to be absorbed by the Union Carbide Metals Company, and I just decided that I would like to get back West. I had been in the East for over twelve years. One day, a man from Bechtel came to see me and asked if I'd be interested in going to work for them. He had heard about me through a friend of mine. So I did. I was very much encouraged by my boss. He said if he was younger, he would have gone, too. If I had gone with the Union Carbide Metals Company, I would have been a very small frog in a large pond instead of the big frog in a little pond.

III CHIEF METALLURGICAL ENGINEER FOR BECHTEL, 1962

President of Mining and Metallurgical Society of America

Shoemaker: When I was at Bechtel, I was elected president of the Mining and Metallurgical Society of America. The MMSA was established in 1908 by a group of prominent people in the mining industry. Actually, because of the efforts of the MMSA in its early days, the U.S. Bureau of Mines was established. It was almost like an honorary society, but it had been very active in most of its years, but it became kind of dormant in the fifties.

I had been a member of it in New York. When I got to San Francisco, I decided to see if I could start a San Francisco section of the MMSA, which I did. It became quite successful. It's still in existence, and it is more active, by far, and it has far more members than the New York section did, even at its peak. Most of the mining people, mining houses, moved out of New York.

Anyway, I also got a directory published, which is still being published. It has a biography of each one of the members in it. It's quite valuable.

Swent: A wonderful resource. It's very helpful to me.

MMSA Gold Medal Winner Plato Malozemoff and the Carlin Mine

Shoemaker: Yes. During the two years I was president, I nominated and was very privileged to award Plato Malozemoff[1] the Mining and Metallurgical Society gold medal, which they occasionally award to some very, very distinguished person in the mining industry. Because Newmont, under Plato, had established the Carlin gold mine in 1964, when I was chief metallurgical engineer at Bechtel, and we built the plant--designed and built it in ten months--I thought the gold that was in this medal should come from Carlin. So I talked to the manager of the Carlin Mine, Jay McBeth, who was a good friend of mine. McBeth sent ten ounces of gold to Tiffany's in New York, who had the dies to stamp this medal with. Shortly after, I got a call from Tiffany's saying that they couldn't melt this gold. It turned into little globules that wouldn't coalesce.

Swent: It granulated?

Shoemaker: They were kind of frantic. It was really very pure gold. So I called my friend who was chief chemist at Carlin, whose name was Harry Treweek. He was a Cornishman. And he says, "There's no problem with that." He says, "That is caused by three or four parts per million of chromium that is in our gold, and it causes the surface tension of the gold to increase, and it forms little tiny globules when you melt it. The cure for that is to melt it with a borax cover, borax poured over the gold in the crucible. Then" he said, "you won't have any problem."

Speaking of Plato, I became quite well acquainted with Plato in New York. I would see him at the Mining Club occasionally and would see him in his office occasionally, too, when I was over visiting with Frank McQuiston.[2]

When we built Carlin, after it was built, they had a dedication ceremony because that was the first gold plant that had been built in over thirty years in the United States. Plato was there to give a speech. They had the governor there,

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[1]See Plato Malozemoff, *A Life in Mining: Siberia to Chairman of Newmont Mining Corporation, 1909-1985*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 1990.

[2]See Frank Woods McQuiston, Jr., *Metallurgist for Newmont Mining Corporation and U.S. Atomic Energy Commission, 1934-1982*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 1989.

and Steve Bechtel, Sr., was invited. He flew in a company plane over there. I was there also.

Plato was put up at the Stockman's Hotel in Elko. The Stockman's Hotel unfortunately was located right alongside the railroad tracks. They've been moved since then. But the suite that they put Plato in had a window that had the railroad tracks right alongside. Plato didn't get any sleep at all because they were switching trains through there all night long. Plato was supposed to stay there for two days, but after the ceremony was over and Plato had given his speech, he asked Steve, Sr., if he could go to San Francisco in Steve's plane so he could get back to New York, which Steve, Sr., was very happy to do.

Strangely enough, Plato never returned to the Carlin plant. Not ever in his life did he return to the Carlin plant. Yet that is--

Swent: The star in their crown.

Shoemaker: Yes. In fact, now they've recombined Newmont Mining with Newmont Gold, and it's all one company again. They're not in any other business but the gold.

Swent: It's one of the major producers in the world, that mine, isn't it?

Shoemaker: Yes, it's one of the very big ones in the world.

Swent: But he didn't like the Stockman's Hotel.

Shoemaker: No, he certainly didn't.

Shoemaker: Speaking of Bechtel airplanes, we had three of them. They were called Lockheed Learstars. They were Lockheed Lodestars and were also the Lear conversion of the original Lodestar, which made them faster. They had a little bigger engines, and they had more streamlining. Bechtel had two of them in the Oakland Airport and a third one in Westchester, New York. When Steve, Sr., still ran the company, business came first for those airplanes.

As chief metallurgical engineer, if I wanted to take a crew of people someplace to work on a plant or even see a plant, I could get one of those airplanes to do that. That was also true when they traded them in on turboprop Grumman Gulfstreams, but those were eventually traded on French Falcon jets when Steve, Jr., took over. And at that time, I couldn't even attempt to get one of those airplanes. They were used entirely for taking clients fishing and taking them on hunting trips or golfing trips and also taking the vice presidents along with the people.

Steven Bechtel, Sr., "One of the Most Honest People in the World"

Swent: This might be a good place for you to talk a little bit about Steve, Sr., and his business ethics?

Shoemaker: Oh, okay, I'll do that. Let's take a break for a minute.

[tape interruption]

Swent: Let's talk about Steve Bechtel, Sr.

Shoemaker: All right. Steve Bechtel, Sr.--of course, his father started the company. I can't remember when it was started. His name was W. A. Bechtel.

Swent: Warren, I think.

Shoemaker: Warren. There was also a son by the name of Warren, who was the brother to Steve, Sr., who worked for the company, too. But then he was more interested other things. Bechtel started an insurance company. He, Warren Bechtel--that is, the son--took over the insurance company. This insurance company became Factory Mutual, which later became--well, it still has that name. I got my automobile insurance when I was at Carbide with Factory Mutual because they gave the Carbide people a discount. I still have it, but it's called Automobile Mutual now.

Anyway, Steve, Sr., was one of the most honest people in the world. He was very, very ethical and wanted all of his people to be very ethical. He was extremely well respected by people all over the world. He had a great memory for names. He surrounded himself with people who were very, very fine engineers, although there was one fellow who was a senior vice president, by the name of Jerry Komas, who had only got as far as the ninth grade and yet he was one of the very senior people at Bechtel.

It was said that Bechtel never tried to influence people with money, like a bribe. I can remember being in New York at an AIME [American Institute of Mining, Metallurgical, and

Petroleum Engineers] convention. The Mining and Metallurgical Society has a luncheon meeting at every AIME convention. I was sitting next to George Munroe, who at that time was president of Phelps Dodge. The speaker that day was Ralph M. Parsons, who at one time had been associated with the Bechtels. Originally, the company was called W. A. Bechtel & Sons, and then it became--John J. McCone, later headed up the CIA--it became Bechtel, McCone, Parsons. Ralph Parsons was that Parsons. Parsons was--he was a very flamboyant type. Although Parsons was in on the building of the Hoover Dam with the Bechtels--they were one of the Big Six--they didn't get along too well, so Parsons left and formed his own company, which became quite successful.

Swent: There's the Parsons Brinkerhoff Company; then there's also Parsons Jurdan. Are they the same?

Shoemaker: They're not the same.

Swent: So he started what was--

Shoemaker: Ralph M. Parsons Company. That company is still in existence. Ralph M. Parsons took over--I think it was called Jurdan Associates. Jurdan was chief engineer of Anaconda. When Anaconda decided to give up their own engineering department--it was so large that they designed and built plants for other copper companies; Anaconda sold their engineering department to Jurdan for a dollar. He formed Jurdan Associates, along with some of his top people, and became quite successful. And then he got ready to retire, so he sold out to Parsons. Then it became Parsons Jurdan. At least the mining and metals part of it became Parsons Jurdan.

Anyway, that day at that meeting, Ralph M. Parsons was the speaker. He was a very short man. He couldn't have been over five foot one or two, at the most. They had to scurry around to find a box for him to stand on so he could look over the podium at the audience. There was, oh, probably 125 people there.

He was supposed to talk about doing engineering and construction overseas. He started out very well, but then he digressed and mentioned that occasionally he would have to pay bribes to people overseas, customs people and other types of people. And then he couldn't get off the subject, and he went on and on and on about how to bribe people. I was just embarrassed, working for Bechtel, to listen to that. Finally, this George Munroe leaned over to me and he says, "I will never give Parsons one dollar's worth of work after this. That is the worst thing I ever heard."

I don't think Bechtel was involved to that extent. You certainly have to have certain people that are lawyers and are well connected in foreign countries, and Bechtel may have had to give money to other people, but I never heard of it. The only two instances I ever heard of was an iron ore company that we built a plant for in Canada. When the thing was being constructed, they had an awful lot of labor trouble. It was a union job. The owner of the plant was approached by one of the officers of the union, who asked for money so that the union wouldn't cause any more trouble.

The owner didn't want to get involved themselves, so they asked the construction superintendent if he would give the money to the union man. He agreed to it. So the owner gave a very substantial amount of money to the construction superintendent, who gave it to the union officer. Somehow the word got out, and when Steve, Sr., heard about it, even though the man was a very senior construction superintendent, Steve, Sr., just fired him out of hand. He wouldn't tolerate anything like that.

There was another one that I heard about. I didn't know anything about the plant. It was a pipeline back in the East. The same thing happened. The owner of that pipeline asked Bechtel's construction superintendent to give this money to a union representative to stop the problems they were having with the union employees, construction employees. Word got out on that, and Steve, Sr., again, fired this man right out of hand, even though he was a very old and trusted friend of his.

Some companies, I do know, and some engineering firms like to work for the government and government installations overseas. Some of them really specialize in that. Bechtel never liked to work for the government after World War II. Occasionally, the government would come around and say, "You've got to submit a bid on this little bitty job, just to keep the other people honest," and Bechtel would take it. But U.S. government work was a very small fraction of one percent of the work. They did not like to work for the government. There were government people asking for bribes, and Bechtel could get along perfectly well without doing any government work.

They worked for quasi-governmental agencies, like, say, the utility districts. Some utilities are owned, you know, by cities. Or they worked for irrigation districts and put in dams. But they didn't like to work for either the state or the federal government.

Swent: Did they do AEC [Atomic Energy Commission] work?

Shoemaker: I don't think so. If it was, it was very little. Of course, they were very big in the atomic power business. They would buy the units themselves, the reactors themselves, from Westinghouse or G.E.--I guess there were others--Babcock & Wilcox. But there hasn't been a nuclear power plant built in a great many years, as you well know, which is absolutely ridiculous because they're perfectly safe. The Three Mile Island plant--Bechtel went in and cleaned that up, by the way--but no one ever got hurt from that, no one got sick, it never affected anyone.

Swent: But they still call it a disaster.

Shoemaker: The environmentalists are still calling it a disaster. The Chernobyl plant really killed a very small number of people compared to what the environmentalists claim. But the nuclear power plants that we built are so much safer. Now they've developed even ones that--the breeder reactors--they make their own fuel, you know? And there isn't anything left over. Now the government has permitted some companies to build two nuclear power plants in China. Seventy-five percent of France's power is provided by nuclear plants.

Uranium is an absolutely useless metal except for making nuclear power. Many years ago, they used to use a little bit of it in pigments to get a yellow color. But it's absolutely useless for anything else today. And yet the government wants us to burn natural gas, which is nonrenewable. It is necessary in the plastics industry, completely necessary, yet they want us to burn more natural gas in power plants. And over in Reno, they just now approved this new gambling casino that's got a--what is it?--a structure like an oil rig, where they drill for oil, you know?--but with a gas flame coming out of the top of it about sixty feet high.

Swent: Burning all the time.

Shoemaker: Burning all the time.

Swent: Polluting the air and everything else.

Shoemaker: It's clean burning, although of course the way that is burned there it's a red flame that is coming from carbon particles that are red-hot. When gas burns efficiently, it has a blue flame like a gas stove. But to destroy these coal and gas resources by just burning them--I think we should save the coal and gas for future generations for the chemicals that are available from them. Of course, we've got a lot more coal than we have natural gas, for that matter. But then, after that, then they have tar sands and oil shales. But nuclear power is the only way to generate power.

That brings me to the next subject.

Swent: Well, we kind of got off from the--you did tell an interesting little anecdote earlier about dealing in Iran. Do you want to mention that now? À propos of Bechtel.

Shoemaker: Yes, I was sent to Iran with four Bechtel vice presidents. We wanted, hopefully, to be able to build a very large copper plant that the government of Iran--that was during the time of the Shah--wanted to build. We didn't get the contract. One of the vice presidents was a financial man, and he had met a man who was part of one of the big families there in Iran that owned so much of the country and so much of the industry, very closely connected with the Shah.

We had an appointment to see him. The night before, we were in the cocktail lounge of the Intercontinental Hotel, which was the only place that you could buy a drink, I think, in Iran. And all the Iranian elite came in there for drinks.

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Shoemaker: This Irani gentleman was there in the cocktail lounge with a very beautiful girl who wasn't his wife. We were cautioned by this vice president, who knew him, not to even--he would not acknowledge our presence, and we should not even look at him because officially he wasn't there. We had a meeting with him the next day at his home, and we gave him you might say a sales talk on Bechtel and how we could do this plant. If we had done the plant, undoubtedly this man would have earned some fees by smoothing the way for us.

In fact, you have to have someone in every foreign company that can help you with their laws and rules, but Steve, Sr., would not just bribe people. He would pay them for their services, but he would not just plain bribe them. He refused to. He had that reputation.

Is there anything more you'd like?

Swent: No, that's fine. There may be other things that will come up as we go along.

Shoemaker: I mentioned tar sands. When I was chief metallurgical engineer, I was the first one at Bechtel. They had chief mechanical, electrical, and civil engineers, but then when I got there, they started getting much more business. After I had been there about two and a half years, they made me chief metallurgical engineer. Eventually, I had thirty-five metallurgists working for me. We were the largest in the mining and metal business.

Building the First Tar Sands Plant, Northern Alberta

Shoemaker: I mentioned tar sands. Northern Alberta has enormous reserves of tar sands. This tar is mixed with sand. I've forgotten the percentage of tar in the sand, but these sands are right near the surface, and they're flat-lying deposits. They're not tremendously deep, like thousands of feet, but I guess they're several hundred feet deep.

Sun Oil Company awarded the contract to Bechtel to build the first tar sands plant.

Swent: When was this, Bob?

Shoemaker: This was in probably, oh, along about 1966 or '67, something like that. Sun Oil formed the Great Canadian Oil Sands Company. These deposits are up by the Athabasca River, a couple of hundred miles north of Edmonton. The closest town is Fort McMurray, which is fifteen, eighteen miles from this plant that we built. We had first to build a pilot plant for them. They had done a lot of research work in the laboratories, but they wanted a pilot plant.

So we set up a camp up there, using conventional northern type of mobile housing that they had--all these big, prefabricated units that they bring in and connect up to make virtually small towns. We had a number of those up there. Bunkhouses and offices and cook houses.

Swent: Was this before Prudhoe Bay?

Shoemaker: Oh, yes, yes. After the sands are mined--they're just coal black. They go through a hot-water extraction process where, at that time, they heated them in the big plant that was built. You had to heat enormous quantities of water with some of this material which was made out of the tar. Anyway, the tar could be separated and it would float to the top of these very large vessels after going through a rotating drum device with hot water in it to get the tar melted, because it was all permafrost. It was frozen down to, I think, hundreds of feet.

Then the tar would be separated, and we had the pilot plant which we set up to treat it. It was around fifty tons a day, as I recall, a twenty-four-hour day. And then a portion of the tar that we produced in the pilot plant was put through a small pilot refinery up there, which then made a material that was similar to conventional crude oil. In other words, the tar was not like crude oil at all. It had to be hydrogenated and I don't know what all they did to it, but it turned into a material that looked and acted and had the consistency of crude oil, which then had to be refined. We put a pipeline down to Edmonton and the refinery down there, eventually.

We first of all needed a good assessment of the sands as to how uniform they were and how some of this equipment, which we had to design specially for this separation business, how it would work. You didn't want to just take the overburden off and just get the top tar sands. We wanted to go deeper than that. So they started sinking a shaft.

I was chief metallurgical engineer, but at the same time, they made me project engineer on the construction and operation of the extraction facility. They had another project engineer, whose name I can't remember, who was in charge of the refining pilot plant, to make crude oil. And then they had an overall project engineer, who was over the two of us. He was from the Mining and Metals Division, whereas the man in charge of the refinery part--he was from the Refining and Chemical Division. This man's name was Earl Johnson. He had been in the copper business. I think he had worked in Chile to some extent. He was in his sixties.

Sun Oil Company was very, very difficult to deal with because they were an oil company, and we were trying to design this extraction plant. They didn't know anything about materials handling or pumping of slurries. They were oil people. It was very difficult. We got into a lot of arguments with those people, trying to make them see that they had to build a mineral processing plant, which it was, differently than a refinery.

Swent: This was a whole new thing.

Shoemaker: Yes. Well, I kept going. We got the pilot plant finally designed, and we built it up there, and I went up to start it up and start the extraction plant up. We were supposed to get feed from the shaft that they had started. Well, the shaft was eight by ten feet inside of the timbers. They laid a concrete slab with a hole in it to start the shaft and started digging in it. They would put in a set of timbers every four feet. These were eight by eight timbers, in a rectangle, and then behind the timbers was two-by-ten or two-by-twelve boards--lagging, we call it--and that kept the tar sands from coming through from between the timbers.

Each of the timbers was connected to the next timber down, which was four feet away, by a bolt that was called a J-bolt, in the form of a J. There was one bolt going up and the other one going down. [demonstrates with a paper] That describes it, you see.

Swent: Sort of interlocking.

Shoemaker: They were excavating with jack hammers. This material was frozen. As they got down, oh, around twenty-five feet--there was a mining contractor, and they were only working on one shift. This started in the springtime. I should say we could fly into Fort McMurray, and in the wintertime we would just take a taxi out to the site, which was fifteen or eighteen miles north, along the Athabasca River. We would drive on the ice on the river, the taxi! [chuckles]

And then after break-up of the ice on the river, then we had an airplane that we would charter, a little twin Beechcraft owned by an old bush pilot who one day landed at Fort McMurray when I was on board with the wheels up. He didn't land completely. He got down--he realized at the last minute that his wheels were not down, and he poured on the power, but the tips of the propeller hit the runway, and it was a paved runway, and it bent them back about a foot.

Swent: Oh, my.

Shoemaker: All four of them. There were two engines, with two propeller blades on each engine. He managed to get it around and broke the gear cases, and oil was going all over.

Swent: Oh, my.

Shoemaker: Anyway, he managed to get it around on a half a propeller blade, which was very little propeller--mostly hub. Anyway, then they took his license away from him.

Getting back to the shaft--when they got down about twenty-five feet, the compressed air they were using--this was in the springtime--the compressed air would warm up--the exhaust from the jack hammers would warm up the shaft, the interior of the shaft. The air would go in back of this lagging and would start melting the tar.

Swent: [chuckles]

Shoemaker: It was actually raining tar down that shaft all the time, and the deeper the shaft got, the more it rained. You had to wear a plastic suit. I went down there each time--I would spend half of each week up there. I wasn't in charge of the shaft, but I wanted to see the ore in place. It was difficult to see because these men--a couple of men down there running these jack hammers, and you had rubber boots on, and they were just walking around in this goo, eight by ten feet in area--black goo.

Anyway, these tar sands kept melting from behind the lagging, and they would create pockets behind the lagging. When they would discover a pocket, they would move one of the lagging boards and pack wood in there, wooden wedges, soft timbers, and fill in chunks of wood. But all of the tar sands around the shaft were melting and getting soft, and so they were moving downward into these pockets, and they were pulling down on these timbers. The deeper the shaft, the more force they exerted on the timbers.

When they got to about forty feet, the J-bolts pulled apart at that point. And these were one-inch steel bolts, and there were about three or four of them on the long side and two on the short side. It was creaking and groaning. It was scary. Well, they managed to get new bolts installed. As they got down, they brought the timbers closer together. Finally, they were only one foot apart. It was just very slow.

I was down there, and they got it down to I think it was eighty feet.

Swent: How were they bringing up the ore?

Shoemaker: With a hoist, in a bucket. These men would load the stuff into this bucket and they would hoist it out.

Swent: But they were drilling down.

Shoemaker: Yes. A spade bit on a jack hammer. I kept telling Earl Johnson, who was the overall project manager, and he was in charge of the shaft, that that shaft was dangerous as hell. Earl wouldn't go down in it because he was big and heavy, and he had a problem with chronic bronchitis or something was wrong with one of his lungs; it wasn't cancer.

I kept telling him that this was terribly dangerous. I finally got him to put on three shifts because the stuff would melt at night, and they would have to repair all the damage during the day, and they weren't doing that much mining for the plant. The bolts pulled apart again at sixty feet and again at seventy feet. By eighty feet, I went down there, and it was just creaking and groaning something terrible.

Earl wouldn't stop them. So I had a great big argument with him. I said, "I'm going back to San Francisco." I went and talked to my boss, who was Bob Cheatham. I walked into his office, and I said, "I quit." I said, "I'm not going to take responsibility for that shaft anymore, and I'm resigning today."

Bob said, "Now, just calm down." Earl was going in to the hospital to have a section of his lung removed in a matter of a couple of days, and he said, "As of now, you're in charge. You take over from Earl."

I said, "Well, I'm going up there and shut that thing down."

He said, "Use your own judgment." So I got right back on the airplane and went up to Fort McMurray, and I told the contractor--by that time, he was working three shifts, trying to keep this thing going down and at the same time not pulling apart and having these cave-ins and so on. I went into the contractor's office and told him to pull his men out of there; we were shutting it down.

That was in the late afternoon. About three o'clock the next morning, the shaft collapsed.

Swent: But no one was in it.

Shoemaker: Nobody was in it. There would have been two men in there at that time if I hadn't shut it down. That was just really lucky. But the whole thing just collapsed. It was a mishmash of timbers and tar sand. They would never have gotten anybody out of it.

Then we used--well, during the time when they were having so much trouble with the shaft, I got an outfit to come up that had what they called a bucket drill. It had a shaft that went down, and it had a three-foot-diameter, round cylinder that was about four feet high on the end of the thing, and then it was closed at the bottom except for one big tooth that stuck down, like an auger. They would rotate that, fill the bucket up, and then pull the whole thing out of the ground. Then the bottom of the bucket would swing open, and we would get samples. You could drill a hole very fast, before it got warm, before warm air got into it. We could get down to eighty or a hundred feet and get more with that bucket drill than you could out of the shaft, and we could go more places, too. That was very important.

I didn't get along very well with this fellow who was in charge of the refining part of the pilot plant. I can't remember what we were arguing about, but we were always arguing. He was a pompous little twit. He would only take, oh, maybe 15 percent of the tar we made, and we made several hundred gallons a day, and the excess we would put into this pit we dug out there. The tar would freeze over at the top, but it was liquid underneath because it wasn't a very good conductor of either heat or cold.

We were standing at the edge of this pit on the chunks of frozen earth that had come out of the pit. He asked me how hard I thought this tar was. I said, "I'll find out." And I picked up this big chunk of earth and dropped it over his shoulder, and it went through that frozen crust and the tar just came up and covered him in goo [chuckles].

Anyway, that was quite an experience. That plant is still operating, and there's another company called Syncrude, and they built a larger plant, and now they're building a third one. Very shortly, Canada is going to be completely self-sufficient in oil from those tar sands. I think the newest plant is treating 200,000 tons a day.

Swent: Good heavens!

Shoemaker: It is a monstrous operation. They have found a way to--instead of heating the water--to use relatively cold water. The stuff is now competing with oil at about eleven dollars a barrel. It originally cost something like thirty dollars a barrel. It wasn't economic. But then oil went up, and their prices came down as they learned how to run these plants. They're a wonderful investment up there for Canada. There's Canadian government money in those plants now. And there's enough reserves for hundreds and hundreds of years. And it's up there where nobody lives. It's just frozen tundra. And they are very environmentally conscious. They take all the overburden off and replace it. They're beautiful plants. They don't do any pollution at all.

Swent: Wonderful. That must have been exciting.

Shoemaker: It was quite an operation. I really enjoyed it. It was tough living up there in those days, because you would carry this tar and sand around on your shoes and on your clothes. You just got sand into everything and tar into everything. The conditions weren't like they are today, of course.

Swent: But they worked around the year.

Shoemaker: Oh, yes. They work year-round up there. They use bucket-wheel excavators and extremely large trucks, and they have to be built out of special steel because they get so cold. Normal steel gets brittle at the temperatures they have up there.

On a little lighter note here, I was in an AIME meeting in Los Angeles one time, the last time they had an annual meeting there. I was sitting with two friends of mine--one from Allis-Chalmers and one from Tyler Screen Company. Somebody walked by and said, "Are you going to the Mines breakfast tomorrow?" "Mines" means Colorado School of Mines. Those of us who haven't gone there--we call it the Royal School of Mines. We said no, none of the three of us had ever gone there.

Well, someone came along a little while later and said, "Are you going to [the] Montana breakfast?" We hadn't gone there, either. They all kind of--particularly the man from Colorado, kind of sneered at us. After that happened about three times, we decided that that was enough, and we decided to start our own school of mines.

One of these fellows, the man from Allis-Chalmers, had worked in the early days at a place called Bouse, Arizona. This is over on the western side of Arizona. It's about thirty miles from the Colorado River and about fifty miles northeast of Blythe. We decided to start the Bouse School of Mines there. So we printed up alumni cards--

Swent: [chuckles]

Shoemaker: And we started having our own breakfasts. Eventually--oh, I don't know--there would be twenty-five or thirty of us alumni, and there were a lot of alumni that didn't come or wouldn't be able to be there. But the thing finally died. It was mostly old-timers. I don't have my alumni card anymore because I was fishing, and I fell in the creek one time and got it all wet, so I don't have that anymore. But we had a lot of fun, making fun of the other people who had gone to some of these fancy schools of mines.

The Very Low-Cost Palabora Copper Plant in South Africa

Swent: You said that the Palabora was the first job you were put on.

Shoemaker: Yes, when I went to Bechtel. This was a joint venture between us and Western Knapp Engineering, which went through a number of name changes and now is called--

Swent: Kvaerner.

Shoemaker: Yes. That turned out to be one of the lowest-cost plants in the world.

Swent: What were they treating?

Shoemaker: Copper. The way they operated it, they ran schools for the black people, and they had the native people there driving trucks, whereas other mines there--they wouldn't let them drive trucks.

Swent: Is Palabora in South Africa?

Shoemaker: Yes. It's in the Transvaal. This plant was designed for 32,000 tons a day, and then later we went back and expanded it. We put in autogenous grinding mills. And then it has had another expansion since I left Bechtel. I don't recall what it is. It's up to seventy-five or eighty thousand tons a day. It's a big plant, a big mine.

Swent: Did you do anything in the way of training people?

Shoemaker: They had wonderful training schools for the people.

Swent: Were you involved with that?

Shoemaker: No, no. I was only involved in the design.

One day I got a call--we were installing the expansion, and we had to put a new primary crusher in. There were originally two primary gyratory crushers in there, what we call fifty-four by seventy-four, built by Allis-Chalmers. We were putting a third one in. We had the thing almost finished, the expansion, and I got a call from George Beals, who was the plant manager at that time. George told me he had a little problem and he would like me to come down to South Africa. I said, "Well, I think I can do that. When would you like me to come down?"

He said, "Can you get on a plane tonight?"

I said, "Well, I don't think I can tonight, but I can probably get on tomorrow night. Why the big rush?"

And he said--"Well," he says, "we've just broken the main shaft in one of our primary crushers." The main shaft of one of these gyratory crushers is about twenty-one or -two feet long, and it's, I think, twenty or twenty-two inches in diameter, and it weighs ninety thousand pounds. He said, "We've broken the main shaft."

I said, "My gosh, that's unusual. I've never really heard of a main shaft breaking." And I said, "You have a spare, don't you?"

He said, "We've used up our last spare." They had a spare. They were keeping a spare on hand, but he said, "We've used it up. Actually, we kept two on hand, and we used them up."

I said, "Well, how about taking the shaft out of the crusher we've just installed that isn't operating?"

And he said, "We've done that, too." He said, "We've broken five of these main shafts."

Swent: Good heavens!

Shoemaker: He said, "We don't have any spares." He said, "We're in serious trouble."

Anyway, I arranged to go down the next night, but I also called Allis-Chalmers and had their chief crusher designer get on an airplane, too. I met him in Johannesburg. We were met there by the son of the founder of Bateman Corporation; it's a big manufacturing and also engineering firm down there--who was a complete SOB.

We went over to his office. They had manufactured this crusher under license, both the crusher and a couple of the main shafts, although they then had started buying from Japan. He immediately insisted that there was nothing wrong with his equipment and made himself awfully obnoxious.

But anyway, I told George over the phone--I said, "I would like you to get ahold of the National Institute of Metallurgy." This is a physical metallurgy laboratory run by the government, and they're very fine. I said, "Get a man to come up there and take some samples of the metal where the shaft was broken and take it back and do some physical metallurgy on it." And so he said he would.

It turned out, when I talked with this man from Allis-Chalmers, that they had manufactured a thousand crushers of this size around the world, they and their licensees, and they had only had five main shafts broken besides those at Palabora.

Swent: And they were all broken at this same place?

Shoemaker: No, they were broken at different places. Three of them, they didn't know why they broke. The other two, they had knocked the protective cap off of the top of the shaft and dumped rocks on it and just beat it to death. This one broke below the threads on the top of the shaft. There was a very large nut that held the mantle liners down onto the mantle. There's this section of the main shaft that is conical, probably four and a half feet at the bottom in diameter, and then these conical liners go down on top of that, on this cone-shaped section of the main shaft.

Anyway, when we got down there, and got out to Palabora, by that time this man from the National Institute of Metallurgy had gotten his samples and he had called up with his report. What it was, was stress corrosion cracking. The ore at Palabora is very tough, but it isn't very abrasive. These liners are made out of manganese steel, which will actually flow under pressure. The mantle liners are installed in two halves with a gap between them, which is filled with zinc so that it will be squeezed out as the liners flow together because of the pressure on the manganese.

That was causing--the liners couldn't go down on the cone as it got tighter, so the liners started flowing upward against the head nut and it exerted enormous pressure, so much so that the head nut, which was made out of steel and it was over--oh, it was thirty inches in diameter and probably four inches thick--it was actually bent up at the edges.

And then there was a locking hole, like on a castellated nut, where you put a cotter pin in to keep the nut from unscrewing on the threads on the shaft. Half of this hole was in the liner, and the other half was in the head nut itself. You turned the nut down until you got two of those half holes to line up to make one hole, and then you would put a pin in there so it wouldn't unscrew.

The water at Palabora, although it has a pH of over seven, it is very corrosive, apparently by some bacterial action, when it contacts the ore. We had to use an awful lot of stainless steel in the plant construction because of this corrosiveness. At any rate, dust was getting into these holes that were open, and then water sprays that were used in the dump pocket would go on, and the water would leak into these holes, and you would get your corrosion on the shaft. So with the stress and the corrosion, you got stress corrosion cracking, and it would just pop the twenty-inch-diameter shaft right in two.

Swent: It's a complicated research project.

Shoemaker: The fix was to put grease in those holes and also to use a torch to scarf out the joint between the two halves, the upper and lower halves of the liners, so you would give the liners more room to flow. At that time, each one of those shafts cost a dollar a pound, and that was ninety thousand dollars a shaft.

They broke five shafts, which was equal to the total number of shafts that had broken in all the other thousand crushers.

Swent: But after that they didn't?

Shoemaker: No more. They've never broken another one. The crushers are still operating.

Swent: Well! That was quite a coup.

Shoemaker: Well, I've been very good friends with George ever since then. I've gone back to Palabora as a consultant, and when George left Palabora, he worked for a time with Amoco when they were trying to get into the mineral business, and then he went back to work for RTZ, which used to be called Rio Tinto Zinc. Originally, it was Rio Tinto Mining. I worked for George down in Panama when he was with RTZ, and then over in Spain at Rio Tinto-Minera. We still see each other every now and then. He lives in Colorado. He was promoted eventually to being a director of RTZ, and he was the only American who was ever a director of RTZ.

George asked me to be on the due diligence committee when RTZ took over Kennecott. There was only one other American, whose name was Paul Hodges. He had worked for Anaconda. In fact, he worked for Palabora before also. He was a mining man. And he was the only other American on the team of sixteen that did the due diligence. So I worked with George a lot.

Swent: That was a big job.

Shoemaker: Yes.

Properly Designed Plants Should Not Have Start-up Problems

Shoemaker: I would like to talk a little about Bechtel and their clients. We always tried, at least until up to the time I quit, to give the client what he needed rather than what he wanted because he generally wanted much more than he needed. And yet the clients were always trying to cut the costs. You had to argue with them to give them what they needed rather than what they wanted. What they needed always cost less than what they wanted.

In the mining industry, you often see annual reports produced by the mining companies. It seems like almost all of these--or at least a great many of these new plants--they have start-up problems. The English call them teething problems. As far as I'm concerned, the start-up problems should never have happened in a properly designed plant. When the company has the press release or in their annual report, saying that they've had start-up problems, I think that all that is is a bunch of lies to cover up the mistakes they have made in building the plant itself, or operating it, or not training ther people. It's lies to the stockholders and to the general public.

Swent: You certainly hear it often enough.

Shoemaker: You certainly do. And sometimes this will go on for a year or more than a year, some of the mistakes are so bad. Or they don't have the proper talent to run the mill or run the mine. But it's always very convenient for these companies to blame the engineering firms. But really, it's the owner's responsibility to watch after them, the engineering firms, to see that the engineering firm doesn't make any mistakes.

Proper design can only be done when you have complete cooperation between the client and the engineer because each has something to bring to the party. If an owner comes to an engineer and says, "Build me a plant," and then he goes away and says, "When you're finished with it, you come back and give it to us and we'll start it up," that plant is always a failure. And it happens.

On the other hand, some clients--they walk into an engineering firm, and they dictate to the engineer where every nut and bolt and piece of equipment should be. An engineering firm that goes along with that, you get a lousy plant--again, a bad plant.

When you cooperate fully and have the right kind of people on both sides, then you get a successful plant. Just because Bechtel or Kvaerner or somebody else has a good name doesn't guarantee that you'll get a good plant because their best people may be tied up on other projects and you get ones that aren't experienced or don't have enough experience.

Swent: Do you want to give some examples?

Shoemaker: Well, a good example was the Carlin gold plant. Newmont came to us. They called for an appointment, and they brought their people out, and that was--when they arrived it was the first time we knew they wanted a gold plant.

Swent: You had talked about this in the McQuiston interview.

Shoemaker: That's a good example. We designed it, and we built it in ten months. But they had their people in our office all the time, including McQuiston and the rest of the people. They probably had six people there.

We had done the same with Gold Fields--that is, after I left Bechtel. Gold Fields would do exactly the same.

When I was at Bechtel, we built the Candelaria heap leaching operation for Occidental Petroleum--a silver heap leach, over in Nevada. We built that entirely, designed and constructed it, in eleven months. I was there at the start-up. I had had one of my people over there, checking out all of the equipment, training the people. It took us, from the time we pushed the first start button until the time we were producing a silver precipitate, just forty-seven minutes. It was operating up to full capacity in forty-seven minutes.

Swent: That's phenomenal.

Shoemaker: And ran, continued to run. That Candelaria operation was an interesting story. Armand Hammer decided that silver was worth going after. He told his people to find him a silver mine. Well, there was this old mining district at Candelaria over in Nevada, which was about fifty-some miles south of Hawthorne. They had some very rich ore there in the late 1800s and early 1900s. But the mining camp was all gone. There were only a few buildings that were made out of stone--houses--nothing big at all. It was just a ghost town.

Anyway, they started drilling that ore body and found out that it was a huge ore body. They came to us to do an engineering study on the heap leach. We finished the engineering study just about the time that the Hunt brothers started to corner the silver market.

Armand Hammer got real smart, and he sold the production from this plant, which we hadn't even started--he sold it ahead, sold it forward for $40 per ounce.

Swent: That takes courage.

Shoemaker: We built the plant for $20 million, and then he had to buy the mining equipment, trucks, and so on. I think altogether he had $30 million in it. By the time we finished the engineering study, which was about ten months later, he unloaded his silver and made $130 million profit off of it before we even turned a shovelful of dirt.

Swent: Ah! [laughter]

Shoemaker: That was one of the more successful operations. But then again, it ran only about three years, and by that time silver was down to ten dollars an ounce, and they shut it down. Later on, some other people bought it and started it up again and expanded it and made it much bigger, made it produce much more. They ran it for another four or five years, and then finally they shut it down. That was a great success story.

Swent: Yes!

Alligator Ridge, Nevada, and Amselco: A Poor Client

Shoemaker: Getting back to this client/engineer business, we did an engineering study for Amselco, which stands for American Selection Trust out of London. They were a big mining company in Zambia for many, many years. They're part of something else now, but this was Amselco. They were looking for gold. They went in with Occidental Minerals or Occidental Petroleum on a heap leach gold plant called Alligator Ridge over near Eureka, Nevada.

We did the study, and we finished it up along about the end of September. This is in 1975. We had a schedule showing that we could design and build this plant and have it started up in a year. They couldn't make up their mind. They would come to us and say, "Will you guarantee that you will finish the operation by next September?" Bechtel never guaranteed a damn thing under Steve, Sr. We always met our schedules, virtually always. I don't recall one that we ever overran in the mining and metals business. If something didn't work, we would fix it at our own expense if it was our fault. That's the way Steve, Sr., worked. They don't work like that any more.

But we wouldn't guarantee that that plant would be finished. They kept stalling around and stalling around. They would call me up and say, "Won't you guarantee this?" But anyway, finally came to us in December and said, "Can you still build it by September?"

Swent: [chuckles] By then it was three months less.

Shoemaker: We got together and we finally told them--we said, "We will try. We will do our best. We're not going to guarantee it, but we think we can do it. We won't have it all completed. There won't be doors and windows and things like that, but it will be operable." So they finally agreed that we could go ahead. We said, "We'll do this only on the basis that you make no major changes in the plant design after the second week of January." Oh, they swore up and down that they wouldn't make any changes. They finally made their last major change in July.

Swent: Good heavens.

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Shoemaker: Unfortunately, Bechtel had started a non-union company called Longhorn Construction, down in Texas. Longhorn put in a bid, and they were the low bidder on the construction of this plant. Boy, they did a poor job, and we had a lot of trouble with them.

Swent: And it was another branch of your own company.

Shoemaker: Yes. We never let the Longhorn Construction bid on another one of our jobs. But anyway, we got it done, and we got it done by September. The biggest change that they made was that they had bought a used, portable crushing plant. It came in on wheels. The manager had bought it. The manager had been an ex-

Kennecott man, working in Kennecott's mine at Ely [Nevada]. They were crushing ore to put on the heap leach pads while we were building the plant. That crushing plant kept breaking down. We spent just countless hours going over there and fixing it for them because they didn't have any maintenance crew to fix it.

Finally, the main steel beams that were supporting the plant--great big I-beams about two feet tall--they split right in two, and the plant fell down [chuckles]. It was just a horrible mess. They got us over there, and we jacked the thing up and welded those big beams together, and then put some quick-setting concrete underneath to support the middle of the plant. We told them, "Now, you can't run this for twenty-four hours."

Sure enough, they started it up after about twelve hours. Of course, the concrete wasn't set up, and it broke, and the support beams resting on the concrete--they went right into the ground, and then all the welds broke again.

But anyway, we got the plant operating. Well, we got it in shape to operate.

Swent: In nine months.

Shoemaker: By the first of September the plant was operable although we were hanging doors and painting and so on--but they didn't want us to help them start the plant up. They had a fellow by the name of Roger Sawyer. He was an Englishman. He was their chief metallurgist. He was going to start the plant up by himself, with his people.

I happened to be in Denver about a month after they had started the plant up and I called up Roger. He had his office there in Denver, and I called him up and said, "I have a few hours before my plane," and asked him if he'd like me to come down and if he didn't mind, I would come down and talk with him. He said, "Yes, hurry on down. We're in real trouble." He says, "The electrolytic cells that produce the final gold product, they don't work."

I couldn't figure that out, so I went down to his office. We talked for--I missed my airplane, but we talked for a long time. Roger was scared to start the plant up. The first thing, he started the pumps that circulated the cyanide solution over the heap. He just kept recirculating it over the heap, and it kept building up in gold concentration. He must have circulated that stuff for--I don't know--a good two weeks. It built the solution up quite rich, much more so than the plant had been designed for.

And then he finally got up courage to put it through the carbon columns that adsorbed the gold onto the carbon--they call it a carbon-in-leach plant, rather than carbon-in-pulp plant, like Homestake has back in Lead. He loaded this carbon up, and he was scared to start the stripping section. He kept delaying that while he ran the solution through the carbon. Finally, he transferred carbon from three of the--I think there were seven columns. He transferred the carbon from all three, rather than the first column in the row.

Well, he finally admitted to me that each ton of carbon that they got out of there contained a thousand ounces of gold per ton. The first column probably contained carbon with twelve hundred ounces of gold, and then the middle one was a thousand, and then the third one was, say, eight hundred. The feed to the stripping section should have been down around two hundred ounces at the very most.

Then he was afraid to start up the electrolytic circuit. Anyway, when he did strip this carbon, he got a solution that contained fifty ounces of gold per ton. Then he put that through the electrolytic cells, and the electrolytic cells were designed to take four-ounce-per-ton carbon. Well, the electrolytic cells were working fine because there were just so many watts going into the electrolytic cells. One watt would produce so much gold. He was putting in fifty-ounce solution, and he was getting forty-seven-ounce solution out of the cells. And he didn't think the cells were operating at all.

Finally, I got the whole story out of him. It was like pulling teeth. I finally said, "Roger, the trouble with your plant is that it's just completely constipated with gold. There is absolutely nothing wrong with those electrolytic cells."

He said, "Well, what will I do?"

And I said, "All I can tell you is that the plant is running perfectly, and you've just got to run it as fast as you can and strip as much gold as you can, and don't shut down the plant for anything because you've got to get rid of this gold that's plugging up the whole circuit." There was even gold plating out a quarter of an inch thick inside of the stripping vessels.

Swent: Did they retrieve all of that eventually?

Shoemaker: Oh, yes, they saved it all, yes. [laughter]

[tape interruption]

Solving Problems at a Washington Power Plant

Swent: We had a lunch break here, and now we're going to start on Washington Water Power, a coal washing plant.

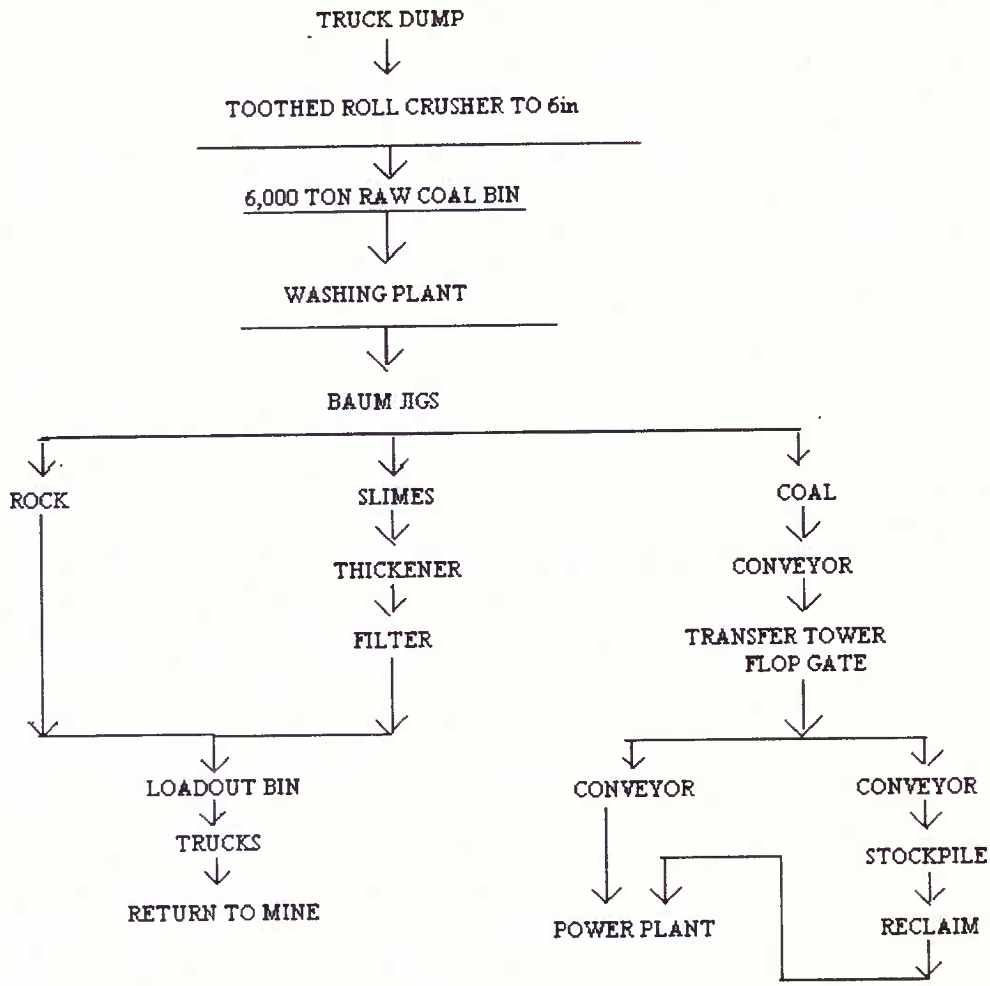
Shoemaker: Pacific Power and Light and Washington Water Power--both of them located up in Oregon and Washington--had Bechtel build them a power plant in Centralia, Washington. It was right next door to a large coal deposit, low-grade coal deposit. Bechtel had built the power plant, which burned 16,000 tons of coal a day. I don't recall how many megawatts it was, but it was a big plant.

Pacific Power and Light operated the power plant. Washington Water Power operated the mine and the coal washing or beneficiation plant. That plant was designed and constructed by Roberts and Schaeffer, who are coal washing plant experts. They're one of the two or three engineering construction firms that build coal washing plants.

Anyway, Bechtel got the power plant essentially finished. They were just doing things like painting and completing the punch list, we call it, of small items. The coal washing plant had started up, and the mine had started up. The mine was supposed to feed 20,000 tons per day of raw coal into the plant. The coal was low grade, and it contained large seams of kaolin clay. It was quite interesting because the kaolin was pure white, and the coal was black. Some of these seams were as much as three feet in thickness. That kaolin clay had to be removed in the washing plant. There was some rock in it, too, that was removed, but not very much.

Essentially, all of the difference between the 20,000 tons of raw coal and the 16,000 tons of washed coal was the 4,000 tons of kaolin clay. The trucks brought in the raw coal from the mine and dumped it into a toothed-roll crusher. And it crushed that stuff to about six inches maximum size, and

WASHINGTON WATER POWER COAL WASHING PLANT, 20,000 TONS PER DAY



then it went up along a conveyor to a concrete bin, which contained 6,000 tons of this raw coal. It was forty feet in diameter and about ninety feet high, a circular bin. There were feeders in the bottom of the bin that fed onto the conveyor that went to the washing plant.

The washing plant was very conventional. It had Baum jigs. These jigs are gravity separation devices, essentially a good-sized tank, with a conical bottom, a screen in the tank which raw coal is fed in on, and then there is water that is pulsated up and down through this screen by air pressure. It's a special jig only used on coal. They're a great big thing.

And that pulsating action makes the rock settle down on top of the screen, and the coal sits on top of the rock. And then the water is not only pulsating but it's flowing up through the coal, and it takes the clay off the top. So you have three products: the rock is bled off and sent out to a load-out bin; the slimes, which are a very dilute kaolin slurry--it was sent to a thickener, which is a large tank with rakes in the bottom, and there is flocculant added to that, which then makes the extreme fines clump together so that they settle rapidly, and then that settled material goes into a huge filter that takes the rest of the water out or most of the rest of the water, and makes a filter cake that joins with the rock in a load-out bin, where it loads into trucks, where it's taken back to the mine. And it replaces at least part of the coal that has been taken out of the mine.

And then the coal came out onto the--first it went into a dewatering device and went onto a conveyor--this conveyor was about three hundred feet long--where it would enter what was called a transfer tower. In this transfer tower, there was a flop gate and two conveyors exiting from this tower. One of the conveyors fed the coal to the power plant, and when the power plants bins were full the flop gate was shifted so that the coal would be diverted to a huge stockpile.

They made a great big conical pile, then they pushed it around with dozers and compacted it. They would try to have half a million tons of coal in the stockpile in case for some reason or other, the miners went on strike or the power plant was shut down. This coal had to be compacted because if it isn't, it will actually spontaneously start to burn. Every coal-fired power plant has one of these huge stockpiles.

It's interesting because the mine buys not just a ton of coal. They buy it by the BTU, British Thermal Unit. This coal that's in the stockpile, if it isn't compacted, it will actually burst into flames. But at the same time, it is still oxidizing. That oxidizing is causing heat, so you put a certain amount of BTUs into the pile but you never get all those BTUs out again because they've been going up in the air as heat. They constantly have to make an adjustment to the BTU content of the stockpile because it's decreasing all the time by itself. [chuckles]

Anyway, this power plant had, as I recall, eight boilers in it. These boilers are seventy-five feet high, probably, and they have these loops of pipe hanging from the top of the boiler roof. They put water through these pipes, which are these long loops that come clear to the bottom of the boiler. There are just masses of these pipes in there.

And then the coal comes in way at the top and goes into a bin for each boiler, and then it is fed out of the bin through feeders into a pulverizer, which is what we call a roller mill. It grinds the coal by steel rollers, and then they blow hot air through it so it dries the coal, pulverizes it, and then they blow the coal into the boiler, into the firebox, with air. It's just like a gas flame. It burns instantly.

So there are all kinds of mechanisms up there in that coal power plant. This big long conveyor that went from the transfer tower--it went up into the power plant, and then it fed two conveyors that fed two more conveyors that fed the two lines of surge bins and kept all of them full.

Any time they had any problem with all of this mechanical equipment up there, they had to stop this main feed belt to the power plant from the washing plant. Well, stopping this long conveyor and all these other conveyors up there--and the mechanical devices are all automatic--when one would stop, the previous machine or conveyor would stop and so on.

So this big long conveyor, which was probably eight or nine hundred feet long between the power plant and the transfer tower--it would stop. Then it would shut down the whole washing plant because at 16,000 tons a day, your coal can pile up on one of these stopping points just instantly and just create havoc.

Well, that was one of their problems. When the washing plant stopped, it would take them--in order to start it again, it would take two hours for it to get balanced out. In the meantime, it was producing very poor-grade coal. The coal was poor enough grade anyway. It was only 7,000 BTUs per ton, whereas normal bituminous coal is 12,000 BTUs per ton. That was one of the problems that they had.

The other problem was that the flocculant wasn't working on the kaolin, and it wouldn't settle in the thickener. The thickener produced a very fluid slurry that couldn't be filtered very well, and the filter cake wouldn't be dry enough; it would just be a liquid. They would put it on this inclined conveyor, and it would run off the back end of the conveyor, and it was all over the ground outside the coal washing plant as much as four feet deep, this slurry.

What stuff they did get into this bin that loaded the trucks out with this rock and the so-called filter cake, it was just like hauling a whole truckload of water. It would just be splashing out all the way back to the mine, and by the time it got to the mine, it wouldn't be in the truck anymore.

Well, Pacific Power and Light was trying to make power. They were having so many interruptions, and this coal washing plant--they couldn't make it work. And Washington Water Power couldn't make it work. So Pacific Power and Light got kind of angry at Washington Water Power and told Washington Water Power they were going to have somebody from Bechtel to come up there.

Of course, I know nothing about power plants, and I'm not a coal washing expert, but a mineral is a mineral, whether it is coal or something else. So I flew up to Portland and talked to the Pacific Power and Light people. They told me that my reception wouldn't be too pleasant because the Washington Water Power people didn't want to admit that they couldn't run this plant.

I talked to them for a day, and then I went on up to Centralia. It turned out that the construction superintendent for Roberts and Schaeffer was an old friend of mine from years and years before. He had operated all kinds of these washing plants, but he couldn't make this one operate. I talked to the vice president and general manager for Washington Water Power, and he wasn't very cooperative at all.

Well, I found what the two main problems were. The first one was this transfer tower. The simple solution to that was just put an electric operator on this flop gate so that as soon as the conveyor going to the power plant stopped, then the flop gate would automatically turn over and would not shut the coal washing plant down, but it would feed the coal out to the stockpile. Why no one thought of that before, I don't know. But it's very common in mineral processing plants to use these electrically operated flop gates.

But this problem of the kaolin not settling in the thickener and not being able to be filtered had just totally confused everybody. The Roberts and Schaeffer man didn't have the faintest idea what was going on, why he couldn't thicken and filter this material. The flocculant was costing five dollars per ton of kaolin, which translated to a dollar a ton of coal. So that was sixteen thousand dollars a day that they were spending for flocculant at a dollar a pound for the flocculant, and they were using one pound per ton of coal when they should have been only using five hundredths of a pound of flocculant or, in other words, a nickel's worth of flocculant. It was actually less than that. I'll have to do some arithmetic. But anyway, five hundredths of a pound per ton of kaolin that was settled, instead of five <u>pounds</u> per ton. The flocculant company was getting rich! They couldn't keep enough trucks full of flocculant coming in there.

So I studied that for a couple of days, and I looked over all the research work that had gone into it. There was nothing wrong with the research work that showed that this kaolin could be thickened and filtered. So I got some flocculant and took some of this clay over to the laboratory that they had there. I added the right amount of flocculant, and the stuff not only thickened but it filtered.

Well, the only thing--I was using water from the laboratory, and I didn't know where the water that fed the washing plant was coming from. So I went over to our construction superintendent at the power plant, and I asked him where that water was coming from. He said, it's coming from what they call the blow-down water from the boiler tubes. The inside of the boiler tubes get built up with scale. The only way they can get rid of it is to put trisodium phosphate--mix it in with the water that is periodically sent through those boiler tubes. This water is diverted and is not used for producing steam.

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Shoemaker: This water is sent out to a cooling tower because it's very hot, and it's just loaded with minerals that have been dissolved out from these miles of boiler tubes. There are literally miles of tubes in there. Then it is sent to a pond and allowed to settle and then they evaporate the water. That boiler tube water, the blow-down water, was being sent over to feed the coal washing plant. Trisodium phosphate is a very powerful dispersant for materials such as clay that has lots of fines in it. And here we are, trying to thicken this stuff, make all the particles clump together or flocculate--so one reagent was fighting the other reagent.

They were making poor coal, and it was costing them far too much. They were spending $16,000 a day for flocculant they didn't need. Well, I didn't go back to this vice president because he resented me coming up there and trying to figure out what was going wrong. So I went out to the washing plant superintendent and told him this and suggested that he connect the washing plant up to their fire system.

Swent: This was the man that you already knew.

Shoemaker: Yes. So we hooked a hose up to the fire hydrant outside, and that was fresh water. Within just, oh, forty-five minutes, the filters and the thickener were working just fine.

Well, then I had to go and tell the vice president what I had done. Altogether, I think I made four trips up there, and this was my last trip. I had to tell him what I had done, and he wasn't very--he just wasn't happy with me at all.

Anyway, before I left--I had been looking at this large concrete bin. They had installed what is called a Long Airdox system. Long is the name of a man. This system injects high-pressure air into bins or other places where material will not move. This air is at a pressure of about 2,000 pounds per square inch. When it is released all of a sudden through holes bored in this bin--it sounds like a cannon going off. It's supposed to shake everything up inside of the bin and loosen it up so that it will flow.

But with all this clay in there, it wouldn't come out of the bin very well. That's another one of the problems. It would just rat-hole, and they would get very little live load in that bin. The rest of it would just pack solid. They had a great number of these holes where this air was injected by a timer. I was looking at the bin, and I noticed that around each one of these pipes that went into the bin there were black marks radiating--little black marks, actually, jagged marks--radiating out from the area of this hole.

It looked to me like those were cracks and that there was black coal dust coming through the concrete to make these black marks that looked like a huge spider web, maybe eight feet in diameter. I was firmly convinced that those were cracks caused by that high-pressure air. Instead of loosening up the coal, the high pressure air was shattering the bin. So on my last visit, I went over to the vice president. I told him, "This is none of my business, but," I said, "I think that your bin is cracking. With all those spider web looking things, I think those spider webs are fine coal coming through with the moisture."

He just exploded. Told me it was none of my business, that I had no right to even bring it up, that there was nothing wrong with that bin, that those were just surface imperfections. He was so angry that he was yelling at me and cursing me. So I went back to San Francisco, and I told my boss, Bob Cheatham, about it. I said, "I think they're in trouble." He said it sounded like it to him, too.

So he got some civil and structural engineers together, and three or four lawyers. We all had this meeting. The lawyers said that if we didn't write them a letter and formally tell them that we thought that bin was in danger of falling down, and if it did fall down, we could be held responsible--even though we didn't build it, didn't design it, or anything else.

Anyway, it finally ended up that I wrote a letter to this man. And this took a couple of days. I had to have it edited by the lawyers. Then I sent it off airmail, special delivery. It got up there, and he opened it the next morning, and this man, this vice president, opened it up and he saw that, and he called me up. It was at nine o'clock in the morning. He was yelling and screaming at me and saying that Bechtel would never get any business out of him, out of Washington Water Power, and accusing me of starting vicious rumors, and all that. Oh, he was so mad. He was going to get me fired. Finally, he hung up. That was at nine o'clock in the morning.

At ten o'clock, the bin fell down. [laughter]

And there wasn't a piece of that that was any bigger than your head. It was eight inches thick, and there wasn't a piece of it that was any bigger than that. It had reinforcing bars, you know, but it was just completely shattered. There was no more support. When it fell, it kind of opened up on one side, and all of this coal packed in there fluidized, just like a fluid, like a snow avalanche, looks solid but it flows like water.

This vice president had just bought a brand-new Buick. His office was in this building that was raised about four feet off the ground, and it was only about 150 feet away from that bin. There was a ramp for disabled people to go up the four feet in wheelchairs, and there was a steel two-inch pipe hand railing that came down the side of the ramp. It was three feet off the ground, and then it had the vertical pipe going into the ground right at the end of the ramp.

Well, his car was parked fifteen or twenty feet away from there, and that flow of coal picked up that car and pushed it against that hand railing and bent it right around the hand railing at ninety degrees. It didn't even bend the hand railing, it happened so quick. The car, of course, was just totaled. It was just bent in the middle, at right angles.

Swent: Oh, good heavens.

Shoemaker: That was at ten o'clock, just an hour after he hung up.

Swent: The lawyers gave you good advice.

Shoemaker: Yes. Well, I knew that the vice president should know about that. Even though I had saved them $16,000 a day in flocculant and saved them a lot of trouble with the plant being started and stopped all the time--it was stopping, oh, at least twice a day, sometimes four or five or six times a day. That was kind of a fitting punishment.

Swent: Did anybody ever express any gratitude?

Shoemaker: No, not a bit, not a bit. What they did, they left the bin out of there. They took all the concrete and steel off and just left the bottom of the bin there with the feeders under it, and then they just dropped the coal on there and had an open stockpile, which they should have had in the first place.

Anyway, the plant is still running.

Swent: Good.

Shoemaker: It's sure an enormous plant.

Swent: Still producing power. Would that be enough for now, do you think?

Shoemaker: Well, I've certainly got enough here for another session, I'll tell you that.

Swent: It does look like it.

Shoemaker: I want a section on scams.

Swent: That's always interesting. I was interested in what you were talking about earlier, too, about working for an engineering company--and guess this is true of all of them. They don't have retirement plans and those kinds of things because they're hiring people for jobs and then letting them off.

Shoemaker: They generally move around from one engineering firm to another. When one is up, the other one will be down--although sometimes they're all down, at times.

Swent: You did say Bechtel had very good benefits to make up for not having a retirement plan.

Shoemaker: Well, they paid well. To some of us, they paid extremely well.

Swent: But it's an insecure kind of life, isn't it?

Shoemaker: Yes, it is. But when I went out there to Bechtel, I didn't know anything about an engineering firm. I thought, well, I'll stay for a year and then if I don't like it, I'll go someplace and get a job with a mining company, in the West because I was born and raised here. Engineering gets in your blood, I guess. I stayed twenty years. There's something different all the time, and you like that.

Swent: You can see what you're doing.

Shoemaker: Yes.

Swent: See the results.

Shoemaker: That's why I liked Union Carbide Ore Company because there was something different--there were so many plants to look at and so many mines to look at, so many problems to solve. That's what's fun: solving problems.

Swent: Yes.

Shoemaker: [sound of papers] I've got a couple of more of these things. One was a little oil shale plant we built up in Colorado. There was a tower that was 200 feet high, and it started to lean. How we fixed that: we straightened it back up.

Then there was a head frame at a mine called Carr Fork, for Anaconda. Somebody else built it. It was a concrete head frame, and it started to lean. So they called us in. We were building the plant. We straightened that one up.

Swent: A lot of what you were doing was mechanical engineering, actually, wasn't it?

Shoemaker: Yes.

Swent: You can't draw lines between these things always.

Shoemaker: I never did any drafting myself, but I supervised draftsmen and supervised other engineers. This one--this oil shale thing--you have heard of the Tosco refinery?

Swent: Yes.

Shoemaker: You know what Tosco means?

Swent: I guess not.

Shoemaker: The Oil Shale Company.

Swent: Oh, really?

Shoemaker: And they raised money to build this oil shale plant up in Colorado. It was the first experimental oil shale plant. Then Union Oil built one, too. They're both shut down now, but when they finally decided it was going to be too expensive to get oil out of shale, at that time, then they started buying up refineries and became a major player in the oil business.

We have more oil shale in the United States than Canada has tar sands in Canada, enough for--I don't know--thousands of years, maybe. But it's going to cost more than oil now, eleven dollars a ton.

Swent: A barrel.

Shoemaker: A barrel, I'm sorry [chuckles]. Anytime you build a plant, a mineral processing plant, the owner expects--say, you build one for 20,000 tons a day. The owner expects that he'll be able to get more out of that, maybe 15, 20 percent. Sometimes you get much more out. But when you build an oil refinery for 100,000 barrels a day, and it turns out that the refinery will produce, say, 103,000 barrels a day, the oil company can get highly irate. They feel they've been cheated [chuckles]. They didn't want a 103,000-barrel-a-day plant. They paid for 100,000 barrels, and you gave them one that's 103,000 and they think they paid for too much. Very strange.

Swent: It's a different culture, the oil culture.

Shoemaker: It certainly is, it certainly is.

Swent: Very different.

Shoemaker: If I keep on, I'm not going to be able to talk.

Swent: Okay. Well, I think it's been a good day.

Improving a Limestone Grinding Plant for Calaveras Cement Company

[Interview 2: May 26, 1999] ##

Shoemaker: We can talk about Calaveras Cement.[3] Grant Metzger, who you know, was vice president of Calaveras Cement at the time I was at Bechtel. We were quite good friends. They, Calaveras, had Bechtel build them a new limestone grinding plant at a new quarry they opened up, up in Calaveras County, to feed their cement plant at San Andreas.

The job was given to the Los Angeles office of Bechtel. That was part of the Power and Industrial Division, which I was in at that time. They finished the plant. It was a crushing, grinding plant, and then they built a pipeline, and I think that pipeline was about--oh, about eight or ten miles long. The ground limestone was pumped over to their--

Swent: Was it mixed with water?

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[3]See James T. Curry, Sr., *Metallurgist for Empire Star Mine and Newmont Exploration, 1932-1955; Plant Manager for Calaveras Cement Company, 1956-1975*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 1990.

Shoemaker: Yes. It was pumped over to the plant at San Andreas. Then it was put into the rotary kilns to make cement. Anyway, the grinding plan wasn't working, so--

Swent: What do you mean when you say it wasn't working?

Shoemaker: It wouldn't produce a product that met the screen analysis specifications that it was supposed to, the size of the material. They had a large grinding mill. I don't recall what horsepower it was, but it was probably up around a thousand or fifteen hundred horsepower. There were some other things wrong with the plant. There were a good many things wrong with it. Calaveras Cement, for some reason or other--well, they hadn't put anyone in Bechtel's office down in Los Angeles to watch over the development of the drawings. Also the Bechtel people down there didn't know anything about grinding plants. How the plant got designed in Los Angeles, I never knew.

So Grant Metzger asked me if I would come up and take a look at the plant, which I did. I told my boss, Bob Cheatham, that he had asked me to do this, and Bob agreed that I should go up and take a look at the plant. There were a number of things wrong. The crushed limestone was put into a large building, storage building, and it had a conveyor underneath it and feeders that drew the limestone out of this large building and put it onto the conveyors going over to the grinding section of the plant.

They used the wrong type of feeders, and they didn't have the draw holes above the feeders designed properly, so they lost a lot of storage room.

Swent: What's the difference between the wrong kind of feeders and the right kind of feeders?

Shoemaker: Well, the first thing, they used vibrating feeders. Vibrating feeders are an electric vibrating device. Feeders, as far as I'm concerned, is a misnomer when applied to a vibrating feeder because there are so many things that control or have an effect on the rate of feed: the size consist of the rock, the moisture content of the material, any drop in voltage applied to the feeder, the condition of the feed pan itself--whether it gets rusty or whether it's smooth. I call them a vibrating, self-destroying erratic transport device sometimes. I hate them.

Swent: [chuckles] I'm trying to--the thing that I can relate this to would be like a meat grinder or something. You've got a crusher and then you have a feeder that leads the stuff out of the crusher?

Shoemaker: Out of the building where--it's stacked inside of the building by a conveyor along the top of the building.

Swent: So it's feeding from a stack.

Shoemaker: Well, a great big long pile. The vibrating feeder, itself, is a metal trough that is vibrated by what is actually called an armature. It's a series of iron plates with coils around them, and the 60-cycle current vibrates these plates. The plates then vibrate this pan, and it makes the material move down the length of the pan. They make very large ones and very small ones. But I hate them.

Anyway, the worst problem that they had, though, was with the size consist of the material coming from the grinding mill.

Swent: This is the second stage, then.

Shoemaker: That's right. The material had been crushed to about a half an inch, a half or three-quarters of an inch before it went into the ball mill. And then the ball mill product went into a sump, where it was pumped to a cyclone. A cyclone is a conical device, where you pump a slurry into the top of the cone and there's actually a conical bottom to it and a straight section, tubular section on the top. The inlet is near the top. The slurry goes in tangentially. The coarser materials go to the sides of this conical section and then exit out the bottom, and the fine material goes out the top of the conical section. It's a very simple device. It was invented by a mining company called Dutch State Mines in Holland.

Krebs engineers took the idea and started building cyclones and examining the workings of a cyclone and improved them so much and became very famous for their cyclones.

Swent: And I've just completed the oral history of Bob Clarkson, who was Krebs's partner.[4]

Shoemaker: Yes.

Swent: He called it a hydrocyclone or a centriclone.

Shoemaker: It's called a hydrocyclone. There are different trade names, like a Centriclone. But anyway, the product going out of the top of the cyclone was supposed to be the proper size for going into the pipeline, and the coarser material coming out of the bottom of the cyclone was returned to the grinding mill. But the overflow of the cyclone, the fine material, went over a vibrating screen to remove any tramp material, tramp oversize. The screen just was completely overloaded at times.

The problem was they had no level control on the cyclone feed sump, itself. The pump would suck the feed sump dry, and then part of the time the feed sump would be overflowing, and it was a terrible mess. Then, because of this--when the sump was being sucked dry, then the cyclone wouldn't perform, and the overflow would contain a large amount of coarse material, and then the screen would be overloaded, and they just had a terrible time. Well, it was easy enough to fix by putting in a level control.

The rest of the things that were wrong with the plant were relatively easy to fix. And so I wrote a report, and it was quite a long report. It was one that called a spade a spade. I sent it--in fact, I only made the one visit up there, and then the plant started to work. I wrote this report, and I sent it to Bob Cheatham. Cheatham sent it on to Ed Garbarini, who was a senior vice president of Bechtel at that time. Garbarini was a big, tall Italian fellow. I think he died. I'm not sure. Just recently.

And then Garbarini sent the report on to "Ike" Caracco. He was the vice president and in charge of the Los Angeles

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[4]See John Robert Clarkson, *Building the Clarkson Company, Making Reagent Feeders and Valves for the Mineral Industry, 1935 to 1998*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 1999.

office. I didn't know that this had been sent on to Caracco. I was sitting at my desk at that time in the bullpen at 101 California Street, along with about fifty other people--draftsmen and engineers. Cheatham's secretary came running down from the second floor, where Cheatham had his office, and told me to get up to Cheatham's office as fast as I could. So I ran upstairs.

Cheatham was talking to Caracco, who had called him. Caracco was Italian, and he was in a towering rage. He was shouting and screaming and swearing that I had no right to go up to that plant, and I had no right to write a nasty report like that, and Caracco was going to have me fired and said that I would never get a job any other place, and he was just out of control. He was doing this over the speaker phone.

Finally, I guess he kind of ran out of breath, and he said, "What possessed you to write such a report?"

I said, "Mr. Caracco, I calls 'em like I sees 'em, and this was a lousy design on the part of the Los Angeles office."

And Cheatham put his hands together and held them up over his head, like this [demonstrating], and winked at me. He said, "Okay, Ike," he said. "You've said enough." He said, "I'll take care of it from here." Cheatham told me, "You won't hear any more from Caracco." He said, "I'll fix him."

That's kind of typical of some people and not necessarily in the engineering business, but they cannot take any criticism at all. Actually, that same type of attitude much later on caused me to leave Bechtel.

Swent: About when was this, Bob?

Shoemaker: Oh, that was in about the middle sixties. I guess that was when I was chief metallurgical engineer, so that would have been--I had an office at that time; I wasn't in the bullpen.

IV OBSERVATIONS ON MINING IN THE SOVIET UNION, THE CONGO, INDONESIA

Russia, Behind the Times in Engineering Design and Operations

Shoemaker: I mentioned in my memoirs that I had been in Russia twice. The first time I was there was when I went for Bechtel, and there were ten of us who went over and looked at various types of plants and apartment buildings and various civil engineering projects.

The second time, I went over under the sponsorship of the Society of Mining Engineers. There were five of us, including Nat Arbiter, who I believe you know.

Swent: Yes.

Shoemaker: And two mining engineers and one geologist.

Swent: Who were the others?

Shoemaker: I would have to look that up. One came from the University of Minnesota, a mining engineer. One was from the Bureau of Mines.

Swent: They were all Americans?

Shoemaker: Yes. To sum up the whole trip, we didn't learn one single thing about metallurgy from the Russians because they were twenty-five years behind everyone else in the design of their equipment and the operation of their mineral processing plants.

Swent: When was this?

Shoemaker: That was in the seventies, early seventies.

Swent: I think you wrote in your memoir that they were at least twenty years behind the times.

Shoemaker: Yes. And they had at least two people on every single job because the Russians had no unemployment. They put everybody to work. So no one worked hard at all, and no one really cared whether they did a good job or not. They had no rubber-lined equipment, like rubber-lined pumps and pipelines and flotation cells. I've talked to a friend of mine recently, who has been over to Russia. He was the vice president of Newmont, and they put in a very large plant over there.

Swent: Who was this?

Shoemaker: Ken Brunk. He's not with Newmont any more; he's with Bateman Engineers. He tells me that they still have very little rubber-lined equipment, and equipment is almost impossible to get. You have to ship in everything. But because of this no rubber lining--

Swent: Do you suppose because they have no good source of rubber, is that it?

Shoemaker: I don't know. They certainly could buy rubber, but they have always had a shortage of hard currency, and so they couldn't--that's one of the things they didn't buy, just like activated carbon for recovering gold. They developed a process using ion-exchange resins instead of activated carbon. It wasn't nearly as good a process as the activated carbon--it had a number of drawbacks--but nobody really cared very much. Nobody cared with any of those plants because they didn't have any cost control. They didn't know what it cost them to produce a pound of copper or an ounce of gold. The management did not know. They just looked blank when you would ask them what their costs were. It was remarkable.

Consequently, their plants were always down for repair. The pumps were made of cast iron, which, pumping abrasive material, would only last a couple of days, whereas our rubber-lined pumps now--they're not really rubber; they're plastic-lined, plastic linings, much more advanced than rubber is, and will last for months or even years. But they didn't have that, either, of course. They were just constantly changing out pumps and pipelines and so on.

A Very Low-Grade Lead-Zinc Mine

Shoemaker: We went to one plant that was processing a lead-zinc ore. It was so low grade that it couldn't have possibly been operated any other place in the world except--I don't know--maybe China or some other place. It had a combined lead-zinc content of seven-tenths of 1 percent. Here, in the United States or Canada or most other places, lead-zinc plants have to have, oh, 7 or 8 percent combined lead and zinc, or even more. But they had put this plant in. It was back, oh, northeast of Tashkent. I've forgotten which of their--whether it's Kazakhstan or Uzbekistan.

But anyway, this big plant--it was nine thousand tons a day, and it was out just in nowhere. It was an underground mine. There wasn't anything near it at all. It was kind of on a sidehill, with a huge, huge valley out in front of them. This valley was all farms. The water that the farmers used came from the dewatering of the mine. They were pumping 60,000 gallons a minute out of that mine. Even then, sometimes they couldn't keep up with it, and the mine would flood. Sixty thousand gallons a minute is an enormous amount.

Anyway, it all went down into the valley, where they had established these farms. The workers at the mine were living in dormitories. They were married people. I won't say dormitories, but apartments. They had dormitories for single people. But, of course, the apartments were one- or two-room apartments with one light bulb hanging from a wire in the ceiling of each room.

I asked the plant manager how much the farmers paid him for the water. He said, "Well, they don't pay anything. The water belongs to the government, to the state." They had to absorb all the cost of that.

But they were quite hospitable. The first time I was in Russia, they wouldn't let us take any pictures, but the second time, when they told us we couldn't take any pictures, well, even though Nat Arbiter was the leader of the group, I got up and I said, "Well, let's leave. We're going back home if we can't take any pictures." And there was a long, long argument back and forth between the Russians, and finally the KGB interpreter who we had there--anyway, we got them to agree that we could take any pictures we wanted. When we got back, when the CIA interviewed me, we found that no one else had ever been allowed to take any pictures. But those type of people at that time--you just had to be as hard-nosed as they are.

But anyway, this KGB agent had mentioned that I had collected miners' lamps. They had a little museum there, and they went over to the museum and got one of their carbide lamps. They used electric lamps then in the mine. But he presented this to me, and they had it all painted up very nicely, and I still have it. Like most things over there, it was a copy of miners' lamps that were made in England or some other place.

The Almalyk Copper Plant, Kazakhstan

Shoemaker: We also went to the largest copper plant, which was called Almalyk. It was about fifty or seventy miles from Tashkent, in Kazakhstan. It was their largest and newest copper plant, and it was treating 80,000 tons a day. They were expanding it while we were there to 120,000 tons a day. Since they had no rubber-lined pumps, they couldn't use cyclones. In order to classify the ore that came out of the grinding mills, they used what we call spiral classifiers, which are a large--you might say a screw that works in an inclined trough. The mill discharge goes into the pool at the base, at the lower end of the screw, and the coarse material settles to the bottom of the screw, and then is conveyed back into the grinding mill. The overflow of the classifier then goes to flotation cells.

At that time, the largest mills that they had were 1,000 horsepower. At that time, we were installing 3,000-horsepower mills here in the United States and in other places in the world. But they didn't have the facilities for making these large mills and large gears and so on. They had two three-meter-diameter screw classifiers for each grinding mill. I wish I had measured or asked them how long that mill was, but I think it must have been a third of a mile because you would have two of these huge classifiers beside each one of these grinding mills. If we had had the same capacity mill, it would have been one-third the size of their grinding plant.

Their primary crushers were very strange. The largest gyratory crusher they had was what was called a 50 x 60 inch. That was in metric system, though. They couldn't put very large rocks into it because of the 50-inch opening. Our 60-inch--well, our crushers at that time were 60 x 89 inches, and also we had a 60 x 102 inches. The second number is the diameter of the mantle in the crusher. But these had 600 horsepower on them, but they had two motors driving the thing, one on either side of the ring gear at the base of the crusher.

I asked them why they used two motors instead of one, one 600-horsepower motor. And they said it was because they couldn't get gears that would take the shock of a single 600-horsepower motor on a crusher. The gears were just--the metallurgy in them was not good enough to take the shock of the crusher.

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Swent: So they were just limited by their own technology.

Shoemaker: That's right.

The best engineers that they had were all working on their space program and their armaments industry and the aircraft industry. Although the aircraft weren't--they had one of the worst--<u>the worst</u> safety record in the world. While we were there, they had built a copy of the Boeing 727, and on its first flight--this KGB agent, who was our interpreter, told us that when they took it off, it went straight up in the air and then turned over on its back and crashed. Their bigger jet airplane had four jet engines. Those were built on the tail, like the British VC-10, it was a copy of that.

The Russian people--they're not very smart. The bureaucracy is just too set in their ways, and they won't be able to change overnight, much less in ten or even twenty or thirty years. I was talking about that with Ken Brunk yesterday on the telephone, and he agreed with me completely on that, with his experience over there. He says there's a lot of mining companies that are investing over in Russia now, and he said they produce reports that say their costs are quite low, but he says they're lying. Their costs are probably as high or higher than what they are in the United States. He says they're all trying to justify themselves to their stockholders.

Congo, Enormously Rich but Terrible to Operate In

Shoemaker: Another country that is terrible to operate in, even far worse than Russia, is the Congo. That country has enormously rich copper and cobalt mines.

Swent: Were you ever there?

Shoemaker: I've never been in the Congo. Well, I flew into the airport there at the capital one time. But I was in Zambia, just about five miles away from the Congo border, for Anglo-American one time. We flew into a small gravel airstrip. We were looking at a mine that had been shut down. I was with Bechtel at that time. It was an underground mine. They thought it was the Queen of Sheba's mine. The outcrop had little veins of copper or oxide material going through it. They were mined down about thirty feet. They must have had children down in there excavating because it was too narrow for a normal-sized person.

But anyway, we had to get out of there before the evening because the rebels from the Congo were coming across the border and raiding. But the Congo--the Belgians had very large copper mines and cobalt mines there, and when the Belgians gave the independence to the Congo, there were several factions that were fighting to take it over and take over power, and those mines had to be abandoned.

Now one of the big oil companies--I think it was Exxon--tried to go back in there a number of years ago and spent hundreds and hundreds of millions of dollars to start up a new plant. Before they got it halfway finished, the rebels came in and killed a bunch of the people, and they finally just pulled out. Now there's another company, a Canadian company, going in there. I've heard that--it's been in *The Northern Miner* [newspaper] that the newest or latest government has revoked their license to mine after spending, again, hundreds of millions of dollars.

Corruption in Indonesia, Just a Crime

Shoemaker: Another one of these countries is Indonesia. When a mining company goes in there, they have to give one of the Suharto family members from 10 to 20 percent of their operation. Newmont is in there with one of the big copper mines of the world that just opened up. Of course, Freeport has been in there with their mine in Irian Jaya, which is the northern part of New Guinea. Oil companies are in Indonesia. But the Suharto family is so enormously rich from all of these things that it's just a crime, when the people are just poverty-stricken.

Swent: Were you in Indonesia at all?

Shoemaker: I've never been in Indonesia, itself. I've been in Singapore and Hong Kong and, of course, New Guinea and the islands there, but I have no desire to go to Indonesia. Newmont built a big heap-leach operation at the Murantau mine in Russia. That's the one I described, I think, in my memoirs, where the CIA had photographs of it and wanted to know how big it was.

Well, anyway, the Russians over the years had stockpiled enormous quantities of low-grade material, and Newmont has gone in there and put in a very large heap-leach. They have to crush all their ore to a quarter of an inch. They have four-stage crushing, and it was high cost. They had to fly every single piece of equipment in from Texas. They use a Canadian company that leases these very large cargo planes from Russia, jet cargo planes. They're bigger than one of these C-5As that are made by Lockheed. They are leasing these--I think they're Antinovs. Anyway, they advertise in the mining journals. They use them to ship large pieces of equipment overseas, all kinds of equipment. That's a good airplane. But Newmont is not going to make enough money out of that thing, I don't think, to ever really give a good return to their stockholders.

V CONSULTING METALLURGIST, MANAGER OF DIVISION METALLURGY FOR BECHTEL TO 1981

Occidental's Heap-Leach Plant at Historic Candelaria Mine

Shoemaker: When I was at Bechtel, also we built the Candelaria silver heap-leach plant for Occidental Petroleum, or Occidental Minerals, which was a subsidiary of Occidental Petroleum. This was in 1980 that we built the plant. Armand Hammer became interested in silver, and he made Paul Bailly the president of Occidental Minerals. They started looking for large, low-grade deposits at Candelaria, which is about fifty-five miles south of Hawthorne, Nevada. It was an old mining camp. It was very rich for a good many years, back around the turn of the century.

It didn't have any water at that time, and they brought their water through a fourteen-mile gravity pipeline from the mountains up to the west. This pipe--we uncovered a lot of it when we built the plant. It was a spiral, riveted pipe, four inches in diameter. It was made out of wrought iron. Wrought iron doesn't rust at all, and it was just as good as when it had been laid back around in the late 1890s. Candelaria--they cut that pipe up and made a lot of claim posts out of it.

But it was interesting because we did a study for them, an engineering study, and we projected the cost of producing silver from this mine to be five dollars an ounce. The capital cost of the mine would be about $30 million. Before we even moved one shovelful of dirt to start building the plant, Armand Hammer and Occidental Petroleum--they sold forward 6.3 million ounces of silver. This was at the time when T. Boone Pickens was trying to corner the silver market, and they sold this forward at forty dollars an ounce.

And then the silver market--it reached fifty dollars, and then it started to collapse. Armand Hammer sold the 6.3 million ounces and made a profit of $130 million.

Swent: Oh, my.

Shoemaker: Before we had even started building the plant.

Swent: A $30 million plant.

Shoemaker: Yes. They made $130 million profit. So he made $100 million net.

Swent: Before he had even built it.

Shoemaker: He was pretty smart. He's one of the few gamblers in silver that have ever made any money. The plant ran for about two years, and when silver dropped to seven dollars an ounce, then they shut it down. It was shut down for a couple of years, and then Nerco bought it. Nerco was a company that Pacific Power & Light bought. PP&L wanted Nerco because Nerco had a lot of coal properties in Alaska and also here in the United States.

Swent: Texas, too, isn't it? Or Wyoming?

Shoemaker: Wyoming and Montana, I think. But anyway, they got this silver property along with it.

Swent: They did produce the six million ounces?

Shoemaker: Oh, yes, yes. Well, they wouldn't even have had to. They could have just bought silver for five dollars on the spot market and sold it. Because it was sold forward, they would have gotten the forty dollars an ounce. But many, many years ago, the government told the public utility companies that they had to agree not to get into the mining of precious metals. Now, I don't know why. But PP&L and New Mexico Power and Light never did sign that agreement. And so Nerco, under PP&L, got interested in silver and gold. I guess Pacific Power thought they were going to make a lot of money, and New Mexico did, too.

Anyway, Nerco bought the Candelaria property and then ran it for about four years, and then they expanded it and got bigger trucks and put bigger throughput through it. They made some money, but then, when the price of silver fell again, even with their increased production and lower operating costs, they couldn't make it and so they shut it down.

The New Mexico Power and Light bought a little company called Transwestern. They were a promotional company. They, Transwestern, leased the 16-to-1 Mine up here at Alleghany and lost an enormous amount of money. They also leased a gold deposit up in northern California. It was a heap-leach operation, and it had quite a good-sized cyanide spill. The state shut them down, and I was hired by the owner to go up there and see if--they had filed a lawsuit against Transwestern, saying the place had been run incompetently.

So I went up, and I spent a week up there with the lawyers. And it was. It was a terrible operation. It was up by Lake Almanor, I think it is, up north, north of Quincy. I spent a week up there, going through all of the records, and it was just a disaster. Finally, it didn't go to court. I recommended that it was such a mess that they would probably spend so much money in court that it wouldn't be worth it, and I recommended that they settle for--I've forgotten--it was a few hundred thousand dollars. Which they did.

Lawsuits Involving Candelaria

Shoemaker: Later, getting back to Occidental and Candelaria, there was a man by the name of Von Kohorn. I think his first name was Henry. I don't know where he came from, but he apparently got interested in heap-leaching, and this was in the early days of heap-leaching. He got a patent on a method of making the leach-heap more permeable after it had gotten blinded off by the decomposition of the ore that sat there over the years. His way of doing this, restoring the permeability of the leach-heap, was to--before they were built--bury six-foot diameter pipes at the bottom of the leach-heaps, and then pull these pipes out of the heap, after the permeability was lost. Pulling these pipes out--the ore would fall into these spaces. [chuckles]

So he went to Occidental and said that they had stolen his idea, which they hadn't. In the first place, the idea wouldn't work because it would have taken a battleship the size of the *Missouri* to pull those huge pipes out of there. But they had to answer the lawsuit, so I was called in and gave a deposition. Anyway, Von Kohorn faded away.

But then there were two companies that had been dormant for years that owned the deposit there at Candelaria. One was called Candelaria Industries, and the other one was called--I think it was Candelaria Mining. These people, the stockholders had had this stock from many, many years ago. Occidental negotiated leases with them. Their claims abutted each other. This one company, Candelaria Industries sued because they claimed that Occidental was doing their assaying poorly and that their mining practice was poor.

Where these claims abutted each other, this company said --you see, you have to do some drilling and some assaying and calculate how much ore goes to the royalty on one side of the line goes to this one company, and the ore on the other side goes to the other one. But you can't mine a vertical face, and so you have to do all this by calculation from drilling and assaying. The metallurgist there had developed a complex but very good method of doing this calculation of paying royalties.

Anyway, I was hired by Occidental to be an expert witness in this lawsuit. It was interesting because one of the stockholders, major stockholders in this company that was doing the suing was the wife of Judge Wapner, the "People's Court" judge. Also, my professor of metallurgy at the University of Wisconsin was an expert witness for this Candaleria Industries. He shouldn't have ever taken the job because he had to testify about assaying, and he never had done any fire assaying. I had, and it was--this man's name was Dwight Harris. He's dead now. Our lawyers just went after him and made it very embarrassing for him.

Anyway, we finally prevailed in the suit. That was later, when I became a consultant, but I bring it in here because we built Candelaria, which was one of the two silver heap-leaching operations--well, actually, one of the three. One of the others was the one that Frank McQuiston, Ed Hewitt, and I had over at Tuscarora, and that third one was down in Tombstone, Arizona.

Swent: When you say you build a heap-leach plant, do you mean the crushing plant?

Shoemaker: Well, it's a crushing plant, and then the materials handling facilities--sometimes conveyors, sometimes truck--to build the heaps, and then you build all the piping to distribute the cyanide solution and the ponds to collect the solution and then the recovery plant. With silver, you use a zinc precipitation plant, which used to be used for gold also. Nowadays, you use activated carbon to recover gold, rather than zinc precipitation.

Changes in Bechtel's Attitudes and Policies

Shoemaker: When I left Bechtel in January of 1981, Bechtel had changed their policies. They had brought in a bunch of people to run the Mining and Metals Division, which had become very large. Many years before, it had broken off from the Power and Industrial Division, and we actually became larger than the Power and Industrial Division. I ended up, when I left, as the manager of the Division of Metallurgy, and I had charge of all the metallurgical plant designs for the San Francisco, Toronto, and Melbourne offices.

But it wasn't like working for them when I first was with Bechtel and for a good many years when Steve, Sr., was there. If we did something wrong when Steve, Sr., was there--if we built something wrong in a plant--we fixed it at our own expense. That's why we became so large. We had such a fine reputation. But when Steve, Jr., came in, well, that gradually changed as the old-time board of directors finally died off or retired. It became a company that was very arrogant, and I just couldn't take that.

Foto 11 - "Formigas" transportando material no ga
rimpo de Serra Pelada - Maio/82.

Foto 12 - "Formigas" transportando material no ga
rimpo de Serra Pelada - Outubro/82.

VI INDEPENDENT CONSULTING WITH SAN FRANCISCO ASSOCIATES, 1981 TO 1984

A Scam Prospect in Arizona and a Lost Fee

Shoemaker: Anyway, when I left, I moved into the Russ Building over on Montgomery Street, with Henry Colen and Joe Wargo. They had an extra office there, and they were subleasing from Consolidated Placer Dredging. One of my very first jobs--and the only one that I ever got beat out of a fee on--happened shortly after I moved in with Joe and Henry. They called me vice president of San Francisco Mining Associates, but I really wasn't. I was operating under R.S. Shoemaker, Limited, my own corporation.

But I got a call one day from a man by the name of John J. McCloy, Jr. John J. McCloy, Sr., was the high commissioner in Germany after World War II. He lived in New York, and he said that he was interested in a proposed gold mine, a gold deposit, out in Arizona, and he was in partnership with a man by the name of John J.--

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Shoemaker: With John J. McCoy.

Swent: John J. McCloy and John J. McCoy! How confusing!

Shoemaker: McCoy was president of Coastal States Gas, which is a big gas company. McCloy asked me if I would come to New York and talk to him about it. He wanted to hire me. I was working for DuPont, and I had to go back to Wilmington, and to get to Wilmington, Delaware, I had to go to New York. I said, "Well, I'm coming back there, to Wilmington, and I can stop in New York and come and see you and you can share in the cost of the air fare."

He said, "Fine."

So I did. I flew to New York and stayed at a hotel and went to see him. He had an office in Radio City, Rockefeller Center. They were both there. They had a bunch of papers there. It was obviously a scam. But they, like so many people who are involved in these scams, they--even though they were supposedly bright people, they knew more than anybody else, and they were bound and determined to invest in this property. I spent the whole day with them and finally convinced them that they shouldn't go into this because--

Swent: What made it so obvious to you that it was a scam?

Shoemaker: The first thing: anytime anybody mentions platinum and platinum metals here in the United States, you know it's a scam. But all of these scams or most of these scams--they generally have an ore deposit that contains platinum and palladium and other rare elements besides gold. [chuckles] Or they will claim they will make a concentrate, a copper concentrate. Well, they sell the copper, they sell the sulfur, they sell the silica that's in it, they sell the limestone that's in it, and they add all of these things up at market price, and it's very apparent that it's a scam, whereas all of these things should go into the tailings.

Well, anyway, I sent them a bill, and McCloy refused to pay for it. I went to my attorney, and he said, "You've lost the money. There's no use trying to sue him in New York. You would have to hire a New York lawyer and so on." From then on, whenever I didn't know anybody, I always asked for a retainer in advance.

An Interesting Job in New Guinea

Shoemaker: Another interesting job that I had, when I was with San Francisco Mining Associates, was for the New Guinea government. At that time, Gold Fields of Australia, which was a subsidiary of Gold Fields of South Africa--well, Gold Fields of London--they had been jointly exploring with Placer Development the Porgera deposit, up in the highlands of New Guinea. You had to fly into Port Moresby and then get a little plane into Lae and then Mt. Hagen; then we got a chartered plane up into the mountains, where this deposit was.

We flew in on a plane owned by a mission. It was used to bring supplies to these various places, little towns that had missions.

What we were looking at was--the government wanted us to see the drilling that the companies were doing and they were planning on doing and what the ore looked like and whether it could be beneficiated properly and whether the test work was being properly done--

Swent: This was gold?

Shoemaker: Gold. When we flew into this mine, it was remarkable because the airstrip was on a 15-percent slope. You came up the Brunswick Hill down here. That is a 9.5-percent slope. This was 15. The pilot came in at the bottom of the hill, the airstrip, and as soon as his wheels touched down, he applied full power because if he ever got stopped at the bottom or anywhere near the bottom, he couldn't get the airplane to get up to the top of the hill. They would have to tow it up there. So by applying full power, he got it up to the top of the airstrip. Then, of course, he took off downhill. I don't know whether any airstrip in the world has ever been any steeper than that, but that was certainly a steep one.

We stayed with the exploration crews that were there for both Placer Development and Gold Fields.

Swent: How did you happen to get this job from the government? Did you have contacts?

Shoemaker: The New Guinea government was using a bank here in the United States called Mace Wespac, Western Pacific. It's an Australian bank, and it had a New York office. They had asked the bank to look up some people who could look at both geology and metallurgy, to check on the lessees of the property, and so they called us up.

We were up there for several days, Joe and I. First we went to Australia and talked to Gold Fields. Then we went to Port Moresby to the Ministry of Mines. The minister was, of course, an indigene. You don't call them natives any more; you call them indigenes. While we were there, we visited the parliament when it was in session. There was probably fifty people there in the parliament building, which is a nice, modern building, very nicely designed. About half of the people in the parliament were dressed in suits, and the other half were dressed in their very best native costumes, with feathers and everything. It was quite a sight.

We also visited their museum, a natural history museum, which was absolutely fantastic. It was not big, but it was done so nicely.

Oh, the name of that place was Mt. Hagen, where we landed after we left Lae.

Swent: How do you spell Lae?

Shoemaker: L-a-e, I believe it is. It's on the map.

There was an Australian up at the site who had gotten a license to mine up there. They had been mining gold up there for many, many years, and he lived in a house. It was a big house. It was the only house at the site. He was about a mile away from the site. The house was all kind of moldy and about ready to fall down, but it must have had six or eight bedrooms in it, none of which he used except one, I guess.

He employed a number of these indigenes to run a sluicing operation. There was coarse gold up there. He also bought gold from the indigenes that had their own little spots. We visited with him, and he showed us all of the different kinds of gold. Every spot there has a different characteristic. You could very easily tell where it came from.

Anyway, we turned in a report to them and said that they were doing very well, and they were getting their money's worth--the government would be getting their money's worth. It later turned out Placer Development bought out Gold Fields, and they have been operating that thing, and it has been one of the richest gold mines in the world. They ran into some enormously high-grade ore there at Porgera. The name of the mine is Porgera.

Assays That Were "Salted"

Shoemaker: Oh, going back a minute to scams. I have a section on scams in the back. Let me talk about this one. I got a call from a man by the name of Burt Applegath. He was a Canadian promoter, mine promoter. He's one of these nonstop talkers. Anyway, he asked me to come down to El Paso. They were in partnership with a company called New Cinch Uranium, which was a reputable uranium company up in Canada. It was on a gold property in New Mexico. It wasn't a very long distance from El Paso, probably fifty miles.

Well, I never heard of Applegath and never heard of New Cinch Uranium. He said they were doing some drilling there, and he wanted me to check into the assaying and the sampling.

So I told him I had had this experience with McCloy, and I told him I'd have to have a retainer, and he said that he would meet the airplane at El Paso with a cashier's check, which he did.

Then we went up to the site where they were doing the drilling, and then we went to the assay laboratory, which was in El Paso. They were getting such rich values there. I just had the feeling that, with these great assays they were getting, I should be seeing some gold there, visible gold. I borrowed a bucket and used it for a gold pan when I was up there. It's very crude, but it can be done. At least you can see the larger pieces of gold. I couldn't find any gold. But I didn't say anything to them about it at that time.

Then we went down to this laboratory, and this fellow had, oh, kind of a general water-chemistry laboratory, and he had a fire-assaying laboratory. He had a man from Asarco who had been an assayer for Asarco, who I'm sure was honest, but this man who ran the laboratory was also buying electronic scrap. He had almost a washing machine that he would put these things in. It looked like one of these old Westinghouse horizontal-drum washing machines. He had made it out of stainless steel, and he was cyaniding this stuff, all the gold from the electronics. He was pouring gold there, and he was pouring little gold ingots right on the same table where they were mixing the fluxes for the fire-assaying.

Well, it was very apparent to me that the assays were being salted. Whether they were being salted on purpose or whether it was just from accidental contact with metallic gold there, I don't know. But anyway, I told them to change laboratories, which they did. And then they began getting nothing.

Actually, I was working for New Cinch Uranium. They were paying my bill. When they started going to another laboratory, they got absolutely nothing, and they closed the project down. As I say, I never figured out whether it was a complete scam, as far as the laboratory was concerned, or whether it was completely by accident.

[tape interruption]

A Doomed Plan to Re-open a Mine in Virginia City, Nevada

Swent: Okay, we've taken a short break here, and now you were just talking about Timothy Collins and a company called United Mining that was going to open the mines at Virginia City, Nevada.

Shoemaker: Right. First of all, Howard Hughes wanted to get involved in mining in Nevada. One of his employees that he put in charge--he just told him to go buy mines. This man bought a large number of claims all over Nevada, where old mines had been and were defunct. One of the properties he bought was in Virginia City--actually, at Gold Hill. But then, when he died--Howard Hughes died--all of these properties were purchased by an outfit called Houston Oil and Minerals. They were trying to operate a plant there, between--well, it was closer to Virginia City than it was Gold Hill. They were developing an open pit there. They had brought a mill down from Canada. They had wooden ore bins that they brought down. They got one of them re-erected, and then it collapsed, the lumber was so bad. So then they put in some steel ore bins.

They had six wooden Pachuca tanks. A Pachuca tank is a large, tall, cylindrical tank where you do your cyanidation, and you keep them agitated with air going into the bottom of the tank. Pachucas were used at the Homestake uranium mill there, near Grants, New Mexico. These were leaking all the time. It's a wonder they even stood up. I went through the mill when I was there. It was a very poorly designed mill.

I'll get back to that in a minute, but Collins had hired a very fine tunneling engineer. They sank a decline down--oh, the entrance to it was probably three blocks or more down the hill from the main street of Virginia City, and it went down at about a ten-degree angle and went through the vein structure, which was right underneath the main street of Virginia City.

They had a lot of problems. They had to timber all the way down, the ground was so loose--running, as we call it. They timbered all the way, and then they got through the vein, which had been mined out--or--they had been mining up to within about three hundred feet of the street in the middle of town. And then they had turned both right and left when they got through this vein and mined-out portion of the vein, and drove a short adit to the right. I don't know which direction that is, but I would presume east, and a much longer adit right under the main street, right in line with the main street, clear to the end of town, the west end of town, and then drove cross-cuts back into the old workings. These workings were all square-set stopes. You couldn't get in--you could look in, but you didn't dare go into these because the timbers were all crushed.

Swent: They were there from a hundred years ago, I suppose, weren't they?

Shoemaker: Yes. We went down--Joe Wargo and I--and Henry--we all three went down in that mine--or--it wasn't a mine yet. We did quite a study for him. He was doing metallurgical work, or having it done, and I supervised that. He was selling some of the material that he took out of this adit to Houston Oil.

Swent: Now, "he" is Collins?

Shoemaker: Collins. Selling it or having it custom-milled in the Houston Oil mill, and had plans on taking it over. We were over there several times and I wrote quite a long report about it. We weren't really enthusiastic about it at all because Joe particularly thought the ore was--there wasn't much ore. They were going to mine up toward the street! Because those mines, you know, had been very deep, a couple of thousand or three thousand feet, they were essentially worked out. The only good ore was up near the street, and you couldn't get too close to that or the whole town would cave in. Well, anyway, Collins ran out of money and he didn't pay us, and we had to sue him to get paid.

But in the meantime, the Houston Oil people wanted me to come over and help them with their mill. They had a very good mill superintendent by the name of Bob Turner, who I later got hired to go up to the Pegasus Gold Landusky-Zortman in Montana. I was helping out Bob, getting this old plant straightened out. It was an interesting job, but it was kind of frustrating because you knew--or I knew--they weren't going to last very long. They had tried to open up the old Sutro tunnel that was supposed to drain all the water from the Virginia City workings. But most of the tunnel had collapsed, and they never could get back in there. Houston was another one that was going to make a fortune. They finally went under. But it was an interesting time, working in that old mill that had been rebuilt. I enjoyed it.

Homestake Breaks a Promise to Buy the Empire Mine Tailings

Shoemaker: Another job when I was still in San Francisco was--I have a friend up here in Grass Valley by the name of Dale Corman. He is a geologist and a mining engineer. At the present time, he is president of Western Copper Holdings. They have a very large copper deposit that they have found in Mexico. At that time, they were interested in geothermal power. They had geothermal claims over in Nevada. They had sold one of them, or leased it, to Chevron, to run a geothermal power plant this side of Carlin.

Anyway, he called me up one day, and he said, "Why is Homestake looking for pyrite?" This was when they were planning on building the McLaughlin Mine.[1] I said, "Well, I have to think about it a little bit." They were going to use autoclaves, Homestake was, at the McLaughlin Mine to oxidize the pyrite that most of the gold was entrapped in. The sulfur --and they had pyrite in their ore--and the sulfur furnishes the heat in the autoclave.

But when I thought about it, I said, "Homestake probably thinks they don't have enough sulfur to furnish enough heat because I do know that they are putting in boilers over there to furnish high-temperature steam."

He said they had been prospecting all over California and clear up into Oregon for any old prospects, old mines or even new ones, that were high-grade pyrite. He said, "They've been doing this for about a year and a half, and have spent a lot of money doing it."

I said, "Well, undoubtedly, they think they need the sulfur."

He said, "Well, I know where there's 40,000 tons of pyrite--not only pyrite, but it contains a quarter of an ounce of gold. It is at the Empire Mine here in Grass Valley." This pyrite concentrate was an idea of Frank McQuiston's, when he was chief metallurgist here. They had made a flotation concentrate which--originally, at Empire, they cyanided all of the ore, but then when flotation came in, in the 1920s, they produced a flotation concentrate which they cyanided. But part

[1]See *The Knoxville District, the McLaughlin Gold Mine, Northern California, 1978-1995*, Volumes I-VII, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 1998-2000.

of the gold was associated with galena, which is lead sulfide, and part of the gold was in the pyrite.

Frank put in a circuit to separate the galena from the pyrite, and they made a high-grade galena-gold concentrate, which they sold to the Selby Smelter. To do that, they had to put in a fine-grinding circuit before the flotation. Then the remaining leached pyrite was put in a separate tailings pond from the old tailings that they had made there ever since the 1920s. This pyrite had actually been drilled by the Bureau of Mines. The Bureau of Mines had done some assaying. They had not written a report about it yet.

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Shoemaker: He told me that the state, which owned the Empire Mine Park, had given the Empire Mine Association the right to sell this concentrate. He found out that they had been talking with White Pine Copper up in Michigan about this because White Pine bought pyrite because their concentrates were very low in sulfur, and they couldn't make a copper matte in their furnaces, so they had to buy pyrite. They had native copper as well as covalite, which is CuS. So it was very high in copper and low in sulfur. Anyway, the Empire Mine Association figured there was no way that they were going to ship that stuff all the way back to Upper Michigan.

My friend Corman talked with the board of directors of the Empire Mine Association, which runs all the docents over there and helps rebuild buildings and so on, and found that this concentrate was for sale. He said, "Do you know anybody in Homestake?"

Then I told him about Homestake probably wanting the sulfur from the pyrite, and I said, "Yes, I do."

He said, "Why don't you call them up and see if they're interested, and don't tell them where it is."

So I called--I'm trying to remember the name of the fellow. He was their chief geologist that quit or was fired--I'm not sure which.

Swent: Anderson? Jim Anderson?

Shoemaker: Jim Anderson. Well, I had called--who was the president at that time?

Swent: Henshaw?

Shoemaker: No, after Henshaw.

Swent: Conger?

Shoemaker: Conger.[2] I called up Conger, Harry Conger, and told him--I said, "I heard that you're interested in pyrite. My partner and I know where there is some. Would you be interested in it?"

He said, "We might be. Why don't you come over and talk with Anderson?" So Dale Corman--he came down, and we set up a meeting with them, and he came down from Grass Valley, and we met over there. We told him that we had this 40,000 tons of pyrite that was pretty much, theoretically, pure pyrite, was almost pure pyrite, but it contained a quarter of an ounce of gold, and that made their ears prick up pretty well.

Oh, we met with--I don't know whether you want to use names or not--

Swent: Sure. That's the whole point of this.

Shoemaker: We met with Anderson, and we met with Rex Guinivere. He was chief engineer. Why he was in on it, I don't know. And then there was a purchasing agent, and I don't recall his name. And then they had a corporate attorney. He later quit and he went to work for the navy. Relatively young fellow. I think he was probably thirty-five or something like that. There were four of them.

And so we discussed this. One of them asked where it was, and the attorney said, "Don't ask that." So we didn't tell them. We wouldn't have told them that time, anyway. They wanted some samples, so we got them some samples, and I took them over to them. Dale sent them down to me. They had them assayed, and they called up and asked for another meeting. Dale came down, and they said that they were interested in purchasing and how much would we want for it?

This work had been going on--or this contact with White Pine Copper had been going on, and we were afraid the word about Homestake would get out to these Empire Mine Association people. So we agreed together to--Dale and I--to tell them at that meeting where it was, because that would then kind of commit them. Anyway, they asked first what we wanted for it.

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[2]See Conger oral history in Knoxville-McLaughlin, Volume II.

We had set a figure of thirty-five dollars a ton. Well, at that time, gold was $400 [an ounce].

Swent: A quarter of an ounce would have been $100.

Shoemaker: A quarter of an ounce would have been $100, plus the value of the sulfur. Actually, they wanted the sulfur, but they wanted the gold also when they found out it was there. Well, we figured to mine it, which would require a front-end loader, and transport it, we had a figure of fifteen dollars a ton. We would pay the Association ten dollars a ton, and we would get ten dollars a ton. We told them that, and they were, of course, very much interested.

Then we said, "Well, we have the rights. We've been talking--we have been given the verbal rights to sell this, to purchase this stuff." We said, "It is at Grass Valley at the old Empire Mine." The lawyer didn't want us to tell, but we got it in before he could shut us up. Well, then they wrote up a contract. They sent it to us, and we had one other meeting. We made some minor changes to the contract. And then they said, "Well, we're not sure we need this at the present time. We'll have to get the mill started before we really know whether we need this or not."

We said, "Well, why don't we just make a handshake agreement that you will buy this through us, since we brought it to your attention?" They asked the lawyer about it, and the lawyer said that's all right, and so we shook hands all around --shook hands with the four of them. And they said they would call us when they found out if they needed it or not.

A few months later--it was eight months or so, when the plant was built, Dale called me up one day, and he said, "They're mining this stuff, this pyrite." He said, "The Empire Mine Association has made this deal with a contractor from Seattle," someplace up in Washington, to haul this. He bought it, and was hauling it down to Lower Lake there, to the McLaughlin Mine.

By that time, Bill Humphrey had come to work for Homestake, so I called up Bill.[3] I said, "Bill,"--I told him about this handshake agreement, and I said, "I think you owe us some money." Of course, he didn't have anything to do with it,

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[3]See William A. Humphrey, *Mining Operations and Engineering Executive for Anaconda, Newmont, Homestake, 1950 to 1995*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 1996.

and he said that he would get back to me. So he called up a few days later and he said, "Well," he says, "I'm sorry," he says, "but we don't think that you had an agreement with us, and there's nothing we're going to do about it."

So I said, "Well, I think I'll talk to my attorney." I had done some expert witness work for John--I'll think of his name in a minute--and his partner, David Hoy--John Miller, who was in Elko, and David Hoy is in Reno. On the litigation part, they hired a litigator who was an expert at courtroom--. His name was Greg Wilson. He was in San Francisco. Greg was just a tiger in court. He put on the most remarkable performances. He had a so-called expert in another lawsuit who was from Reno, the expert was, and he asked him a question, and this fellow said, "Yes, positively, yes, yes."

So then he started asking other questions. I could tell that he was going around in a circle, and he asked about a dozen questions, and this guy kept giving answers back. Finally, he came back and he asked the same question that he had asked at first, and the guy says, "No." Then he just tore into him. He was just a little puddle of sweat on the floor. His coat was absolutely soaked through with sweat.

Anyway, I went to Greg, and I told him about this. He says, "I'll take this on and win it for you, on a contingency, no cost to you." He says, "We'll not only take them for the $400,000. We'll get you the $400,000, but we'll get damages." By this time, that lawyer, Homestake lawyer, was working for the navy, and we would subpoena him and get him to testify under oath, and subpoena the rest of those fellows.

Well, neither Dale nor I wanted to really get involved in a lawsuit because, being a consultant--and I was working for other mining companies, and I didn't particularly want the word to get around that I was suing a mining company--and Dale being president of this company, his own company that he was president of, he didn't really want to get involved in a lawsuit.

But I called Bill up again, and I went over to see him, and I said, "I've talked with this lawyer, and he says that he's absolutely certain that we will take you for the $400,000 plus some damages." I said, "We want to settle."

He said, "Let me talk it over." He came back, and he offered $25,000. I said, "No, for both of us that is $12,500 apiece." Well, we finally got--if we had held out longer, we could have gotten more, but we got $50,000 apiece.

Swent: What do you suppose their reasoning was in not continuing to deal with you?

Shoemaker: The contractor from Seattle or Washington turned out to be a cousin of the purchasing agent, and the purchasing agent had gone to his cousin and told him about this, and then the contractor came down here and made the negotiations. He was ready to offer the Association a contract right then, and so they took it. That was just plain crooked. And for the Homestake people to go along with something like that, when we had this agreement--it was just--to me, it's unthinkable. Anyway, that's the story of--

Swent: So that's how the Empire tailings ended up over there.

Shoemaker: That's right. And the Empire Mine Association really lost on that because they only got nine dollars a ton instead of ten, and there was no cleanup work. We had promised them that we would clean the thing up, all of the tailings, and reclaim the pit and bring in topsoil and all that.

Swent: It had been in a pond, you said.

Shoemaker: It was in a separate tailing pond, yes.

Swent: That had drained.

Shoemaker: Yes.

Swent: Well--

Shoemaker: There are crooks in all businesses.

Swent: I guess so.

Shoemaker: I think it's probably a good place to stop.

Swent: I think so.

Tosco Oil Shale Plant: A Materials Handling Nightmare

[Interview 3: December 8, 1999]##

Swent: You wanted to say a little bit more about Tosco--I don't think we had said much about it, actually, so let's begin with the Tosco oil shale.

Shoemaker: Well, it was a very interesting plant because they had to first remove the kerogen.

Swent: And where was this plant, Bob?

Shoemaker: Near Rifle, Colorado. Near Grand Junction.

And this kerogen has to be removed from the shale first, and then it has to be refined to some extent to make it equivalent to crude oil. Then it has to be re-refined into gasoline and all of the products that come from crude oil. The way that they did it is with heat, and the problem is that you cannot heat it too much, otherwise it destroys the kerogen and you can't make crude oil--you can't extract it and you can't make crude oil from what you do extract.

So it has a maximum temperature at which it can be treated, and their flow sheet was to crush this shale and then heat steel balls--like grinding balls; they were about three inches in diameter--and heat these steel balls and then mix these balls with the crushed oil shale. And then the kerogen vapor comes off and is collected, and then the residue, which is almost like an ash--it's not quite that--but it's quite fluid; that is, it's dry, and hot, but it's almost fluid. That is separated or screened out from the balls and the balls are then returned to the top of this big tower where all the equipment was and put into a furnace and reheated, and then when they are reheated, mixed with more of the oil shale.

The balls, after they were separated from the oil shale, were elevated in a bucket elevator, which is the biggest bucket elevator I've ever seen in my life. I think there was at least a half a cubic yard in each bucket and it was a kind of a material handling nightmare. These Tosco people were all petroleum types and they didn't know anything about materials handling, and that's how I got into it.

Anyway, this plant was built on the side of a very steep hill which was mostly just talus--just loose rock--

Swent: Excuse me, I need to interrupt for a minute just because I don't understand. This kerogen is part of the oil shale; is it chemically different or physically different?

Shoemaker: The shale itself is rock, you might say. And it's fairly soft rock. I've forgotten the percentage of the kerogen in it, but it's a black material and they mine it.

Swent: Is it a question of mechanically separating it?

Shoemaker: After it's mined and crushed and mixed with these balls in this rotating drum, the shale just falls apart and is very, very fine. And the residue is very difficult to handle. So they were going to--if they ever built the big plant--were going to haul this residue back into the underground mine, because the shale occurs in horizontal beds.

Swent: So that residue was valueless, then.

Shoemaker: Oh, yes, yes. There's nothing in it at all.

Swent: The kerogen had the value.

Shoemaker: That's right.

Swent: Okay.

Shoemaker: And there's an enormous amount of that oil shale there. Eventually it will be used when we run out of oil and run out of tar sands up in Canada, and there's tar sands a couple of other places in the world, too. It will have to be mined unless the government shuts it up into a wilderness area which they're trying to do with coal and every other mineral.

Swent: You were saying that the hill was mostly talus.

Shoemaker: Yes, and this tower that all of this equipment was in was 200 feet high. It was all open and a conveyor out from the crushing plant at the mine entrance to the top of this tower where the crushed ore was fed into the equipment that was in the tower. Well, Tosco--they were very difficult to get along with and they apparently were running short of money for this pilot plant. They told Bechtel that they didn't want them there any more, that they would finish up a few odds and ends, one of which was the drainage problem when it rained. There was a road just above the plant, and there was a ditch just above the road, between it and the hill, and they had a fire loop built around the plant, with fire hydrants on it. So they were going to finish up this drainage and they didn't.

Then somebody backed a truck into one of the fire hydrants and broke it and all this water went into this ditch on the upper side of the road, and got down in underneath this big concrete slab the tower was sitting on. The tower was about 40 feet wide by 60 feet long, and it sat on six legs that were 200 feet high. The tower started to lean and I was up there--I had made several trips up there--and they have what we call a manlift which is a conveyor--a vertical conveyor--that has steps on it. You use this instead of stairs, although there were emergency stairs there. This was attached to one corner leg of the tower, and the tower was leaning and the manlift wouldn't work when it was at an angle so they kept moving the manlift out--the bottom of it out--so that it would be completely vertical.

By the time I got there, it was about eight feet out from the leg at the bottom and this tower was completely open, of course. And you're riding these steps up on this rubber conveyor belt and you have to step on and step off when the belt is running.

Swent: And the whole thing is on the concrete pad that is slipping!

Shoemaker: It's leaning, yes.

So anyway, Tosco called Bechtel back in--they were desperate, and so the first thing we did was fix the drainage properly and then the civil engineers came up with an idea how to straighten it up again. And it weighed, I don't know, it was up in the thousands of tons, so they cut off some of the legs, and--on the uphill side they cut those off. On the downhill side they cut in and put extensions on the legs, and jacked this whole thing back into the vertical position. It was a remarkable engineering achievement that Bechtel did.

Swent: And nobody was hurt.

Shoemaker: Oh, no, nobody was hurt, but eventually they shut the plant down because they just couldn't make it work economically. Technically it was not nearly as good as a Union Oil pilot plant that was a few miles away. And even that wasn't enough to make it--good enough to make it economic. Someday it will; we will hopefully be able to mine that material.

Swent: Well!

Shoemaker: It was quite an experience riding that conveyor belt--

Swent: Very frightening.

The Carr Fork Copper Plant and Rescuing a Toppling Headframe

Shoemaker: That kind of brings up another one. When I was with Bechtel, we built a copper plant called Carr Fork. And it was just over the hill from Kennecott's Bingham Pit.

Swent: This was for Kennecott?

Shoemaker: We built this plant for Anaconda because they had the claims and--

Swent: Excuse me, I would like to just go back before we leave Tosco completely. Who were the people that were involved at Tosco?

Shoemaker: Oh, I don't remember any of the engineers.

Swent: It was an independent company just put together for this purpose?

Shoemaker: It was a company that was formed--I don't know where they got their money--but as I said before, Tosco means "the oil shale company."

Swent: These were all oil people then.

Shoemaker: As far as I know they were not in the business of refining like they are now. They were formed just to produce oil from oil shale if it was possible. But then afterwards they began buying refineries.

Swent: They've been in the news around here so much lately because of the refinery and a terrible accident.

Shoemaker: Yes, the one in Martinez and the one in Los Angeles. I don't know if they have any other refineries or not.

Swent: When was this that you were involved?

Shoemaker: Oh, this was in late--middle to late--seventies.

Swent: So they were at that point producers, or trying to be producers?

Shoemaker: I don't know whether they had regular oil refineries at that time or not. I don't think so.

Swent: You said they were difficult to deal with. In what way?

Shoemaker: Yes. Well, I think their whole attitude. They didn't know anything about materials handling and bucket elevators and conveyors. For instance, the separation vessel which was like a very large ball mill where they added the heated balls to the shale, it had to be sealed, so it was airtight. The seals were difficult to maintain and they would get the oil shale into the seals and then they would get leaks of air and then they would have fires.

They were much like--I have dealt with other petroleum people. For instance, I worked at the El Segundo refinery. They were making petroleum coke, which all refineries make, and they had quite a problem with materials handling, handling this coke and getting it out of the vessel in which it was made and cooling it and conveying it and putting it into a big storage building. There were a lot of things there; it had been built by--maybe it was Bechtel, I don't know, but there were a lot of things there that needed materials handling expertise.

So it was much like when I worked on the oil sands. It was difficult working with people--that was Sun Oil Company for the tar sands. They just don't understand materials handling any more than I understand petroleum. But we were talking about Carr Fork--

Swent: Yes, go on to Carr Fork.

Shoemaker: It was in this very, very steep canyon, and very narrow canyon on the--I would guess the north side of the Kennecott pit. We built the plant, and it was so narrow, the canyon was, that we couldn't put two buildings side by side across the canyon. There was a secondary crusher--the primary crusher was underground--and then the tertiary crushers and then the stockpiles, as they went down the canyon, thickeners for the tailings were the last pieces of equipment. We knew that a lot of rainwater would come down that canyon and we built two drainage canals, concrete canals. One was ten feet by ten feet in cross-section, on one side of the canyon, and the other one was eight feet by eight feet. And after we got it built--

Swent: Is that an unusually large drainage canal?

Shoemaker: Well, if you can imagine a ten-foot square canal.

Sometime after we got it built, they had a rainstorm and it overflowed both of these canals at the same time. It was an enormous rainstorm and it did some damage. It shut them down for a while. It was just an enormous amount of water coming down, and those canals were at an angle, too, because they were in the bottom of this narrow canyon that was at an angle. But they had an underground operation and they had hired another engineering firm--I can't remember which--but they were specialists in sinking shafts. The headframe was a concrete headframe rather than steel like you very often see, and it was a circular headframe.

As I recall, it was 180 feet high, and it was built on another talus slope. Our civil engineers had warned them that they should prepare a drainage system before they started sinking the shaft, and they were sinking through this talus about 180 feet down to bedrock. They got down to about 100 feet and they were encountering water all the time, and then the headframe started to lean again just like this oil shale. So they called Bechtel in, since we had built the plant and they didn't think that the shaft-sinking people had the expertise to fix the situation.

Swent: You had completely built your treatment plant before they began to sink the shaft?

Shoemaker: No, they started to sink shaft first but the shaft was a couple of thousand feet deep, so they actually started that when we first started building the plant.

Swent: So then they had to go down over 180 feet to get to the ore?

Shoemaker: A hundred and eighty feet to get to bedrock to anchor this headframe. Well, they only got down about 100 feet before the thing started to lean, and they were excavating three shifts a day in order to try and get down to bedrock and anchor it so it wouldn't lean any further. But they didn't quite make it, so they had to stop work on sinking down to bedrock and brought Bechtel in. Bechtel put in a drainage system that kept the water from going underneath the foundation. Then they what they call "mud-jacked" the base of this headframe. They pumped cement in underneath the lower side of the concrete platform, and jacked it up so it was horizontal and the headframe was vertical. I was there quite often at that time watching, and of course I was there during the plant construction quite often.

It was very interesting to watch that 180-foot-high concrete headframe being jacked back into the vertical position. When they finally started operating, they were mining with what was called a "scoop tram," which is a front-end loader that is built very low to the ground, to work underground. The thing weighed a good many tons--twenty tons or something like that--and it was quite long and so to get it underground they had to tip it up on end and lower it down through the shaft. The hook on the hoist was supposedly good for--I think it was 90 tons. They got it just up to where they were almost ready to start lowering it into the shaft and the hook on the hoist broke, and this 20-ton scoop tram went down the shaft.

Amazingly, there was all kinds of electrical cables and air pipes and water pipes anchored to the sides of the shaft--it never damaged any of those. It made some scratches in the concrete. No one was hurt except one man who was standing near the shaft on one of the tunnels or drifts leading off of the shaft and he got knocked over by the air blast. It ended up at the bottom and that thing was not more than three feet high when it had been probably 20 or 25 feet long. It set them back for a while.

Swent: Oh, my.

Shoemaker: There was apparently a flaw in the casting of the hook, and even though it had been tested--Bechtel wasn't involved in that part of it. But I was there when it happened, and there was all kinds of excitement there. That plant didn't last very long. I think it ran for maybe about a year and Anaconda just underestimated their costs--their mining costs--and so they shut it down after about a year. It was quite a loss at that time and eventually the claims were sold to Kennecott and Kennecott just moved their pit over to mine that ore body. That is one of the things that engineering firms get into and--

Swent: They call you in when things are desperate.

Shoemaker: Yes. [chuckles]

Swent: But you have to work with what you've got.

Shoemaker: Yes, you do. You certainly do.

Free Advice for Eastman Kodak

Swent: About when was that, Bob?

Shoemaker: That again was in the seventies. I can't give you an exact date. But we can go on to some of the consulting now.

Swent: Okay.

Shoemaker: This was a kind of a minor thing, but it was interesting. I got a call one day from Eastman Kodak. It was the purchasing agent, and he wanted me to bid on some consulting work. Well, I never did put in bids on consulting work. He couldn't tell me very much about what they were doing, and what they wanted, and so he finally transferred me over to one of their engineers.

This engineer told me that they had a very large sludge pond that they put all of their liquids and scrap and everything else into. They had two of these ponds and they let one of them dry out while they were putting material into the other one, and it was full of silver.

Swent: Where was this?

Shoemaker: In Rochester, New York.

Once a year they would excavate this pond that had dried out and put this material back in one of their furnaces and smelt the silver, and there was an enormous quantity of silver. But this year they had been putting this material into the furnace and it foamed, and the foam would just come out of the top of this--it was an electric furnace--and cover up the whole charging floor. They just couldn't run it, and they were getting desperate and they didn't know what to do about it. So apparently the consistency or the chemical makeup of the material had changed, causing this foaming, and--they made a slag as well as the metal. Anyway I said, "Have you tried adding borax to the mix going into the furnace?" He said "No."

Borax is a very common slag-forming reagent and you add it in smelting gold and it makes a much more fluid slag. I said, "Why don't you try adding some borax to it?" He said he would and he would call me back. So he called me back the next day and he said they added borax and the furnace was behaving perfectly well and they didn't need anybody. [laughs] I didn't even send him a bill.

Swent: How wonderful! Yes, well, borax has been used for hundreds or thousands of years.

Shoemaker: But they just didn't happen to think about it.

Swent: No.

Shoemaker: As I was saying this morning, I recently wrote a paper on plant operations and stated that people are making the same mistakes that are tried and true ever since the time of Agricola and they're still making exactly these same mistakes today. And that's what a consultant generally--much of his work--is involved in, is to go to a plant and see these mistakes and correct them. It takes someone with gray hair, I guess, who has made those same mistakes, to be able to correct them.

Swent: Who has seen them a lot of other places.

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Shoemaker: I mentioned that when I went into consulting for myself, the only other gold consultant was George Potter, who had worked for the [U.S.] Bureau of Mines for many years. I've learned a lot from George. I've known him for--he's still alive--I had known him for a great many years when he was with the Bureau of Mines. In fact, he was the one that was in charge of the research work that resulted in the carbon and pulp plant being put in at Homestake at Lead [South Dakota]. I will tell a little story about him, because he's such a famous man.

George is very soft-spoken and he never swears and never says anything off-color at all. He's taking care of his wife who is paralyzed for many years and in a wheelchair and he just treats her like a queen, takes her on all of his trips. But during World War II he was working in a plant in Los Angeles for recovering mercury from a flotation concentrate of cinnabar [mercury sulfide] that was mined in Mexico. One part of his job was to take care of what is called the hoeing table. The mercury volatilizes in the furnace; the cinnabar decomposes under heat and the mercury is volatilized, and then the mercury vapor goes into big condensing tubes that are probably 24 inches in diameter, and they are built in a U-shape.

A lot of dust goes into these tubes along with the mercury vapor, and the dust and mercury vapor condenses. It collects in the bottom of these U-joints in the condensor piping, and then it is drained out onto a hoeing table. The mercury at that point is very, very fine globules that will not coalesce into a liquid because they're all coated with this dust. This mercury and dust mixture is hoed in a circle. The table is about eight feet in diameter. You add lime to the material and there's heat applied underneath the table. The combination of the heat and the lime and the hoeing action coalesces the mercury, which is drained off a hole in the bottom of table and into the mercury flask.

Whoever built this plant didn't know anything about mercury poisoning, and normally these hoeing tables are outside in open air. But this one was in the inside of a room that didn't have any ventilation in it except for the door, and it was a small room. George told me one time that if anyone should have ever gotten mercury poisoning, he should have gotten it. It was just almost a certainty that he would get a severe case of mercury poisoning, but he didn't.

Swent: Were there any fumes in the room?

Shoemaker: Oh, yes, it was just full of mercury.

Swent: I was thinking the globules, but there were fumes as well.

Shoemaker: Yes. Even if there wasn't any heat underneath it, there's vapor coming off of liquid mercury at room temperature all the time.

But he said that on the other hand, he had never gotten--and this is what surprised me--that he had never gotten syphilis either. He says there's most certainly a connection there because--and this was the time of the tuna fish and mercury scare--he says on the other hand, there has never been a validated case of a tuna fish contracting syphilis either. [laughs] I was quite shocked that he would tell such a story on himself. I guess he's fully retired now. I see him about once a year and he's a very great metallurgist.

Swent: Did you ever run into Hugh Ingle?

Shoemaker: Oh, yes, I knew Hugh.

Swent: I did his oral history.[4]

Shoemaker: He worked for Frank McQuiston, and Ed Hewitt and I--

Swent: That's right. Yes, of course. He tells about his wife. His wife did the hoeing for him. Up at the Corona Mine, she did the hoeing table, and they actually slept within a few feet of the furnaces. Of course it wasn't very tightly enclosed. There was a lot of ventilation. It was just a shed, actually, that was right next to their furnace, and that's where they slept, and they spent twenty-four hours a day sometimes there.

Shoemaker: Mercury poisoning is very, very difficult to get. I'm surprised that George didn't get it, but this present EPA scare about mercury--they're checking all the rivers in the Sierra now for mercury that was left there, or spilled, by the old hydraulic miners. It's absolutely ridiculous. There's not

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[4]See Hugh C. Ingle, Jr., *Independent Small Mines Operator, 1948 to 1999; Corona Mine*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 2000.

enough mercury there to--what was lost has been washed down and ended up in the Pacific Ocean, or in the bay muds out here.

Swent: It could be in the bay.

Shoemaker: But there's not enough in the bay to bother anybody. There's a plan of removing silt from the bay and putting it up someplace in the San Joaquin Valley to build houses on and of course the environmentalists are all up in arms about that. The EPA, they don't know what they're doing. In Grass Valley, the county has a department of--it's an environmental control and hazardous material department. One of the people that they have there as a so-called expert, his total training was as a truck driver.

I thought I'd talk a little bit about Zortman-Landusky Mining Company. It was the Zortman-Landusky Mine, which was owned by Pegasus Gold, whose headquarters are in Spokane. It was a heap-leach operation which was originally started by a man by the name of Ed Sholtz. He had his two sons working there, and then it was just a baling wire, heap-leach operation. Their recovery plant was in two trailers. In fact they had two recovery plants, one for the mine on each side of this mountain. This was way up in the north part of Montana, about fifty to sixty miles from the Canadian border.

When Pegasus bought it, Jack Crowhurst, who I've mentioned before, was consulting for them. He was a mining engineer and I knew him very well and worked with him before. He knew that they were having all kinds of trouble with these two plants, and he got them to ask me to come up and work with him. So I did, and I worked up there for about three years and designed two new plants--both these plants were virtually designed on the back of envelopes. But anyway, they are now shut down. They had a cyanide spill up there a year or so ago, and the ore was also very low-grade. The EPA has been after them. The cyanide spill is like all other cyanide spills; it never hurts anybody. Cyanide is--well, I can talk about cyanide later.

Swent: It scares people.

Shoemaker: Yes, it scares people.

But the manager there was a new manager they hired and I arrived there the day that he did. His name was Ed Roper. He was a mining engineer. He was there for about three years and then left to work in Colorado for Galactic Resources, which was owned by Robert Friedland, who was acknowledged as being the best money-raiser in Canada. He was putting in this plant about fifty miles west of Alamosa in Colorado at an altitude of about 12,000 feet, and it was called Summitville.

Ignoring Good Advice Led to "Disaster" at Summitville

Shoemaker: Summitville had been mined in the very early days for gold and there were still a few of the miners' houses there that had a second entrance because the snow got so deep. It looked like a very large chimney coming out of the roof of these houses. It was probably at least ten feet about the peak of the house, and they had to get out of the houses that way--get out of them and get into them because the snow was so deep.

And then there was a very large gold mill, the remains of it. It hadn't quite all fallen down. That was mined, I think back in the late 1800s. Then Cleveland-Cliffs iron company got interested in copper, and so they put in a drift, or an adit, into the side of this side hill and were doing some test-mining of this copper ore that was there. They had a small pilot mill that they had put up. But Friedland and Galactic were after gold, and they had hired Ed Roper to be manager, and Ed asked me to help him. Actually, the deposit had been drilled out by Anaconda, and so Ed and Roger Leonard, a metallurgist that I--

Swent: By drilled out, you mean just outlined, not completely taken out?

Shoemaker: Yes, that's right. The exploration drilling.

Roger Leonard I had known before, over in Nevada, and the three of us went down to Tucson and talked to the research people about this deposit and got all of their--

Swent: What research people were in Tucson?

Shoemaker: Anaconda built their research lab down there. Nat Arbiter was the director of research.

Swent: Did Anaconda still own the property?

Shoemaker: They still owned the property.

Swent: I see.

Shoemaker: Galactic Resources, which was Friedland's company, bought the deposit from Anaconda. Then they put in two or three test heaps. They were going to heap-leach this ore. Roger was a metallurgist and he was the one that put in the test heaps. I don't like test heaps. I like to use large leach columns, maybe five feet in diameter. Five or six feet and twenty or thirty feet high.

Swent: What's the difference?

Shoemaker: You have much better control and you can also test more different types, more ores from different parts of the ore body. Whereas when you start to take a sample of say, 5,000 tons, which is about the minimum you can really use for a test heap, it all comes from one place and it is very difficult to measure the amount of solution--leach solution, that has the cyanide in it. It is very difficult to measure that going on and coming off of the heaps and to sample them. You can do a much better job if you use a smaller sample but still large enough, maybe it's ten tons in a leach column.

Swent: Is this enclosed in something?

Shoemaker: Sometimes you use a column that's made out of steel or a large piece of pipe that's say, five, six feet in diameter. Sometimes we use concrete pipe in six-foot sections that are stacked on each other. Like large diameter sewer pipe.

Then they decided to build a plant and I had not done any work between the time that I was down in Tucson, looking at data down there with them, until the plant got under construction and Bechtel gave them a lump-sum bid for constructing the plant, which they accepted.

Swent: But you had left Bechtel.

Shoemaker: Oh, yes. And also in the contract, they had received as part of their payment some warrants to buy stock in Galactic, and then if the plant was as successful as they hoped, they would be able to buy more warrants to buy more stock.

Swent: Was this usual for them to do that?

Shoemaker: No, it was the first time they had ever done anything like this.

Swent: And the last, I'm sure.

Shoemaker: Ed Roper asked me to come up there and help them out with Bechtel. They were having some problems. As it happened, Bechtel's project manager was a man by the name of Carlton Smith, who had been their construction manager in San Francisco and who I had never gotten along with because he was one of these people who says, "Damn the torpedoes! Full speed ahead," and he didn't care how the plant got built as long as it got built. We used to have bitter arguments because the construction people couldn't make a concrete floor slope in the right direction. Big puddles would develop, and I finally got Bechtel to change their specifications so that all concrete floors would have to slope a certain amount.

Anyway, he was the construction superintendent up there and they were in a terrible hurry to get this plant built. It was a crushing plant and also the plant to recover the gold from the leach solution. They were, I think, designing some of it off the back of envelopes. One of the things that they had done when they had put in the primary crusher which was a large crusher--it was 54-74, what we call Allis-Chalmers crusher. It was driven by a motor and Vee belts, rather than the motor having its shaft direct-connected to the crusher shaft. I took a look at that and they had put a large concrete beam right where those drive belts had to go.

So I went up to see Smith and he and I just didn't get along, and he said that there was nothing wrong with that beam being there and that I didn't know what I was talking about. It ended up that they had to take the concrete beam out and that delayed them quite a bit. There were other things, and finally I wrote to Steve Bechtel, Jr., about it, and Carlton Smith was fired, which made me happy because he'd been a thorn in my side for many years.

Swent: Were you just called in kind of on an *ad hoc* basis on this project?

Shoemaker: I was consulting on a regular basis.

Swent: You were there on a regular basis.

Shoemaker: They built the heaps, or the leach-heap in a valley. It was a fairly steep-sided valley and they blocked off the lower end of this valley with overburden that they had removed from the ore body. Then of course it was--the sides of the valley and the face of this dam--which was something like 200 feet high, they lined that all with plastic. Winter was coming on and there was a lot of just plain black mud that had to be excavated from one side of this valley; otherwise, the weight of the ore would sink the plastic liner into the mud and it would tear.

The contractor had to bring in special dozers that had specially-wide tracks so they wouldn't sink into the mud and they never did get all the mud out of there. They left some of the mud there and put earth and rock over it and then put the plastic over it. Then they started bringing the ore, the crushed ore, in to put on this leach pad.

Swent: Whose responsibility was it to design this, all this mud removal?

Shoemaker: The leach heap and the dam building had all been done by some other engineering firm. I've forgotten who it was.

Swent: You weren't involved in that?

Shoemaker: I wasn't involved in the building and designing of it, no.

Swent: What was your role?

Shoemaker: To oversee the design of the plant. The recovery plant.

Swent: But this dam wasn't part of the recovery process?

Shoemaker: Well, yes, but Bechtel didn't have anything to do with that. They gave that to some other contractor, some other engineering firm.

Anyway, they got quite a bit of ore in there--I don't know how many thousands of tons. But then it snowed. An avalanche came down one side of this valley and tore up all this plastic on that side of the valley, and just rolled it up into a mess, and rolled a lot of the ore that had been placed on the heap--rolled the plastic up into the ore. It was a terrible mess and they tried to remove as much of that as they could. They wanted to remove all of the damaged plastic, and they apparently didn't get it all moved and so they replaced as much of the plastic as they could. I know that there were holes and damaged plastic that they never did fix. There had been springs in this valley, underneath this area where they were going to put the heap. So they had put a lot of French drains in the ground underneath the plastic and that drained water out of the springs and it went through a pipe underneath the dam.

Swent: What is a French drain?

Shoemaker: It's a plastic pipe with holes in it that the water-- they bury it with rock around it and the water goes through these holes and it drains out. There's a French drain around almost every house at the foundation.

Swent: I think I have one.

Shoemaker: It used to be they used clay pipes and let the water go in at the joints of the clay pipes but they don't use those any more; it's all plastic now.

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Shoemaker: They finally got the plant started, and started leaching, and they began to realize that the water coming out from underneath the dam from these springs contained cyanide solution, and some gold, too. This had been leaking through the holes in the plastic, and so they collected it and started pumping it over back above the dam, and this flow amounted to about five million gallons a month. I kept telling them that they had to do something about this because this valley was slowly filling up with leach solution at the rate of 5 million gallons a month. The ore that was underwater, that was covered with leach solution, was not being pumped out of the heap. They had mounted the pump inside a five- or six-foot diameter pipe that went vertically down into the heap and was supposedly down at the bottom of the heap. They had rails mounted in these pipes --there were two of them--so that they could pull the pumps out. The weight of the ore on these pipes deformed the pipes and deformed the rails and the pumps didn't work any more. They couldn't pull them out for maintenance, and so they had to drop pumps in on cables, and they couldn't get them clear down to the bottom of the valley where this solution was building up.

Swent: How deep was this area that we're talking about?

Shoemaker: The heap at that point was about 200 feet high. That is, the dam was 200 feet high, and then as it went up the valley the heap got less thick, although they added ore above the height of the dam, back as you went up the valley. This old underground mine that Cleveland-Cliffs had put in was draining out acid water from the sulfides that were in the ore body. That part of the ore body contained sulfides, and that acid drainage went into a creek. That creek converged with another creek that came from the valley that the heap was in and they converged a couple of miles below the plant, and continued on to the Alamosa River twenty miles away. There was no fish or no life at all in this latter creek, and the first mile of the creek bed was just red with iron oxide.

I kept trying to get them to combine some of the barren solution from the plant with the acid mine drainage because the acid would have been neutralized by the lime in the excess barren solution from the plant. This would have resulted in neutralizing the acid and the cyanide and not cause any problems downstream. And it would have taken care of this five million gallons of increase in the heap every month.

Swent: You would have had to pump the water up from that creek to the--

Shoemaker: Well, we would have only had to pump it just over a slight hill. But the way the laws were set up, even though that adit was on Galactic's property, the State of Colorado couldn't force them to do anything about that acid mine drainage. In fact Galactic didn't want to even touch it because if they said that they touched it, did anything with it, then they would be responsible for it.

Swent: They would be liable.

Shoemaker: They would be liable.

Well, I can't quite believe that because they could so easily have neutralized it with this barren solution and it wouldn't have--

Swent: Do you know if anyone from Cleveland-Cliffs ever got interested in this?

Shoemaker: Cliffs was out of it. That had been years before.

Swent: I would think they would have been concerned about it.

Shoemaker: I don't know how that turned out, but anyway, they didn't use this barren solution and this heap kept getting more water in it every month, until eventually there was over 100 million gallons of water and after a couple of years they had a very small spill, which got the EPA involved, and then the EPA insisted on them putting in a plant to mix hydrogen peroxide with the cyanide in the barren solution because they couldn't put any more water behind this dam. It was terrible. It was just a complete mess.

Swent: Had they planned originally to cope with it? I mean, after the solution went through the rock, how would they get the rocks out of there?

Shoemaker: The waste rock was just left up on the hill above the leach heap.

Swent: They had not planned to remove it.

Shoemaker: No, they hadn't planned to remove the waste at all.

Swent: So it seems pretty obvious it would fill up with water and--

Shoemaker: Well, it would fill up with leach solution. They were hoping that they could evaporate the excess water if they had any, but they wouldn't really have had any if they hadn't been adding this fresh water from these springs underneath the heap.

Swent: And the drains weren't working?

Shoemaker: The drains were working, but it would drain water into the creek, so they couldn't drain this water with cyanide in it into the creek, so they had to pump it back over. And besides it had gold in it.

Swent: So they miscalculated the amount of water there would be.

Shoemaker: Yes. Anyway, they put in this hydrogen peroxide plant to neutralize barren solution in the hopes that it would give them water that was sufficiently clean and it could be put into the creek. The EPA didn't know anything about what they were doing and they shouldn't have used hydrogen peroxide; they should have used ferrous sulfate. They didn't, and then the EPA imposed such strict conditions on Galactic and Summitville Consolidated Mining Company, what they called it up there--that there was a little bit of silver in the solution, less than half of drinking water standard, not enough to hurt anything, not enough to hurt any fish or anything else, but of course there wasn't any fish in this creek clear down for another twenty miles until it met the Alamosa River, which then diluted the acid mine water and would have diluted the cyanide, too. There wouldn't have been any cyanide left in the water down there anyway after a mile or so because it would be aerated and decomposed.

But the EPA finally forced them to shut down and of course they weren't making any money anyway. They hadn't made any money because of all of these problems, and so they declared bankruptcy. Then the EPA took it over and so far they've spent something like $100 million and they haven't solved the problem. A group of mining companies, including Newmont and I don't know who else, offered to help the EPA and actually kind of take charge of reclaiming this disaster up there, but the EPA said no, and they have been working with that hydrogen peroxide plant ever since. And it isn't the right thing to do.

Swent: It has become such a symbol now. Everybody who's anti-mining brings up Summitville.

Shoemaker: Actually, there was never a drop of cyanide put into the creek but the media keeps repeating that there was a large amount put in the creek. The report of the Colorado Geological Survey even agrees there wasn't. Actually, for many years that creek had no fish in it because of the acid mine drainage from the old adit, but when it got to the Alamosa River it was diluted so much it never hurt anything. But the EPA has over-reacted like they always do. I understand that the EPA has never completed the reclamation of any of these--what do they call them? Hazardous--

Swent: Superfund sites?

Shoemaker: Superfund. They've never completed any of these Superfund projects. They're still working on them. Even right from the very start, they've never completed one. It's just an enormous waste of money.

Anyway, I was at the dedication ceremony. I was there and they had speeches and everything and then they took us for a ride on the railroad that goes from Silverton to--

Swent: Durango?

Shoemaker: Durango. And Friedland was there and made a speech, and after the speech he came over to me and asked me to serve on the board of directors of Galactic, and I very politely turned him down, and I'm certainly glad that I did.

That was a very frustrating couple of years that I spent there because they just didn't know what they were doing and they had so many problems that were unsolvable.

Swent: Well, that's one place that everyone calls a disaster, and I guess everyone agrees it was a disaster, wasn't it?

Shoemaker: Yes, for Summitville, but it wasn't an environmental disaster. As you say, it has become a symbol of disaster in the mining industry, and certainly it is Galactic's fault. It was too low-grade. It was one of these places where you couldn't make a single mistake, and they made mistakes in everything. The crushing plant that they had designed, I didn't agree with it, and yet between Roger Leonard and Bechtel they built it and it was an enormous problem. They didn't cover up the conveyors so that they got buried in snow. In the wintertime there's enormous snowfall up there, and there were just all kinds of problems.

Swent: When you're called in as a consultant in a case like that and they ignore your advice, what--

Shoemaker: The only thing you can do is quit and that's what I did after a couple of years. I saw that they were going to go belly-up and I just quit. I told them I just couldn't take this anymore.

Swent: But you stayed with it through to the dedication.

Shoemaker: Well, the dedication was right at the start. That is, as soon as the plant got operating, but it was too much a mess and I didn't want to be associated with it anymore.

Swent: No. They did get into operation?

Shoemaker: Yes, they ran it for, I guess eighteen months or perhaps two years. I quit probably six months before they shut down. They didn't have any money to do things right and they had a lot of stubborn people. Ed Roper had quit and he completely disappeared. I've never heard from him again. I don't know where he went. He was given a lot of stock in the company and Friedland had run the price of the stock up with all of his great speeches about how wonderful this plant was going to be, and of course all that money was lost. But Ed sold out his stock and made himself some millions and I guess maybe he just retired from then on; I don't know.

Swent: Leonard? What happened to him? Did Leonard stay?

Shoemaker: No, he quit, and he went to Africa. In Ghana.

Swent: Well, it was a bad story.

Chilean Mills and a "Secret Ingredient" at Andacolla

Shoemaker: Did I talk to you about when I was with David Lowell at Andacolla, and they had these Chilean mills and the superintendent of the Chilean mill had this secret ingredient?

Swent: I think we talked about it off the tape when we were talking. Let's do it and if it's a duplication we'll cut one out, but I think that was something we just talked about; I don't believe we taped it. Incidentally, since then, I have interviewed David Lowell. At that time I hadn't met him, but I have done his oral history this last year, so let's talk about your associations with David Lowell.[5]

Shoemaker: I had known David Lowell for quite a while and he had asked me to get involved in the metallurgy of a heap-leach project down near Antofagasta for his company, which was called Minera del Inca. I supervised the test work down there for a heap-leach plant, but then it was sold to a drilling contractor who had a lot of extra money and who eventually then sold out to a subsidiary of Battle Mountain Gold.

Anyway, when I went down there to do that, to take a look at the sampling and recommend how it should be sampled for the metallurgical test work, we went up to the town of Andacolla. David wanted to look at this area that had an old copper mine up there, and there was a falling-down concentrator and a falling-down smelter that hadn't been run for many years, but there were dozens of very small gold mines there run by anywhere from two to a half a dozen people in each. I don't know how many mines, but there were a lot of them with the mills in Andacolla, and in the little town of Andacolla, which was only a few hundred people, and this was quite a ways up in the Andes, not really high but it was probably eight or nine thousand feet.

There were about two dozen Chilean mills--they call them "trapiches", and each one of them had what is called one or more Chilean mills. These are large, you might say, wheels--there's two wheels on an axle, and these wheels are about four feet in diameter, and many of them are just chiseled out of one piece of rock with a hole drilled in the center of them. They have a rim that's about eight to ten inches wide, and the

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[5]See J. David Lowell, *Using Applied Geology to Discover Large Copper and Gold Mines in Arizona, Chile, and Peru*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 1999.

center of the wheel is probably fourteen, sixteen inches wide where the axle goes through. They are turned in a circular trough made out of concrete with a steel bottom, and they're turned--

Swent: Do they rotate horizontally?

Shoemaker: The wheels are about say, four feet apart on a horizontal shaft, and then there's a vertical shaft connected to the horizontal shaft that turns these wheels around in a circle.

Swent: But are the wheels going horizontally or like a--

Shoemaker: Like a wagon wheel and they are just going around in a circle. They shovel ore into the path of these wheels and the wheels are also pivoted--the axle has got a universal joint on it so that when it runs over a big rock, the wheel will lift up, one of the two wheels or both of them. They actually can put rock in as big as five and six inches, and the sides of this concrete bowl that these wheels run in are kind of sloping, and they have copper plates hanging around on this sloping side. Then as the wheels turn, they add water, and as the ore is crushed and ground into this slurry, the slurry is splashed up onto these copper plates, which are coated with mercury, and the gold that is in the ore is collected on the mercury amalgam plate.

I'd never seen one of these; I'd seen pictures of them--

Swent: I've heard the term but I've never known how they operated. They have motors, then, little motors that turn them?

Shoemaker: Fifteen-horse electric motors. The power lines were there originally for the copper plant, which--they still had electric lights and enough power to run these little mills, and there were, as I say, perhaps a dozen of these with one to three of the Chilean mills in them, in the plant.

When we arrived there, at this one little plant, there were three of these Chilean mills, and they were taking these copper plates out of the mills and replacing them right away while they cleaned the gold amalgam off of the plate. They laid these copper plates--they were about an eighth of an inch thick and say, twelve or fourteen inches wide and about four feet long--they laid them on a couple of boards that were sitting on top of a water tank, which was made out of a couple of 55-gallon drums cut in half.

First they would scrape the amalgam, as much of it as they could, off of the plate with a section of rubber belting that they had cut with a sharp edge on it, and amalgam would go down into the water and then they would recover that and put it through a small retort, and recover the gold and recover the mercury. After they had scraped the amalgam off of the plates, they would then put sand on the plates and rub the sand in to make remaining mercury amalgam on there very smooth. They would just scour them and it would also remove other things that would get in the amalgam, like copper and so on, and refresh the plate. And then they would take a bottle that had a cork in it with a small hole and the bottle contained mercury and they would sprinkle the mercury around on the plate and rub that in with their hands. Of course that wouldn't be allowed here in the United States but they didn't know that they could get mercury poisoning because they never did.

Oh! Just before they did that, before they put the mercury on, they had a bottle--a plastic liter bottle--and it was full of this yellow fluid, and they sprinkled that on the plate and scrubbed that in with their hands also. This was between the sand and the mercury.

All mill superintendents who have ever used mercury amalgamation plates--it seems like all--had their secret ingredient to make these amalgam plates pick up the gold more efficiently. They used everything--salt, and vinegar, and borax, and I don't think any of it ever worked. But they had the reputation of never telling anybody what their secret ingredient was, and I asked David, who spoke Spanish, to ask this foreman there what this yellow fluid was.

He said to David, and David translated that he couldn't tell me because that was his secret ingredient for making the amalgam plates perform better. I asked David to tell him that I was from the United States and I was a metallurgist and I was very much interested, and I would promise not to tell anyone what it was if he would tell me. So he did. He told David, and David told me, it was a bottle of his own urine. I had never heard of that before and I said, "David, ask him if wouldn't it be better if he used urine from eighteen-year-old virgins?" The foreman laughed and he said back to David that it would be very much better, but there were no eighteen-year-old virgins in Andacolla. [laughs]

Swent: Did you work with David any other time?

Shoemaker: I worked with him--

Swent: Didn't you take a trip to China with him?

Shoemaker: I went to China with him. We did that for DuPont.

Swent: I don't know that you've talked about that, have you? I don't believe you have.

Shoemaker: I don't think so. That's still--

Swent: That's coming. Okay. All right.

Amok Uranium Company; Mistakes Through Lack of Oversight

Swent: You were going to talk about mistakes that have been made.

Shoemaker: I mentioned all the mistakes at Summitville, but I was hired by an outfit called "Amok Uranium." It was a French company; I don't know what "Amok" stood for, but they had a uranium mine up in northern Saskatchewan. They had put in a mill, and they had one of the Canadian engineering firms put in this mill, and it was a case of--it happens fairly often that the owner does not furnish enough people to oversee the engineering firm and the engineers are not very often operators, and so the engineering firm didn't have any guidance and they made a number of mistakes. They had a lot of trouble, Amok did, when the plant was finished and they tried to run it. So they hired me to come up and take a look at what the engineering firm had done, and to see if they should sue.

Well, in my opinion it was partly their own fault because they hadn't overseen the engineering firm. But then again, the engineering firm made some horrible mistakes. One of them was that they put a lot of their piping, not only water piping, but slurry piping and air piping, right in front of the main air intake to the plant building. This was in northern Saskatchewan, up in the tundra area, with enormously cold winters, and the fresh air they brought in was--they had furnaces in there, air-heating devices, to heat the air, but all of these pipes promptly froze up and shut them down and caused quite a bit of damage in the plant because everything got frozen. Not only those pipes, but they had to shut down the heating plant and they finally got started back up again.

Another one was they had a fire loop, piping, around the entire plant out from the plant building, with fire hydrants, and this was buried in the permafrost. That way it was insulated, even though it was buried, but it would have frozen if they hadn't--they would pump water through this loop constantly, and as long as the water was moving, it wouldn't freeze, even below freezing temperature. There is some heat put into it because the pump itself is inefficient and that amounts to heat.

Anyway, the fire loop didn't make a complete circle; it was two half-circles. Those pipes at the far end--they were supposed to be joined and they weren't, so their whole fire system froze up, which is a horrible mistake. I finally told them that I thought it would cost them probably more than they would be able to get out if they sued, so they ought to try to settle out of court, which they did. They did collect quite a bit of money from the engineering firm because the engineering firm didn't want the bad publicity, and they were justified in collecting some money. But it was too bad that people don't oversee their engineers like they should, and it's too bad that these mistakes are just made over and over again since the time of Agricola.

Swent: You would think the engineers would have known it gets very cold in northern Saskatchewan. It doesn't take a--

Shoemaker: Terrible.

Swent: As they say, it doesn't take a rocket scientist to know that.

Northumberland Mine; False Economies and Poor Management

Shoemaker: There was another one that made a lot of mistakes, which was the Northumberland Mine over north of the Round Mountain heap-leach operation, which is partly owned by Homestake and partly by Echo Bay.

Swent: This would be in Nevada?

Shoemaker: Yes. Northumberland was owned by Amoco Oil Company at that time and they had a vice president from the oil company that--they established a minerals division--this is during the time when all the oil companies were trying to get into the mining business, and this vice president, they put him in charge of this construction of this heap-leach operation. The mine was at an altitude of nine or ten thousand feet, and they had to put the crushing plant up at the mine and then haul the ore down the hill to the Smokey Valley, which is only at five or at the most six thousand feet. They had a twelve-mile haul, and it was low-grade ore to start with.

This vice president, he was going to make a name for himself because he was ready to retire, and--

Swent: Do you want to say his name?

Shoemaker: He wanted the glory of their first gold mine.

Swent: Do you want to name him?

Shoemaker: I would really rather not.

He had drawings from seven different engineering firms. He got a little piece of the plant done here, and another piece done there, and another piece done someplace else. When they finally hired a construction contractor and tried to put all these pieces together, it was just a complete mess.

But they finally got it built, and finally got it repaired enough so that the plant would run and it would extract gold, but the trouble was, they couldn't leach any of the gold out of this ore. The ore had a lot of clays and fines in it, and the heaps were being built right near the plant, and the haul trucks that they used to bring the ore down off this hill were bottom-dump--the tractor, the truck, would pull two bottom-dump trailers, and they were normal-type of trailers and tires that would run on a highway. They put a lot of money into this road coming down the hill. They bought cheap trucks and these trucks, although they were diesel, they didn't have proper retarders on them, so they could use the engine for braking. They lost I think three of their trucks coming down that hill, before I got there, and killed one of the drivers. The retarders wouldn't work well enough and they had to use the brakes and the brakes wore out and they ran off the road.

Swent: Oh, dear.

Shoemaker: But they were driving these trucks up on top of the heap and dumping this crushed ore in windrows and these high-pressure tires that are built for highway travel were just compacting this ore. It was so hard it was almost like asphalt, an asphalt road. They had a dozer up there on top of the heap, and were flattening out these windrows, and then these trucks were driving all over this heap and it was just virtually solid rock. Not quite that, but almost.

I got a call from the Amoco people in Denver, and they asked me to go out and take a look at this. That's one of the major things that I looked at and I told them that they just couldn't do this. They had to dump the crushed ore in one spot and push the ore with a dozer to distribute it around on the heap. They could not run those trucks on top of those heaps. That was the major thing but I made some suggestions about the crushing plant and also the plant itself. But that was the major thing, and so they got my report and they called me up. They said that they were going to have this manager--told him that he couldn't run the trucks on the heaps any more, and a month went by and they called me up again and they asked me to meet them. Their headquarters are in Denver and they asked me to meet them in Salt Lake City. They were bringing their company airplane out, and then I would fly with them over to Nevada to where the Northumberland plant was. They had an airstrip there.

As we got over the plant, I asked them to ask the pilot if he would make a circle of the operation. And here they were still running the trucks over this heap, and consequently when we landed, the first thing that the vice president did was fire the manager.

That's where I first met Roger Leonard. In fact I recommended him to them as mill superintendent there. I'd known him--I had first met him over at Pinson--the Pinson Mine. But I recommended they hire him because their mill superintendent didn't know anything about a gold plant.

It's just typical of some of these oil companies, what they did, like Arco bought Anaconda and found they didn't know what they were doing. Every one of these have been disasters. I think the only oil company that's still really in the mining business is Exxon, and they have a major piece of one of the large copper mines down in Chile. Even Exxon has had a couple of plants that have been disasters and they'll never get their money back.

Swent: It's interesting that with all this talk about corporate culture, I guess the mining culture and the oil culture just don't go together, do they?

Shoemaker: No, they certainly don't. They certainly don't. You know, mining isn't really a very profitable business. I was reading a report put out by the National Science Foundation the other day, a book, in fact, on mining in the United States and how the laws are enforced badly by the Forest Service and the Bureau of Land Management and the EPA and so on. It mentioned in there that mining companies make on the average one of the lowest returns on investments of any industry in the United States. Very, very few mines really end up as--for instance, like Homestake is lasting over a hundred years, but on the other hand, Homestake in the last few years has done virtually nothing except lose money, or trade dollars. I guess they're in a little better shape now, but they've had some very disastrous years which takes many years to make up. Many, many good years to make up for one bad year.

Wigglers and Wobblers in Brazil

Shoemaker: I worked in South America, I think I've mentioned, for CVRD, and I helped them put in the first heap-leach plant in Brazil.

Swent: What was this?

Shoemaker: CVRD. It's Compania Vale do Rio Doce. We had it mentioned in the previous--

But this one was a gold deposit. It was called Fazenda Brasiliera. It was in Bahia Province, up north of, probably 300 miles north of Rio and west of Salvador, which is on the coast. But they had been doing their research work at the Belo Horizonte laboratory, and they couldn't get any activated carbon. At that time, it was very difficult to import things into Brazil. I had been working on something else and when they found out this ore body might turn out to be a heap-leach, I, the next time I went down, I took a couple of two-liter bottles of activated carbon, or activated charcoal, down with me. I put them in my bag and the customs unfortunately opened my bag at that time and I knew I was in for trouble there and he asked me what it was and I said it was activated charcoal and he says, "What are you going to use it for?" and I thought quick and I says, "I can't drink the water here and I filter this water through activated charcoal to keep me from getting sick." And he said, "Okay, fine. Go ahead." [laughter]

Later on, I consulted on that plant and helped them with their test work. Then when they started to build the plant, they were using what we call "wigglers" to distribute the solution on top of the heap. And wigglers--in the early days of heap-leaching, they used pieces of surgical tubing that were about eighteen inches long, connected to the distribution pipes, and these things whip around, they wiggle, and they weren't very good, they didn't give even coverage of the leach solution.

So I smuggled in a half a suitcase load of what we called "wobblers" at the time, which was a plastic sprinkler. They used those on the heap that they put in, along with wigglers, and they worked so much better that they finally got a special license to import some. And then a company started making them down there.

Swent: So you stimulated the business down there.

Shoemaker: Yes, having to smuggle things in like that is interesting.

Swent: What would you have said if they had caught you with the wobblers?

Shoemaker: They would have confiscated those because they would have known I was going to do something with them. Sell them or something. But they didn't happen to open my suitcase at that time.

Investigating a Secret Process for J. P. Morgan

Shoemaker: I can talk a little bit about J. P. Morgan.

Swent: Well, that's a good old name.

Shoemaker: I got a call one day from one of the J. P. Morgan people and they had loaned quite a large amount of money to an outfit called Geobiotics over here in Hayward. This was a small startup company doing research and they were producing enzymes, but they were doing research on other things and for some reason or other, they thought they could develop a process for treating carbonaceous gold ores. [chuckles] So they wanted some more money and Morgan wanted me to go down there and take a look to see if this might be something--they didn't want to loan them any more money without assurance they would get it back.

So I drove down there and stayed overnight in Hayward and went to the plant the next morning, and I spent most of the day there and they wouldn't tell me anything. They just wouldn't tell me anything!

Swent: No secret ingredient?

Shoemaker: It was all so secret that they wouldn't tell me anything. So I went back home and I called up the person at J. P. Morgan and said, "That was a complete bust; they wouldn't tell me anything," and he said, "Well, you go back tomorrow," and he said, "They will tell you everything." He was pretty mad.

So I went back down the next day, the day after I got home, and even then it was like pulling teeth, trying to get information. The carbonaceous gold ore business has been solved by roasting, and some it has been solved by ultrafine grinding, and some it has been solved now by bacterial leaching. But they had a process of flotation of the carbonaceous material from the ore, and then they would burn the carbon and recover the gold from it and then they would cyanide the residue from the flotation. I finally got that out of them.

That sounded familiar to me, and I realized that I'd been talking with Frank McQuiston at one time, when I was with him over at Carlin. They had developed the very same process over at Carlin, but it hadn't worked. These people had gotten hold of a sample of ore from someplace and it contained some carbonaceous material. They had spent several months and then they wanted a lot more money from J. P. Morgan to develop this, and I told J. P. Morgan--I didn't tell these people at Geobiotics--but I told Morgan that Geobiotics had developed a process which was already invented, but it hadn't worked. So apparently they didn't loan them any money.

Swent: But that's what the consultant is good for.

Shoemaker: Yes, that's right. [shuffling papers]

I wanted to talk about--

<u>CVRD's Caue Mine, Brazil; Tailings Pond as Gold Sluice</u>

Swent: I'm nervous when I see you skipping through a lot of things. Are you--

Shoemaker: Well, some of these are just notes.

Swent: I don't want to miss anything good. Is that a flow sheet here?

Shoemaker: When I was working for CVRD they asked me to go up to their Caue Mine, which was north of Belo Horizonte by about seventy or eighty miles. It was a very large iron ore plant; they mined 60,000 tons a day of iron ore, and the iron was in the form of specular hematite. It was hematite, which is iron oxide--two irons and three oxygens--but it was in a different crystal form than normal hematite and it was called "specular hematite." This specular hematite is black and it forms into small crystals and doesn't make a homogeneous mass. It breaks up easily into these little crystals which are maybe an eighth of an inch long. There was clay mixed in with this, but the ore, when they shoveled it from the pit into the truck, it virtually all broke apart. They didn't have to crush it; they just fed it into a large drum with water and the drum had blades in it, and it just all pulped up into an easily-handled slurry, and they separated--after cycloning it to remove the clay, the cyclone underflow went to magnetic separators--high intensity magnetic separators because a normal magnetic separator will not pick up any hematite. Hematite is not really very magnetic. Specular hematite is magnetic only under very high intensity magnetic separation.

They had a tailing pond. The plant was up on kind of an escarpment, and they dumped their tailings over this escarpment, and they went down kind of a little narrow canyon that gradually spread out, and 60,000 tons a day is--well, there was probably only maybe about 20,000 tons a day of tailings going out there with the water too. It's almost like a waterfall down this escarpment into this canyon, and then as the canyon widened out, there were deposits of tailings in this canyon that had kind of filled it partially full--not very thick because it was slanting quite a bit. Then they had this enormous tailing pond out at the end of this little canyon.

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Shoemaker: Someone had heard that there had been gold mined at that place way back in the 1920s. They didn't know where the gold had been mined. The records had all been lost and they couldn't find any evidence of mining there, so one of the geologists decided to go down into this canyon where there was some of the tailings, and he put a drill down there to take some samples. Well, it turned out that this narrow canyon was a wonderful gold-concentrating sluice, and there was a lot of gold there. The largest pieces, of course, settled out right at the base of this escarpment, and then the finer ones went farther down and very little of it ever got down to the tailings pond, or probably none of it. This canyon was probably a third of a mile long.

Serra Pelada and Ingenious Garampieros

Shoemaker: As soon as he had put that drill down there, it attracted garampieros, like I told you about at Serra Pelada. And they swarmed in there and started concentrating the gold in little rockers and excavating these tailings, and they got so many of them in there that CVRD couldn't get rid of them. They couldn't kick them out. They finally found that there was an English mining company--they knew it was an English company that had been mining the gold--had found a one-foot-wide seam in this specular hematite deposit that contained about an ounce of gold to the ton. It was impossible to determine by just looking at it that there was gold there, and so much of that had gone down into that canyon and was lost--and this plant was probably ten years old at the time. At 60,000 tons a day, they had mined an awful lot and they had lost a lot of gold that the garampieros picked up.

So they very quickly put in a couple of big wooden sluices, up in the top of the plant. And these sluices were four feet wide; there were two of them, they were four feet wide, about three feet high, and and a hundred feet long, and they had riffles in the bottom. They put all the plant tailings through those sluices, or riffles, and they collected I would estimate probably half of the gold in the ore. The velocity of the water and the tailings was so very rapid that I'm sure they only got the coarsest gold. The garampieros cleaned up. They were still working when I was there. They were working down at the lower end of the canyon, picking up the very fine gold.

They had another tailings line that was actually a launder, that went kind of around the tailings pond so they could fill up another area, and these garampieros would break into the top of this concrete tailings pipe--it was a square pipe that they had built out of concrete, and they would break into the top of that and put riffles in the bottom of the pipe. They had to have armed guards all over the place. They found them in the plant itself in the night time, and they would open up the bottom of the sumps that fed pumps, and gold would collect in the bottom of those sumps. They would find these garampieros in there at night.

I drew a little flow sheet for you and it shows the sluices. They first pulped the material with water and then cycloned and got rid of the slimes, the clay, and then the underflow of the cyclones went to magnetic separators. The nonmagnetics, which had some quartz sand in it and also had the gold, went to these sluices, and then the tailings from the sluices went down to the tailings pond.

Well, they did get some of the gold, but it was so easy to see that those nonmagnetics, which were a very small quantity, should not be mixed in with the tailings, and sent to the sluices to be recovered. This amount was so small they could just go to simple gravity separation. So I designed up a little plant for them with a couple of shaking tables, and a furnace, and they were able to then remove all of the gold, a very considerable quantity, and they were producing gold at about twenty dollars an ounce, and they're still doing it to this day. The heavy black line on the flow sheet shows the gravity separation portion I added.

Swent: That was a lot simpler than what they were doing.

Shoemaker: It was very simple and it collected twice the gold they had been collecting through these sluices, and they were extremely pleased.

Swent: Of course they were. And you, too. That must make you feel awfully good.

Shoemaker: One of these things you kind of fall into occasionally.

Let's see, I talked about Serra Pelada already, didn't I? Serra Pelada was another mine that was discovered in late 1979 by CVRD.

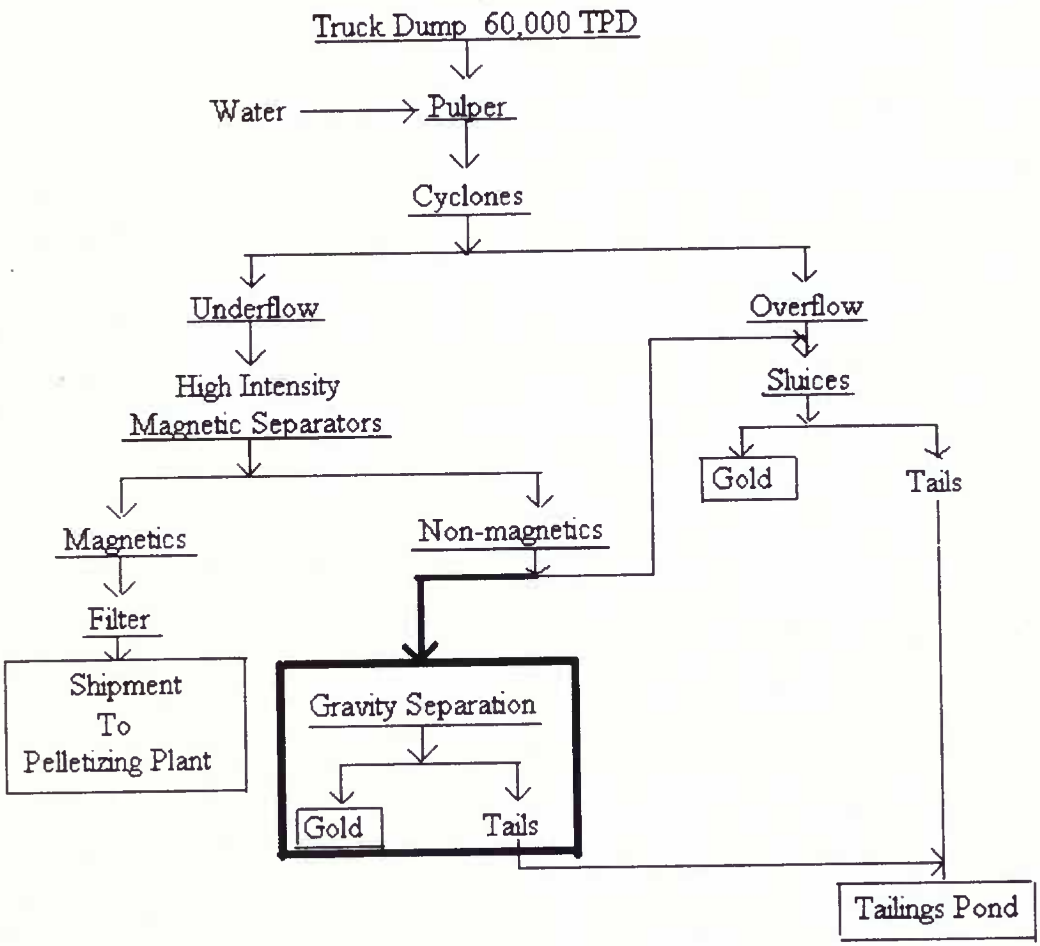
Swent: This was in Brazil also?

Shoemaker: In Brazil. They put some drill rigs in there and as soon as they did that, the garampieros came in in swarms.

Swent: Oh, this is the one you took the fabulous pictures of. Oh, yes!

Shoemaker: The ore body itself was in a very soft rock, much of it just plain clay, and very quickly the garampieros, which means "independent miner"--there were so many of them that CVRD just couldn't kick them off the property. All the equipment they used was just a hollowed-out log that they put their ore and water into and crumbled up the ore with their hands, and

CAUE' MINE-BRAZIL



separated the rock, which contained part of the gold but very little. Most of the gold was in the clay, and then they put this broken-up and slurried material into a little rocker, like the old miners used all over the world for that matter, and up in the Mother Lode country where I live.

They established claims that were two meters wide and three meters long, and ten men would work each claim. They were all independent but these ten would have this claim, and the government stepped in to keep order. They put the army in there to keep order and the military men would carry submachine guns, and they would settle arguments right on the spot. There were always arguments going on between these people: maybe they stepped over the claim line or something.

At the very peak there were 60,000 men--garampieros--working there at that operation, and the pit became deep and with very steep walls. The government twice hired a contractor to come in and lay back the edges of the pit because it was caving in. In fact, the day I was there it caved in and killed several men. The government also put a diesel-operated pump in the bottom of the pit to keep it dewatered, but that's the only thing the government did.

The government allowed no women in the camp. There was a town twenty kilometers away that had stores and women and bars and so on, and I guess that was just like a frontier town in the United States. It was pretty lawless. But the government kept order at the mine, and the government kept promising CVRD that they would kick all of these garampieros out. But they kept coming in more and more, and finally they just couldn't put that many people out of work and so they just had to tell CVRD that they had lost their deposit. Of course CVRD was owned 51 percent by the government at that time. It has now been privatized in the last two or three years.

But the ore went about, they think, an average of about an ounce per ton. CVRD was able to get in in the early days and dig some trenches in the pit and obtained fifteen or twenty tons of sample they took to the research laboratory at Belo Horizonte. There were some very large nuggets found, and some of the early people got extremely rich. It was fairly common to find nuggets that would weigh twelve or fourteen kilos, and I have a number of pictures of them that are that large. There would be one man digging the ore and eight men hauling the ore out of the pit in sacks on their shoulders, and then one man running the concentrating operation. There were hundreds of these concentrating operations, and everybody lived in tents.

The government bought their gold right there. They would weigh it, and they would actually smelt the gold which the miners would bring in, individually in a crucible. Then by taking the ingot and rubbing it across a silica plate, scraping a little of the gold off onto this white silica plate, they could tell very closely from the color of the streak left on the plate how pure the gold was. They would pay the miners for the gold right then. They had to bring the money in in huge boxes because that was during the time when inflation was so rampant in Brazil and you were paying thousands of cruzeiros just for a taxi ride.

In the early days of this operation, CVRD still had very high hopes of taking it over and putting a plant in there. They asked me to help them out and they had designed a plant that was all gravity separation. They were sizing the ore into different size fractions with cyclones and they had nothing but jigs for the coarse gold and shaking tables in the plant.

Well, first of all, they would hand-pick the large nuggets out, and then run the material through jigs and then over three sets of tables--shaking tables in series. But they still lost about half of the gold; it was just absolutely microscopic and it wouldn't separate out by gravity. They had tried flotation but the clay was so viscous that flotation wouldn't work. It was almost like trying to float oatmeal. It was not quite that viscous but almost.

It struck me that they--there is nothing wrong with diluting this material. They had been working with it at 30 percent solids, trying to float that and it was still like oatmeal. I suggested that they dilute it down and they did and at 20 percent it looked better. At 10 percent solids it looked even better, and finally at 5 percent solids, the viscosity of the slurry was such that it could be floated; and gold is a naturally-floating mineral. It worked beautifully and they were able to get virtually 100 percent recovery of the gold.

Swent: There was plenty of water there?

Shoemaker: Plenty of water. Ninety-five percent water and only 5 percent solids.

Swent: No, but I mean you had plenty of water supply there.

Shoemaker: At least in the laboratory we did. And I'm sure they did up there because that was in the Amazon Basin.

But anyway by the time we had finished that, shortly after, that work was finished and we started to design the plant. But then the government wouldn't kick the garampieros out, so all that work was done for nothing.

Swent: That was an amazing situation, wasn't it?

Shoemaker: It certainly was. There were all kinds of people there. There were doctors and lawyers and they would haul this stuff out on their backs. The pit eventually became almost 500 feet deep, and all the slimes, unfortunately, the tailings from these rockers, still contained a half an ounce of gold per ton, but it was so fine they couldn't recover it. The government built them a tailings dam out of the rock that was in the tailing, plus other rock from nearby, and they put all of these slimes containing a half an ounce of gold per ton into this tailings dam.

But with all these independent miners, they could never agree to use any of their money to maintain the tailings dam or to lay back the edges of the pit. The tailings dam finally washed out and it all ended up in the Atlantic Ocean--all of that gold. Finally the pit got so deep that it was so dangerous the government finally shut it down and today there's no one there. It was an interesting experience, though.

Swent: I'll never forget those pictures that you took.

Shoemaker: Yes. I've still got them.

Swent: We'll put a couple of those in here.

Shoemaker: Yes, I could give you some of the gold nuggets--pictures of the gold nuggets.

Swent: Pictures of the people, too. Didn't you take those pictures of the pit? It looked like scenes from Dante's Inferno.

Shoemaker: Yes, I'll give you some of those pictures. A couple of them, anyway.

[tape interruption]

Swent: All right, we're continuing after a break. We've had our lunch and we were talking about Serra Pelada, but we're ready to move on to something else.

Testifying in Australia

Shoemaker: Maybe we can talk about another one of these lawsuits that I've gotten involved in. This last one happened a couple of years ago, and I was working for a company--or I was called by a company called Kalimantan Gold, and they got their name from Kalimantan Island, which is part of Indonesia and is the same island that the Bre-X scandal happened on.

Kalimantan was--I didn't know it at the time, but they were controlled by Plutonic Resources in Australia. Plutonic Resources was later merged into Homestake. But Kalimantan had found a gold deposit on Kalimantan Island and had started to drill it out and it looked like a pretty good deposit. They didn't have too much money. It was a small company, and so they brought in CRA, which really is Conzinc Rio Tinto of Australia. CRA, they were the people that built and operated the Bougainville copper mine and then lost it when the Indigenes shot a couple of their people and they had to close it down.

So CRA had 80 percent of the stock of Kalimantan Gold, and they took over the drilling program and they became managers of the entire project. They developed a very large gold resource and finally they had the deposit drilled out and they had decided that they would put in a plant that would process seven million tons of ore a year. They made a call--a cash call--on Kalimantan for their 20 percent share of the cost of building the plant and the mine. Kalimantan didn't have enough money.

CRA made an offer to Kalimantan for all of the 20 percent of the stock that they didn't own in this company--it was called the Kelian deposit, Kelian Mine--they based their price for the stock offer on the projected grade and tonnage of the gold and the projected recovery of the gold. Kalimantan accepted the offer. So that left CRA with 100 percent of the stock, minus a fraction that went to the Suharto family, and they built the plant.

It wasn't a real high-grade deposit; it was down about two grams of gold per ton, which is about .06 ounces per ton. They started up the plant and ran it and during their first year, they made 50 percent more gold than they had projected they would make. So Kalimantan sued, and I was asked to be an expert witness for Kalimantan. After reading enormous amounts of documents and--when you're in Australia, you prepare a report for the court, you don't prepare it for the company who's paying you, you prepare it for the court, an expert witness does.

And then that report is given to the opposition's experts for them to rebut. You get a copy of their rebuttal and then you can write a re-rebuttal. Then that report is actually given to the court and the attorneys ask you questions about it. They do not ask any questions that aren't about things that are not in your report, and you are not supposed to volunteer anything that is not in your report. [laughs] The rules are kind of complicated.

Swent: I'm going to ask you another question. I was told at one point that Australian legal documents don't allow internal punctuation, that every sentence--you can have a period at the end of a sentence, but they don't allow semicolons and commas and things like that. Is that still true?

Shoemaker: I haven't run into that.

Swent: Your reports could be punctuated the same as they would be here?

Shoemaker: Yes.

Swent: I see. Someone told me once that in order to avoid any kind of ambiguity that they had this restriction on legal documents in Australia.

Shoemaker: I haven't run into that. I'm sure it wasn't in the reports from the other side that I reviewed.

Swent: Okay. All right.

##

Shoemaker: While I was writing this report, I kept getting more documents, and even got more documents after my report was written under their discovery principle, you know. I knew something was wrong right at the very start, but anyway I finally began to realize what it was.

There was mention in the research work of the presence of coarse gold in the ore, but CRA didn't believe it. They thought there was nothing but extremely fine and microscopic gold present in the ore. They ignored these couple of reports from research laboratories that there was coarse gold. Additionally, they did virtually all core drilling, which was fine, and they would split the cores in half every two meters.

They would then take that half-core, which amounted to probably fifteen or twenty pounds at least, and they would crush it all to a very fine size, about one millimeter, or one and a half millimeters, and then they would split the sample down to about 500 grams. Then they would further grind that to about minus-150 mesh, and then split out a 10-gram sample from that and use the aqua regia digestion method of assaying, where they would dissolve--or attempt to dissolve--the sample in aqua regia and then read the gold content on an atomic adsorption unit rather than doing a fire assay.

The final sample was far too small in my opinion, versus, say, Round Mountain Mining Company which is partly owned by Homestake and partly by Echo Bay. Their final sample is two five-assay tons of ore, about three hundred grams, and they have coarse gold. They have to use such a large sample in order to make an accurate assay.

So I got some assay beads from a laboratory over in Reno, from one-milligram size down to a thousandth of a milligram, or a microgram, of gold, and mounted them on black paper so they would show up and put clear Scotch tape over them so they wouldn't fall off. I took those with me. I had, I think, five different gold beads. I told the attorneys about this and explained to them that the ten-gram sample that CRA ended up with might or might not have one of these relatively coarse particles of gold. When I say coarse particles, I'm talking a number of microns in size rather than, say, two or three microns; it might be twenty-five or thirty, or even fifty microns or even larger.

They told me if I could manage to answer one of the opposing attorneys' questions by bringing this in about the size of the beads of gold, or particles of gold, that maybe the judge would allow it. During my testimony of three days, the attorney asked me a question in which I could slide in this business about the size of the gold beads, gold particles, and what the size of one of those particles could do to a sample or not do to a sample.

The opposing lawyer--the lawyer was asking me the questions--he immediately jumped up and started objecting. Which was the third time that he'd objected. I got him so mad, so angry, three different times that the third time, and this was the third time, the judge had warned him against this. The third time, he fined him; he held him in contempt of court. He was so angry he just lost his temper. Anyway, the judge, who was a very, very intelligent man, very imposing in his robe and his white wig, he said, "I will overrule the objection. I want to hear this."

I told him, I'd mentioned in my remarks that I had these gold beads in my briefcase, and I also had a sample of an ore that was five hundred grams and a sample of ten grams that they finally ended up with. So he asked me up behind his desk, and I had my hand lens with me, and I showed him how to use the hand lens. He was looking at these tiny beads of gold and even a one-milligram particle of gold is equivalent in a fire assay to a one-ounce-per-ton ore, which is very rich, and yet the bead is just very, very small. He was very much interested in this and kept asking me questions. The lawyer was sitting down there, standing down there just raging, but he couldn't say a word.

What it did, they had tried to use regression analysis on the data, on their assays. Regression analysis will take a number of data points and try to draw a curve through them that is supposed to represent the true, you might say, average, of these data points. But there was a lot of these data points that were way off of the curve in both directions. It turned out that anything over one gram of gold per ton--their analyses were way off, and if they had done their sampling and their assaying properly, or their assaying on the proper size samples, they would have known that the ore was 50 percent richer than they had thought it was. And that they would then have had to pay more for that 20 percent stock that they bought from Kalimantan.

So that was the key to the whole trial, and shortly after I got back from Australia, I talked with a lawyer and he said the judge had asked the attorneys how much longer the trial would take, because it was then six months already. CRA hadn't even had a chance yet to put any of their witnesses on. He said that they had told the judge it would be at least another six months, which would make the trial a year long. So the judge had told the lawyers that he was going to appoint an arbitrator, and they brought somebody in with a "Sir" in front of his name. I don't know who it was. The lawyer said, "There's not a chance that we can come to a settlement."

But three days later he called me up and said, "We just settled." They settled for $125 million that CRA had to pay, which was--the client, Kalimantan, they thought if they would win, they wouldn't even get that much, and here they had a chance to settle and not spend any more money. The lawyers' budget for this lawsuit was $7 million. And there was this fellow from Plutonic Resources--I don't remember his name, I've still got his card--but he was in the court every day and I got to talk with him a little bit. But that came out very, very well. It all depended on the size of these little gold beads.

Swent: Where was the trial?

Shoemaker: It was in Melbourne.

It was in what they call their Supreme Court, but it is not equivalent to our States' Supreme Court, but that's what they call it anyway. I don't know what other courts would be called. It's in a very old building. It was built back in, I think in the middle 1800s. It was a big, stone building and all the stairsteps were worn, and they had pictures of the old-time judges. That is, paintings of all the old-time judges, and they were very, very imposing in those beautiful robes that they wore. Very stern-looking judges and some looked like hanging judges, but they had these fantastically beautiful robes. And huge pictures, they were over life-size. It was a very interesting time.

I don't think I'd better talk about this new case that I've mentioned, because we've been cautioned against saying anything about this lawsuit.

Another Australian Suit

Swent: Can you just say that you're involved in one? Can you mention that much?

Shoemaker: I'm presently involved in another lawsuit in Australia, in which the plaintiff is Pegasus Gold, who I've already mentioned. They had put in a heap-leach at a place called Mt. Todd in northern Australia, about 100 miles south of Darwin. They had operated this heap-leach on a low-grade ore, for about a year, year and a half, and then they decided that they could make more money if they built a mill and used flotation plus cyanidation and carbon adsorption.

They had a consortium of three different engineering firms--one is based in South Africa, one is in Australia, and one is in Canada--do the engineering. The company did a feasibility study at first, and what I would rather call an engineering study rather than a feasibility study. Then they built the plant, which was supposed to be eight million tons a year, in capacity, and the plant only ran for about a year. It started in the first of 1997, in January and it only ran until about December of 1997. Of course that's when the price of gold was going down.

They claimed that everything was wrong with the plant, and that the engineering firms were liable. About all I can say right now is that they are suing for $330 million.

Swent: And you're a witness for--Pegasus?

Shoemaker: I'm a witness for the consortium of engineering firms. There are a number of us. Maurie [Maurice] Fuerstenau is another one, and Ron Roman is another one. He's an academic type. Then there's others from the United States, and then there's three others that I know from the United States that are working for Pegasus, one of which I've worked with on the Kalimantan lawsuit. We were on the same side on that one.

Australian Courts: Old Traditions and Modern Technology

Swent: Tell about your computer problems with all of this.

Shoemaker: When they called me up and asked me if I would work for the lawyers for the engineering consortium, I asked that they give me a synopsis of the case before I would take it, because I don't believe in working for the sides that are wrong. After I said that I would work for them, they told me that I had to have Windows 98, and at that time I still had a computer that was about three years old. It was Windows 3.1. So I had to buy a new computer, and I didn't buy a new printer because my printer was quite new. They sent me a couple of floppy disks and after installation of those disks in my new computer, I could just click on this icon that appeared in the main menu, and it would automatically connect me via the Internet to the attorneys' files, or to the attorneys' computers, in Sydney. Then I could look at all of the numbers of the documents, and they weren't sorted by metallurgy and mining. They were just miscellaneous--they were everything, every document that the clients had, that the engineering firms had, were on it and some of them were as long as a couple of hundred pages.

So I went through each one number by number eventually, and you had to call them up and you could find out what they were from the first couple of pages. I had a problem that I could not print any of them out, and it was useless to try to read these documents and try to remember everything you wanted from, say, a 200-page document. So I told the attorneys that I was having problems, and I also talked with the people who I bought my new computer from. They sent out a very good technician, and he talked with the lawyers' computer expert, and we found out that the program that all of these documents were on would only print out on old Hewlett-Packard printers, plus a couple of other printers that I never heard of.

So the lawyers' man told me to go out and buy a newer printer that would be compatible with these very old Hewlett-Packard printers, and that they would pay for it. So I did, and the computer people brought it out and it would print. However, the printing took eight minutes per page, and it would also only print out these documents that were supposed to be printed out on a Hewlett-Packard printer and not the ones on this Huey printer, whatever that was. So the attorney, shortly after that, came to Los Angeles, and I don't know what he was doing there but he tried out this system. He called me up and he said that he agreed with me; it was a terrible system and it wouldn't work, and he apologized because I was the guinea pig on this system of document retrieval. He decided that he would put all of these documents onto a CD-ROM, or several CD-ROMs, and send the CDs to me and then they would print out on any printer that I had. So that's the way it has been, and he has done the same with the other expert witnesses that he has called on for this project.

Swent: So you don't have to wrestle with tons of paper any more.

Shoemaker: Australia was the first court that I've ever been in that the court stenographer, who was of course using a stenotype--the stenotype was connected to a computer that translated what she was typing and the judge and each one of the attorneys had a monitor in front of them. When I was testifying, my translation of what I said appeared in front of the judge and those attorneys instantly. I had never seen that before. And then my morning testimony was printed out and given to me at five o'clock that evening so I could read it and make any corrections on it and bring it back in the morning so that they could print out the final version of it. Remarkable, really.

Swent: Was it an accurate transcription?

Shoemaker: I had really very few corrections. I think if I had had an Australian accent, it would probably have been perfect.

Swent: Right. It was a foreign language, wasn't it?

Shoemaker: It was remarkable. I had never heard of that before, and I guess it's here in the United States now, but I've never seen it. And I've talked to lawyers who said they have heard about it but they haven't seen it.

Swent: The old stenotype seems a little bit antiquated now, doesn't it?

Shoemaker: Yes. But to have this very latest thing in this old, old courtroom with all the attorneys, or barristers, in their black robes and the judge, too, in the white wig--and then of course the solicitors were there, too, but they couldn't talk. They're not permitted to talk.

Swent: Well, that's a wonderful experience.

Shoemaker: Lawsuits to me are very enjoyable because you're always matching wits with an attorney.

Swent: So you're enjoying this new trend in your career.

Shoemaker: Yes, I think so. I have a certain amount of reservations about this one, which I can't talk about, but anyway, it is interesting. Very interesting.

Swent: I would guess this is something you had never anticipated doing.

Shoemaker: No. I'm reminded of my statement about mistakes--that there are no new mistakes in this business. They're all old, tried-and-true mistakes.

Swent: You had said that you could talk for a whole day about cyanide, but we don't have time now.

Shoemaker: I was going to talk a little about theft.

Swent: We have a little bit left.

Shoemaker: And I have got some about cyanide here, which I'd like to talk about, and some of these scams I've encountered.

Swent: We have a little bit more on this tape and I can always run up and get another tape.

Shoemaker: Well, I think I'd better be going. Why don't we just talk a little bit about gold theft, Carlin being the first plant--I'm not sure, maybe this one was in my memoirs. I'm pretty sure the one about Carlin and also Alligator Ridge. I think I've probably talked about the theft of silver and that fellow over in Spain who was stealing silver chloride by putting it in his shoes. Maybe we could leave that until later.

Swent: All right.

Shoemaker: Yes, why not? It would be a good time to stop. It won't take too long to do the rest of this, but I think it would be-- I've got an awful lot of notes here about cyanide, but it won't take too long. I think we should stop, though. I can come down again.

Swent: The weather is kind of coming in, so I don't want you to get caught in a snowstorm.

Shoemaker: Yes, it's supposed to be down to 2,500 feet tonight.

Swent: You're right about there, aren't you?

Shoemaker: We're at 3,150. I doubt if there would be very much of it tonight because it's too early in the season. Probably only a couple of inches; otherwise I'd have to be out in the morning plowing snow.

Swent: We don't want that.

[Interview 4: June 9, 2000] ##

Swent: We're in the Strouse Press Room at The Bancroft Library, and this is interview number four. Our last interview was in December, wasn't it?

Shoemaker: I think so, yes.

Swent: That's quite a while ago. You had some more consulting jobs that we wanted to talk about.

Chimney Creek: Best Designed Gold Plant Ever Built

Shoemaker: The first one I wanted to talk about was the Chimney Creek, which was fifty miles north and east of Winnemucca, and owned by Gold Fields, who I had consulted for for a total of about fifteen or seventeen years. This was a gold mill, 2,000 tons a day, and there was no electric power up there. It was about seven or eight miles farther north than the old Getchell mine that Newmont had an interest in many years ago. The power line to the Getchell was not sufficient to supply power for Chimney Creek, but the Chimney Creek was about twenty-four miles in a direct line to the Valmy power plant that was owned by Sierra Pacific. You could actually see the power plant, which is alongside of Highway 80, and it was a coal-fired power plant.

When Gold Fields contacted the Sierra Pacific, they wanted just an outrageous amount of money for running a new power line and putting in new transformers and the total cost would have been somewhere around 9¢ a kilowatt hour. So Stan Burns, who was Gold Fields' electrical consultant, got hold of Harney Electric, which was a Rural Electrification Administration power company up in southeastern Oregon, that got their power from Bonneville [Dam] Power Authority, and they gave a quote which was a couple of cents cheaper than Sierra Pacific's quote.

Swent: Even though it was much farther away?

Shoemaker: Yes. And Sierra Pacific then wrote Gold Fields a letter and said that if Gold Fields bought power from Harney Electric, that Sierra Pacific would sue because they claimed Gold Fields' plant was in their sphere of influence. This would hold up the construction of the plant by at least a year, or maybe more, and so Stan Burns, who's a very good friend of mine, had a good idea:

There was a natural gas line that ran along Highway 80 and he got hold of the gas company and got them to quote on supplying gas to the plant. He priced out a set of--

Swent: That is gas to the Chimney Creek plant?

Shoemaker: Chimney Creek plant. It would have been a twenty-four-mile pipeline, and he priced out a gas-diesel power plant. There were four gas-diesel engines in it, and it turned out that, all in all, not only the construction of the pipeline, and the construction of the diesel plant, but the cost of the gas, it all came out to another two cents saving, so they got their power for five cents, and said to Sierra Pacific, "Heck with you," and Sierra Pacific couldn't do a thing about it. Sierra Pacific was just trying to hold them up, which really is highly unethical, but some corporations are like that.

Swent: Is this unusual to have a gas-diesel plant?

Shoemaker: Well, there's a lot of plants that have diesel plants. A lot of mills have diesel plants, but not particularly in the United

States, because there's so much power available. But other--Canada and other countries do.

Swent: It's a combination. They got the gas from the gas line and then they had to bring diesel in some other way?

Shoemaker: Diesel with electric generators attached to them, so they generated their own power.

Swent: But where did they get the diesel fuel?

Shoemaker: No, these were diesel engines. In other words--

Swent: Oh, diesel engines!

Shoemaker: Like a gasoline engine.

Swent: Okay, I was thinking powered by diesel oil.

Shoemaker: No, they were powered by gas, but it was still a diesel engine.

Swent: All right.

Shoemaker: So they ran along for several years that way and then Santa Fe Pacific, which was Santa Fe Railroad who took over Southern Pacific, they found a deposit just about a mile south of Chimney Creek on their own property. This was the old railroad checkerboard, you know, that they got every other square mile way back in the 1860s, for I think twenty miles on either side of the railroads. Anyway, they found this deposit.

Swent: Of coal?

Shoemaker: No, it was gold. And so they decided to build a gold plant. And then when they contacted Sierra Pacific, Sierra Pacific had had a lesson and they brought their power price down to where they equaled the price that Gold Fields was paying for their gas-diesel power. And eventually Gold Fields was sold to Santa Fe.

Swent: Chimney Creek, that is?

Shoemaker: Chimney Creek was sold to Santa Fe, and then the Chimney Creek plant was connected up to the Sierra Pacific power line and they sold the gas-diesel plant for more than it cost them. It's kind of amusing that Sierra Pacific Power was taught a lesson at their expense.

Swent: Now, who do you sell a power plant to?

Shoemaker: Oh, I don't know who bought it, but some company that was not near a power line or that wanted some standby power bought it. It was kept in perfect condition--it was just like new. Really nothing ever goes--well, the pistons and the cylinders--the cylinders had sleeves on them, and so when they get worn, you replace the sleeve; you don't have to replace the whole engine. And bearings are replaceable and so it was a beautiful power plant and it just ran like a clock.

Swent: Did you do the metallurgical work there at Chimney Creek?

Shoemaker: Oh, yes, I did all the metallurgical work because I was, in effect, Gold Fields staff metallurgist. They never had one, and so I took that place. I was in charge of all of the research on all of their prospects, including--well, I did the same with Mesquite down in southern California--their heap leach, and then other prospects that weren't developed.

Swent: Is there anything special about Chimney Creek?

Shoemaker: It was probably the best-designed gold plant that's probably ever been built. Gold Fields kept their plant manager, the mine superintendent, the mill superintendent, the chief metallurgist, and the maintenance superintendent at the Davy-McKee offices over in San Ramon, and I was over there every week. And Bob Thurmond, their consulting mining engineer, was there and so was Stan Burns, the electrical consultant.

Swent: This is during the construction?

Shoemaker: During the design. And so we very, very closely supervised the engineering firm, Davy-McKee, and these were all operating people that we had. And it turned out to be the prettiest plant.

There's one thing to say about that Chimney Creek. Gold Fields of London was the owner, but they owned Gold Fields-USA and they were bought by a very large English conglomerate, Hanson PLC. But before that conglomerate bought Gold Fields and later sold Gold Fields-USA to Santa Fe Pacific, Newmont took a run at Gold Fields and I got a call from Bill Brown, who was the president.

Swent: President of Gold Fields US?

Shoemaker: President of Gold Fields US. And he asked me to charter a plane and come over to Chimney Creek the next morning to take the Newmont metallurgist around the plant. Newmont sent a team of metallurgists and a team of mining people and geologists. And Bill didn't want his people taking these Newmont people around, so Bob Thurmond came up and took all the mining and exploration people around, and I was the host for the metallurgists.

The metallurgists were headed up by a young fellow by the name of Jim Komadina, whose father was quite a famous metallurgist; his name was George. George Komadina had been chief metallurgist at the Sierrita plant which was owned by one of the oil companies. It was a copper plant, very large, south of Tucson. And Jim Komadina I had known casually and he was--he was full of himself. We started out at the primary crusher and this was a very nicely designed crusher and it was kept just spotlessly clean. It looked like it cost a lot of money, but it didn't; it was just a very good design. And Komadina, after we finished the tour and went back into the office in the conference room to talk about it, he says, "Why did you build such an expensive primary crushing plant?"

And I said, "Well, there was one reason." I said, "We didn't want to build a complete abortion like you people put in over at Gold Quarry," which was Newmont's big plant that's over near Carlin. Oh, he was very angry. But he finally got calmed down.

The primary crusher at Gold Quarry was just terrible. It was--it isn't even worth looking at, or describing, it was so bad. And he didn't like me saying so.

A Poorly Designed Primary Crusher at Gold Quarry Mine

Swent: [laughs] Well, now, it would seem to me that after all these decades of crushing, that designing a primary crusher would be more or less standard. What can you do?

Shoemaker: People still make the same mistakes over and over again, and there's not very many people that really ask questions and take advantage of other people's experience.

Swent: What are the variables in a crusher that make it so tricky?

Shoemaker: Well, this one at Gold Quarry, they put in a jaw crusher, which was smaller than it should have been, and they had to--

Swent: Now what does that mean? Because the size or toughness of the rock, or the quantity that they wanted to put through?

Shoemaker: Well, it was partly both. But a jaw crusher has to be fed by an apron feeder; you can't just dump a truckload of rock into a jaw crusher like you can with a gyratory. And they put in a grizzly in at the bottom of the dump pocket. This is the large stationary screen, you might say, with openings that were say three feet square, or four feet square, and the dump pocket had this apron feeder underneath it that fed the jaw crusher. Well, first of all, it fed a vibrating grizzly that took out the finer material and then the oversized went into the jaw crusher. The dump pocket was very deep. It was about, oh, I would say twenty-five feet deep and they were using 150-ton trucks to dump into it. When the truck got its bed elevated and was doing the dump, the total drop into that grizzly was close to fifty feet, and dumping boulders that were four and five feet in diameter. The grizzly just sagged in the middle and sagged so badly that it had to be rebuilt about three times during the first couple of months of operation.

Then below that, there was another 75-foot-long apron conveyor, and it had to be a steel apron conveyor because the undersized rocks from the grizzly were dropping quite a distance; you couldn't drop them on a rubber belt. Anyway, the whole thing was about 100 feet high, and it was built in a hole. It was almost a half of a conical hole, with very steep sides. And they started this up in the winter time, and during the first week of operation, a maintenance truck went down this slope to do something--maintain something--and the slope was icy and the truck just slid. They couldn't stop it, and it collided with the electrical transformer. The transformer of course was smashed, and so was the truck, and they had to shut the plant down for about a week until they could get a new transformer. It was a poor design all the way through.

Swent: Well, I interrupted you. You said the jaw crusher was too small.

Shoemaker: They replaced it after a couple of years with a gyratory crusher, and it was built more along conventional lines. As I say, people just--[Frank] McQuiston and I wrote this book on primary crushing plant design and the book outlined all the mistakes that had been made on various crushers and made recommendations for how one should be designed.

Swent: So you took your crowd through the Gold Fields plant?

Shoemaker: Yes, we went all through the plant, but anyway, Newmont decided not to buy Gold Fields at that time. But it was interesting shepherding those people around and answering all their questions.

Swent: Did you ever go back? Were you ever called back to do anything after it operated?

Shoemaker: Well, after it was sold to this Hanson P.L.C. out of England, I only went back there I think twice. Then the manager that Hanson put in--he knew nothing about mining and had never been connected with mining before. He said mining can be run just like any other business. Anyway, he didn't want to pay a consultant, so he told Bob Thurmond and I that we weren't needed any more, so I never went back. Later on, of course, Santa Fe bought it and then Santa Fe was absorbed by Newmont, so Newmont eventually got the plant.

VII THEFTS, SCAMS, AND EXAGGERATED FEAR OF CYANIDE

La Camorra, Venezuela: A Poor Plant Run by a Crooked Manager

Shoemaker: One of the people--the vice president of finance for Gold Fields--was named Tony Cialli. When Hanson took over Gold Fields, they put in their own people, so he lost his job. And somehow he got--well, he knew some of the Consolidated Gold Fields board of directors in London, and one of those had an interest in a consortium of financiers that somehow had got a hold of a gold prospect in Venezuela. They made Tony a vice president. He lived in New Jersey, and they built a gold plant in Venezuela, and it was designed and built by Bateman Engineering out of South Africa. The Bateman construction manager was then hired as manager of the plant. He was a construction man and didn't know anything about running a plant, and this consortium had hired no consultants to look over Bateman's shoulder and the plant was--it just didn't run very well. It was just full of faults.

Swent: What sort of plant was it?

Shoemaker: It was a gold plant.

Swent: What kind of process?

Shoemaker: It was a cyanidation plant, and it was built--

Swent: Excuse me--we didn't find out what was the Chimney Creek--that was a heap leach?

Shoemaker: Chimney Creek was a milling plant--milling and cyanidation. Later a heap leach was added to treat low grade ores.

Swent: Thanks. Now, back to the plant in Venezuela.

Shoemaker: It was a gold plant, and it was a milling plant and used carbon-in-pulp processing. The ore body was actually not in situ: it was tailings from a whole bunch of little independent miners that had been mining in this area for a long, long time. They dumped their tailings into a very small creek and as they came into this valley, well, the tailings spread out and they were twenty feet thick there for quite a ways.

Swent: Where is this located?

Shoemaker: It was to the east of Caracas. It was over near the British Guiana border. You had to fly east to a city, I can't remember the name of it, which had a couple of big aluminum plants, and then drive a long, long distance. But anyway these tailings had some gold in them, supposedly, and--Bateman had done the test work, and based on Bateman's test work, they put in the plant.

But it turned out that the tailings were much lower grade than the samples that Bateman had taken. They did a poor sampling job. And the plant was very poorly designed and it was very inefficient. They weren't making recovery even if the gold had been what they thought it was. And in addition, this manager was--his name was John Brownlee. He was a Scotsman, and he talked continuously; you couldn't interrupt him. But he was on the take.

It turned out that he had gotten kickbacks from every subcontractor that was engaged to build the plant, and it turned out that he was also getting kickbacks from the independent truckers that were excavating these tailings and hauling them to the plant. He also had the chief chemist falsify the assays and increase the assays of each load on the truck. But anyway, Tony--

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Swent: When you come into a place as a consultant, how do you find out this sort of thing?

Shoemaker: Oh, just because I always look for these things.

Swent: All right. [laughs]

Shoemaker: Anyway, Tony Cialli asked Bill Brown, who had been president of Gold Fields U.S., and Bob Thurmond and I to go down and take a look at this plant. We were pretty well horrified at everything that was going on. They didn't have a mill superintendent; Brownlee had a foreman, is all, who didn't really know--he was a Venezuelan and he had worked in mills, but he wasn't really very experienced, and so we told Cialli that he had to get a competent mill superintendent. He agreed under protest and I, when I came back to the States, got a hold of Joe Young, who was the old superintendent at Homestake's mill, or had been, up at McLaughlin. Joe Young had worked for me when I was at Bechtel. He was Chinese, but he'd been born in the States and is a very good metallurgist.

So he went down there and found all of this out by working there, and found that the assays were off and he found that Brownlee was taking kickbacks and he also found that there were two or three people had found a way into the refinery. They would crawl through a couple of electrical ducts and get into the ceiling of the refinery and come down some pipes and you could see their footmarks on the wall [laughs] and stealing gold there.

The company was just not making any money and this consortium of financiers had to contribute more and more money to keep it operating. Then the three of us--Brown, Thurmond, and myself--we went down there again after Joe Young had been there for a couple of months and when Joe told us all of this--

Swent: He was able to tell you in person. I suppose he couldn't have written a letter.

Shoemaker: No.

Swent: This is kind of tricky, isn't it?

Shoemaker: Of course he had to report to Brownlee. And when you report to a crook, well--

Swent: You have problems.

Shoemaker: So he told me all of this, and I told Bill and Bob Thurmond.

Swent: What were the circumstances of his telling you?

Shoemaker: Oh, I went to his house. They had a camp, or a company village, you might say. And Joe Young had to confide in somebody because he knew that things were going wrong and it wouldn't do any good to talk to Brownlee. So we told Cialli that he had to fire Brownlee, and Cialli wouldn't do it. So anyway, Brownlee promised to make Joe Young the operating manager, and Brownlee was going to be in charge of building a second mill on another ore deposit which was fifty, sixty miles away. But that never happened and after a couple of more months Joe Young quit. Eventually the financiers stopped putting up money and the plant was sold and Brownlee was out of a job.

Swent: What was the name of this operation?

Shoemaker: It was called La Camorra. It was very close to a town called El Callao.

The sequel to that story: Newmont put in a very large heap leach operation in Kazakhstan in Russia. There was an article in one of the mining journals and it mentioned John Brownlee was there as construction manager. Later on they had a manager, but he was still there, doing more construction. A friend of mine was working for Newmont and they sent him over there, and I happened to be talking with him one day and asked him how Brownlee was doing. He was very negative about Brownlee and he didn't want to say too much, and I said--well, I told him what had happened down in Venezuela. Then he opened up and said he's doing exactly the same thing in Kazakhstan at the Murantau plant, which is one of the largest gold mines in the world.

This was on their low-grade material that had been stockpiled for many, many years. This was the same plant that when I was at Bechtel, I mentioned that the CIA came with photographs taken from the U2 spy plane and wanted to know how much production could be put through in that plant--I think we talked bout that.

And I said to my friend, "Well, did you tell the Newmont management about this?"

He said, "Yes, but they haven't done anything and Brownlee is still there."

Shortly after that, I was at a Society of Mining Engineers meeting in Denver, and at the Mining and Metallurgical Society luncheon, the speaker was Ronald Cambre, who was chairman of Newmont at the time. I had met Cambre before at the dedication ceremony of the Gold Quarry operation that we just discussed. And so before the meeting, before the luncheon started, we were--they had cocktails there ahead of luncheon time, and I went up to Cambre and reintroduced myself and asked him if I could have a word with him. I told him about Brownlee and my experience with Brownlee, who was an absolute crook, and that I had also heard that he was doing exactly the same thing in Kazakhstan for Newmont. He thanked me very much and there was never anything done about it. Brownlee was there for another year and a half.

So these things always puzzle me, how the chairman of a company could tolerate something like it. The least he could do is investigate, and he never did.

Swent: Maybe he thought that that was the way of doing business in Russia.

Shoemaker: Well, in Russia you have to pay off a lot of people; you don't have to, but it makes it easier. But it shouldn't be done, and there are plants being built in Russia which do not do that.

Swent: Just as an aside, but speaking of Newmont and Russia, you were talking about this other mine, Chimney Creek, that belonged to Gold Fields and Newmont was trying to buy it. Plato Malozemoff's father worked for Gold Fields in Siberia. Long ago, nearly a hundred years before. He managed a mine for Gold Fields.

Shoemaker: His father was a manager of the plant.

Theft of Gold at Carlin

Shoemaker: I wanted to talk a little bit about--relate a few instances about theft of gold. Carlin, the Carlin mill of Newmont, which was the first gold plant that Newmont had built in thirty years--in fact, it was the first plant that had been built in the United States in thirty years. This was in 1964. They had a theft.

It turned out that there was a jewelry manufacturer in Chicago--and this is at the time when it was illegal to have gold, you know, unless you had a license from the [U.S.] Treasury [Department]. The Treasury people had been keeping their eye on this jewelry manufacturer because they thought he had more gold than he had a right to have, and so they began following the owner. They followed him to Reno and he met in Reno a couple of men who it turned out, when they started following them, that they were working for Newmont at Carlin. And so the Treasury agent went to Jay Macbeth, who was manager of the plant at the time, and told Macbeth that some of his people were stealing gold. He couldn't believe it, but they convinced him.

It turned out that the chief chemist and two of the refinery people were in on it. The chief chemist was cooking the books, so that his calculations of how much gold that was produced was verified by his assays. And so he was covering up the theft out of the refinery by that. They were stealing zinc precipitate that they recovered the gold in.

These three fellows had been stealing gold for about a year, and they had stolen, it turned out to be over a million dollars. They had quite a high old time. When one of them would have a birthday, the other two would arrange with one of the local houses of ill repute there at Carlin to throw a party for the third guy, and he would have a wild weekend with several women. Anyway, they arrested all three of them but they only got about $40,000 worth of gold--$40,000 back. One of the men had put all of his money in his wife's name somehow and she got away with it, and there wasn't anything more to recover; they had spent it all.

Only the chief chemist went to jail, and he was only in jail about four months. He later became chief chemist at another plant over in Nevada, and the manager of it told me that he was the most honest fellow in the whole plant.

Swent: Oh, really. [laughs]

Shoemaker: He had completely changed his ways. I knew him and I talked with him. I was consulting for this other outfit and he told me all about it--that he just lost his head and he would never do it again.

Swent: Well, that's kind of nice.

Shoemaker: But they got Frank McQuiston back over there and Frank went over the assays of all the blast hole samples and the chief chemist had not cooked those; he had only cooked the assays in the mill, so Frank was able to back calculate from those assays of the blast holes and compare them with what their production was and establish to the insurance company's satisfaction that there was a million dollars that they had stolen, and so the insurance company paid Newmont off, that million dollars.

Swent: I'm surprised you could be insured against that kind of thing.

Shoemaker: Well, they had insurance.

Swent: Well, that was smart.

Theft at Battle Mountain

Shoemaker: Another one was Battle Mountain Gold. I was hired by Battle Mountain Gold because their chief of security had quit, and some three months after he had quit he came down with a bad case of mercury poisoning. Mercury poisoning can be fatal, of course, but he recovered. He went to the hospital and he did recover.

They had been using amalgamation with mercury in the plant because they had coarse gold. The company refused to pay him because they had been taking blood samples from him on a regular basis. Anyone who was in the refinery or around the gold room where the coarse gold was and the amalgamation was taking place was checked on a--I think it was a bi-weekly basis--for mercury in the blood. And his--I've forgotten the figures now, but he had a slightly elevated mercury content, like any of the people that worked there in those areas, but it was way under what the government would say is dangerous--the EPA and so on. However, when he got the mercury poisoning, after he had quit, they analyzed his blood and it was about 300 times the allowable limit.

He was on workman's compensation, but he was going to sue the company. The company didn't want to pay him because when he left, his mercury in his blood was very, very low. And so I went over and I looked at the whole place and they did have--the mercury retort they had was very poor and it was leaking, but no one else had got any high levels of mercury in their blood. And so I told them that they had to get a new retort with much better seals on it, which they did.

Then I talked to a toxicologist here in San Francisco who knew a lot about mercury and he verified my thoughts, that there was no way that if his mercury level in his blood was normal when he left his job, that three months later it could be 300 times more, so I told the company that they'd better go and get a subpoena and take some samples in this man's garage or his house or wherever, which they did.

It turned out that there was all kinds of mercury in his garage because he had been heating this amalgam, you know, on an open gas flame. [laughs] That's where he got the mercury poisoning.

Swent: He was stealing?

Shoemaker: He was stealing gold. Stealing amalgam.

Swent: Processing it himself at home?

Shoemaker: Yes, processing it in his garage. So the man couldn't sue them, and they didn't try to put him into jail because it would be so hard to prove and he was gone anyway. At least they didn't get sued. He had a lot of gall to sue the company for that.

Swent: I would think so. [laughter]

Shoemaker: I guess the state cut his workman's compensation off, too, because he got it illegally.

Theft at Alligator Ridge

Shoemaker: Another one was Alligator Ridge, where we built the heap leach plant. At the dedication where they had the governor of Nevada give his speech, and there were other speeches, I was standing --and they had, you know, they had food and beer, and all kinds of soft drinks and everything and there were a couple hundred people there--and I was standing talking with a man by the name of Don Koza, who was a manager of a gold plant down in Pioche, Nevada, and who I had known. There was a bunch of guards, security people around. There were half a dozen of them and they had pretty sky-blue uniforms on, brand new. Don started to laugh and I said, "What are you laughing at?"

And he said, "You see those two guards over there in the pretty uniforms?"

I said, "Yes."

And he said, "I fired them for stealing two months ago."

Swent: Uh oh. [laughs]

Shoemaker: It turned out that about four months later they found that these guards had been stealing gold. They were the head of a ring of about six people that had been actually stealing carbon--loaded carbon from the carbon-in-leach plant. They caught them, and I think one of them went to jail, the chief of security. I don't think the other ones did.

But you see, with carbon, normally you like to keep the concentration of gold in the carbon that absorbs the gold from the cyanide solution. You like to keep it fairly low, and some people don't--I don't know why these gold companies are so casual about these things, but I've seen a number of companies that load their carbon to as much as 500 ounces of gold per ton. But if you load it to 500 ounces of gold per ton, then one pound of carbon contains a quarter of an ounce of gold. You can put a pound of carbon in your pocket, and that's seventy-five dollars worth. They can take it home and just burn off the carbon and recover the gold.

It's amazing that these carbon plants very seldom have screens over the carbon columns. Carbon is very easy to steal, and they don't check these people. Even so, if they would check them with a--occasionally they'll check them with a magnetometer, but that won't show up on a magnetometer because the gold is in a form of gold cyanide, which isn't magnetic at all. Gold is not magnetic either. And in foreign countries, when you have laborers who work for two, three, four, five dollars a day, and they steal a pound of carbon worth seventy-five dollars, the temptation is extremely high.

Theft a Problem Especially in Some Less Developed Countries

Shoemaker: Here in the United States when these operators are making $40,000 a year, the temptation is less, but it's still a temptation, and there's still a lot of gold stolen. Very often when you have a theft, very often it involves the security people that they hire, because they are not paid very much. They're paid not much more than minimum wage, so that they are susceptible to temptation.

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Shoemaker: When I was at some of these operations, they all had guards and some of them would have these magnetometers, but they were very casual about their use. At one down in Brazil, which I've already talked about--Fazenda Brasiliera--after they got the plant up and going, I was just trying to tell these people, the managers and the people I was working for, that they ought to cover their carbon columns. This was a heap leach operation. And, nah, they couldn't get much interest in it, so I took a--I found a piece of steel that weighed about a pound, a short piece of flat bar. I put it on top of my head and then put my hard hat over it, and when I went out of the plant, of course they ran the magnetometer over me, but they never got above my shoulders, and they never got below my ankles to my shoes, and when the guard passed me through along with the superintendent, and the plant manager I was with, as I went through, then I took off my hat and just dropped this big piece of iron on the floor. And the manager of course was very embarrassed. And so the next time I was there I found that he had put screens over the carbon columns.

Swent: His recovery was better?

Shoemaker: That was my last visit and I don't know what happened, but I'm sure that they were trying to steal gold. They all do. I don't think there's a plant in the world that hasn't had a theft. One of them was Homestake at Lead. And this was kept very quiet. I don't know whether you ever heard about it.

Theft at the Homestake Refinery

Swent: No, I've always been curious about it. I've heard many mentions of it, and I've never heard the story. I'd love to hear it.

Shoemaker: Well, they had guards. I don't know how they got onto it, but this had been going on for years. It was people in the refinery who when they would pour their ingots, they would also pour very small ingots, maybe five or ten ounces--something like that. They would put these small ingots in some of the electrical boxes, starters for the motors, or an electrical panel. Then they would call the maintenance shop and say that they had some electrical problems and they would send over this electrician with his toolbox. Of course he would go in and he would go to this electrical box and he would take the gold out and carry it out in his toolbox, which they never searched.

Then another way of doing it, they took the slag from the refinery and put it in barrels, and the slag contains a little bit of gold. Rather than putting it out on the dump, they sent it back to the crushing plant on the surface. Primary crushers were underground and this was the secondary and tertiary crushing plant. They would hide small ingots of gold in the top of this slag which they had crushed in the refinery, and put it in a sack or a box or something and hide it under the slag and then this would be sent back over to the crushing plant where the man would know--they would put a mark on the barrel, and the man would open the barrel and recover the gold. Apparently this had been going on for years.

And so they asked Frank McQuiston to come and help them out. And Frank never told me very much about it, except that he was doing this and he was helping them out by making calculations of what they should have recovered. They wanted to keep it quiet. It never got into the newspaper. Most of these companies, they are very embarrassed and they don't want the word to get out that they're subject to theft.

Theft at Candelaria

Shoemaker: The last one I have here is Candelaria, the silver heap leach plant we built when I was at Bechtel. We built it over south of Hawthorne, Nevada, about fifty miles. You have to steal a lot more of it in weight than you do of gold. But the filters that collected the zinc precipitate were in the refinery room--you pre-coated the filters with diatomaceous earth in water, to make a filter media on the filter cloth. This tank in which they mixed the diatomaceous earth with water was outside of the refinery, and by changing some valves--opening some valves and closing others--inside of the refinery, they could make pregnant solution containing gold flow back into that tank. They put a sack that had powdered zinc in it and they tied it around the end of this pipe that went into this tank and of course it precipitated a lot of silver.

I don't know how they found that, but the manager is a friend of mine and he told me how it happened. So those are just examples of how gold and silver can be stolen.

Extreme Security Measures at the Rand Refinery

Swent: They have to be very ingenious, don't they?

Shoemaker: They can think up methods of stealing it faster than you can think up methods of preventing it. So even the best of them--like Homestake and Newmont--they've had bad experiences. I went through the Rand refinery in Johannesburg and I got special permission to go through that. They just didn't allow any general visitors and I got some people at Anglo-American to permit me to go through. Of course that's the largest refinery in the world and it is huge--and I'm sure they have never had a theft because the search that you have to go through coming out of that refinery is a little bit embarrassing to describe because you have to go through there naked and they investigate you very thoroughly. They look into your mouth and they x-ray you to see if there's anything in your stomach.

Swent: Do they do this every day for all their employees?

Shoemaker: Yes.

Swent: That would give you quite a load of radiation, wouldn't it?

Shoemaker: Well, it's very low dosage. And they also investigate your body cavities. I don't think they've had any thefts. There are no exceptions. Managers go through this. But this Rand refinery is owned by all of the gold companies down there, and I'm sure the government has an interest in it, too. It is a fantastic refinery.

Swent: So that's the only way to be sure, is to have an extreme caution.

Shoemaker: Before I quit I want to talk about some scams and then I want to talk a bit about cyanide and that's all. If you want to break now--

Swent: Well, let's do.

[tape interruption]

A Scam at Cle Elum, Washington

Swent: We are continuing here after a short break. You wanted to talk about mining scams?

Shoemaker: That's correct. A friend of mine who is a geologist worked for Rio Algom in Canada. They had been approached by a man in Washington who told them that there was this mountain of silver not far out of Cle Elum and sounded like it was crazy, but they couldn't afford to not look at it, was the way they felt. This geologist didn't know much about sampling and he knew that I did, and so he called me and I met him up at Cle Elum.

We met this man, and this was shortly--actually we had to put it off for a while because this was right after Mt. St. Helens erupted and it was on the east side of Mt. St. Helens, and Cle Elum still had just huge piles of this volcanic ash pushed up in parking lots and so on, and this mountain had three or four inches of ash all over it. And so we went up with him and took a look. And it was in a heavily timbered area of the whole mountain, and he claimed that there was silver just all over the place. So we agreed to meet him the next day, and I would take samples. We went back to Cle Elum and I bought two pieces of half-inch plywood and I rented a gasoline-driven post-hole digger--and we went back up there the next day.

The post hole digger would drill 6-inch holes and he said this silver was right on the surface all over the place, and so I cut a little over 6-inch-diameter hole in one of these pieces of plywood and this fellow that was a friend of mine, he helped me with the drill, the auger. There were handles on both sides of it. It was a quite heavy thing.

We also had an extension so we could drill down to about five or six feet. I had gotten a couple of wooden boxes to stand on when we were drilling that deep and we made this man stand about twenty feet away when we were taking samples. We would drill down and then the sample would come up through the hole in the plywood in the form of kind of a cone around the hole. We would scrape that away to one side and then drill a little further. Then we would transfer the sample, which was probably fifty-sixty pounds or more from the 5-foot hole--maybe even seventy-five pounds--to the other sheet of plywood. Then I had a shovel and I would cone and quarter this and work it down to a sample that was about five pounds and put it in a plastic bag.

Then I had purchased a very cheap tin footlocker--sheet metal footlocker--from a local variety store. In fact, I had two of them, but they did have hasps, and I bought a couple of locks and we would put these samples in the foot lockers. We worked two days up there getting these samples and we had filled up two of these footlockers and locked them; each time we locked them, even at nighttime when they were in my room. I would put them in my room at the motel.

The second day this man brought a fellow from Portland, a young fellow who had invented this process for recovering silver. He claimed he was a chemist. He wasn't. He vaguely described his process, because it was secret. And so anyway, after two days, I shipped the samples back to San Francisco and had Martin Quist, you probably know him, assay them.

Swent: I've heard a lot of Martin Quist. I don't know him, but I've certainly heard a lot about him.

Shoemaker: He ran an assay laboratory down in San Francisco. I can't think of the street now. And there was absolutely no silver in it. He did fire assays and there was absolutely no silver there.

Swent: Of course Martin Quist didn't have that secret process.

Shoemaker: That's correct, yes. [laughter]

I had done some work for Lurgi, which was a division of Metalgesellschaft, a German company--done some consulting for them. I worked for a man by the name of Arthur Bergmann, and he was a metallurgist and he worked with a fellow by the name of Hans Teichert.

This Teichert was quite a character. He had been in the German army at the age of sixteen and was captured by the Russians. They put him to work in an underground coal mine, and the coal seam was flat-lying and it was such a narrow seam that in the morning he could choose whether he would mine coal on his back or on his stomach. With a hand pick.

Swent: Oh my!

Shoemaker: He would push this coal back to another fellow, who would pull it back, and they would eventually get it onto cars. He said a lot of prisoners died there and he was starved, but then somehow either the coal ran out or--but anyway, he was transferred to a copper mine. They dug the copper ore by hand, by pick. He was one of the few to come back after war, and strangely enough he decided to become a mining engineer.

In Germany, like in some other countries, before they will accept you into a mining school you have to have a year's experience working in a mine, and of course he had all kinds of experience.

Swent: Literally all kinds.

Houston Minerals and the Haber Process for Gold Recovery

Shoemaker: Yes. But anyway, one of Lurgi's or Metalgesellschaft's very large stockholders had been approached by some people in Texas. This company was called Houston Minerals, and they were asking this man to sink a lot of money in a gold and silver mining development.

Swent: Where was it?

Shoemaker: They were going to develop a mine or actually several mines in Arizona, and the promoter was there. I met both Bergmann and Teichert in Houston and went to this Houston Minerals office where they had--I don't really know what those people did, but they didn't know anything about mining. They had their consultant there who had developed this process. This promoter--I don't think I had better give you names because he's still alive. He was going to develop these gold mines--several gold mines--and connect them all together by computer, and he was going to run them by computer.

Swent: Oh, good.

Shoemaker: And he would only have a manager and maybe one or two employees at each of these mines.

Swent: What, he had robots or something?

Shoemaker: He was a great talker and every time you would ask him a question he would dodge around it. But he was going to use what had been called the Haber process. A man by the name of Haber was back in New Jersey and he had a company that made dental alloys. It was a public company and it was a going concern, apparently.

But he got interested in recovering gold and he had a chief chemist by the name of Frye and they developed this process called electromolecular propulsion, [laughs] and this was what this promoter was going to use. It was a vat leaching operation and they would build these big vats and the vats would have an electrode at each end, and then they would fill the vat with ore and add water to it and circulate the water which contained his secret reagent, and with the electricity turned on, the gold atoms would hurl themselves--and I'm quoting him--at the electrodes. [laughter] Anyway, I told the Germans that this was a scam.

Haber was around for several years and was trying to sell his process to a number of people. He took over a place called Silver Reef. It was a mountain and it was called Silver Reef down in Arizona, and this promoter--that I referred to and wouldn't give his name--had originally owned the claims on this Silver Reef. Both Haber and this promoter were trying to sell this process to recover this silver, and Hans von Michaelis--you may know of him--he's a South African and he lives here in the United States and he has put on a number of--oh, I'll call them seminars. It has evolved into small equipment shows, and he has published some books that were originally supported by mining companies. He's a promoter himself and he's not a metallurgist, but he goes around and asks questions of every mine in the country--and in Australia and South Africa and so on. He has made a living at this, and he has done the industry a service, but you can't always believe what he says in his books.

I've got a shelf full of I think twelve volumes each a couple of inches thick, and he has brought these--he has added to these. I haven't gotten the rest. In fact, he gave me those twelve volumes free.

But [laughs] anyway, he held one meeting in Scottsdale and I went to it and he had this man Norman Haber give a paper. Well, von Michaelis shouldn't even have done this, but he would do anything--and I say you can't believe everything you read in his books.

Haber got up on the platform and was trying to describe this process without giving any details, and I started asking questions. Some of the others picked it up and he was finally just hooted off the platform. It was a waste of time to listen to him. He got very angry about that.

And later, [laughs] I got a call from this man, Frye, the chief chemist. He wanted me to consult for them and endorse the Haber process to refine silver and gold from over in Nevada because he was under the impression that all of the gold and silver producers shipped zinc precipitate to the refineries and he wanted to put in a refinery using his own process. I told him that in the first place I wasn't interested at all and I thought the Haber process was a scam and, besides, none of the gold plants over there ship zinc precipitate. They all smelt their own gold.

Sonora Gold, a Failure

Shoemaker: Another one was--I think the last one I'll talk about--is Sonora Gold up at Jamestown, California. This was promoted by a young man by name of Agar, who was a geophysicist. He became a promoter and he promoted this Sonora Gold and sold a lot of stock, and then they built that plant at Jamestown. [laughs]

Swent: Was that the one that was on both sides of the road?

Shoemaker: Yes. They had a lot of problems getting permits, but they finally did, and they had a metallurgist working for them by the name of Joe Davis, who I had met when I was--actually when I was with Bechtel. We did some work for Copper Range, up in Michigan, Upper Michigan. Joe Davis was a nut.

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Shoemaker: He was a metallurgical nut. He was a metallurgist, but he had been working with thiourea, as a reagent to recover gold from ores. Thiourea has been investigated for--oh, I think--as far as I know it was first investigated as a gold leaching agent back in 1925, and no one has ever been able to make it work. It does leach gold under certain conditions, but it operates--to be efficient at all it has to operate within a pH range of about .2 on a scale of one to fourteen, and no one has ever been able to make it work. It's been tried by many people and it's still being investigated by a lot of university researchers who seem to believe that they can solve this problem--and also write a paper.

And so they got their permit to build this plant, and it was a good-sized plant. The gold was associated with pyrite and they were going to put in a flotation plant. They bought a flotation plant that had been a copper flotation plant down in Arizona, and that plant had failed. And that's another story, but I won't tell that one.

They bought this plant and they put it in, and then they were going to leach the concentrate with thiourea. He had convinced Agar and his bunch of vice presidents and directors who had gotten rich on selling the stock that they had allotted themselves, convinced them that this would work. He also convinced the county authorities that they were going to use theiourea, and that it would be non-toxic, and they wouldn't be using cyanide. Actually thiourea can be toxic--maybe not as much as cyanide, but that's another story.

So they put the plant in and the thiourea process didn't work at leaching gold out of the sulfide concentrate. They couldn't change over to cyanide because the county wouldn't let them, and so they found a little carbon-in-pulp plant over in Nevada, west of Yerington, and about halfway over to Highway 395. I've forgotten the name of it, but it was put in by a promoter, and it was very cheaply built.

They started trucking this concentrate over the the pass. They didn't go over Highway 80; they went one of the other passes, I've forgotten, and went out of Sonora, over that pass.

And trucked that over there, and there were, I don't know, three or four big truck and trailer loads a day, and they were going to cyanide it there. Unfortunately the plant was built so cheaply, it wouldn't work. They hired a fellow--a Canadian --as manager and then they were getting about 10 percent extraction of the gold out of this concentrate. This plant had been treating a so-called gold ore that was just full of copper. They had a tailings pond there and I don't know for how long it had been running, but it failed, and there were probably a few thousand tons of tailings there with copper in them.

Well, making only a 10 percent recovery of the gold was a disaster. The pyrite concentrate, which became tails--leached tails, went out and got mixed with this copper. And so the manager of the plant at Sonora, who I had known slightly, called me and asked me to go over to look at this carbon-in-pulp plant.

I wrote him a report and I told him that he ought to hire somebody that knew something about carbon-in-pulp plants as a manager. I outlined what I thought the changes needed to be, and they would have to hire an engineering firm, which they did. And I didn't have anything more to do with it. I didn't want anything more to do with it.

But it took them a year to get their recovery up to about 90 percent. And you know, later on, that plant ran for about four years, but it never made any money, and finally failed, that is, the Jamestown plant did. And it's kind of interesting because even after a year when they were making a 90 percent recovery over there from the pyrite concentrate, it still contained about a quarter of an ounce of gold per ton. Barrick then bought all those tailings because they were running an autoclave plant over there in Nevada near the Carlin operation. They have this big autoclave plant over there north of Carlin, and they used the sulfides to furnish heat in the autoclave just like we were going to sell the Empire tailings to Homestake for the heat. I told you that story.

But actually at Jamestown, all in all, it was a scam.

Swent: They spent an awful lot of money on that plant, didn't they?

Shoemaker: They spent an awful lot of money and a lot of the money went into the pockets of the promoters. They were more interested in the money that they could get from their stock that they had allotted themselves than they were in building a profitable plant. And hiring Joe Davis, who later ended up in jail for

I've forgotten what it was--but he has been in jail for a number of years. Nothing to do with metallurgy. So I always considered that a scam.

Moapa Valley, Nevada, a Hotbed of Scams

Shoemaker: I have another one. I ran into a fellow in Grass Valley whose name was Tom Newmark. He has some money and he dabbles in various things. I was talking with him one time. I had just come back from Brazil and I had mentioned it, and he said he had just come back from Brazil. He was down there buying semi-precious stones to sell up here, but he also said he had an interest in a mine in Nevada that they were getting ready to build a plant on. He said he had invested in it. And I said, "Well, where in Nevada is it?"

And he said, "It's in the very southern part of Nevada."

I said, "Oh, you must mean the Moapa Valley."

And he says, "Yes." He says, "How did you know that?"

And I said that there's no mining, no gold plants in the very southern part of Nevada, except one called Castle Mountain, which is west of Las Vegas about fifty miles. And I said, "Moapa Valley is a hotbed of scams. There have been more scams over there promoted than any place on earth."

And he says, "Oh, no, this is a very honest group of people and investors."

I said, "Well, who are you working with down there?"

And he said, "A fellow by the name of White."

I said, "Oh, you mean Merwin White?"

And he says, "Yes." He says, "How did you know that?"

I said, "Well, he has been promoting scams all over in Arizona and Utah for a number of years, but he has never been caught."

He said, "Oh, no, he's a very honest man. He drives an old car and he wears bib overalls and he says he doesn't have a lot of money."

[laughs] Anyway, I said, "Well, I would be very careful. He is known for running these scams."

I periodically would run into him in Grass Valley and ask him how things were going and he would tell me that they were having little problems building the mill, and then they had run into some more problems, and finally he told me that he had had $80,000 invested in this and that one of his friends had $160,000 invested. And he said the last time--this was several months after I first met him--he admitted to me that I was right. This plant that they were building turned out to be on Bureau of Land Management land, [laughter] and BLM had come in with dozers and tore it down--tore down the plant, and there was no mine. And so he had lost his $80,000.

Swent: Oh, that's a pity, isn't it, really?

Shoemaker: People are just greedy.

Swent: And it gives the whole profession a bad name.

The Exaggerated Fears of Cyanide

Shoemaker: Well, now maybe we can end up with a little talking about cyanide. Cyanide is really catching hell. The State of Montana passed a law against the use of cyanide in mining operations and the mining people were prevented from doing any advertising or lobbying against this proposed law. The environmentalists were, of course, very much against the use of cyanide. They had proposed this law, and yet somehow the state did not permit the mining companies to publicly oppose it by advertising or anything. And it passed. And there is now a bill in the legislature in Colorado for the same thing.

Swent: What is the chemical formula?

Shoemaker: Well, hydrogen cyanide--HCN, all capital letters--is what kills people. It is extremely poisonous, but the mining industry uses sodium cyanide, NaCN, carbon and nitrogen. It's a white powder that is compacted into briquettes the size of a charcoal briquette. And it's perfectly safe to use as long as you keep the pH up in the range of ten or ten and a half and generally around eleven and sometimes even eleven and a half. But if you allow the pH to drop around nine, then 50 percent of the cyanide is present as hydrogen cyanide. And hydrogen cyanide is a liquid, but it boils at about 75 degrees Fahrenheit and so a lot of it will evaporate and go up in the air, and so at all the mining operations, they keep the pH of their solutions very high.

Cyanide attacks the nervous system and you just suffocate if you get a dose of it. The cyanide process for extracting gold from ores is the oldest chemical process that has ever been invented, 110 years. No other chemical process is that old without major changes. In this hundred and ten years--the first cyanide gold plant in the United States was put in in 1889--there have been a lot of cyanide plants--thousands of them in North America, and we can only find two accidental deaths from using cyanide in gold plants in North America. This includes Canada, Mexico, and all the way down to Panama. And you can't say that for any other industry. It is a remarkable safety record. And there has never been anyone killed, that we can find, by a cyanide spill, or someone who doesn't work in a gold plant. There have been a lot of people who committed suicide by cyanide and there has been a lot of people who have been murdered with cyanide; cyanide used to be and still is relatively easy to obtain.

Swent: It degrades, doesn't it?

Shoemaker: In a solution. The nice thing about cyanide is that it is self-destructing. Under the influence of sunlight and the atmosphere--there is oxygen in the atmosphere--it very readily hydrolyzes and forms carbon dioxide and ammonia. For instance, in a pond that has cyanide in it, in the sunshine, cyanide from water in a pond will be gone in three days--something like that. If you spill it out on the ground as a solution, it will be gone in a couple of days and leave no trace.

If you get a small dose of cyanide accidentally, the symptoms are a lot like drowning. The average human--say, 160 pounds, something like that--it takes about 160 milligrams of cyanide--sodium cyanide--to kill a person. If you get less than 160 milligrams, you get sick, but you don't die, and the next day you are perfectly all right. There are no lasting effects if you ingest cyanide. If you get more, you die right away, but every cyanide plant has a cyanide kit that they use and it contains amyl nitrite and it's in an ampule you break under the person's nose and have them breath it and then you feed him oxygen, too--very quickly. If you get to a person that has ingested even enough to kill him, if you get to him quickly with a cyanide kit, you can save him.

But as I say, there's only been two in over a hundred years in the United States that have been killed by cyanide accidentally in a gold plant. No non-plant worker.

Cyanide is actually a fertilizer, and years ago they used to inject hydrogen cyanide into the ground to fertilize it, just like they do with ammonia today--inject gaseous ammonia into the ground; they used to inject gaseous hydrogen cyanide underground, as a fertilizer. The man had to wear a mask that drove the tractor, but it was used that way.

When I was working in the laboratory in Niagara Falls, we used flotation reagents which were xanthates. It was a very sticky reagent if it would get on your hands, and you couldn't wash it off with soap and water. It also smelled like the dickens and the only way you could get it off is wash your hands in a cyanide solution, and so we would keep a bottle of cyanide solution and wash our hands with that and then wash them with soap and water. There was no problem.

There had been cases of men wading through cyanide solutions in a plant, wading through a spill, and then wearing their wet shoes and socks for a day. There will be enough cyanide absorbed through the skin to make a man sick, but it won't kill him.

Swent: Well, then these stories of spies that have a tiny little thing hidden in their tooth, or something, that's not--

Shoemaker: Oh, yes, well, that may be true, I don't know. I've never been a spy.

Swent: Would that be enough to kill you?

Shoemaker: Oh, yes, 160 milligrams is less than the size of an aspirin tablet. But it is popularized in all these murder mysteries.

There's actually cyanide in your blood; cyanide is a part of the DNA molecule. You have cyanide in your blood. You can measure it with today's modern instrumentation. There's literally hundreds of plants that produce cyanide. That so-called loco weed that kills cattle contains high levels of cyanide. They will eat a lot of it. Cattle, when they break through a fence and drink from a pond--cattle only drink out on the range every two to three days. They walk for miles to get something out there in the desert of Nevada to eat, and then they come back to the water in about three days and they will drink ten, fifteen gallons at a time, and that's enough to kill them in a fomide pond or in a tailings pond.

And of course the cattle that are killed are always the prize cattle. They are very expensive when you reimburse the farmer for his thoroughbred cows. A human drinking a normal cyanide concentration from a heap leach or a tailings pond would have to drink about three liters of solution all at one time to get enough cyanide to kill him. I challenge you to even drink three liters of water all at one time. You can't do that.

Swent: One liter is more than most people can do.

Shoemaker: You see people who drink beer, and they can drink beer pretty fast--but cyanide tastes so bad, you don't want to drink it anyway.

But in fact, the Mining and Metallurgical Society right now is preparing a paper on cyanide. You might say it's a white paper or position paper, trying to counteract all this adverse publicity about cyanide. People up here in the Gold Country, where I live, claim that old mine tailings have cyanide in them. That is absolutely false. Cyanide long since has decomposed, and children have played in the tailing piles up there for years and years.

They also claim that there is lead and arsenic in the tailings. Well, there are some lead minerals and some arsenic, but they're insoluble minerals. If there was lead or arsenic or cyanide poisoning, probably every kid in Grass Valley would have died a long time ago. But no one has ever gotten sick from playing in those tailings up there and yet the Park Service at the Empire Mines has got all the tailings blocked off with yellow tape.

Swent: My children had a sand table in the basement filled with sand from tailings, and I sent them down there every afternoon to play for hours, in the sand, in the winter. [laughter]

Shoemaker: Yes, cyanide is a dirty word. In fact, even chemicals is a dirty word nowadays. And the misinformation these environmental groups put out is just absolutely false. One time, I was at a plant and I saw a man fall into the thickener.

Swent: Oh, my.

Shoemaker: That had cyanide solution.

Swent: You wouldn't recommend that.

Shoemaker: Well, the thickener was full of not only solution, but ground up ore and that was something horrible to drink. Oh, he just held his breath and he swam over to the side of the thickener and climbed out and went and took a shower, and he was never hurt at all. It just makes you so angry being in the mining business to listen to all of this terrible publicity about cyanide and any type of reagents and any type of chemical. Nowadays, everything--these environmentalists claim everything is poisonous. Anyway, I've been around cyanide for much of my life and certainly I'm still alive.

Swent: And in very good health.

Shoemaker: Oh, I think maybe we had better end on that note.

Swent: All right, Bob. We've covered a lot, and thanks.

Transcribed by Mim Eisenberg, Cathleen Young, and Amelia Archer
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TAPE GUIDE--Robert Shoemaker

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INDEX--Robert Shoemaker

ROBERT SHOEMAKER
MEMOIRS

TABLE OF CONTENTS

ROBERT S. SHOEMAKER

MEMOIRS

Started July 16, 1995

EARLY YEARS

I am writing this in the hope that my descendants will enjoy reading about the times in my generation and some of the things that happened to me during my lifetime. It would be interesting if at least one in each generation following me would do the same and add their contribution to mine so that succeeding Shoemakers will know more about their ancestors than I do of mine. Molly, Jean's and my daughter, put together an excellent book on the Shoemakers that goes back several generations and hopefully it will be passed along to those that follow.

Today, as I start this, I am 13 days past my 70th birthday. I was born on July 3, 1925 in the Mercy Hospital in Roseburg, Oregon, the second son of Samuel John and Lesta Elizabeth (Rhoads) Shoemaker. My brother, Sam Jr., was 17 months older than me having been born February 5, 1924. We first lived in a small house on Stephens Street which was part of the highway through town but my first recollection was of our house on East Lane Street where Dad had built quite a large house with a full basement about 100 feet long. The first floor had a large living room, a dining room, a kitchen, a breakfast room, a room we called the back porch, a laundry room, two bed rooms and a bathroom. The upstairs was unfinished. I was later told that the house and lot cost $5,000. The recollection that I spoke of was that I slept in a crib in my parent's bedroom until I was about 4 years old when it was replaced with a single bed. Shortly after that Dad had the attic made into two bedrooms, a bathroom with a shower and another small room. I had my own room then and Sam slept in the second downstairs bedroom. My other earliest recollection was that Sam continually punched, kicked and teased me, always out of sight of my parents. My life was pretty much hell until the day after I became 18 when I went into the army.

There was no kindergarten in those days and I went to Rose School which was named after Aaron Rose who the town was named after. He was the first settler there. Roseburg had 3 grade schools, each with six grades and only one class per grade, a Junior High School and a Senior High School. Rose School had been a High School and Mom was in its first graduating class. The year I was in the first grade was the year that the County introduced school busses to bring in kids from the country. There were two kids in my class that were 12 years old. There never was any discipline problem because if a kid acted up he was sent to the principal's office. He was also the 6th grade teacher. He had only the stump of his left arm (the rest of it was cut off when he fell into the saw in a sawmill) and he would make you lean over his knees and give you 6 to 10 whacks with a piece of garden hose. I was pretty much an average student, getting threes and twos (C's and B's). I was also pretty well behaved; I never got sent to the principal's office.

Recreation in those days consisted of walking the hills in the back of our house where we would pick wildflowers (and later camp out), going to the movies (they cost ten cents) if we had the money and in the summertime we would spend two weeks at the beach at Bandon, Oregon. Dad would go back to work at his store after the first week. One night a week in the summertime we would go to the band concert next to the city library. It was put on by the municipal band who were all volunteers. Grandfather Rhoads had a large wooden bin on his porch that held corn and wheat that he would buy in 100 pound sacks from the flour mill to feed the chickens he kept. He and I would sit and talk and eat handfuls of wheat. It was good and it sure gave my jaws lots of exercise chewing it.

When I was seven I started selling the Saturday Evening Post weekly magazine, from door to door mostly in the business district. They sold for five cents and I received 1 1/2 cents for each one I sold. I sold 70 per week and thus made all my spending money and had a savings account. When I was 13 I got a newspaper route. I delivered 80 papers a night and was paid 25 cents per night. If a carrier forgot a customer and they called in it was a "kick" and he was docked 10 cents. I got the job of carrying kicks and received the 10 cents. Sometimes the customer lived two miles away from our house so I rode my bicycle four miles for a dime. From that time on I bought all my own clothes and paid all other expenses. In High School I washed dishes and made ice cream at the drug store and worked at a dry cleaners checking in the clothes, brushing out the pockets and pants cuffs and helping with the cleaning. At 15 I was driving the delivery truck when the owner was drunk which was quite often. The Chief of Police, Erwin Short, knew I didn't have a license. He just told me to not run into anyone. The town's police car was a Nash coupe that didn't have any second or third gear. It would go about 15 miles per hour and it was that way all through World War II. The town had only 4,000 people and there didn't seem to be much crime.

Speaking of Nash coupes, the County had only one juvenile officer whose name was Agnes Pitchford. She was tall and gawky and always wore baggy tweed suits. She drove a Nash coupe which was equipped with a siren. She was a good friend of my parents too. At the dry cleaners one of our best accounts was the local house of ill repute which was called the Leˆon rooms. Correct pronunciation was Lay-on. The owner was Dorothy Winneger. Anyway, one day the boss was drunk and we had a large order of lingerie and negligees to deliver. At 15 I was pretty innocent but I had to make the delivery. The place was on the second floor of an old building across the street from the railroad and I went up the stairs with much trepidation carrying all those garments over my shoulder. I had my hand raised to knock when the door was flung open by a girl who was nude from the waist up and swearing at the Madam. The girl slammed the door shut and walked off down the hall. I had never seen a pair of those before and it wouldn't have taken much more to send me back down the stairs. I got up the courage to knock and Mrs. Winneger opened the door I said that Gordon (the owner of the cleaners) was sick and I was making the delivery that day. She said "Sick, Hell, he's still drunk from last night". It turned out that Gordon had been there the night before but Dorothy had kicked him out because she wouldn't allow drunks or married men in her place. Anyway she asked me in, sat me down, poured me a Coke and talked to me for about 15 minutes. She was a very good looking woman of about 40 and always dressed expensively and in the latest fashion. She had a daughter going to Vassar. Her husband was smaller than she was, always wore bib overalls and carried a bucket and a mop every time that I saw him. It turned out that she liked to go into Dad's store and talk classical literature with him. He didn't know she ran the Leˆon rooms and I didn't tell him. I made many deliveries there after that and she always gave me a Coke and wanted to talk. To get back to the point of the story, I went down the stairs feeling as guilty as if I had been there for the purpose the place was intended and when I went out the door who should drive by but Agnes Pitchford. I was scared to death she would tell my folks and they would make me quit my job but she never did. I ran into her after the war and she reminded me of that time. She said she saw my truck across the street and knew what I was doing but that she never saw a kid with a guiltier look on his face. She was a wonderful woman who straightened out a lot of kids who would have gone wrong if it hadn't been for her.

During the summer of 1942 I worked in a grocery store stocking shelves waiting on customers and delivering groceries in a 4 cylinder Ford van that didn't have the power to go up some of the hills in town. During my senior year in high school I worked Saturdays and Sundays as a section hand on the railroad, replacing old ties, raising and leveling track, tamping ballast and running the "speeder", a gasoline powered one cylinder car about seven feet long that pulled trailers loaded with new ties, new rails and tools. I got paid $0.53 per hour on Saturdays and time-and-a-half on Sundays. The war had started and high school boys were the only labor available. That kind of money made me practically rich. During that year there was a passenger train wreck some miles north of town and I worked on that for 48 hours with four hours off for sleep. The steam locomotive, the tender and some baggage and mail cars had rolled down a hill. They brought in two huge cranes to pull the cars and engine back up the hill and set them on the new rails that we laid.

I made $20.00 per week working six days a week, nine hours a day at the grocery store. I kept my job at the cleaners and also at the drug store during that year too. The ice cream that I made is worth mentioning. It was made in a 7 gallon copper can sitting in a wooden tub filled with ice and salt and the paddle was driven by a 3 horsepower motor via a flat leather belt. Vanilla ice cream was made from 5 gallons of whipping cream bought from a farmer, sugar and vanilla extract. For chocolate ice cream I cut down on the vanilla and added a syrup of Mother's Cocoa. The cost of a cone was 5 cents. I also made fresh peach and strawberry ice cream when they were in season.

The drug store was owned by Harold McKay and like most of the other stores in town was open on Saturday evenings to accommodate the farmers. The six or seven doctors in Roseburg would all congregate at the drug store on Saturday evenings and sit around the wood stove drinking Cokes or lemon phosphates and talking. Each of them had a chair he had bought with his name painted on it. They all liked to pull jokes on each other and anyone else for that matter. Every Saturday night a Salvation Army lady would visit all the stores on the street with her tambourine to collect money and she never missed the doctors in the back of the drug store. One night they decided to hide from her and they put me out on the sidewalk so when I saw her coming down the street I could come in and warn them. They hid behind counters, in the prescription room, behind the soda fountain and in the back where I made the ice cream and washed the dishes. When she came in the door Harold McKay took her by the hand and showed her where each doctor was hiding. Harold made each one contribute double that night. The event was even written up in the newspaper.

The dime store two doors down the street was owned by Noble Goettel, a well-to-do man who got that way by never spending a nickel if he didn't have to. He didn't have a telephone in his store and made and received all his calls at the drug store. Harold finally decided to put a stop to this. The phone was on the wall. The microphone stuck out about eight inches on a metal stalk, there was a little wooden desk under it, the receiver hung on a hook on the side of the desk and when you would pick up the receiver the operator would ask you for the number you wanted. (I should say here that Goettel was a nervous man and when he talked on the phone he constantly twisted the receiver against his ear like he was trying to screw it into his head). On this particular Saturday night Harold coated the receiver with lampblack and sent me over to Goettel's to tell him that he was wanted on the telephone. Harold took the receiver off the hook and put it on the little desk just as Goettel came in the back door. He picked up the receiver and said "hello" and the operator said "number please". He demanded to know who was calling him and quite an argument took place. All the time he was screwing the receiver around his ear and by the time he hung up in disgust most of the side of his face was black. As soon as he gave up and left the doctors were almost rolling on the floor from laughing so hard. Goettel never used the telephone again.

During the middle of my sophomore year in high school I decided that B's and C's weren't good enough and from then on I got all A's except in English where I got a C as I never did like English. The school had a rule that if you got A's in your four major subjects you didn't have to take final exams at the end of each semester. Since I didn't qualify I got permission from the principal to take another major subject and was therefore exempt from finals in all but English. The end of that story will be told in another chapter.

When World War II started I was in the middle of my junior year. I joined the Sheriff's Reserve which was composed of mostly World War I veterans. We took infantry training on weekends and also a course in unarmed combat. There were three or four State Police officers in the course and they took great delight in practically crippling me at every session. It was a lot of fun and I heard a lot of stories about the fighting in France by the old timers. There was a troop of cavalry stationed at the armory in Roseburg and their job was to patrol the Coast Range mountains to find the incendiary bombs that the Japanese sent over in balloons to start forest fires. Mom worked in the filter center at the armory to keep track of all airplanes and the balloons that the spotters in the mountains saw.

In high school I took chemistry, physics, algebra, plane and solid geometry and a friend of mine and I went to the school board and got them to put in a year of trigonometry which four of us boys took. The mathematics teacher was Alice Ueland who was a great teacher and who had taught Mom when she was in high school. I also took one semester of typing which came in handy later. I still type with ten fingers instead of two.

I should mention here that I always helped Dad at the Bookstore. From the time I was twelve I repaired all the fountain pens and did all the picture framing. When I was fifteen I repaired typewriters. I think I read every book in the store and there were a lot of them. I particularly remember the Horatio Alger stories and those about Tom Swift.

On Mom's side of the family, her parents were Elias and Alice Rhoads. Grandfather Rhoads was born in Illinois on August 30, 1854 and his parents moved to Iowa when he was an infant. He stayed in Iowa until he was 16 and then moved to Kansas. Grandmother (Dysinger) was born in Paulding County, Ohio on November 1, 1860. Her family moved to Humbolt, Kansas and she and Grandfather were married there on November 2, 1879. They owned a farm and had three children, Earl, Blanche and Lesta Elizabeth in that order. Grandfather visited Roseburg for six weeks in 1888 where Mom's uncle Will Dysinger had established a planing mill. The family moved to Roseburg in 1904 when Mom was 10 years old. (She was born on June 20, 1894). Grandfather bought a half interest in Uncle Will's planing mill and worked there for five years. Earl worked there also much of the time running a sanding machine. There was no dust collection and he suffered the rest of his life from severe asthma. During the depression of the 1930's he used to cut my hair for ten cents. The barber charged twenty five cents. Earl's wife Dorothy was a terrible shrew who didn't get along with the rest of the family or anyone else for that matter. They had one child, Ruth, who married but died childless. Blanche married Henry Snider and they had two children, Marjory and Don. Marjory married Louis Miles who worked at the post office until he retired. They had one child, Mary Jeanne, who died in her mid 30's. Don married but had no children. Henry worked for the Southern Pacific Railroad as an engineer and later as the roundhouse foreman. I used to ride the steam engines when he occasionally ran the switch engine or was making up freight trains with the big 24-drive wheel engines. Don also worked for the railroad all his life until retirement.

My first recollections of Grandfather Rhoads were after he retired. He had an old white horse named Dolly who pulled a wagon when grandfather took occasional jobs hauling various things. I can remember riding on the wagon and Grandfather letting me drive. He also kept two cows that I learned to milk. He had a magnificent white mustache and had a bad heart but he lived to be 88 when he died in May of 1942. Grandmother fell and broke her hip when she was in her mid-seventies. In those days all they could do was put her in a body cast for six weeks and hope it would heal. It did but her leg was about 5 inches shorter and she walked with a crutch for the rest of her life. She died at the age of 96 in 1954. She was a fine woman and used to tell me somewhat racy stories that horrified Mom. She and I used to pick blackberries and she would make juice which she bottled. She also bottled Concord grape juice from a monstrous vine beside the back porch. After my paper route I would sit on the porch and drink cold blackberry or grape juice and nothing ever tasted better on a hot summer afternoon.

Before I leave the Rhoads I want to tell about the coverlet that one of the children will inherit. In my papers is a piece of a Montgomery Ward paper sack and on it grandmother Rhoads has written "Made by John Rhoads father's father in 1753 out of wool off of sheep he raised & sheared & carded & spun & dyed & wove in his 17th year". Aunt Blanche has written on it "This is about the woven coverlet Aunt Elosie sent to me in 1938", and Mom has written "Elosie was John Rhoads' wife and John Rhoads was Elias Rhoads' (my father) [Mom's father] brother. Therefore he [the maker of the coverlet] was my Great Grandfather & your (Bob Shoemaker's) Great-Great Grandfather. Lesta Shoemaker Jertson. This year 1973 It is 220 years old" As of this writing it is 242 years old. Hopefully Molly will do some genealogical work on this side of the family. By the way. Grandfather's house on the southeast corner of Mosher and Fullerton streets is still standing and occupied but the barn was torn down many years ago.

WORLD WAR II
JULY 20, 1943 TO JANUARY 4, 1945

The first four months

Before I became 18 in 1943 I went to Portland and enlisted in the Army Engineers. I didn't know exactly what the Engineers did but I figured that I could learn something that might be of value to me and if I waited to be drafted I wouldn't have any choice. So on my birthday I went to the draft board with my papers from the Engineers and they started the paperwork to get me into the army. On July 20 I was given a railroad ticket to Portland for the next day's midnight train. Sam was home from his first year of college and on that day he decided to give me one last going over. That was the first time that I had ever won one of our fights and when it was over he had to stay in bed for three days. I had my physical exam in Portland, was sworn in and sent by train to the reception center at Fort Lewis, Washington all on the same day. I had to wait there for two weeks until they had enough men to make up a trainload that were all going to Camp Claiborne, Louisiana. While I was at Fort Lewis I got another physical, a bunch of shots, all my clothes and a haircut. I met a fellow who had re-enlisted and he talked me into volunteering for latrine duty with him the next day. We spent about two hours making it shine and then spent the rest of the day in the Post Exchange. All the other recruits spent the days shoveling gravel from one pile to another. On the fourteenth day I was put aboard a troop train bound for Camp Claiborne. The trip took seven days and as we took the southern route through Bakersfield, CA (where they let us off to have a shower at the YMCA) it was an insufferably hot journey. Camp Claiborne was a new engineer basic training camp and all the buildings were stick framed and covered with tar paper held on by laths nailed through to the studs. Each barracks held about 40 men. Besides the usual training of marching, rifle practice on the range, obstacle courses and bivouacs we dug a million foxholes, lots of tank traps, and strung many miles of barbed wire. The most interesting were the gin pole cranes we built of timbers as much as 100 feet long and the bridges we built with them. In 90 minutes we could erect a 100 foot mast with a 75 foot boom that could pick up a two ton block of concrete and all we had to work with was manual labor, ropes, block and tackle and timbers.

Basic training was cut short for reasons they did not tell us and I was given a seven day furlough. There was no way to get home to Oregon so I decided to go to Washington D. C. to visit my Uncle Carl Shoemaker. I didn't have enough money for the train trip so I telegraphed Dad for $100.00 and asked that it be sent to New Orleans where I picked it up at the telegraph office between trains. Uncle Carl was the secretary of the National Wildlife Foundation and he knew just about everyone in Washington. He took me to both the House and the Senate and I toured the Library of Congress, the Smithsonian Institute, the Lincoln, Jefferson and Washington memorials and even the National Art Gallery. Uncle Carl was an extremely fine magician. In the late 1920's he had been invited by President Coolidge to accompany him and a bunch of Congressmen on a boat trip to the Philippines where they were to sign the documents of independence. In Seattle, Uncle Carl knew the trip would be a long one so he bought a bunch of magic tricks and books on magic. He practiced in his stateroom until he was good enough and then gave magic shows in the evenings. He continued on with his magic and gave performances for presidents Coolidge, Hoover and Roosevelt and for both houses of Congress. When he would visit Roseburg (he had the first travel trailer I had ever seen and a third of it was taken up by his magic) he would perform in our living room for all the neighbors and the Shoemaker and Rhoads families. He got me interested and I practiced magic for many years. I used to give shows when I was traveling to other countries and they went over very well.

When I got back to Camp Claiborne I was immediately sent to Fort Ord, California where I joined, as a replacement, the 533rd Engineer Boat and Shore Regiment of the 3rd Engineer Special Brigade. The First Brigade had gone to North Africa and then to Sicily and Italy and the Second Brigade was already in the South Pacific. The Third Brigade had been training for a year in Florida. and needed replacements for men who had got sick or couldn't go overseas for some reason or another. There were three regiments in each brigade and ours had the 532nd, 533rd and 534th. Each regiment had a boat battalion and a shore battalion and each battalion had a headquarters company and three operating companies (A,B and C for boats and D, E and F for shores) I was assigned to C company. Each boat company had twenty, 56 foot landing barges which were used for landing troops on invasions, (we called them landings) and afterwards were used to haul cargo from ships to shore. They were also used to supply troops on isolated landing beaches when they couldn't be supplied by trucks or DUKW's (amphibious trucks). The shore companies were heavy engineers (trucks, dozers, cranes, graders, etc.) and each operated 8 DUKW's which were used for the same purposes as the landing barges. At this time I don't remember what the acronym DUKW stood for. It was pronounced DUCK. We knew we were going to be shipped overseas very shortly but we didn't know where. I called Mom and Dad and they managed to get enough gasoline ration cards so that they could drive to Monterey to see me. They stayed three days and I was able to get off the post in the evenings to visit with them. In the three weeks I was at Fort Ord we had rifle practice, machine gun practice, grenade practice and those who couldn't swim were taken to Watsonville to learn to swim at a pool at a high school. Although I had taken swimming lessons in the South Umpqua river in Roseburg several summers I never learned how to swim. Later I learned that I was like a few people who had a high density body and my specific gravity was almost exactly that of water which made swimming very difficult. I didn't learn to swim at Watsonville but I will say more later on how I finally learned how to swim. Lastly, at Fort Ord, we were all issued new clothing and it was all for cold weather, sheepskin lined parkas and other such gear. After a couple of weeks I was reassigned to F Company of the shore battalion which needed my talents more than the boat company did. At the end of three weeks we were put on a train to Camp Stoneman which was the Port of Embarkation near Martinez on the upper end of San Francisco Bay. We again received another dose of shots (it seemed that every time I was moved they gave me another series of shots, tetanus, typhoid, small pox, yellow fever, cholera etc.). We were also started on atabrine which was to protect us from malaria. We had to take one pill each day and they were foul tasting even though you swallowed them as quickly as possible. Our company commander stood at the end of the chow line in the morning and as we passed him we had to open our mouths so he could toss in the atabrine pill and then we had to chew it and open our mouths again to show him the result. It sure ruined breakfast. Eventually we were allowed to take them ourselves but some men didn't because of the taste and of course they eventually got malaria. If they had it bad enough they were sent home. Even some who took the atabrine every day got malaria Several who did get it died including one of my best friends.

On the fourth day we were loaded onto an automobile ferry and taken down the bay to San Francisco where the ferry tied up alongside the West Point, a passenger liner which was the America before the war. There were 9,000 of us and I was bunked in one of the holds where the bunks were twelve high with just two feet between them. To get to any of the upper ones you had to climb up the sides of the lower ones. The West Point sailed with no escort because it was so fast and it was believed because of its speed it would be almost impossible for a submarine to torpedo it. After four days we were told that we were going to New Guinea. We had only two meals per day and the line to the mess hall wound up and down and around for what seemed like a mile. We were on board on Thanksgiving day of 1943 and were served a turkey dinner with all the trimmings. The tables on which we ate were just two mess kits wide and we stood up to eat. On that day I was eating next to one of my friends who had been continuously seasick. He brought his helmet to dinner and put it beside his mess kit on the table. He would take a couple of bites and then vomit into the helmet. He ate all his dinner but it all ended up in his helmet. I got up on deck to get some fresh air as soon as possible or I would have been sick too. I never even came close to being seasick after that.

New Guinea

The trip took nine days and we landed at Milne Bay on the southeast end of New Guinea. Milne Bay had been established as the main supply base for the US forces in New Guinea. The Japanese had got as far south in New Guinea as Buna on the east coast and had started overland towards Port Moresby on the west coast. Port Moresby had a good port and was the seat of the Australian protective government for New Guinea. The Aussies had retreated from Buna but finally stopped the Japanese advance in the mountains. Then, with the help of the Americans who had arrived, they pushed the Japanese back to Buna which was finally taken after a very bloody battle. Then the Americans and the Aussies had made landings at Finchhaven and Lae north of Buna. Lae had an airstrip that was built in 1930 by Bulolo Gold Mining Company who used three German Junkers trimotor airplanes to fly eight large gold dredges piece by piece to a placer gold deposit at Bulolo, 58 airline miles from Lae. The Japanese feared that these airplanes would be used against them and with carrier based planes destroyed them. The American managers of the mine sank the dredges and evacuated their employees. After the war Bulolo Gold raised the dredges and started operations again until the deposit was exhausted in the 1950's.

We were at Milne Bay only a couple of weeks and spent our time getting equipped with our vehicles and engineering equipment. Some of us were put to work as stevedores in the holds of Liberty ships filling cargo nets with all kinds of supplies and food that were hoisted out and sent to shore in LCMs and LCTs (landing craft tank), the latter being 105 feet long and operated by the navy. We were then loaded on a Liberty ship and after a couple of days landed at Finchhaven. Liberty ships carried 9000 tons and were built by the thousands during the war. Bechtel (who I later worked for) and Henry Kaiser who was also an engineer-constructor ran the ship building yards on the west coast at San Francisco, Vancouver and Portland and with prefabrication techniques could put an entire ship together in as little as four or five days. Just as we dropped anchor the Japs put on a bombing raid to welcome us. All our ship got was pieces of shrapnel from near misses. A lot of the bombs landed on the shore as Finchhaven was being built up as an advance supply base for new landings further north. We had our camp in a coconut plantation and about the second day a coconut fell on the head of a friend of mine and killed him. Several of us were then given a pair of climbing spurs and a belt and spent three days climbing the trees and cutting off all the nuts with machetes. I was then assigned as a stevedore again and spent the next two months loading out cargo in ships holds.

At Finchhaven I met two of my Roseburg neighbors who were both four or five years older than me. They had had been to college and had taken ROTC and were both lieutenants. Don Wimberley was in Ordnance and Louis Dillard was at the Sixth Army headquarters. They both took me around the base, had me eat with them and took me in their jeeps to movies that were shown out in the open but were too far for me to walk to. I didn't see Don again until after the war but I ran into Louis again in the Philippines..

The Jap bombing runs rapidly decreased as their own airstrips at Rabaul and Cape Glouchester on New Britain and Madang and Saidor north of us on New Guinea were bombed by us. They continued to send over one plane every night at 2:30 but it seldom dropped any bombs.

New Britain

At the end of two months we loaded most of our equipment into a Liberty ship and a few dozers and trucks into the boat company's LCM's and made a landing at Cape Glouchester on the western end of New Britain. The navy had shelled the Jap installations for a day before we landed and there wasn't much opposition. We established beach control and then brought in the infantry. They cornered all the Japanese about a mile inland from our camp and it took about a week of hard fighting to kill them all. Only two or three surrendered.

I should mention here that at Finchhaven someone started to call me Junior, because I was the youngest man in the company, and I was never called anything else while I was in the army. Most of the men in my company were from Kentucky, Tennessee, South Carolina and Georgia. There were a few from New York and other states. About 25% couldn't read or write and I was one of about 10% who had finished high school.

For the first couple of weeks on New Britain I unloaded cargo from Liberty ships. It was so hot in the holds that we could only work every other hour. One of my friends operated the winches that lifted the cargo out of the hold but he was a mechanic by trade and wanted to work in the motor pool. On my odd hours when I wasn't in the hold he taught me how to run the winches and within a week I was better at it than any of the other operators so they moved my friend Barnes to the motor pool and I took his place. A Liberty ship had five holds, three forward of the deck house which contained the bridge, radio room, galley and living quarters and two aft. Each hold had two wooden (in later model ships they were steel) cargo booms at each hatch mounted and pivoted so they could be tied down horizontally when the ship was sailing or elevated at about a 50 degree angle when they were being used to unload cargo. Their upper ends were anchored with a cable to a steel mast assembly. Two steam driven winches had cables that went up to the end of the booms to snatch blocks (pulleys) and then down to a clevis where the cables joined and which also had a hook for attaching cargo nets or cables, the latter being used for large boxes or pieces of equipment. One boom was positioned over the center of the hatch and the other over the side of the ship. The booms were rated at five tons capacity. When a cargo net was loaded the winch lowered the cable into the hold where the men hooked the cable to the net. The cable from the outboard boom was slack while the cargo was raised but as the net approached the hatch the outboard cable was tightened so that the cargo traveled across the deck to a position over the LCM or LCT (a 105 foot open deck landing craft) which was tied up alongside. and then lowered. It was quite a trick to raise the cargo with one winch, smoothly and gradually transfer the load to the other winch to carry the load across the deck, and then lower the load to the boat alongside which could be going up and down as much as fifteen or twenty feet on the ocean swells. The lowering was done according to hand signals given by the signalman sitting on the ships rail. The winch operator and signalman always worked as a team. The operator stood between the winches and could look down into the hold. Each winch had a handle that went from full down to neutral and then to full up, and the speed of the winch was infinitely variable. There was also a foot brake for each winch. The winches also had low and high speeds which had to be set by the ship's bosun. Only the best operators were allowed to use the high speed. All five hatch crews were under a sergeant but the winch operator had total control as to how he would do his job. If the load wasn't rigged right he didn't have to pick it up. Only the beachmaster, a lieutenant or a captain could overrule a winch operator's decision. Men working in the hold or on the landing barge alongside could (and did) get badly injured or killed if something went wrong. Loose lumber was one of the worst things to handle as it had to be stacked in two steel slings and if it wasn't loaded just right it would slide out of the slings, drop back into the hold and fly all over. If the corporal in charge of the hatch crew insisted I pick up a load I didn't think was rigged right I would tell him to get his men out of the way and then give the line a little jerk when the load was four feet off the deck and it would slip out of the slings and the crew would have to load it all over again. They soon learned to load things right.

In 1944 ships were still pretty scarce and they towed from Australia a forty year old Italian ship whose engines didn't work which had been captured off Panama at the start of the war. It was about 12,000 tons and had six holds. Like the Liberty ships one of the hatches was equipped with a jumbo boom for very heavy lifts. That boom was made of wood that didn't look too good. The top of the boom was connected to the mast with a ten part block that would lift the boom up and down and a ten part block for hoisting the load. When the load was brought up to deck level the whole boom was moved beyond the ship's side by luffing ropes that were pulled by niggerheads (that word is not acceptable now), wide concave pulleys attached to a winch axle. Someone who didn't know any better had loaded a 32 ton tank into the hold with a shore mounted crane. I was working that hatch that day and because the boom didn't look good to me I refused to pick it up. The deck sergeant ordered me to pick it up and I still refused so after an argument he went ashore and brought out the beachmaster. He was a lieutenant I didn't like and he first asked me to pick up the tank. I told him the boom wasn't safe and that I would pick it up only if he gave me a direct order. He didn't want to do that because then he wouldn't have anyone to blame but he finally did in the presence of the sergeant who didn't like anyone who he couldn't give orders to. I had the hold cleared of men and also the deck cleared. I got the tank up about 30 feet to where its turret was above the hatch when the middle of the boom started to vibrate. Immediately I started to lower the tank back down but a ten part block moves very slowly. When the boom vibrated to about six inches to either side of its centerline it broke. I ducked down between the two winches while hundreds of feet of cable thrashed around over my head and wood splinters 4 and 5 feet long flew all over. The tank landed on top of the propellor shaft housing which slowed it down so that it only went through the floor of the hold and not the hull of the ship. They had to take it back to Australia to get the tank out. The lieutenant was so angry that he said he was going to have me court martialed but he backed down when I reminded him that three other men had heard him give me a direct order to lift the tank.

One night I was working a ship when an LCM pulled up alongside with a message for me to immediately come on the LCM to another ship. A winch operator named Paxton who wasn't very good had foolishly tried to load a loaded 6x6 truck into one of the small hatches which had only the two 5 ton booms when it should have been loaded into one of the large hatches with its jumbo boom. The truck weighed over 5 tons and the booms were wooden and old and didn't have any safety factor left. Paxton had got the truck up over the ship's rail and across to the hatch but the truck was too big to go into it and at that time Paxton froze at the controls with both feet on the brakes and the levers in the half-up position because the weight of the truck would pull the winches backwards unless he stood on the brakes. When I got there I replaced his feet and hands on the controls with mine one at a time and he promptly fainted. I got the truck back across the deck and down into the LCT where the truck had come from but Paxton never was allowed to run a winch again.

As I said before, DUKW's were often used to transfer cargo from ship to shore. They were useful that way because when they got to shore they could go right to where the cargo was supposed to go whether it be a ration, quartermaster, ordnance, or fuel dump or some other place. A loaded LCT approaching the beach would drop its rear anchor a couple of hundred feet off the beach and then run its bow onto the beach where they would lower the bow ramp. Trucks would back up the ramp and a crew of men (usually infantrymen) would load the trucks. LCM's didn't have an anchor, either front or rear. With calm seas an LCM could raise its ramp and back off the beach. When the surf got to more than three or four 4 feet the LCM would be thrown sideways on the beach and had to be pushed off with a D-8 bulldozer. This would often damage the boat so they always tried to quit work before the surf got too high. An LCT could pull itself off the beach until the surf got to eight or nine feet and then it had to quit. A DUKW, however could go through surf up to about 14 feet although once, as I will tell later, I took one out through surf that was 20 feet high. To get into a loading position alongside a ship an LCT, LCM or DUKW would hook its bow onto a cable hanging from the side of the ship, keep the propeller turning at idle speed and turn the rudder so it would hold the stern against the ship. The cable would hold the bow against the side too. However, with a swell running the boat or DUKW would continually be going up and down and it was quite a task to drop a cargo net or 18 drums of gasoline or anything else into an LCM or DUKW without sinking it when a heavy sea was running. There were always a couple of infantrymen in the cargo well to help guide the load down and unhook it and it was a dangerous business.

One of my friends, Norman Stenson, was a DUKW driver at the time. He was about 45 years old, from Milwaukee, WI and had been a silk stocking knitter before the war. They were loading a very large wooden crate into his DUKW one stormy night and the two infantrymen were both scared and awkward so Norman left the driver's seat and went back to help them. Unfortunately he got his little finger between the crate and the steel sling as the DUKW dropped out from under the load. All the skin and meat was pulled off the first joint of his finger. He drove to our medic tent and the doctor pulled the remaining skin up over the end of the bone, sewed it tight and bandaged it. A few days later he went back to the doctor to get the bandage changed and found that the stitches had pulled loose. The first joint of the bone was sticking out and the doctor said that it would have to be amputated but there was no hospital on Cape Glouchester so Norman would have to wait until we moved back to New Guinea in about a month. Until then he would leave the bandage off and let the bone dry out. Norman loved to play poker but he generally lost more than he won. He also had a habit of tapping his little finger on the table as he was studying his cards. Tapping the bone on the table unnerved the other players so much that Norman was a consistent winner until he got to the hospital at Aitape where they shortened his little finger by one joint.

Our food was always pretty good and I was called the pancake king of F company because one morning I ate fifteen mess kit sized pancakes. We never had to do KP in the kitchen because there were enough men who liked to work in the kitchen that they were permanent KPs.

We also had a company barber who wasn't much good for anything else except as a part-time officer's orderly. One day the Military Police came and took him back to Finchhaven where the 6th Army headquarters was. It turned out that he was sending military information (troop dispositions, ship names etc) to his wife using invisible ink in his letters to her. She in turn would send it on to Portugal and from there it went to Germany and to Japan. Tokyo Rose and a couple of other Japanese propagandists would often mention the names of outfits including ours in their broadcasts. Undoubtedly there were other spies besides him. Anyway, they court martialed him and brought him back to our company in New Britain where they picked out six men for a firing squad and shot him. We buried him in an unmarked grave in a swamp.

It was in New Britain where I almost didn't survive the war for the first time. One night at about midnight I was going to work and a DUKW took three of us out to a ship. It was raining as usual and I was wearing a rain suit. We pulled up to a Jacobs ladder which was made of steel and was hanging from the deck of the ship. The first fellow climbed the ladder and I followed him. Just as the third man was about to step on to the ladder the rope holding it broke. The third man pulled on the ladder so it wouldn't fall on the two of us in the water. The ladder landed on the front deck of the DUKW but it split the man's head open although it didn't knock him out. I went straight down and as I did I felt a rope going through my hand and I grabbed it. It was about six feet long and had been holding one of the rope fenders that covered the front edge of the DUKW's deck. I found that I had grabbed the last 6 inches of the rope. The swells were pushing me under the sloping front of the DUKW and I had quite a time pulling myself back up the rope. In the meantime the driver and the third man had pulled the first fellow out of the water and I heard one of them say to the injured man "Junior's a goner, and we had better get you to the medics". I couldn't yell at them because my mouth was full of water but I managed to reach up with one hand and waggle my fingers over one of the rope fenders. Luckily one of them saw my fingers and they pulled me out. They took me back to camp so I could get into some dry clothes and then I went back to the ship. It was that night that I vowed to learn how to swim or else.

About four miles inland from our camp there was an active volcano about 3,000 feet high and a small stream came down from its flank. The volcano smoked all the time but never did erupt. Some of our men had dammed the stream and built a road up to it so we could use it for a swimming hole. Strangely enough the water was ice cold. It took a while but I learned how to swim even though I would sink if I stopped moving my arms and legs. It is still an effort for me to swim although at one time I swam the North Umpqua river across and back, a distance of about 300 yards. I sure couldn't do it now.

With a landing at Talasea up the north coast of New Britain, Rabaul, a major Japanese base at the northeast end of the island was pretty well isolated. All its planes had been destroyed as was the airstrip and it was left to die on the vine as the infantry there was of no danger to the Americans. We didn't have but two or three ships to unload so we went to rebuilding the roads and bridges which was interesting work. We had to cut trees for piling, haul them to the bridge site, drive the piles with a pile driver attachment for a crane, fit the crossmembers on the piles and lay the decking. I cut into one tree and found it was balsa wood. I cut a log about eight feet long and twelve inches in diameter, put it on my shoulder and carried it back to where the other fellows were working. For a few minutes they thought I was Superman.

An interesting thing about the jungle was a vine called water root. This vine had several stems that grew, as I remember, up to 50 feet high. At the ground they were up to about two inches in diameter. When you wanted a drink you would cut off a two or three foot section on a slant and hold it vertically over your mouth. Fresh, pure water would immediately start to run out of the cut in a stream about a quarter inch in diameter. About a pint of water would come out of a two foot section of water root.

Aitape, New Guinea

At the end of August, 1944 we loaded all our equipment into the boat company's LCMs. and set out for Aitape back in New Guinea. We passed by the cone of an extinct volcano that was sticking up out of the water almost 1,000 feet. About a quarter of the cone had blown out and there was a beautiful harbor inside. The cone was so steep that it was uninhabited. The sea was very rough so the LCMs pulled into the harbor and we spent that night in the calm water in the cone. There were ten men and a 6 x 6 truck in the boat. I slept on the steel deck under the truck when it was raining and on the hood of the truck when it wasn't. We had to land at Boogie Bay on the coast of New Guinea to refuel and then went on to Aitape. The trip took five days and we landed on September 4, 1944.

After we got our camp set up our Company Commander called me in and asked if I would like to be transferred to the DUKW pool. There were two men assigned to each DUKW and the fellow I was working with was not only a terrible driver but he didn't know one end of a cresent wrench from the other. He was always damaging the DUKW and did his maintenance very poorly. In a couple of days they took him off, put him on a job where he couldn't do any harm, and gave me the DUKW. They also gave me an assistant driver named Sears. He was from Kansas and we painted OREGON LUMBERJACK on one side of the DUKW and KANSAS CYCLONE on the other. I got to meet a lot of fellows from Oregon that way.

Aitape was about a hundred miles north of Wewak, which was a very large Japanese base. The landing had been a couple of weeks before and the Japs had been pushed about 50 miles south to the Drinumor river where they made a stand. Our infantry was desperate for supplies as there were several small rivers between Aitape and the Drinumor and trucks couldn't get across them. Some supplies were getting to them by landing barge but the surf was so high that the boats were thrown ashore and couldn't get off. All along the coast south of Aitape there were only three or four miles of flat land back of the beach and from then on west there were very steep and impassable hills. The battle lines were then only about three to four miles long. When we got there we were immediately put to work hauling supplies to the front. Part of the time we had a road of sorts but most of the way we traveled on the beach and could make very good time until we came to one of the creeks or small rivers. We would use second or third gear in low range and hit the creek as fast as we could go. (DUKWs had five speeds forward in high range and five more in low range). The creek or river mostly flowed through the sand rather than over it and it was almost like quicksand. If you got slowed down by the sand being too fluid you couldn't shift down fast enough to prevent getting stuck. Some of the rivers were too wide to even try to cross on the beach so we would go out through the surf and then get back to land south of the river. The rivers were always shifting position and we could never be sure that because we got through the day before that we would get through a day later. Each DUKW had a winch with 200 feet of cable mounted on the rear and the cable could also be run forward through a hole in the dashboard and through an eye on the front of the DUKW. They also had an anchor that you could pull right into the sand to act as a dead man. Although the front lines were at the Drinumor the Japs would send platoons around through the hills and attack any supply vehicles. Later model DUKWs had a four foot ring mounted over the right hand seat that a fifty caliber machine gun could be mounted on and the gunner could stand on the seat and shoot in all directions. Ours didn't have the ring mounts so our weapons platoon would put a tripod mounted fifty caliber on the deck over the engine and hold it down with sand bags. The two men who operated the gun had to sit on the steel deck. On my second trip there were four DUKWs and I was the last. As we were traveling through a coconut grove that had all its trees cut down by the Japs to give a clear field of fire a Jap opened up on my DUKW from the rear with one of their light machine guns. The gunners swung the fifty caliber around and fired directly over my head. I was deaf for a week. The Jap wasn't too good a shot and only two bullets hit the rear end of the DUKW. Fortunately they hit the left rear because the gas tank was mounted in the right rear. On our way back some infantrymen told us that they had found the Japanese machine gun and two dead soldiers.

When we got to the Drinumor on our first trip the Japs had established a defensive line on the south side of the river which was about fifty feet in width. They then brought up reinforcements from Wewak and counterattacked back across the river. The river was literally running red with blood. The attack lasted two days and was unsuccessful. Our infantry didn't try to go any farther south as the Japanese had no way to get more supplies. Our infantry established a defensive line on the north side and held it for about a month when we transported Australian troops to the Drinumor to replace them. Wewak was isolated and left until the end of the war just like Rabaul and many other places.

The Australian air force had ten Mosquito bombers at Aitape which were used to bomb and strafe Wewak. For a carton of American cigarettes they would take a passenger along and I went twice. The Japs would shoot back with machine guns but the Mosquitoes, which had two engines and were made out of plywood were very fast and none were ever shot down.

Our DUKWs kept the Aussies supplied once a week and it was always fun to see how many of the rivers or creeks we could cross without getting stuck. When we did get stuck sometimes as many as three more DUKWs would get stuck trying to pull the first one out. The reason we always tried to go across the rivers was that the surf in that area was so high. At Aitape it was bad enough but to the south it was even worse.

DUKWs didn't last very long because of the beating they took. In the 15 months that I drove them I wore out three. We kept one of the old ones to haul garbage out to sea for disposal and each driver took a turn. One day I had garbage duty and the cargo compartment was completely full of garbage cans. Two men were assigned to load the cans and dump them when I got three miles out. The surf wasn't too bad, only about ten feet high and we got out through it without even getting wet. Coming back in, however, was another matter as the surf had increased to almost twenty feet. Bringing a DUKW in through high surf was a lot like riding a surfboard today. You would bring the DUKW in through the swells slowly and keep watching behind you for a wave that was going to break and curl over. As the swell built up it would raise the rear end of the DUKW and you would gun the engine to maximum rpms. For a while the DUKW would be at an angle of about thirty five degrees and going like hell. As the comber passed under you about ten feet of the DUKW would be sticking out in the air ahead of the wave. At that point you would drop the propeller rpms to idle and then wait for the next wave. Most of the time you didn't get wet but once in a while one of the waves wouldn't conform to the pattern and would break right on top of you and that is what happened that time. One of my helpers was holding on to the spare tire which was mounted on the rear deck with two, 1/2 inch bolts. The bolts pulled out and he and the tire went overboard. I threw my seat cushion to the other fellow and he tried to throw it to the man in the water but he was already too far behind us. I couldn't turn around in the middle of that surf so I headed for the beach as fast as I could go. As soon as my wheels hit the sand I turned around and went back out through the surf. I couldn't wait for a gap in the surf so I hit the first wave which was twenty feet high. Both of my bilge pumps were pumping water overboard at the rate of 200 gallons per minute. After ten minutes I gave up the hunt and went in to the beach and as soon as I got out of the water the engine quit. All the garbage cans were full and even after all that pumping there was still two feet of water in the bilges. Why the engine didn't quit sooner I will never know. If it had quit the waves would have rolled me under. As I got to shore the man was washed in too. I gave him artificial respiration but it was too late. A doctor arrived and pronounced him dead.

The surf at Aitape was by far the worst of all the places we were stationed in the South Pacific. If the surf was more than about eight feet high and you hit a wave at the slightest angle you couldn't recover fast enough to prevent the next wave from rolling you over. Just before we left Aitape they brought in a Negro DUKW company to replace us. They were the worst drivers in the world and one night I saw four DUKWs get rolled by the surf in a half hour. All the drivers were drowned.

The surf was composed of a mixture of sand and water, a perfect grinding compound, and consequently we drove about 80% of the time without brakes. We would slow down using the gears and only use the brakes when we were almost stopped. I had five accidents, the lowest number of anyone in our DUKW pool. Fortunately I never hurt anyone. One day I was driving down a one way road cut into the rocks on my left and with a drop-off into swamp on my right. A Jeep was in front of me and for no reason at all, stopped. I wasn't about to wreck my DUKW and I wasn't going very fast so I hit him. I pushed him down the road about twenty feet, knocked his spare tire over into the back seat and also knocked the metal bows that held up the canvas roof down around the driver. He crawled out and it was then that I found out that he was a Military Police lieutenant. He was so mad he was stuttering. He made me follow him to the Provost Marshal who turned out to be a full colonel with leather puttees and a swagger stick. I thought I was really in for it. The lieutenant wanted me court martialed. After about five minutes of him ranting about how I had wrecked his Jeep and how long I was going to be in the brig the colonel turned to me and asked, "what kind of a vehicle were you driving, Son?" I said "a DUKW sir." He then said, "you may go, Son" and then he turned to the lieutenant and said, "you dumb son of a bitch, don't you know that a DUKW doesn't have any brakes?" I was so flabbergasted I was still standing there and the colonel turned back to me and said, "I said you could go, Son". As I left the tent the colonel was still chewing out the lieutenant.

DUKWs weighed about eleven tons loaded and it took a lot of defensive driving to avoid hitting someone when they did something stupid. All the time we were in the South Pacific we had to drive on the left side of the road which didn't make it any easier. One of my friends, a boy named Squadrito, was killed when his DUKW was hit by a Caterpillar D-8 dozer blade. The dozer was being carried on a lowboy trailer and the corner of the blade cut him right in two.

DUKWs were very quiet on a dirt road. All the machinery was enclosed by the hull with the air intake for the engine being behind the driver and the engine exhaust pipe being through a grill to the left of the driver. One day I was driving on a dirt road and came around a corner to find a native woman standing in the middle of the road with her baby at her feet. Although the army employed a lot of native men as laborers it was a rare occasion when we saw a woman as they stayed in their villages back in the jungle. This woman had the longest breasts I have ever seen. As I stopped she threw her right breast over her left shoulder and her left breast over her right shoulder (they were only about an inch and a half thick and hung down to her hips), picked up her baby and ran into the jungle. One time I saw a native man who had elephantiasis in his testicles. They were the size of a soccer ball and he carried them around in a wheelbarrow.

Before I go any farther I should say a few words about the living conditions in the New Guinea areas. New Britain was the worst, partly because we were still learning how to live in the jungle and partly because of the conditions we encountered. On Cape Glouchester our camp was in a swamp. Drainage was very difficult even though we dug ditches around the edges of the tents. During heavy rains we would have as much as 6 inches of water on the tent floor which was dirt anyway. When we were cutting timber we would cut off the fan roots of the trees to make wood triangles three to five feet on a side and lay them on the dirt to make a floor. Our barracks bags had to be hung on one of the poles that was used to hold the mosquito net. If we would accidentally leave our shoes on the floor they would contain one or two land crabs that had crawled in during the night. Rats were also a problem and we would take a five gallon can and install a wooden teeter totter on one edge. The can was then put in a hole with the open top about level with the ground and we would tie some food on the end of the piece of wood. The can would be half filled with water. A rat would walk out on the stick which would then tip and the rat would fall into the water and drown. In the morning there would be so many rats in the can that the latest arrivals would merely jump out of it. We killed thousands of rats that way and eventually got them fairly well under control.

We also had centipedes that were 12 inches long and had a poison stinger in the tail. A sting from one of them would put a man in the hospital for a week. I saw one of them run across a man's back when he was in his cot and its feet left two red tracks. His back swelled up so bad that he couldn't work for ten days. We also had what we called wood roaches although I'm sure they weren't roaches. They were nine inches long with the body being as thick as a big cigar and divided into three pieces. Their eight legs were two inches long. They were harmless but I sat on one on my cot one day and tore my mosquito net apart trying to get off it.. There were also billions of ants and most of them had a bite like a bee sting. Also at Cape Glouchester we had a five foot lizard living in a tree over the cook tent.

The food was wholesome if not always tasty and one time we ate creamed corned beef three meals a day for thirty days straight. This wasn't because there was a shortage of food but because the army had moved on up north and the First Marine division had been transferred from Guadalcanal to Cape Glouchester for a rest. We were the only army outfit left and they just wouldn't give us any food. We shot and ate parrots and monkeys and one day we got a wild pig. One of our trucks was sent to the beach one day to haul a refrigeration trailer to a supply dump but he brought it to our company instead. We could keep fresh meat and other perishables in it and it would also make ice cream. We quickly painted out the Marine markings and kept it throughout the war. The DUKW operators would also commandeer fresh meat and butter and hide them in the rear hatch to take back to the company. I would trade butter for hot bread at the bakery. That sure was a treat.

We also built an eight hole privy and took it with us every time we moved. It was always the first thing we installed at a new camp. One of our backhoes would dig the hole for it. We also built a portable water heater and eight man shower unit which we kept with us.

Two of the worst things about the tropics were fungus and jungle rot. The fungus was caused by continual dampness and we would get it on our feet and in our ears. The treatment was to paint the fungus with potassium permanganate which was bright purple in color. Jungle rot was similar but far worse because the skin would slough off and take some of the meat with it. If you had it bad enough the only cure was to send you home to another climate. I had it on my scalp once and they shaved my head and painted the whole thing with permanganate.

On the first of December, 1944, we left New Guinea. We were told that we were going to be transported by an LSD (Landing Ship Dock) and were to load at about six o'clock in the evening. An LSD was about 400 feet long and is essentially a self propelled drydock. The rear of the ship is a door which is hinged at the bottom and can be let down by cables so that it is several degrees below horizontal. The ballast tanks are filled and the ship sinks far enough so that good sized ships could be floated inside. The process is reversed before the ship is under way. The well deck is 325 feet long and the rear 200 feet is open. The superstructure covers the forward 125 feet of the well deck plus about another 100 feet at the bow.

The LSD was anchored about three miles offshore and when our eight DUKWs got there we found that they were loading three 105 foot LCTs into it and there would be just room enough to put our DUKWs in a row alongside them. There was a heavy sea running and they were having trouble getting the LCTs in the well deck. They told us it would be at least three hours so instead of going back to shore we said we would wait on a small island about a half mile away They were to fire two green rockets when they were ready for us. The island was only a few feet above the water and was made of nothing but sand mixed with mud. As soon as we got ashore we were in trouble. Four of us got stuck as we landed and as the rest of us pulled them out some more got stuck. We would try to find a firm spot and winch them out and we would have as many as three DUKWs pulling on one. It took us six hours of constant work to get all the DUKWs free and lined up at the water's edge and just as we finished they fired the rockets. We had a slot just a foot wider than the width of a DUKW to go into and with the heavy seas it was not only very difficult but very dangerous. We almost lost two of the DUKWs. There were sleeping quarters for us on board and of course we ate with the crew. Since there weren't very many of us we got fresh water showers.

Philippines, Luzon

We were in convoy with several other ships and as we got close to Luzon in the Philippines we joined other convoys until there were 900 ships. We traveled up the west side of Luzon and as we got close to Manila we began having Japanese air raids. We were on the edge of the convoy and were both bombed and strafed several times. A kamikaze pilot crashed into the LST about 200 yards to one side of us. One afternoon I was standing right in the bow with the navy lookout when a torpedo missed the bow of the ship by not more than ten feet. We were looking straight down at it. It missed all the other ships too. I don't believe that any ships of the convoy were sunk although of course there were so many that I could see only a small portion of them.

On D-Day our DUKWs were dropped off first;, we had to back out of the well deck and luckily the sea was calm. When I put the propeller in gear there was a loud squealing noise; one of the propeller shaft bearings had frozen and the whole bearing race was turning in its housing. Fortunately it lasted until I got to the beach. They dropped us off eight miles out and we had to go right by the battleship Missouri. As we got past it they let go a broadside which almost blew us out of the water. That was the opening shot of the invasion. Then all the rest of the navy ships opened up on the beach as it was heavily fortified. The beaches we landed on were the same ones the Japanese had used when they landed on Luzon. There were three beaches, (Blue, Red and Yellow) covering about five miles from east to west. As we got within about 200 yards of Red beach the barrage was lifted inland. I had the beachmaster's tent and equipment on my DUKW and got it unloaded so I could pull up the floorboards of the cargo compartment and change the propeller shaft bearing. Fortunately I carried a spare and it took only about an hour. The infantry came in on that beach in LCMs right after me. On Yellow beach they came in on Alligators which were tracked and armored amphibious vehicles. Unfortunately there were sand bars about a half mile out that created quite a surf and the waves came over the back of many of the Alligators and sank them There was no way to save any of the men as they were drowned before our DUKWs could get to them. Blue beach had some good sized mountains just to the west and both Blue and Red beaches had a range of low hills about 400 yards to the south. Yellow beach had flat land to the south and was undefended and no problem for the infantry. On the other two beaches the infantry and tanks went south between the hills and unknowingly left a lot of Japanese in tunnels and dugouts on and behind the low hills. Also, to the west, the Japs had two 8-inch cannons on rails in tunnels on the back side of the hills. These would be run out to fire a round and then run back in to reload. The Japs on the low hills to the south would do the same with mortars. They kept both Blue and Red beaches under fire for three days as our infantry had all gone south towards Manila. One mortar round hit about 25 feet from my DUKW but it went into the sand before exploding and it only made four holes in the DUKW. I got them welded up at our motor pool and went back to work. My assistant driver had malaria come back on him while we were on the LSD so I drove alone for 38 hours straight when we got ashore. After a night's sleep he was better and we were on twelve hour shifts for the next two weeks.

On the second day I had just got to the beach with a load of ammunition when I heard a lot of antiaircraft fire from out in the bay. The navy was shooting at a Jap Zero which was heading right towards me at about fifty feet elevation and strafing as he came. I bailed out and tried to dive under the DUKW. The pilot tipped the plane on one wing as he got over me and I could see him plainly. The DUKW was hit twice and the load four times but fortunately the ammunition didn't explode.

On the next day I was hauling ammunition directly from a ship to the front lines about twenty miles south. A couple of miles from the front I was stopped beside a Jeep by a lieutenant. The man with him got out of the Jeep and climbed onto the DUKW. He was Lieutenant General Krueger, the Commander of the Sixth Army. He sat and talked to me for about ten minutes until the officer he was waiting for drove up. He had been an officer in the German army before WW I, came to the United States, enlisted in the army as a private, and rose to be a Leutenant General in charge of the sixth army. He was respected by the troops much more than MacArthur was.

On the third night the Japs counterattacked and I was assigned to take some of the command staff off the beach in case the Japs got to the beach. They got far enough north to shell the beach and I spent most of the night under the DUKW. Fortunately the attack failed but the generals were pretty worried. I got only two holes in the DUKW that night. The next day the infantry cleaned out the mortars in the hills to the south but it was another three days before they got the cannons in the hills to the west.

I kept hauling supplies to the front and was in Manila the day Santo Tomas prison was liberated. My folks had written me that old friends of theirs, the Stanley Kidders, were there so I went in and found them. They, as well as the other 5,000 people in that prison were like scarecrows. I went to see them several times before they were put on a ship for home. Both of their sons who were in the diplomatic service were with them in that prison.

Philippines, Mindoro

On the first of April, 1945 we left Luzon in a navy LST. We were sorry to go because we could get our clothes washed by the Philippine people. Four days later we landed on the island of Mindoro which is south of Luzon on the western side of the Philippines. The landing there was what was called a barracks bag landing as there was no fighting. The Japs had evacuated it after we landed on Luzon. We stayed there only five or six days as it was the staging area for the landings on Mindanao, the largest Philippine island. This time our DUKWs were put in LCMs (one to an LCM) and three LCMs were towed by LCIs, (Landing Craft Infantry). These were about 175 feet long and had narrow ramps that could be lowered on each side of the bow so that infantry could go down them to the beach or the surf as generally happened.

Philippines, Mindanao

On about April 20 we made a landing at Parang on the western side of Moro Gulf. Parang isn't on any of my maps but it is midway between Cotabato and Malabang. It was a small landing with only one division of infantry. There were no battleships, only destroyers to shell the beach and the hills behind it. There was a stone fort with a tower on it at the inland edge of the very narrow beach and it had a small cannon that was firing at us as we approached the beach. We also got a lot of rifle and machine gun fire but the destroyers knocked out the cannon and machine guns when we were about 200 yards from shore. The beach was very narrow, only about 150 feet and hills rose steeply from the back of the beach. There was only one way up to the flat land about 400 feet above the beach and that was a narrow cobblestone road in a gully. On the flat land above was a large coconut grove where we set up camp and supply dumps. Again I was loaded with the Beachmaster's tent and equipment and was first ashore. The infantry was held back for an hour while the navy shelled the Japs that aircraft had spotted for them. At that time our LCMs and the DUKWs brought in the infantry from the navy transports. We were already setting up supply dumps in the coconut grove when the infantry came through even though there was some rifle fire at us. As soon as we got one of our D-8 dozers ashore it was put to work pushing a second road down the hill to the beach as the existing road couldn't take two-way traffic. The cobblestone road was so steep that I had to use first gear and low range to get up it with a load. The new road was just as steep and as it was raining it quickly turned into mud. Going down it you had absolutely no control and some trucks turned over and rolled down to the bottom where we kept a dozer to push them out of the way. At the end of the week there was a huge pile of wrecked trucks and a couple of DUKWs. One time I turned a complete circle going down the hill. The beach was so narrow that it quickly turned into a massive jam of equipment and supplies brought in by the LCTs and LCMs from the Liberty ships. For the first two days we kept getting shot at in the coconut grove but couldn't figure out where the firing was coming from. On the third day I pulled into the ammunition dump and ahead of me I saw a trap door raise up and a Jap stick his rifle out. DUKWs were almost silent as the hull directed the gear noise upward and he didn't hear me coming from behind him. I speeded up and squashed him with my left front wheel. Then we knew where they were and the weapons platoon soon found two more. That was the end of the shooting at Parang.

Our troops had gone both north and south to Malabang and Cotabato to capture their airstrips and we had to supply both places from Parang. Most of the people on Mindanao were Muslims and many of them didn't like us any better than they did the Japanese. They saw the arrival of the Americans as a chance to break off and form their own country. We had to run in convoys with armed escorts to both of those towns because the Moros would capture single vehicles. One day I was number two behind the lead weapons carrier when a Moro jumped down a bank into the road and started to throw a grenade. He was shot down immediately and the grenade exploded in his hand. We didn't stop because there could have been more of them. I should mention here that we couldn't trust any of the Filipinos; they would steal anything they could get their hands on. We had to have guards everywhere there was equipment, clothing or food.

Philippines, Del Monte

On about July 12 we were moved to Del Monte on the north coast of Mindanao. We stayed only three or four days and set up camp at a pineapple plantation which was owned before the war by the Del Monte Foods Company. We sure got our fill of pineapples while we were there.

Philippines, Leyte

My assistant driver, Freeman, was sent home because he had malaria very bad and I got a new one named Savage. He was a replacement from the States and thought he knew everything. He had had some DUKW training but far from enough as he wiped out a brand new set of brakes in one shift the day after I had spent twelve hours installing them. Our camp area was overrun by frogs but they weren't as bad as the land crabs on New Britain.. The second night we were on Leyte it rained harder than I had ever seen it and there was six inches of water running through the tent. Then the wind started to blow and it blew the tent down. What a mess trying to put the tent back up with no lights. About August 12, 1945, we were loaded onto a navy troop carrier to go to Hawaii to train the 98th Division in amphibious warfare for the invasion of Japan. We left all our trucks, dozers and other heavy equipment on Leyte as we would get new equipment in Hawaii. The only vehicles we took with us were the DUKWs as they didn't think that new ones would be available there. Ours were in bad shape and we were due for new ones. The one I took was the third one that I had worn out. They sure took a beating. A few days out of Leyte they announced over the loud speaker system that the President would give a speech and then we heard him tell about the atomic bomb dropped on Hiroshima. Then two days later they announced that one had been dropped on Nagasaki. The next day, three days out of Hawaii, they announced that the war was over. The crew shot off every gun on the ship and I saw one crew who was firing a 40mm antiaircraft gun take off the gun barrel, throw it over the side, put a new one on and continue firing. The first one had got so hot that it wouldn't shoot any more. I think they shot off every flare also. It looked like a 4th of July celebration. They also flew every signal flag on the ship the rest of the way to Hawaii. That day I got a tooth ache and went to the ship's dentist. He said it was abscessed but he wouldn't fix it because I wasn't in the navy. I called him every name in the book while his two corpsmen who were standing behind him clasped their hands over their heads and shook them while they grinned. It was apparent that they didn't like him any more than I did. I suffered with the tooth ache until we got to Hawaii where I went right to a hospital at Schofield Barracks to an Army dentist. He said it was too late to save it and had to pull it. He also said he would file a complaint about the navy dentist with the inspector general. We were on that ship fourteen days.

Hawaii

We were in Hawaii six days and were able to get new DUKWs plus all our other equipment. We were very busy during the days getting the new equipment in shape, getting new clothes and physical exams. Every night they gave us a pass to go to Honolulu and I was able to drive my old DUKW wherever I wanted. I visited with my cousin Sue Mar, Uncle Carl's daughter, and also my cousin Doris who was in the women marines. She promised to get me a date with one of her friends but when I got there Doris had gone off with her boy friend and hadn't got me a date. That was typical of Doris. Sue Mar was wonderful and drove me to see all the sights On the night of the sixth day we were supposed to load onto an LST at about six o'clock but we found that it would be after midnight. Six of the fellows in the DUKW pool and I got into my DUKW and decided to go to Honolulu but they wouldn't let us out of the embarkation area. We weren't going to let that stop us so I drove into the ocean and across Pearl Harbor. It was dark and we couldn't see a navy cruiser coming until it was almost on top of us. It had to back water, blow its siren and someone cursed us over a loud hailer. Anyway we got ashore and went to a USO. As we were going back the navy shore patrol stopped us but they couldn't do anything to us as we were in the army. We got back to the embarkation point, the marine's base at Ewa, in plenty of time. My DUKW was the last vehicle to be loaded and would be the first to get off when we got to Japan.

Speaking of marines, I should go back and relate a couple of experiences with them. About two months before we left New Britain every bit of the army except our company was pulled out and sent someplace north. They were replaced by the first marine division which had been on Guadalcanal and had been relieved by the army. Strangely enough that whole division was attached to our Company rather than us being attached to the marines. Of course it was just a paper attachment and didn't mean anything but it didn't set well with the marines. We had to draw our rations from them and as far as they were concerned we were second class citizens. We ate creamed corned beef on toast three meals a day for 30 days straight. Four of us went hunting and shot some parrots which we cooked. The meat was as black as coal and tough as nails but it tasted pretty good. Then we shot a wild pig but as we were bringing it back to camp some marine military police caught us. Their captain said we weren't supposed to be shooting and took us back to our company and told our company commander to court martial us. He said he would but when the marines left he told us to cook the pig for the whole company. Since it weighed about 200 pounds we had a couple of good meals out of it.

On the fifth day of the landing at Lingayen Gulf on Luzon I was returning to the beach after dropping a load of ammunition. As I got to where I could see the beach I was stopped by some military police and was told I would have to wait for about an hour. LCMs were landing, dropping their ramps and marines were running up the beach in full battle dress, flopping on the sand and pretending to shoot. Some pretended they had been wounded and others pretended they were dead. There was a crew taking movies of the whole thing. I asked the MP who they were and he told me the first marine division. I told him I had to get to work and drove my DUKW right through all the uproar.

About a month later I went to a movie and there was a news reel with it. It showed the first marine division landing at Lingayen gulf on D Day and then my DUKW drove right through where all the action was. You could clearly see Oregon Lumberjack on the side and the three horizontal stripes (our indentification symbol) painted on the rear. All of our men who were at the movies made such an uproar that they had to stop the movie to restore order. Any time we wanted to give a marine a hard time all we had to do was to ask him how much was deducted from his pay for marine publicity.

As I recall the trip to Japan took about twenty days. LSTs traveled at about nine knots and it was a pretty boring trip. We slept in bunks about five high and of course there was no fresh water for showers, only salt water. They gave us salt water soap but the salt stayed on you and wasn't very comfortable. We stopped at the island of Saipan for refueling but they wouldn't let us off the ship. The harbor was full of sunken ships, both Japanese and American but much more of the former.

Japan

We landed in Japan on September 27, 1945 at Wakayama which was the port city for Osaka. In the harbor they opened the bow doors, let down the ramp and I drove down into the water with a general and three colonels. I drove them all over Wakayama and there wasn't much left of it after all the bombing it took. We found a big two story warehouse that was still standing and the four companies of our battalion took it over to sleep in. We were the first Americans the Japanese had seen and they all turned their backs to us as we would drive by as a mark of respect just like they did for their Emperor. After a few days only the older people continued to do that. I had been suffering for about three months from intense pains in my lower back and at Schofield Barracks in Hawaii the doctors told me that my kidneys had been shaken loose from their moorings and I had to stop driving a DUKW. Truck drivers often had this problem because their seats weren't built to absorb the shocks from rough roads in those days. Anyway, the company commander called me in and asked me if I could type and I told him that I had had one semester of typing in high school. He knew that I was one of the few that had been graduated from high school. The company clerk had been in the army long enough so that he had sufficient points that he could go home so I was made company clerk. The first sergeant and the clerk slept in the orderly tent just outside the warehouse so I moved in there. I was also promoted to T5, a corporal. The night that we got off the LST we found a fire hydrant on a street corner. We turned it on and found that it worked and although the weather was about forty degrees some of us wanted to get the salt off of us so we took off our clothes and had a bath. We about froze but we felt clean for the first time in three weeks. Our stay in Wakayama was only three days. Most of the time was spent in bringing equipment ashore

Our company was then sent to Kure, the big naval base. To get there (I went with my DUKW because no one trusted the new driver they had given me) a couple of trucks two D8 dozers and my DUKW were put on an LCT. Fortunately, as we found out later we were jammed in so tight that nothing could move around. Two of us slept in the DUKW under the tarp and the other eight men slept in the trucks. The day after we left a typhoon blew up and it sure was rough. We didn't dare get out of the DUKW and when it was over we found that the crew all thought they were going to sink. The sea coming over the side tore the steel door right off the pilot house.

Kure was the biggest Jap naval base. It had several big dry docks, one with an aircraft carrier in it and the other with about a hundred two-man submarines in it. The carrier's deck was bulged up where a bomb had hit it and the submarines were just about complete. A couple of us toured the carrier and the Japs showed us the whole thing. We also got into one of the subs. Kure was wrecked by bombing about as bad as Hiroshima. I was in Hiroshima several times and climbed to the top of the eight story newspaper building. It was one of the few reinforced concrete buildings and they were left standing although they were burned out and badly cracked.. The bomb had gone off directly over the newspaper building.We were never told about radiation but none of us were affected. Like most hazardous materials today their effects are much overblown. As soon as we got to Kure the men with the most time in the army started to go home. They had a point system for discharging you. One point for every month in the army, one point for every month overseas, five points for each landing, five points for each battle, five points for each child and five points if you were over 35 year old. I spent most of my time cutting orders for the men to leave. The first sergeant was one of the first to go and the company commander made me acting first sergeant. The order to that effect is in the last book of my letters home.

We moved up within about eight miles of Hiroshima to a place called Koyaura and we took over a Japanese army barracks. At that time there were only about 50 men left in the company. We had an earthquake one day and if I hadn't been standing next to a window and hanging on to the sill I would have been knocked down. The barracks was made of wood and it creaked and groaned with a lot of noise. A truck was in the yard outside the window and even with its brakes locked it hopped twelve feet across the yard. Every day we would visit a Catholic mission on the outskirts of Hiroshima to help them repair some of the damage. There were nine German nuns there. They told us they had been there ten years and had made only one convert but after the bomb they had converted a dozen Japs to Catholicism. One day another fellow and I took my jeep about twenty miles back into the hills and found a village. It had a post office and I wanted to get some Jap stamps for my Uncle Carl. When we went in the post office the two women thought we were going to murder them. We were the first Americans they had seen and they were screaming and crying and kneeling on the floor in front of us. We finally made them understand we wanted some stamps and they dumped the whole drawer on the counter for us to take. I took a handful and gave them some Yen. We were being paid in occupation currency.

On December 3, 1945, I left by train for Nagoya which was the port of embarkation. The trip took 24 hours and I was at the POE for seven days waiting for a ship going to Seattle. Finally we were loaded onto the Lurline, a famous US passenger ship. There were 7,000 of us aboard and I had one of the hundreds of bunks installed on the enclosed promenade deck which had no heat and even though the ship went quite a ways south we still about froze. We docked in Seattle two days before Christmas and the few of us who were going to Fort Lewis to be discharged were allowed off the ship at 1.00 PM but had to be back aboard at 11:00 the next morning as they were going to move the ship to Tacoma. I slept the first night in a Turkish bath. You could take all the baths you wanted (including the steam room) and had a cot in a cubicle all for $1.50. On Christmas day the local radio stations asked people to come down to the docks and take soldiers to Christmas dinner. There was a line of cars a half mile long and three of us went home with a man and wife who gave us a wonderful dinner and insisted that we stay overnight. I wrote them every Christmas for thirty years until they both had passed away.

The ship was moved to Tacoma on the last day of the year and on January 1, I was sent to Fort Lewis. On January 4th I was discharged and took the bus home, almost two and a half years after I had enlisted. The army did me a lot of good, much of it in learning how to deal with many kinds of people but mostly it matured me which stood me in good stead when I went to college. I never regretted a minute of the time I spent in the army..

HOME AGAIN, 1946

For a month I loafed, visited with friends and collected $20.00 a week unemployment benefits. I also went to Corvallis and enrolled in Oregon State College to start in September. At the end of the month I was bored to death and got a job with a contractor who was going to move a bunch of houses along Stephens street as it was the main highway through town and it was going to be widened. He had never moved a house before and we had to build all our moving equipment

House moving was a lot of fun and also a lot of work. I made $1.50 per hour which was carpenter's wages at the time. We got so proficient we could jack up a house in two days, move it in one day and lower it on to the new foundation in one more day. Those were the simple ones, the larger the house and the more complicated place we had to put it took more time. We moved 25 houses and thirteen detached garages. We even moved an outdoor rock barbecue which weighed five tons. After we ran out of houses to move we built logging camp bunkhouses that were ten feet wide and forty feet long and were built on two 16 inch square timbers about fifty feet long. We built them in Myrtle Creek, some twenty miles south of Roseburg and moved them about ten miles from Tiller on the Crater Lake highway. A week after we moved the last one a forest fire burned all thirteen of them. By the way, we had two crews of eight men each. I was the foreman of one crew and always drove the tow truck that pulled the houses for both crews.

There was one house I will always remember. It was owned by Maurice Newland who worked in a bank and had inherited a lot of money and property. He was the tightest man with a nickel that I ever knew. He owned a house that was about seventy-five years old and wanted it moved so he could build a commercial building on the lot. A woman about seventy years old rented the house and it was a real pig sty. Some time in the past a toilet room had been tacked on to the kitchen which was at the back of the house. There was an old clawfoot bathtub in the kitchen that was filled with a hose from the sink. The other foreman went to the house to see how we would do the job and when he looked in the toilet room it was so filthy that he tossed his cookies in the kitchen sink. When the crew went to jack up the house they took an ax and chopped the toilet room off. It was so rotten that it would have fallen off when they moved it. They then found that the back wall of the kitchen, which the tub sat up against, was rotted at the bottom and was only held on by the nails at the top. They got the house jacked up and somehow the neighbors where it was to go found out what shape the house was in and went to the sheriff to get an injunction to stop the moving. The boss found out about the injunction and told the crew to get on the road in a hurry. We had to move it about a half mile and we were just pushing it onto the new lot when the sheriff got there. It was too late then so he couldn't do anything. We were to set the house on 4x4 posts on concrete blocks but Newland was so cheap he was going to have his handyman nail the diagonal braces on the posts and install the skirting around the house instead of having us do it.

When the boss went to collect the fee, Newland kept stalling him off with some excuse or another. In the meantime the old lady moved back into the house even though it had no lights, water or toilet. About three weeks went by and one day it was clouding up to rain. We knew that the rain would soften the ground under the concrete blocks and the house would fall down. The 4x4s were about a foot high in the front and three feet high in the back. The boss sent me to the bank where Newland worked and I told him if he didn't give me the check right then I would make such a scene that the bank might fire him. He wrote out the check right then and I deposited it. That afternoon the rain came down in buckets and for some reason the old lady decided to take a bath, probably the first one in weeks or maybe more. She carried water in a bucket from the neighbor's house and heated it on a wood stove. After she got into the tub the ground around the blocks got soft enough and all the 4x4s leaned toward the back of the house. The neighbor happened to be watching as the house fell. She said the back wall of the kitchen swung out and the bathtub with the old lady in it rolled out into the back yard. Fortunately she wasn't hurt but she was screaming as she got up and ran back into the house. The neighbor said she never laughed so hard in all her life. Newland had to hire us to jack up the house again but the boss made him pay in advance.

A week or so after I got out of the army I found a lady who had a 1929 Harley Davidson motorcycle in her garage. I bought it for $100, tuned it up and rode it until the middle of the summer. I then sold it for $200 and bought an army surplus Harley that was almost new for $300.

OREGON STATE COLLEGE
(After I was graduated they changed the name to Oregon State University.)
SEPTEMBER, 1946 TO JUNE, 1951

Because I had registered in January I got assigned to Weatherford hall, a dormitory with only thirty students in it, all veterans. It was built to form an archway connecting two buildings each of which contained two dormitories. Weatherford was the third, fourth and fifth floors over the two story archway. They were hurriedly building several other temporary wooden dorms to house the influx of veterans. I shared a study room with another fellow and we slept on a sleeping porch in double decked beds. We ate at the Memorial Union cafeteria across the street. The GI Bill paid for all my tuition, books, supplies, and room and I also got $50 per month for clothes and incidentals. We had the highest grade point average of all the dorms and the fraternity houses. I was the youngest at 21 and the oldest was 45. We didn't tolerate any hell raising and about the only relaxation we had was on Saturday night when we went down town and had a good steak and a couple of beers. There was about an acre of lawn and trees in front of the dorm and occasionally some of the non-veterans, mostly 18 year olds just out of high school and generally fraternity members, would have a rally (or something just as noisy) on the lawn and we would water balloon them from our fifth floor sleeping porch balcony. We had an elevator that served the first floor lobby and the three floors of our dorm. There was also a concrete enclosed stairway from the lobby to the fifth floor. One night the Greeks held a big rally on the lawn and we really gave them a barrage. We had blocked the elevator at the fifth floor and locked the third and fourth floor doors to the stairwell. About twenty-five of them didn't think what we did was very funny and came running up the stairs looking for a fight. We met them at the top of the stairs with a fire hose and washed them all the way down to the ground floor. Using a fire hose was against the rules and we knew that the Greeks would report us to the Dean who always favored the Greeks anyway. The Dean showed up in about 45 minutes and we were all in bed "asleep". He got us up and accused us of using the fire hose and we denied everything. He had come up the elevator and hadn't looked at the stairwell yet. He also had a half dozen soaking wet Greeks with him. We then showed him that the stairwell was absolutely dry. He knew we were lying but couldn't figure out what happened. He even checked the fire hoses on all three floors and they were dry too. Finally, they all left and we didn't hear anything more about it. What he didn't know was that we had only a blanket on each bed. Every sheet, mattress cover and towel had been used to dry up the stairwell and were piled in the shower room and the wet fire hose had been traded for a dry one from one of the other dorms. We veterans could always get the best of the Greeks.

Because I liked chemistry in high school I signed up as a chemistry major and it was the best decision I ever made. Bill Caldwell, who taught general chemistry to freshmen and advanced inorganic and metallurgical chemistry to upper classmen, took a shine to me and was a great influence on my life. The summer after my freshman year Bill offered me a job working in the Champion mine, about thirty five miles east of Cottage Grove, OR. It was at an altitude of about 7000 feet with a very narrow and winding road to it. The last five miles was very steep also. The mine hadn't been worked since 1929 and at that time they mined copper and gold ore. There was a three story bunk house held onto the side of the canyon with cables, otherwise it would have been pushed into the creek below by the deep snow in the winter time. There was also a 100-ton mill and a large repair shop. The entrance to the mine was an adit that started in the repair shop and was the 1200-foot level of the mine. All the old workings were above that level and the 600-foot level daylighted on the other side of the mountain. The 1200 adit was 1500 feet long and ended at an internal shaft that went up to the 900 level. There was also a 1050 level which was where we were to start mining. Bob Tonneson, a mining engineering student, and I were put to work repairing the track and the four-inch compressed air line in the 1200 level and also cleaning out the drainage ditch alongside the track which was full of jellylike iron hydroxide. It was a wet mine and water dripping from the backs (ceiling) was highly acid from oxidizing of the pyrite (iron sulfide) that was in the ore. Air and water pipes and the track would be eaten up by the acid in a few days when water dripped on it and we had to protect them with rubber sheeting. This was in the days before plastic. To clean the ditch we used a barn scoop to shovel the glop into mine cars. When they were full we would give them a push to get them started and then ride the rear coupling out to the dump. It was downhill going out but uphill going back in and we had to push them all the way.

Bill's partner in the venture was Ken Watkins, a logger and miner. Ken's sixteen-year-old son Fred was a real pest and worked on the survey crew that was staking out new mining claims. When it rained he got his father to let him work in the mine with Tonneson and me. He was worthless as a helper and would goldbrick all the time unless we kept our eyes on him. One day we had filled three cars with glop and we told Fred to ride the first one out. I waited a couple of minutes and pushed off my car. The adit wasn't straight and as I came around a curve I found Fred standing at the back of his car which had derailed. I was going about ten miles an hour, there wasn't any brake on the car, and there wasn't room between the Fred's car and the walls of the adit for him to get around to the front. I yelled at him and he dove into the glop in his car head first. He didn't come back in the mine for several days.

When we got everything in the adit in good shape we had to install an air operated hoist called a tugger at the 1050 level and a 4x5 foot rectangular bucket in the shaft. Watkins was directing the work and we got the bucket set in its wooden guides and hoisted to the top but the guides were old and somewhat warped and it wouldn't go back down more than ten feet. Ken had me get a bucket of grease and a paintbrush and I got in the bucket to grease the guides as he lowered me down. The tugger had a forward-neutral-reverse handle and a brake handle. He forgot the tugger was in neutral and when he let off the brake I dropped out of sight in total free fall. He had enough sense to apply the brake slowly and finally stopped me just 10 feet off the bottom. My carbide light had gone out and the water raining down the shaft had got it wet and I couldn't re-light it. I yelled for them to pull me back up but the acoustics in a shaft or tunnel are bad because of the echoes and they thought I was injured. They came down the ladders in the manway next to the shaft to see how badly I was hurt. When they found I wasn't injured they went back up to hoist me up because I didn't have a light to see by. When I got out of the bucket my knees gave way and I sat down in a puddle of water.

When we got the 1050 level cleaned up we started drilling, blasting (in a 30-inch wide stope) mucking the ore into cars, dumping them down the ore pass beside the shaft, filling other cars on the 1200 level and tramming them out to the ore bin for shipment to the smelter at Tacoma.

Fred continued to make a pest of himself until everyone was sick of him. Our opportunity to teach him a lesson came when a rock hound club came up one weekend. One of their members was a sixteen year old girl that Fred took a shine to and got a date with in Eugene for the next weekend. A couple of us filled Fred with stories of all the horrible diseases he could get if he fooled around with her. We also told him all of the symptoms he would get and one of them was that he would pee blue. That weekend I went back to Corvallis and got some methylene blue, an indicator that is used in titrating solutions for acidity or basicity but is also a powerful blue dye. A couple of days after Fred had his date we got Myrt the cook to make a blueberry pie and dosed it with the methylene blue. I have never seen anyone look so worried as Fred was for the next two days when he finally got up the courage to tell his father. When he did we caught hell from his father. Bill Caldwell laughed until he cried. I just remembered that the above two stories are in an article which I wrote with Alan Taylor but we never tried to publish it. There are some more stories about that summer in it and it is also attached as an appendix.

During the summer of 1947 I started to date Jean Wiley who I had known for years. This continued until we got married on June 13, 1948, a decision I never regretted.

The 1947-48 school year was even more fun and interesting than the year before and this continued for the rest of my college years. I had Dr. J. P. Mehlig for analytical chemistry and he was a great teacher. I also had a Chicano lady English teacher who gave me hell because I wasn't doing as well as she thought I should. I agreed with her and told her that this was a holdover from high school and that I would do better. From then on I got nothing but A's in English too.

At the end of that school year Dad had loaned me $7,000 to buy a little one-bedroom house in Corvallis as with the great influx of married veterans there were just not enough apartments to supply the demand. Jean and I lived there for three years and sold it for what it cost. She had $300 when we were married and I used it to build a garage in which to put our 1948 Chevrolet which my folks gave us for our wedding present. I remember that the car cost $2,000. The wedding was quite an affair and as I recall there were 500 people in attendance.

That summer I went to school as I had one class of algebra to catch up and I also built the garage. Jean got a job in the office of the power company That gave us a little extra money to supplement the money the GI Bill gave us. In my junior year I took organic chemistry. The laboratory part of the course was three, 4-hour labs per week and that time was far from enough. We each had to prepare a large number of organic reagents from scratch and each was tested for purity by the teaching assistant. I teamed up with Sam Likens, Ken Baker and John Sacklin. Each of us would make a double amount of every other reagent we were supposed to make and share it with our team mate. Since our partners were working right alongside us we knew exactly what they were doing and finished up learning everything we were supposed to in about half the time. The other members of the class had to work nights and weekends to keep up. The teaching assistant never did catch on to how we got our work done in the three lab periods allotted.

Each year for the homecoming football game, all the freshmen Greeks would have to build a huge bonfire to light at the celebration the night before the game. The power company would set four poles in the ground in a thirty foot square and the freshmen would wrap cables around them to keep all the burnables inside the poles. They would spend days collecting trash all over Corvallis and have a thirty foot pile of trash to burn. The seniors would always try to burn it down but seldom succeeded because the freshmen would guard it with upwards of a hundred men. I was discussing this with one of my friends when I was a sophomore and decided to burn the thing down myself. It was easy. I got a big cardboard box, filled it with flammable trash and put in its middle an open bottle containing a two inch piece of yellow phosphorous covered with kerosene but with no lid on it. Then I took it down to the field where they were almost finished with the burn pile and gave it to one of the freshmen. He took it up the stairs to the top and dumped it in. A couple of hours later when the kerosene had dried off the phosphorous it started to burn. By then it was buried and even if it hadn't been it couldn't have been put out. I furnished the same device twice more before I left OSC.

The summer of 1949 I got a job in the analytical chemistry laboratory of the U. S. Bureau of Mines in Albany, Oregon. I assayed thousands of samples for such things as chromium, iron, calcium, nickel and other metals. It was a most interesting time and I learned a lot about applied chemistry. Albany was only ten miles from Corvallis and I commuted with a man who was a famous electrolytic zinc expert. He had a Model A Ford four-door and during the war had the caster, camber and toe-in removed from the front wheels so they ran perfectly straight. He claimed his tires lasted much longer that way but the car wandered all over the road. Each trip to Albany and back was an experience in itself not only for those who rode with him but for the people in the other cars we met on the road. During my senior year I worked at that laboratory on many Saturdays and Sundays when they needed extra help. Another way I earned extra money was to go from door to door asking for any kind of work from mowing lawns to splitting wood.

It was also during my senior year that I took a course in advanced analytical chemistry from Dr. Mehlig. With my experience at the Bureau of Mines I finished the semester's work in five laboratory periods and got every one of my unknowns right the first time. It was the first time since Mehlig had been teaching the course (about twenty years) that anyone had ever done that. Mehlig lived and breathed analytical chemistry and after he retired at 65 he worked until he was ninety in the agricultural chemistry department doing assays for the farmers who brought samples in for analysis. I corresponded with both Caldwell and Mehlig until they died. Mehlig was over 100 when he passed away.

Jean became pregnant with Steve during my senior year and worked at the power company until about a month before he was born on July 7, 1950. I was graduated with a 3.9 grade point average and decided to spend another year at OSC to get my master's degree in chemistry. The summer of 1950 we went back to Roseburg and stayed with my parents until Steve was born and then with Jean's parents until it was time to go back to school. Dad had bought a lot on the North Umpqua river about a mile above the dam at Winchester, five miles north of Roseburg. I persuaded him to let me build the house after a lot of argument. He had a contractor form and pour the concrete foundation which was ready at the time we arrived in Roseburg. We didn't have any drawings, only a picture I found in a magazine. Dad was my helper and as we didn't have any power until it was almost finished we had to saw every board in the place by hand. The only things we didn't do were the rock fireplace and chimney and the cupboards in the kitchen. I had a retired electrician lay out the work every day or two and did all the electrical work myself. The house was about 20 x30 feet and had a living room all across the front with a kitchen, bathroom and utility room at the back. Over those latter rooms were two bedrooms and the roof was a shed type that slanted upwards from front to back. My brother Sam who was in law school, spent the summer running our boat up and down the river, getting a tan on the dock and refused to help in any way on the house. Near the end of the summer I realized that I wasn't going to have the time to put in the septic tank before I went back to school and the house would be unlivable until the next summer so I asked Sam to dig the septic tank hole and the ditches for the leach field. He refused so I gave him two fists in the stomach and one on the jaw. He picked up the shovel and started to work. You couldn't buy a pre-cast tank in those days so I had to build a form and pour the concrete in place.

Back at school I got a teaching assistantship for Bill Caldwell that paid me $900 for the school year. I had one recitation class a week for freshman chemistry students and supervised two 3-hour laboratory classes a week as well as having to grade exam papers. I was still on the GI Bill so even with Jean not working we made out very well. During the last half of the year Caldwell took a sabbatical and I taught his fire assaying course as well. I had taken a metallurgical chemistry course from Caldwell, a water chemistry course from Mehlig and as much mineralogy as a Ph.D. geologist would take and ended up with minors in mineralogy and analytical chemistry as well as my major in inorganic chemistry. My master's thesis was entitled *Recovery of Electrolyte from Waste Aluminum Reduction Carbonaceous Pot Liners.* The process I developed was later used by all the aluminum companies.

My mineralogy, petrography and petrology courses were taught by Prof. Bill Wilkinson who had served in the army as a first sergeant in Panama before he went back to school in the late 1920's. In class he would very often resort to the army vernacular. One other chemistry major by the name of Wayne P. Van Meter took the mineralogy course; all the rest of the class were geology majors. Van Meter was quite a prude and one day when

Doc Wilkinson was using a few swear words, Van Meter leaned over to me and said "he's a crude fellow, isn't he ?" I got along good with Doc and after class I told him what Van Meter said. After that every time Van Meter got anywhere near, Doc would start to swear and take great enjoyment in making Van Meter squirm.

Doc was a real expert in mineralogy. The geology majors would bring in rocks they had found on the weekends and line them up on the lecture table before Doc came in to give his lecture. He would say good morning and then pick up each rock in turn and say "this is a piece of calcite, this is a piece of pyrite, this is a piece of hematite" etc. and he was never wrong. One day one of them brought in an old piece of brick that looked more like a mineral. Doc came in and started down the row of rocks like he always did. He said "this is a piece of calcite, this is a piece of pyrite, this is a piece of hematite, this is a piece of damn foolishness. You bastards thought you could fool old Doc didn't you?" After I went to work for Union Carbide I used to send him all kinds of minerals and finally stumped him with a piece of spessartite, a manganese garnet that looked like sedimentary jasper. He wrote me a note saying "you bastard, you finally got me. I had to put it on the x-ray machine to find out what it was." One of the things you had to do to identify some clays was see if it would stick to your tongue. One time in one of his tests he slipped in a piece of very old and hard bat guano. No one identified it even after they had licked it with their tongue. He got a good laugh out of that.

In June of 1951 I got my MS in chemistry, and Jean, Steve and I returned to Roseburg for the summer. We lived in the Winchester house and I laid a concrete patio, the walkway, the side and back porch concrete and built the carport and tool house. I also fought fire for the Douglas County Fire Patrol. I was put in charge of a crew of ten men and a bulldozer and was put out on the head end of what turned out to be a 50,000 acre fire. We put out spot fires from burning branches that the wind took over our heads. Some of them were three or four inches in diameter and twenty feet long. It was cold at night and the only way we could stay warm was to dig a hole in the ashes, lie down in it and then cover ourselves with warm ashes. We got paid $1.33 per hour from the time we left head-quarters in town until we got back or got to a rest camp. The longest I was out at one time was 63 hours.

UNIVERSITY OF WISCONSIN
SEPTEMBER, 1951 TO JUNE 1953

Oregon State had a policy that they wouldn't give a person more than two degrees. They thought a person should take one degree in another part of the country and it was a good policy. Doc Caldwell had gone to college with a professor at the University of Wisconsin so it was easy for him to arrange a teaching assistantship for me there. I had built a trailer out of the front axle of an old car. It was about five feet wide and eight feet long and had side boards about four feet high. We put all our possessions in it and in the Chevrolet and started out for Wisconsin at the end of August. My folks traveled with us in their car as they were going to drive to Washington to see Uncle Carl and Dad's relatives in Ohio. We went north to Montana and stopped at Anaconda where I had arranged to have a tour of Anaconda Copper's concentrator and smelter. Many miles of the highway through Montana and South Dakota were not paved at that time.

I had arranged to rent an apartment at a married-student housing project at Badger, Wisconsin, about 35 miles north of Madison. The buildings were all one story with eight apartments to a building. They were built to house people who worked during World War II at the rocket powder plant across the highway. The outsides were one layer of half-inch fiberboard and the inside walls were only three eighths of an inch thick, even the walls between the apartments. They rented us all our furniture, 50 cents a month for a bed, 10 cents for a chair, 25 cents for a pot bellied coal stove etc. I didn't want the coal stove so I bought an inexpensive oil stove. I also bought a 25-year-old Maytag washing machine with wringer rolls on it for ten dollars. The rolls were driven by wooden gears and a couple of months later one of the gears broke. I went to the hardware store in Baraboo where I got the machine and they got me a new gear for a dollar. During cold weather the walls of the apartment at the back of the kitchen cupboards would be coated with a half inch of ice and if we didn't keep a rug up against the bottom of the door the snow would blow under it and several feet across the floor. We had a one-bedroom apartment at first but on the weekend of the 45 below weather I moved us into a two-bedroom place.

The students were transported into Madison in school busses and I immediately got a job driving into Madison for 74 cents an hour. I would get up at five in the morning, sweep out the bus and after loading up leave at six-thirty. I drove an old White 41-passenger bus. None of the busses had generators large enough to run the lights and the heaters at the same time and the temperature that winter got down to 45 degrees below zero. I had a hole poked in the fire wall and got some heat off the engine. The snow would freeze on the highway and by winter's end there was a foot of ice on the road. Some of the drivers were not very good and wouldn't make it up one long hill. I never missed a trip and the fellows would line up to get on my bus because they knew I would always get them to school on time. I took the last bus out of Madison at ten o'clock in the evening and got home at eleven. That worked out well because as I was going to school and teaching during the day I had to do my research for my thesis in the evenings. Jean was very sick during her pregnancy with Janet and I had to give her shots with a hypodermic needle every day. I had to sharpen the needles myself and as her veins in her arms were small I often had to make three or four tries before I hit the vein. Baraboo was the home of the Ringling family and one of the Ringling sisters' home had been turned into a hospital. Janet was born there. One of the brothers' home was turned into an Elks Club.

At the University of Wisconsin I taught freshman chemistry and did my research for my Ph.D. for a professor by the name of Meridith Holt. During my first week they gave the Ph.D. preliminary exams I signed up for the exams in inorganic and analytical chemistry but decided to wait a year before taking the physical chemistry exam because I'd always had a tough time with that subject. During that year I would take three quarters of P Chem and knew I could pass the exam after that. Holt saw I was on the list to take the two exams and raised hell with me because no one ever took the prelims as soon as they got to Madison and since I came from a second-class school (he said) I would fail them. He said that not only would I have only one more chance to take them but my failing them would make him look bad. I said I thought I could pass them and refused to wait a year. The two exams I took were scheduled for four hours each on the same day. The inorganic exam was a breeze and I knew I got an A which was confirmed a couple of weeks later when the results were posted. I had always made a practice of never trying to cram before an exam and the night before for something to do I picked up my fire assaying book and got interested in re-reading the chapter on fire assaying methods for the determination of lead in ores. When I got to the analytical chemistry exam there was only one question and that was "Write in detail all the methods you know for the determination of lead". Thanks to Doc Mehlig at OSC I gave all the wet chemical methods for lead determination in about ninety minutes. I hated to walk out so soon so I wrote out all the fire assay methods also. Two weeks later Holt called me into his office to tell me that I had failed the analytical exam. He really read me the riot act for making him look bad and predicted doom and destruction for me. I couldn't figure out what I had done wrong so I went to see the professor who had given the exam. He told me that I had done the wet methods perfectly but he had failed me for giving the fire assay methods. I told him that fire assaying was just as accurate as the wet methods and I would be damned if I would let him fail me because he didn't know anything about fire assaying. The argument got pretty loud until Professor Melosch who had been head of the analytical department and was then professor emeritus, walked in and asked what all the shouting was about. I told him what had happened and he asked to see my blue book. He also told us both to shut up while he read it. After about fifteen minutes Melosch told the professor that he didn't know nearly as much chemistry as he should and that he was to change my grade to an A. I promptly went back to Holt and told him my grade had been changed to an A. He blew up again and I walked out in the middle of his tirade. Holt didn't like me for several reasons; he didn't think a graduate student should be married because it would interfere with his school work (he didn't know I was married when he agreed to take me on as a grad student), he thought that my bus driving to Badger would also interfere with school, and mostly he didn't like the idea of me minoring in metallurgical engineering, he thought I should be a pure chemist.

Minoring in metallurgical engineering meant I took courses at the School of Mines, only two blocks away from the chemistry building. Professor Shorey was the head of the department and we got along together fine.

Along in March of 1952 I was expecting to hear that my application for a research assistantship for the next year had been approved but I couldn't get a word out of Holt and I began to get worried because if I didn't get it I would have to teach and I wouldn't have time to do my research to get my Ph.D in 1953. My GI Bill money ran out at the end of 1952 and I would be broke at the end of 1953. Finally I talked to Doc Shorey about the situation and he offered me a research assistantship on the spot. He told me to not tell Holt until the appointment came through. The assistantship paid $900 per year, the same as a teaching assistantship. About a week later Holt called me in to tell me that my chemistry assistantship had come through and I told him that I would have to think about it for a week. He couldn't understand my not accepting right then and when I refused to tell him why he exploded again. A couple of days later Shorey told me that the research assistantship had come through and when I told Holt he told me I would be a failure when I got out of school, my quitting chemistry would reflect on him and a lot of other things. Our relationship for the rest of the school year was very strained to say the least.

In November my Dad had been diagnosed as having cancer of the brain and he gradually became paralyzed on his left side. By April of 1952 we knew he didn't have too long to live so I took Steve and went back to Roseburg. Jean was quite sick with Janet and couldn't make the trip. To get the money for the airplane ticket I called my brother Sam and asked to borrow $500. He said he would make me the loan but only if I signed a note beforehand specifying I would pay him 10% interest which was usury at the time. I also had to argue with Holt who didn't want me to go..

We flew from Madison to Minneapolis in a DC-4 and the took a night flight to Seattle in a DC-6. Steve wouldn't go to sleep at all. At Seattle we had to take a taxi to Boeing Field where we got a West Coast Airlines DC-3 to Roseburg via Portland and Eugene. When we got on the DC-3 the pilot told me the flight would be rough and he was right, it was one of the roughest flights I have ever been on. Steve would do nothing but sit on the floor with his arms around my legs and scream at the top of his voice. He screamed for ten minutes and then he slept the rest of the way to Roseburg. Dad was in a wheel chair by then but still had all his faculties about him. We stayed four days and then Steve and I flew to Portland and then to Chicago but had to take a train to Madison as the weather was too bad to fly. Dad died on May 16, 1952 but I didn't have the money and couldn't take the time at the end of the school year to attend his funeral.

Janet was born on May 10, 1952 in the Baraboo hospital.. Everything went well even after all the problems that Jean had had during her pregnancy.

Shorey offered me two alternatives, a master's in metallurgical engineering in two years or a master's with no designation in one year. The latter was because I was lacking in some of the sophomore and junior courses in engineering but I chose it anyway because I wouldn't have enough money for another two years of college. He really bent over back-wardS for me by giving me credit for a mining engineering course because I had worked one summer underground, and credit for a strength and materials course because I had been a house mover. He also told me to write for a summer job at two minerals research laboratories, Jones and Laughlin Steel in Negaunee, Michigan, and Cleveland Cliffs Iron in Ishpeming, Michigan. I was invited for interviews at both companies and had a job offer from Jones and Laughlin which I accepted. I was supposed to report to J&L the day after school was out but the day before they sent me a telegram saying that because of the steel strike they were cutting the work week to three days. I went to Shorey and told him of the telegram and he told me to send them a telegram declining the job. He then told his secretary to get Lloyd Severson on the phone. Severson was a VP for Oliver Iron Mining Co., the mining division of U.S. Steel, and had been student of Shorey's. His opening words were "Lloyd, I'm sending a young man up to you and you are going to give him a summer job". I could hear Severson objecting but Shorey said "don't argue with me Lloyd, he will be there tomorrow morning." "There" was Duluth, Minnesota. Shorey told me I had better get going as I shouldn't be late for work on my first day.

I managed to trade bus trips with another driver so I could get back to Badger at six that evening. With a few clothes I got in the car and drove all night, arriving in Duluth at seven the next morning. A service station provided me the facilities to get cleaned up and shaved and I arrived at Severson's office at eight o'clock on the dot. Severson's first words were, "So you're the kid I've got to hire". We talked awhile and he told me to report to Ron Morton, the manager of their research laboratory in the south end of Duluth. He put me to work on a research project to determine the rate of reduction of magnetite ore. That evening I bought a paper and found a rooming house that had a vacant room, and a couple of days later I found a furnished apartment in a big house right across the street from the rooming house. Friday night I drove back to Badger, packed up the trailer and brought Jean, Steve and Janet back to Duluth on Sunday.

The work at the laboratory was very interesting and I had a most enjoyable summer. Although Oliver's mines were on strike the laboratory worked full time. After I went back to Madison where I had rented a two-bedroom apartment for the next school year, Oliver sent me a check for $150 as a retroactive increase that they gave to all the salaried people after the strike was settled. That made my salary for the summer $300 per month which just got me through the school year.

At the School of Mines my major professor was Dwight Harris who had just received his Ph.D. from MIT. My research work resulted in a thesis entitled *The Determination of the Mineral Contents of Wisconsin Taconites by X-ray Analysis and Other Techniques.* It was the first time anyone had ever used X-ray diffraction to quantitatively measure the amount of a specific mineral in an ore and resulted in a paper I gave at the annual AIME meeting in New York in 1954. Many years later I was an expert witness in a lawsuit and Harris was the expert witness for the other side. My side won that case.

I was taking a course in flotation from Shorey and as he was ill fairly frequently that year he would ask me to teach the course when he had to stay home. I also filled in for another professor who taught fire assaying. I was the only one in the department besides Shorey who had the combination to the department safe and I also had the key to Shorey's office which I used to study in when he wasn't around. Some of the other professors weren't too happy about that. When my thesis was finished and approved I had to take the original to the university library to be put in their files. I also found that its title page was used to furnish the proper information for putting on my diploma. The librarian looked at the title page and said I had forgot to put the discipline title under the line which said Master of Science. I told her there was no designation and she said there was no such thing and I couldn't graduate with it that way. I couldn't convince her that she was wrong so I used her telephone to call Shorey. He confirmed that she was wrong but said it wouldn't pay to argue with her. He then said to borrow her typewriter and type the words "Metallurgical Engineering" under Master of Science on the title page. I did, she accepted the thesis and my diploma and all my records read Master of Science in Metallurgical Engineering!

In the spring of 1953 company recruiters were on the campus and I had already picked out three companies I thought I would like to work for: Hanna Mining, New Jersey Zinc and Oliver Iron Mining Co. Before I left Duluth the summer before Oliver had told me that I had a guaranteed job with them the next year. In fact they wanted me to stay on instead of going back to school. A U.S. Steel recruiter was on campus and I got an appointment with him because I wanted to keep my hand in with Oliver, however, he convinced me to interview in Pittsburgh which I did. I made interview trips to Cooley, Minnesota and Cleveland, Ohio for Hanna, Pittsburgh for U.S. Steel and Palmerton, Pennsylvania for New Jersey Zinc. Hanna wanted me to go to Riddle, Oregon where they were building a nickel plant but I wanted to go someplace more than 25 miles from home and turned them down. I liked U.S. Steel better than the others and was writing a letter of acceptance to them when Dwight Harris came into my office with Rush Spedden whom he had known at MIT and who the year before had been hired by Union Carbide to set up a minerals research division in their laboratory in Niagara Falls. Dwight had a class to teach so he asked me to show Spedden around the Mines building and to tell him about my research. At the end of the hour Spedden asked me to come to Niagara Falls for an interview for a job. This was on a Monday and I told him that I was writing an acceptance letter for another job and that it was due the following Monday. He asked that I not mail it for a couple of days and he went back to Niagara Falls that night. The next morning I got a telegram from him asking me to come up the next day. On Wednesday I flew to Chicago but because of bad weather in Buffalo I had to take the train which took until three in the morning and there was no bus to Niagara Falls until seven in the morning. I slept on the station bench, got the bus and arrived at the Union Carbide Research Laboratories at eight thirty. The interview took two days and on Friday evening they offered me a job for $375 a month which I accepted. The U.S. Steel offer was for $25 a month more. I chose the Carbide job because I would be doing research on all kinds of minerals and mineral processing whereas with U. S. Steel I would be working only on iron ore. It was a very good decision.

Our second daughter, Molly, arrived on May 11, 1953. She was born at the University Hospital in Madison. I couldn't pay the doctor and told him he would have to take payments for his $150 fee.

UNION CARBIDE RESEARCH AND DEVELOPEMENT
JUNE, 1953 to FALL, 1957

I didn't attend the graduation ceremony as I was too broke. The morning after my last class I started out for Niagara Falls, slept that night in the car and arrived on Saturday afternoon. My Dad had given both my brother and I memberships in the Elks Club when we were discharged from the service. I went to the Niagara Falls Elks Club to ask if anyone knew of a rooming house and there was a man at the bar who owned one and had a vacancy. It was seven dollars a week and I stayed there for the next week. During that week I rented a two-bedroom apartment and Friday night after work I drove straight through to Madison, about six hundred miles. As soon as I got the trailer loaded the five of us started back to Niagara where we arrived Sunday night. I had just enough money left to pay the $7.00 I owed at the rooming house, half of the first month's rent on the apartment and one week's worth of groceries. On Tuesday night I went to the Elks Club to pay the rooming house owner and he persuaded me to come to the monthly meeting which was being held that night. At the end of the meeting they had a drawing and I won $90 which was the prize. That was the biggest $90 I have ever seen in my life!!

The laboratory that had been given the minerals group was an old temporary building that had been built during WWII to produce enriched uranium metal for the first atomic bomb. For about a year my desk was right beside one of the vacuum furnaces that produced the metal. The whole building was radioactive but in those days the regulations weren't nearly so strict as they are now. The whole laboratory was composed of several buildings and there were about 100 engineers and 200 technicians working there, mostly on ferro-alloys and welding materials.

My first job was an interesting one even though it was a failure. The Electrometallurgical Company, a subsidiary of Union Carbide, had a large furnace plant across the street that employed about 1500 people. The plant made calcium carbide in four electric furnaces and various ferroalloys in 16 other furnaces. Electromet had other plants at Alloy, West Virginia; Marietta, Ohio; Ashtabula, Ohio; and Portland, Oregon. Electromet's Chief Metallurgist was Joseph Brennan. Another Carbide division was Haynes Stellite which had made armor piercing shells during WWII. Particles of tungsten carbide were mixed with cobalt powder, packed into graphite molds and baked in an electric resistance furnace until the cobalt bonded all the tungsten carbide particles together. During the process the excess cobalt seeped into the molds which eventually cracked and could not be used again. They had an enormous stockpile of these used molds and wanted to recover the cobalt from them as cobalt was a very expensive commodity.

Brennan had asked Spedden's help and when I got there he had already ordered a small ball mill, classifier and the most powerful magnetic separator that had ever been built. Cobalt was magnetic and Spedden was about to make a hero of himself by magnetically separating the cobalt from the graphite. When the equipment arrived I was given some space in the experimental furnace building, and some mechanics, welders, and electricians to put these all together into a pilot plant. Brennan was there every day watching the progress. When I got the plant running I could remove only about half of the cobalt and no matter what I tried I couldn't recover the rest. Brennan got more angry every day and after about three weeks told me to shut the plant down and go back to the laboratory. I felt pretty bad about it as I hated to fail in my first job but no one blamed me because it didn't work. Over the next six months I thought about the problem often and finally one day I ground up one of the molds and put it through a laboratory magnetic separator and then sent the nonmagnetic fraction to the x-ray lab. That gave me the answer. About half of the cobalt had been converted to cobalt oxide because of the high temperature in the furnace and it was not magnetic. Of course Spedden or Brennan should have thought of this and tested the material just as I had done. I went over to Brennan's office and showed him the results of the x-ray. He swore for about five minutes and finally said he wasn't swearing at me but at himself and Spedden for not thinking to do the proper testing in the lab before going to the expense of building a pilot plant.

After about seven months we were able to buy a house on 98th street in Niagara Falls with the help of the GI Bill. It had three bedrooms and a full basement and cost $17,000. Construction had just been started and the contractor finished it very quickly. I remember the interest rate was 3% and all I had to pay was the closing cost. There was no down payment. About a block away Bob Forgeng was building a house. He was superintendent of the packing department at the Electromet plant and we became close friends.

The plant did not allow any of the people from the research lab to visit the plant even though the research was the basis for all the plant's processes and products. The plant had been started there in 1898 to make calcium carbide which by adding water would produce acetylene. Carbide was made in an electric furnace and the first commercial power plant was put in at Niagara Falls by Thomas Edison. Anyway, I was curious about the plant and asked Forgeng if he would take me through it. He agreed and I put on some old clothes and a hard hat and spent the morning going all through the plant with him. Part of the carbide that was produced was made into four million cubic feet of acetylene per day and piped to other plants at Niagara Falls. As Forgeng and I came out of the acetylene generator house I saw a huge pile of gray glop which was being loaded onto a truck. Bob explained that the glop was the residue from the generators and consisted of lime hydrate and some unreacted limestone and coke from the carbide furnace. Because of my curiosity I filled one of my pants pockets full of this wet goo and when I got back to the lab that afternoon put it on a vanning plaque which is something like a gold pan. The lime hydrate, unreacted limestone and coke easily washed away with water and left a residue of metallic globules which I sent to the x-ray lab for identification. The metal was ferro-silicon, an alloy of iron and silicon and contained about 23 % silicon. The next day I had Bob get me a whole bucket of it and I recovered the ferrosilicon with a gravity concentrator called a jig. The glop turned out to be 17% by weight ferrosilicon. The iron came from the coke and the silicon came from the limestone and since the carbide furnace made only carbide and no slag, the ferrosilicon that was formed came out the furnace tap hole with the carbide.

Bob told the carbide plant superintendent about it and the word eventually got up to Joe Brennan. His secretary called and told me that he wanted to see me so I went over to the plant where he had his office. He was about as angry as a man could get because I had been in the plant and he said that both Forgeng and I could lose our jobs. Finally he calmed down and said, "Now what's this nonsense about ferrosilicon being in the generator sludge?" When I told him what I had done he told me to come with him to the generator building. When we got there he told me to take a sample and I told him to take it himself as I was probably going to be fired anyway and he wouldn't believe any results that he could get from a sample that I took. He got a bucket and a shovel from a nearby laborer and filled the bucket himself. Then he wanted to go back to my laboratory so I could show him what I had done. The jig was already set up so all I had to do was turn it on and feed the material to it. As he watched the clean ferrosilicon come out he kept saying, "Hot damn, son of a bitch, hot damn, son of a bitch." He then told me there was at least four or five million tons of the stuff in their dump and that the ferrosilicon in it was worth about $40.00 per ton. He asked what I would need to process the material and when I told him he took me over to one of the old furnace rooms where there was a jig plant that hadn't been used for over 25 years. It needed a lot of repairs but I told him I could make it work. He swore me to secrecy and said I would be hearing from him.

A couple of days later Spedden called me into his office and said he had been told to loan me to the plant for a while and asked me if I knew anything about it. I said I knew all about it but I couldn't tell him as it was a secret. Of course then *he* got mad at me.

Anyway, I went over to the plant the next day and was given a crew of men to put the plant in running order. Besides the bins, feeders and conveyors there was an old Woodbury jig, two 2-cell Harz jigs, an Esperanza drag classifier for dewatering the concentrates and a tailings pump. It took about two weeks to get the plant in working order and the day I started it up Brennan was there to watch. I had two operators, one of which, a fellow named Washington Gravel, is shown with me in the photographs on the next page as we watched one of the 2-cell Harz jigs.

After ten days I had the operators trained and Brennan, who came to look at the plant every morning, told me to go back to the laboratory and again cautioned me to not tell anyone what I had been doing. We were making the ferrosilicon concentrate for $5.00 per ton and selling it to another company in Niagara Falls for $40.00 per ton. The secrecy business was ridiculous but it was company policy and had to be observed. Spedden got angry again when I wouldn't tell him what I had been doing.

A couple of months later I was called into the office of the Manager of the laboratory. His name was Barney Field and he always wore Hoover collars. He told me to shut the door and then said that he had an envelope for me. He said he didn't know what was in it and that I wasn't supposed to tell anyone what was in it. He said he supposed it was something to do with "that damn foolishness over in the plant, whatever that was." The envelope had a check in it for $4500.00 and that was the net amount, the taxes had already

Robert Shoemaker examining a jig, Union Carbide Company Research Laboratories, Niagara Falls, NY, 1954.

been taken out. $4500.00 was my yearly gross salary!! Brennan and I got along fine after that and I worked with him a lot.

[Photo not included]

I got to work with a lot of different minerals there at the laboratory as the Union Carbide Ore Company's geologists were always sending in samples to test. It was a fine education. After a year we were given new laboratory space in the basement of the main building and got a 100 by 50 foot building to use for a pilot plant. I was able to get enough equipment to make any kind of a flow sheet that I wanted. I had two technicians and about a dozen laborers and we made quite a contribution to Union Carbide's capabilities.

There was a wildcat strike by the workers at the plant and the supervisors were trying to keep the plant running. I volunteered to help out and I was put to work tapping a carbide furnace. I worked 4 hours on-four hours off for seven days and by that time many of the workers were coming in over the fence and I was cut back to one eight-hour shift. The cafeteria was kept open by bringing in food through a tunnel from the Kimberly Clark plant across the street and they also brought in cots and blankets so we could sleep in a warehouse. When our clothes got dirty they just gave us new ones. All the strikers came back to work at the end of two weeks. They couldn't find out from the union what they were striking about so they were happy to get back to work.

After the lime hydrate-ferrosilicon incident Brennan got me involved in crushing, screening and materials handling problems in the plant. They only had furnace type metallurgists there and I was the first extractive metallurgist-ore dresser type that they had ever seen. About 80% of a ferroalloy plant is materials handling and a lot of that could be improved radically with a little ore dressing know-how. Electromet had just built a large new ferroalloy plant at Marietta, Ohio and the Niagara Falls engineering department who had designed the plant had built a large jig plant in it to separate high carbon ferrochrome from slag. They had made a lot of mistakes and the plant wouldn't run so Brennan sent me down there to fix it. There was a lot of work to be done and as bad as the plant was running it had to be kept operating at least part of the time. Changes had to be scheduled and I had to make many trips there over a year's time to get the plant so it would perform properly.

In search of a jig that would perform on ferrochrome and slag, both of which were very heavy, I met Ulysses S.(Skid) James who built about a dozen jigs for me and became a lifelong friend.

By the end of my second year at the research laboratory I was being borrowed so much by the development department that Paul McVicker, their manager, asked that I be transferred there. He called me in to his office to talk to me about it (that was the first time that I had met him) and as he talked he put a cigarette in his mouth but didn't light it. As we talked the cigarette kept getting shorter until it finally disappeared. This happened with a second cigarette and I was having a hard time keeping my mind on the conversation because I was watching the cigarette. I found out later that he ate about 30 cigarettes a day. Anyway I came out of his office with a $200 a month raise. I was already making $475 a month plus the two bonuses I had received. I was given a large office in the plant office but much of my work was at the Marietta, Alloy and Ashtabula plants.

Alloy was 35 miles southeast of Charleston and I stayed at a small company-owned hotel called the Glen Ferris Inn about five miles from Alloy. Across the road was a wreck of a jig plant that was about 50 years old and hadn't been used for at least 30 years. It had been built to recover metal from slag made at the Gauley Bridge plant next to the Inn before there was an Alloy plant. They asked if I could put the plant in running order, which I did. They gave me three operators, one of whom was called Sheriff. He had a star and the word Sheriff painted on his hat and he really thought he was a sheriff. Actually he wasn't playing with a full deck but he was a good worker as long as you told him what to do. He would work until you told him to stop and one day I forgot to tell him it was quitting time. I remembered at eight o'clock and went over to the plant to find him still shoveling slag. We made a lot of money out of that plant and I got another bonus for what I had done.

While I was at the laboratory I worked out a flowsheet for upgrading a manganese ore from a prospect that the Union Carbide Ore Company was developing in British Guiana (now called Guyana) and that resulted in a trip down there. Hugh Nicholson from the Ore Company and I flew down there, stopping at about six islands on the way down. From Georgetown, the capital, we flew in a Grumman Goose amphibian and landed on a river in the northwest part of the country. There was a boat about 25 feet long that had a brass single-cylinder diesel engine in it that was waiting for us. The crew was a white man and two Carib Indians. We started upriver about six o'clock in the evening and traveled for eleven hours. The boat had a spotlight and we could see the orange eyes of the crocodiles reflected in the light. Fortunately they were only about five feet long because every time we came to a rapids we had to get out and push. Where we finally landed was only seven miles from the exploration camp but the road was so bad that the Land Rover they sent for us took 14 hours to get there. There were nine geologists at the camp and each one lived in a separate little aluminum hut. We had to sleep under mosquito nets not because of the mosquitoes (because there weren't any at that altitude) but because of the vampire bats. The Ore Company's chief geologist, Olaf Rove, had visited the camp a couple of week before and had got his foot outside the net one night and a bat had sliced his toe and Olaf had almost died from loss of blood. We had brought a live sheep with us in the boat and it was tied under one of the huts and a light was hung over it to hopefully keep the bats away but they got to it and it was dead in the morning. Because of the heat the meat was spoiled in that short time. The geologists were all English and worked for the African Manganese Co. which was a subsidiary of the Ore Company.

African Manganese developed the mine and built a railroad to haul the ore to a river where they built a port facility. Two-thousand ton river boats then took the ore to Trinidad where it was transshipped to large ships which brought the ore to the United States. After the mine was exhausted some years later the port facility and the housing there stood idle for several years until it was take over by a San Francisco evangelist named Jones. He moved all his people to that port facility and called it Jonestown. Later he and over 900 of his people committed suicide there.

Before I leave Niagara Falls I must take note of the fact that our second son, Robert Scott, was born there on June 12, 1955.

I should mention that when I transferred to the school of mines at Wisconsin I joined the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME) as a student member. At the annual AIME meeting in February, 1954, Carbide sent me to New York where the meeting was held and I presented a paper based on my thesis from the University of Wisconsin. I was introduced to Herbert Hoover while I was there and he asked me questions for about 15 minutes. He was a mining engineer who made many millions before his government service for which he never accepted a penny. Since then I have attended every annual meeting but three. Membership in the AIME and its Society of Mining Engineers has been of tremendous benefit to me and to my career. I became very active in the organization and became Chairman of the Mineral Processing Division, President of SME and Vice President and Director of AIME. Among other honors I received the Richards Award *For Proficiency As A Leader Of Technical Innovation And Its Application To The Engineering Design Of Many Major Mineral Processing Facilities.* The award was a sterling silver vanning plaque with the above citation engraved on it. I also co-authored with Frank McQuiston three technical volumes published by SME and was the co-editor of two more. I also became a Member of the Canadian Institute of Mining and Metallurgy, a Fellow of the Institution of Mining and Metallurgy (Great Britain) a Fellow of the South African Institute of Mining and Metallurgy and finally the President of the Mining and Metallurgical Society of America.

UNION CARBIDE ORE COMPANY
FALL 1957

The trip to British Guiana was the start of my being borrowed from Electromet by the Ore Company and in the fall of 1957 I was transferred to the Ore Company's office in New York. During the winter of 1956-57 I had been running a pilot plant for the recovery of rutile, ilmenite, monazite and zircon from beach sands at Fernandina Beach, an island about 35 miles north of Jacksonville, Florida for the Ore Company. They insisted that I go home to Niagara Falls every weekend which was quite a commute. Every Friday afternoon at five o'clock I would leave Jacksonville for Newark, New Jersey, take the helicopter to La Guardia field on Long Island and then another plane to Buffalo. I would get home at two o'clock Saturday morning. On Sunday afternoon I reversed the process.

I was transferred to the Ore Company in the late fall of 1957. It was quite small, only about 15 people. We operated manganese mines in Ghana, British Guiana and South Africa, chromium mines in New Caledonia, and Rhodesia, two ferroalloy plants in England and two ferroalloy plants, two limestone quarries and two silica quarries in Norway. All of these operations were staffed with either nationals or in two cases English people from African Manganese Co. in England. Our overhead was very small and we made as much or more money than Union Carbide Chemicals, the largest division in the corporation. Carbide's main office was at 42nd and Madison in New York but the Ore Company had one floor in a four-story building on Madison between 40th and 41st. The Ore Company had been founded in 1914 by William Sneath who was also one of the founders of Union Carbide in 1898. He was president of the Ore Company until he retired but he owned 3% of Carbide's stock and he came into the office once a week while I was there until he was 90 years old. Another founder of Union Carbide was Major Morehead who used to come to Niagara Falls to sit in my laboratory and talk. Both Morehead City and Morehead College in North Carolina were named after him. He liked mineral processing and would fly up in the company plane, talk to me for three or four hours and then fly back to New York.

The Ore Company's offices were luxurious and each room had an oriental rug on the floor. My desk was made of mahogany and once a month a man came in to rub it down with rottenstone and oil. A woman came in once a week to clean the telephones and a man came in twice a week to shine our shoes. All this changed after two and a half years when we had to move into a new fifty-story office building that Carbide built on Park Avenue.

I worked for Tom Meek who was the chief engineer. He was a civil engineer and was another of several men who had a large influence on my life. He had two other men who worked for him, Hugh Nicholson, an ore dresser like myself, and Les Pullen a mining engineer. Progress had passed Nicholson by and he was often difficult to work with. Pullen was mediocre to say the least. However, Tom knew how to get the best out of everyone. I was kept so busy that for six months I didn't have time to look for a house and Tom insisted that I go home to Niagara Falls every weekend. I lived at the Engineers

Club a couple of blocks away from the office. Spedden was moved to the Ore Company shortly after I was and we really covered New York from one end to the other, the museums, a number of Broadway plays, the Guggenheim orchestra that played in Central Park and even Coney Island. Spedden was director of research and although he had the use of the minerals lab in Niagara Falls he never did very much.

I found a house in Plainview, about 25 miles out on Long Island, in a developement that was just being built. As I recall we paid $20,000 for it. It was a split level with three bedrooms and two and a half baths. The neighborhood turned out to be about 85% Jewish, 10% Italian and then there were the rest of us. Jean would drive me to either Bethpage, or Hicksville, both about 4 miles away, where I would catch the Long Island Railroad to Jamaica to change trains there to Long Island City just across the East River from Manhattan. I would then walk a block to the subway entrance and take the subway to Grand Central Station on 42nd street. Waiting for the connecting train at Jamaica and walking the block to the subway was purely hell in the wintertime as the wind howled and the snow blew. The railroad cars were overheated in the wintertime and much of the time I would ride standing up on the platforms at the end of the cars.

Early in my time with the Ore Company Tom Meek took me to Norway to the ferroalloy plant at Sauda, about five hours north of Stavanger on the southwest coast. It was put there by Mr. Sneath in 1917 and employed 1500 people. Electric furnaces require a lot of power and the operation had eleven dams and five power plants. Like Electromet, the Electric Furnace Products Co., as it was called, had many operations that could be improved with some materials handling experience I laid out a program for Tom and he told me he wanted me to visit the plant often. As a result I made four trips to Norway every year and the trips lasted for a month to six weeks until I left the Ore Company in January of 1962. Among the things I did were convert the ship unloading cranes from mechanical to electric operation, convert an old lime kiln to a manganese nodulizing kiln, install a manganese ore sintering plant, rebuild all the belt conveyors in the plant and a number of other things. The company owned a hotel about three miles out of town and they kept a three-bedroom apartment in it for visitors. I also looked after silica quarries on islands in Oslofjord, Trondheimsfjord, and at Narvik and a limestone quarry on another island in Trondheimsfjord. I also had to look after a second ferroalloy plant at Meraker east of Trondheim near the Swedish border. The guest house there was a magnificent place with a copper roof covered with two feet of sod that had a foot of grass growing out of it. The king of Sweden stayed there every year for a week to go salmon fishing. I had dinner with him one night and we had a very good time. He invited me to see his castle in Stockholm any time I was there. Some time later when I was there I called on him and although both he and the queen were gone I got a personally conducted tour of the castle by his secretary. The castle was a three story square building probably 200 feet or more on a side. There were four-foot-wide and eight-foot-high windows spaced about eight feet apart on each floor, The architect had made each one a slightly different size but the difference was so small that you couldn't tell it. I remember I was taken into the state dining room and it had one table about 125 feet long that would seat over 100 people.

Working around ferromanganese furnaces both at Niagara Falls and at Sauda I knew that they were subject to explosions because the manganese ore was quite soft and contained quite a lot of fine material which made dust in the furnaces. The dust would build up around the sides and up against the cover and had to be constantly pushed into the center where the electrodes were so it would react with the flux. Unfortunately sometimes it would build up too fast and then cave in toward the center where it would trap the carbon monoxide that was produced during the reaction. When that happened the carbon monoxide would ignite and explode. Ore, flux and molten slag would erupt from around the electrodes (there were three of them four to five feet in diameter) and sometimes the steel furnace shell would rupture and molten ferromanganese would drop into the sump under the furnace. The furnace shell was cooled on the outside with water that dropped into the sump after which it was pumped away. When the molten metal went into the sump it would form hydrogen gas which would produce flames up to 100 feet long on the tapping floor. One time I was standing on the charging floor around the top of the furnace when an explosion occurred. I ran and got out of the way of all the stuff that was spewing out of the top of the furnace and so did the two operators. The shell had cracked and the three men on the tapping floor were killed as well as the crane operator and another man who was 100 feet away and around a corner.

I was talking about this with Cato Eide, Sauda's Chief Metallurgist one day and he was telling me they had to run their ferromanganese furnaces at reduced power to prevent these explosions. I recalled that a friend of mine, Fritz McGonigle, a Vice President of Howe Sound Co. had told me about a manganese mine they had in Henderson, Nevda where they concentrated a ground manganese ore by flotation and then put the concentrates through a rotary kiln. The heat in the kiln fused the particles of ore together to make nodules about the size of a baseball. I suggested that we might screen out all the fine material in the ore and nodulize it in an old lime kiln at Sauda that wasn't used any more.

When I got back to New York I talked to Tom Meek about it and he told me to put a proposal together. I visited the mine in Nevada (it was called the Three Kids Mine) and also Anaconda in Montana where they had a similar manganese kiln. Each of these kilns had a boring bar which was a water-cooled pipe about twenty-feet long which could be pushed into the kiln to scrape off the buildup (called rings) from the inner wall of the kiln. The pipe had a large tooth or cutter that did the work. They also used an 8-gauge shotgun that shot a one-ounce lead slug to shoot off rings that they couldn't reach with the boring bar and also to break up large nodules that would sometime form and get as large as five feet in diameter.

The furnace people at Sauda wanted 1500 tons of nodules for a test and it wasn't worth the expense to buy a boring bar but they did let me buy a gun. It weighed over 100 pounds so we mounted it on a wheeled carriage that we could push up to the firing hood of the kiln and shoot through a small door. I went over to Sauda to run the test and we made 500 tons of nodules before we had to shut down because the ring in the kiln had got so big and long that we couldn't shoot it out anymore. We made two more runs (each was three days long) and got our 1500 tons. I shot the gun 5,000 times during the three runs and stayed in the plant for 72 hours for each test. I slept in a chair that I leaned up against a compressed air turbine that fed combustion air to the kiln burner. When the furnace people finished their test they found that they could use twice the power on the furnace that they had before. We then bought a boring bar and the kiln was run on a regular basis. I got a nice bonus for that job.

The kiln was fired with the carbon monoxide that was produced by the ferromanganese furnaces and a little fuel oil to make the flame luminous rather than a pale blue. The luminous flame transferred the heat much better. We got the CO free because it had been flared off on the furnace room roof ever since the plant had been built. Anyway, we used up all the available CO and the furnaces made so much more money that they wanted more nodules. The other two lime kilns were busy making lime so I suggested a sintering plant. We found a Swede who designed sinter plants and had him come to Sauda. In sintering, fine coke is mixed with the fine ore on a grate and a burner ignites the coke on the top of the mixture. Air is drawn down through the mix and the ore particles are fused together. This Swede could speak only a few words of English and it was decided that Sauda's Chief Engineer and I would go to Finland and then to England to see two sinter plants he had built there.

We flew from Stavanger to Oslo and then to Stockholm and took an overnight boat to Turku on the southwest Finnish coast where the first sinter plant was. The Swede (his name was Anders Holmberg) was with us and he and I spent until two in the morning going over his drawings on the floor of the boat's saloon. We had a terrible time conversing and we spent a lot of time drawing pictures to each other. He kept buying Aquavit and we were both pretty well sloshed when we finally went to bed. We went directly from the boat to the plant and spent most of the day there Fortunately one of the Finns spoke good English as most of the people in Norway, Sweden and Finland do. The children in all these countries must start English in the third grade and another language in the eighth grade. We were able to get a plane back to Stockholm and catch another to London where I had cabled for a car and driver. We got to London at seven in the evening and were met by our chauffeur He was driving an Austin Princess, a car the royalty used. It was about seven feet high and had wooden spoke wheels. It was too expensive for my blood so we drove with him to the garage where he got a Humber Hawk which was about the size of a mid-size car today. We had to go to Scunthorpe which is about 150 miles north of London. The car ran out of gas about midnight and the chauffeur and I pushed it about a mile and then a motorist stopped and gave us three gallons. We finally arrived at the Scunthorpe Hotel at two in the morning. There had been some kind of party there and the room clerk was drunk. He finally took us upstairs and dropped the chauffeur and Chief Engineer off at their rooms first. Then he took me to my room which didn't have a bath that I had specified in my cable. I hadn't had a bath since I left Sauda and I was determined to have one that night, drunk room clerk or no drunk room clerk. I told him I had cabled for a bath and I was going to get one or else. He said the bath was down the hall and I demanded to see the manager. He argued and I swore and finally he went down the hall talking to himself. In about ten minutes I heard a racket coming down the hall so I looked out the door. Here came the clerk with the manager right behind him wearing an ankle length night shirt and a long night cap with a tassel on it that hung down to his waist. He looked exactly like Ebenezer Scrooge. When he got to the door he stopped chewing on the clerk, apologized to me and took me to the other end of the hotel where he gave me a bedroom, a sitting room and a bath with a tub that was seven feet long, three feet wide and about thirty inches deep. The pipe going into it was two inches in diameter. That was the best bath I ever had. The next morning when I went to pay the bill they charged me two shillings more than the other room was.

On another of my trips to Norway our Chief Geologist, Olaf Rove, asked me to go to Finland to look at a chromite deposit at a place called Kemi at the northern end of the Gulf of Bothnia. I flew to Helsinki and then flew in a DC 3 to Kemi with a couple of stops along the way. The pilot and co-pilot stayed overnight and went to a party where they got drunk. They went directly from the party to the plane the next morning and when they took off they crashed and killed all aboard. I looked at the deposit and talked to the geologists but the chromite was very fine grained and had to be ground and concentrated. We weren't interested in that kind of ore as we had other mines where we could just scoop it up, ship it to the states or Norway and put it into the furnaces.

I had become acquainted with two brothers named Hukki, one of which was the mill superintendent at a magnetite and ilmenite mine about 150 miles south of Kemi. The other was a professor an the school of mines in Helsinki. They both had asked me to visit with them when I got to Finland. From Norway I called the mill superintendent brother and he was happy to show me his plant. I hired a car in Kemi and was driven to the mine of which I cannot remember the name. He put me up in the guest house, showed me the entire operation and I put on a magic show for the plant workers in the chemistry laboratory. Actually it was two shows as half of the people had to stay in the plant while the other half watched the show. This mine was many miles from the nearest town and all the people lived in company provided apartments and traded at the company store. I put on many magic shows all over the world and they certainly helped me make a lot of good friends besides bringing enjoyment to people and their children who were very isolated.

Hukki had arranged for a party that night at his summer cabin on a lake about ten miles from the plant and had invited both of his assistants and all three wives. He told me we would be taking a sauna, an experience I had never taken part in. His cabin was a room about 15 by 30 feet with bunks at one end, a huge fire place on one side, an eating area at the other end, a kitchen on the porch and a sauna with an entrance off the porch. This was about the middle of September and the weather was below freezing at night so when we got there he built a huge fire in the fireplace. The four of us men had five drinks of aquavit and the ladies had less while Hukki kept going out and stoking the fire for the sauna. When he came in after his last stoking trip he said the sauna was ready and he and his two assistants started to take off their clothes. Obviously I was supposed to do the same and what the hell, when in Rome do as the Romans do, so I took off my clothes. When we were all naked in front of the ladies we had to have one more drink before we went in to the sauna. Fortunately there wasn't room in the sauna or the ladies would have joined us. If you want a real unique experience try taking off your clothes in front of three members of the opposite sex while their spouses look on and at the same time try to keep up your end of the conversation. (They all spoke good English).

Anyway, we were in the sauna about twenty minutes when Hukki said it was time to go. He opened the door and the four of us ran about 75 yards to the lake and dove in. There was a skin of ice about a sixteenth of an inch thick on it!! None of us could get our breath until we climbed out of the water and then we ran back to the sauna. After another twenty minutes we ran to the lake again and then went back into the cabin to stand in front of the fire to dry off. Then Hukki poured us another drink before we put our clothes on. I wasn't embarrassed because after being in the lake I didn't have anything to show anyway. We had a fine meal that the ladies had prepared and got back to the apartment about midnight.

Hukki said I should take the opportunity of seeing a new zinc plant about 150 miles further south so the next morning he sent me in the company car about halfway where I was met by the car that the zinc company had sent for me. I had a most interesting tour of the zinc plant that afternoon and had a wonderful dinner at the guest house. Hukki's brother was there for a visit and also some of the company directors. Before dinner we all took a sauna but we took cold showers afterwards. The next day they sent me in the company car back to Helsinki.

About the second year I was with the ore company I called my mother and told her she was going to Norway with me. I had been trying to convince her for some time and she had got her passport but couldn't get up the courage to go. This time I already had the tickets and she couldn't back out. We flew to Amsterdam where we stayed a couple of days seeing the sights (I had been there several times before working with equipment manufacturers on things we bought for Sauda) and then went to Stavanger and Sauda. She had a great time there as all the ladies were very hospitable and they played bridge which was Mom's favorite pastime. I had to make a trip to Stockholm and while I was there I found that Tom Meek needed me back in New York. When I was traveling I had to cable Tom where I was going and cable him when I got there so he could not only tell Jean that I was OK but to be able to reach me if he needed to. I cabled Mom and had her meet me in Copenhagen. The Electric Furnace Products Company had people in both Stavanger and Oslo and they met her and saw that she got to the planes all right. We spent two days there and I took her to the Tivoli, a very large amusement park, museum and historical display as well as to the Royal Copenhagen China Company where she got to see how they made all their chinaware.

A few days after we got back to New York I told Mom I had to pick up a package at LaGuardia Airport and asked her if she wanted to come along which she did. When we got there I asked her to come in to the terminal as I would be awhile. When we got inside I walked up to the New York Helicopter desk and asked for my tickets. I hadn't told her she was going to ride a helicopter because I knew she wouldn't want to go. Anyway she couldn't back out at that time so she said she would go. She was hanging on to me for dear life as we took off but then she was trying to look out of both sides of the helicopter at the same time. We flew over Manhattan Island and on to the Newark Airport in New Jersey where we took a bus back to New York and another bus back to LaGuardia. She made a couple of trips to see us while we lived on Long Island and we pretty well covered New York and even took her to the top of the Empire State Building.

The manganese nodulizing kiln in Norway was such a success the Metals Company (they had changed the name from Electrometallugical Company) wanted us to build one in the United States. The Ore company operated a US bonded warehouse in Newport News, Virginia, because the port facilities there were excellent for unloading ore ships. The warehouse wasn't a building but about a hundred acres of flat land next to a railroad. We kept about a half million tons each of manganese and chromium ores there and loaded them out for shipment to any of the Metals Company plants.

Hugh Nicholson was made project manager and I worked on the plant design with Hans Boedlander, a vice president of Kennedy van Saun Company who would build the kiln. Nicholson pretty well left the kiln design up to me because he had never seen a kiln much less operate one. It was going to be 9 feet in diameter, 200 feet long and fired with natural gas supplemented by number six fuel oil to make the flame luminous. There was to be a steel tower at the feed end which held a 100-ton feed bin filled by a long inclined conveyor. At the bottom of the bin was a feeder and a belt scale which fed the ore into a twenty foot long by 24 inch diameter pipe sloped at 55 degrees down into the feed end of the kiln. This was the arrangement at Sauda as well as the two manganese kilns I had seen in Montana and Nevada. Unfortunately, Nicholson thought he ought to demonstrate his vast experience and told me that there should be a screw conveyor inside the pipe to be sure the ore wouldn't plug the pipe and to keep hot gases from coming up the pipe. I tried to explain to him that at that angle the ore would just rest on the flights of the screw and little or no ore would be fed to the kiln but he said he knew more about screw conveyors than I did and I was going to put in the screw. We argued about it for a few days and finally I told him that I wasn't going to put the screw in and that was final. He was so angry that his face turned purple and he went to Tom Meek and ranted and raved that he wanted me off the job. Tom called me in and told me that I had to learn how to compromise and that the screw was going to have to go into the design.

He was right, of course, and I said I would put it in. However, I asked him to keep Nicholson in New York until I had the kiln operating and he agreed. I had the foreman of the kiln department at Sauda come over to help me start it up when the plant was finished. We started it up in late morning on a Monday and from the start we couldn't get enough feed down through that screw. About every hour we would have to run water down the pipe to wash the ore out of it. We fought it for three days and two nights and at about ten o'clock on the third night I turned down the burner just enough to keep the kiln hot and had the operator I was training go to the maintenance shop and bring back an arc-air. The screw was made of stainless steel and had universal joints every two feet since it couldn't have any center or lower end bearings. We took the motor and gearbox off and used a comealong to pull the screw out of the pipe about thirty inches as that was as far as we could pull it in the room we had. An arc-air is like an arc welder except it blows air down the welding rod and was the only thing that would cut stainless steel. I would cut off a two foot piece of the screw and then pull another length out of the pipe. When it was all out I remounted the motor and the gearbox so that a six-inch piece of the screw shaft would stick through the back plate of the pipe and you could see the stub shaft turning except there was no screw on the end of it. We threw the pieces of screw down to the ground and I told the operator to go back and start firing the kiln as hard as he could. While he was doing that I got a front end loader and dug a hole about a hundred yards from the kiln and buried the pieces of the screw in the hole. When I was finished he had the kiln hot and we started to feed ore. In an hour we were making nodules at the design capacity of the kiln. I swore the operator to secrecy and the only other person I told was the foreman from Norway when he came on to relieve me. I remember now the foreman's name was Trygve Abramson.

The next morning I called Tom and told him the kiln was working and Nicholson could come down to see it. Nicholson came down that afternoon and the first thing he did was to look at the control panel to see if the operating light for the screw was on, which it was. He then went up the tower and he could see the stub shaft of the screw was turning so he assumed the screw was working fine. He then came to see me and gave me a twenty-minute lecture on how right he was and how wrong I had been. Tom came down a few days later and asked me about the screw and I told him not to ask.

About six months later Nicholson went to Newport News to supervise the laying of some new water pipelines and as he was watching the backhoe dig the trench for the pipe it dug up the sections of the screw. He came back to New York the next day and told me to come in to Tom's office where he cursed me for almost fifteen minutes. Finally Tom told him that was enough and he wanted to talk to me alone. When Nick closed the door Tom laughed until he cried. Then he told me that the only mistake I made was to not bury the screw a lot deeper.!!

During the construction of the kiln I had been going to Newport News for a day or two every week. In June, about a month and a half before startup (when the children got out of school) we moved to Newport News and stayed with Fred Battle who was the plant engineer. We stayed with him and his wife for a month and then rented a cottage on the beach at Virginia Beach for the rest of the summer while I got the kiln working and the operators trained.

In the winter of 1958-59 the Ore Company was approached by Lang Hancock, an Australian who had a bunch of mining claims in Western Australia. He later sold his iron ore claims which turned out to be extremely large iron mines and he became a multi-millionaire. At that time he had a manganese deposit that he wanted to sell and Nicholson was sent over to look at it. It was about 200 miles southeast of Port Hedland on the north coast of Australia and about 700 miles northeast of Perth on the southwest coast and was called Limestone Wells. The nearest habitation was at Roy Hill, sixty miles west of us, a cattle and sheep ranch where a man and his wife lived and had several aborigines working for them. The deposit was a big mesa that stuck up about 300 feet above the rest of the land around there. Nicholson had said it was a real good deposit but it might need some simple concentration. I found out much later that he had flown to Roy Hill and then been driven by Hancock to Balfour Downs (the name of the mesa). He hadn't been feeling well that day and had Hancock take him back to Roy Hill without even getting out of the car at the foot of the mesa. Graham Nelson, a geologist, and I were to be co-managers of the exploration party and Bill Brown, an English mining engineer was to run the drill crews. We also had an American chemist by the name of Rivers Powell. They all went to Australia (Perth) to get a crew of fourteen men, buy all the equipment we would need and get three temporary buildings erected on the site. When I was at Niagara Falls I had a heavy media concentrator built from sketches I had drawn from one I had seen on the iron range in Minnesota. I had improved it quite a bit so I had another built to ship to Australia. I wasn't needed for about five months. Tom Meek had called me into his office and told me I was to go. In those days, if the company told you to go someplace, you went. Later on while I was at Bechtel we had to plead with some people to go on an overseas assignment. If they didn't want to go there was no way you could make them..

Six or seven weeks before I was supposed to show up in Australia Jean and I put the four children in our 1957 two-door Chevrolet and drove back to Roseburg where they would stay with her parents six to eight months while I was gone. They went to grade school there on the site of the old Rose school both Mom and I had attended. After they were settled I flew to Vancouver and then to London and Stavanger. I worked at Sauda for a month and flew back to London where I stayed overnight. Then I took a British Overseas Airways Corp. (BOAC) Bristol Britania four-engined turboprop plane to Darwin, Australia, via Zurich, Beirut, Karachi, Delhi, Calcutta and Singapore. The plane had some sort of mechanical or electrical trouble at every stop and the delays lasted from two to eight hours. At Beirut they were having one of their wars with someone but they let us go into the terminal with a soldier with a machine gun walking behind every person. It wasn't easy to go to the men's room with a machine gun pointed at your back. Forty-eight hours later we landed at Singapore and after six hours they told us the delay would be twenty-four hours. It eventually was four days before they flew a Qantas plane up from Australia to pick us up.

During those four days they put us up at the Glen Eagles Hotel and kept one of their people there to give us chits for drinks or meals any place in town. I was with nine fellows from Australia who were returning home from the Cardiff Games in England. After the first day we got her to give us each a book of chits instead of having to ask her for one or two at a time. They took us for bus rides around the city, to the Singapore Swimming Club where the ten of us ate 105 sandwiches, (my friends were weight lifters and wrestlers), and to the Tiger Balm Gardens, a huge park built and maintained by the Tiger Balm Company that made Tiger Balm which was good for everything from the common cold to a broken leg. They are selling it here in Grass Valley now. BOAC even held a dance for us every night at the hotel and equipped it with stewardesses. After four days and nights we finally got on the Qantas plane and I was dropped off at Darwin. It had been a huge army supply and staging area during the war but at the time I was there it had decreased to a couple of thousand people and one poor hotel. I had to stay there two days because I had missed the twice weekly flight along the northern coast to several small towns and finally Port Headland.

I flew in a DC 3 and stopped at three or four places including Derby and Broome and got to Port Headland in eight hours. I had cabled the Esplanade Hotel three different times giving them a new time of arrival. When I got to the hotel it was a two story, sheet iron building with a bar and a lobby on the first floor. There was a balcony on the front which I found was used to put people on mattresses when the rooms were full because of the horse races which they held four times a year. The lobby was about 15 feet square and the desk was a wooden packing case in front of a closet and attended by an enormously fat woman. There were also three or four chairs and a large cage in which there was a white cockatoo about thirty inches high. Whenever you would walk by the cage the cockatoo would yell “Shut up ya lousy baaaastard”. I told the woman who I was and she said “So you’re the toff that cabled for a room”. Apparently no one had ever cabled for a room there before! The room cost a Pound ($2.40 at that time). When she told me the room number I asked for a key and she said “Ya don’t get no key”. I went up to the room and it was about seven by eight feet with two iron cots with thin mattresses and a wooden packing case for a dresser. I went back down to the lobby and told the woman that there were no sheets or blankets. She said “Ya don’t get no sheets, and blankets are in the closet at the end of the hall”. Later that evening they put another man in the other bed in my room.

The next morning two of the Australians of the exploration crew picked me up and we drove to Limestone Wells. The road was just dirt and the 200 miles took eight hours. I slept in the smallest building with Graham Nelson, Bill Brown and William (Bill) Shakespeare. He was the radio operator, purchasing agent and first aid man. The largest building held the bunk house for the crew, Shakespeare’s office, the assay laboratory and my mineral processing laboratory. The last building was the cook house. There was a small spring about a hundred yards away and we had a generator that furnished plenty of power. We also had an airstrip which was required by the government to land the Flying Doctor airplane which was a DeHaviland Heron, a two-engined turboprop that would have held about ten people if there were seats in it. We were on the Flying Doctor radio network as were all the inhabited ranches and a couple of small mines in an area of several hundred square miles. Each morning and evening the doctor in Port Headland would call every station and if anyone was sick he would prescribe medicine from a trunk full of medical supplies that we had to have. Of course everyone in western Australia knew what everyone else had and it was quite interesting to listen. There was also a two-bed hospital staffed by a nurse at Marble Bar a hundred miles north of us and the doctor visited there once a week. If a person was injured the doctor would fly out, pick him up and take him or her to the hospital in Port Headland. It had ten beds.

The next day I went out to look at the deposit. It had been pretty well trenched with a backhoe down to about twenty feet and by the end of the day I was convinced that it was so fine grained and interlaced with very fine silica that there was no way it could be concentrated to make good ore. I sent Tom Meek a cable saying so and he sent back a cable saying "Prove it". Proving it took three months and Graham and Bill both agreed with me. When Tom got our report he told me to come home immediately and let the others break down the camp and sell all the equipment.

Rivers Powell was a good chemist but somewhat unstable and after I had been there over three months we agreed that he was going bush happy so we sent him to Perth for a week to relax. We knew there was only about a month of work to be done and it would be impossible to get a replacement for that short a time. He had spent much of his time in a house of ill repute and nine days after he returned (the incubation period for gonorrhea) he asked to use the radio alone. Graham , Bill and I had a good idea what he wanted to talk to the doctor about and since the radio room was next door to my laboratory and there was only thin sheet metal between them the three of us listened in. He was trying to tell the doctor his symptoms without letting everyone else in western Australia know what he had. The three of us were rolling on the floor with laughter by the time the doctor got the idea and told him to come to Marble Bar the next day and get a shot of penicillin.

Union Carbide had an Eveready battery plant in Sydney and somehow they heard I was coming through there on my way home so they asked Tom to have me stop and look at a problem they had. They were crushing local manganese ore to blend with our high-grade battery ore from our mine in Ghana and they told me that their jaw crusher didn't seem to be working right. They had had it two years and even the manufacturer couldn't find out what was wrong. The plant's chief engineer took me out to see the crusher and said he would be back in half an hour. The crusher was running backwards so I found an electrician and had him reverse the leads in the motor starter. The crusher would then crush more ore in an hour than it had been crushing in two days. There was considerable embarrassment for the chief engineer.

I flew back to the States the next day. The plane was a Boeing Stratocruiser which took thirty hours to get from Sydney to San Francisco with stops at American Samoa and Honolulu. The first-class seats made up into upper and lower berths so the trip was not as tiring as the fifteen-hour non-stop trips are today in a jet. Four hours out of San Francisco the right outboard engine caught fire and fell off the wing. The pilot took the plane down to about 100 feet off the ocean and I helped the steward throw out all the baggage and the extra seats. (We didn't throw out my bag). We came in under the Golden Gate and Bay Bridges and landed safely. When Jean reads this it will be the first time she has known about it. I spent a couple of days visiting with Mom and then the six of us drove back to New York. I was gone for five months altogether.

Our London based African Manganese Company had a Chief Geologist named Tom Hurst. He had a very pompous attitude and looked like John Bull, the typical English aristocrat you often see caricatures of in the newspapers. He was Mr. Manganese in geological circles. He had written many scientific papers about what he called the very unique genesis of the manganese deposit in Ghana. He said that the black manganese ore was underlain by limestone and in fact the contact between the two was the width of a pencil line. No other deposit was like this, he said. One day when I was working at the laboratory in Niagara Falls we received from Ghana a very large box made of two-inch thick mahogany and it contained several hundred pounds of a pearl gray rock that looked exactly like limestone except that it had a much higher specific gravity. I had it X-rayed and it turned out to be rodochrosite, a manganese silicate that contained 33% manganese. It turned out that this was the "limestone" that Hurst was referring to and it threw all of Hurst's theories and papers into a cocked hat. At that time there was about a square mile of this "limestone" exposed where the high-grade black ore had been removed. Hurst had apparently never picked up a piece of it because if he had he would have immediately known from its heft that it couldn't be limestone. Hurst resigned from African Manganese and went into seclusion and died not too long later. We never found out who sent the sample of ore. We had many thousands of tons shipped to Norway where we nodulized the whole ore, not just the fines, and made silicomanganese out of it. I took the mahogany and used it to build a workbench top for my shop. Our son Scott has it now, about forty years later.

About the third year I was with the Ore Company, Tom told me to take Jean with me on my next trip to Norway at the company's expense. They even paid for the sitter who we hired to take care of the children. We spent a couple of days each in London and Amsterdam and then I worked a couple of weeks at Sauda. After that we took the car I had there and drove all over southern Norway. We were passed from one company guest house to another for ten or twelve days. On the way home we spent a couple of days in Copenhagen before flying home. We had a berth on the plane and became members of the mile high club.

While I was in New York I became acquainted with Frank McQuiston who was Vice President for metallurgy for Newmont Mining Co. He sponsored me for the Mining Club of New York which was a luncheon club and I ate there often. We worked together on several projects that Bechtel built for Newmont and when he retired to Napa, California we co-authored three books together. Two were titled Gold and Silver Cyanidation Plant Practice and the third was Primary Crushing Plant Design. We gave them to the Society of Mining Engineers for publication and the first two sold over seven thousand copies each. The third sold over two thousand. The SME made a lot of money from their sale. When we wrote the first one we thought SME would sell 300 and hoped they would sell 500 so they printed 750 as it wouldn't cost them much more. It went through four printings.

I had joined the AIME as a student member when I was at the University of Wisconsin and about the second year I was at Niagara Falls I was put on one of the committees of the Minerals Processing Division of the SME. The committees solicited technical papers from authors to present at the session at the annual or fall meetings of the SME. When I was in San Francisco I was made a committee chairman and with Jim Forceia we put on the first Panel Discussion that SME had ever had. We got four well-known plant operators for the panel who were experts in crushing plants. We prepared questions for them and also had them questioned from the floor. The room was packed with over 200 men and we ran an hour overtime (four hours) before we had to stop. I had my secretary make a verbatim transcript and was so busy that I didn't get around to working on it until about six months later. Fortunately (or unfortunately) I got a case of hepatitis and after being in the hospital for a week had to spend the next six weeks on my back at home. I got a tape player and checked the transcription with the tape. Some of the voices from the floor were barely audible and some people had foreign accents. I spent three weeks on it and my secretary made seven or eight drafts before it was finished. Anyway, Mining Engineering Magazine published it in two issues and I got the award for the best technical paper of the year.

I mentioned that the sinter plant we put in at Sauda used fine coke to mix with the manganese ore fines to supply the heat to fuse the ore particles together. The heat also removed oxygen from the ore which was pyrolusite (MnO_2) and turned it into Mn_2O_3. Normally we would have used coke breeze which is coke less than 1/4 inch in size that has been screened out of the larger particles after it has been crushed to 4-inch size. We got our coke from Germany and it came to us in ships. It had been crushed to 4 inches after it had come out of the coke oven but the fines were still in it. These fines didn't do us any good because they would be sucked out of the furnaces by the dust and gas collection system as soon as they were put into the furnaces. We lost about 15% of our coke this way. We couldn't screen out the fines as the coke was stored in the yard under a gantry crane that reclaimed it as we needed it. In the wintertime it was covered with snow and in the summertime the rain made it wet. Screening at 1/4 inch was impossible under those conditions. We could buy 1/4 inch coke from Poland but it was very expensive and we had to buy a shipload of it at a time. I got the idea that we might be able to put our four-inch coke in a fluid bed dryer that was fired with the same carbon monoxide gas that we used to fire the nodulizing kiln. With sufficient hot gas velocity in the dryer the 1/4 inch coke would be blown out of the unit and collected in the dust collector. That way we wouldn't be putting coarse wet coke into our furnaces and we would also get dry fine coke to use in the sinter plant for free. On my way home I stopped in Oslo and talked to the representative of the Dorr Oliver Co. in the United States. He didn't know much about their fluid bed units and advised me to go to Amsterdam to see the Dorr Oliver licensee there. They had never sold one of their fluid bed units, either a dryer or a calciner, that was fed material more than a 1/2 inch size but were willing to try it.

When I got home I wrote a report on it and Tom Meek told me to do a cost study on it. The study showed that we could repay the cost of the dryer in four months. It was so much of a savings that it was hard to believe and we had the Norwegians as well as Joe Brennan in Niagara Falls check it. No one could find any mistakes so I got the go ahead to buy and install the unit. I also visited a fluid bed lime calcining plant in Vermont just north of the Massachusetts border. I drove to North Adams, Massachusetts to stay the night as the closest motel to the plant was there. I got up early the next morning so I could be at the plant at eight o'clock and when I walked into the manager's office the first words he said were "Your mother is safe and uninjured!!" He had just received a call from Tom Meek telling him that there had been an explosion in Roseburg but Mom was all right. Tom had heard on the television a news report that a truckload of dynamite and ammonium nitrate had blown up in Roseburg at two o'clock that morning. He tried to call Mom but the phone company was accepting only emergency calls from other fire departments and police. Tom called the president of the Ore Company who called the president of Union Carbide who in turn called the president of AT&T. He called Mom personally and then called Tom. The truck had been parked at a lumber yard by the railroad and the paint department of the lumber yard had caught fire. The firemen didn't know what was in the truck and as it was next to the paint department it caught fire and blew up. It completely flattened about ten square blocks and badly damaged a lot more. Our house was about a half mile away on a hill. Mom had got out of bed when she heard the fire siren and was standing beside the window when the truck blew up. All seven of the windows on that side of the house blew in as well as the basement door which was below ground level. All the glass went right by Mom. She still owned Dad's store building and although it was protected by buildings across the street and was a quarter mile from the lumber yard all its front windows were smashed and the roof had been sucked up a foot and then dropped three feet between the brick walls of the building. As I recall nine people were killed, one of them a good friend of ours who was a volunteer fireman, and many were injured.

One of the insurance adjusters who was sent to Roseburg was John Jertson who arranged for the insurance payment to Mom for the Bookstore building damage. He had been called out of retirement to go to Roseburg. He and his wife liked Roseburg so much that they moved there. His wife died a few years later. Fourteen years after Dad died Mom married John. She was seventy three at the time. Mom sold our house and they lived in the apartment that John and his wife had lived in. John died when he was about ninety five and Mom was eighty eight. When she was about ninety-two I persuaded her to move into a retirement home and later when she was about ninety-five I got her to move into an assisted care home where she died two months short of one hundred years of age. She was bright and alert until about six months before she died on April 6, 1994. Jean and I were called and told that she couldn't last much longer and we went right to Roseburg. She opened her eyes when we talked to her and recognized us and an hour later she was gone. We had her cremated and the ashes buried next to Dad in the Shoemaker plot along with Grandfather and Grandmother Shoemaker and Uncle Bert and his wife Anne.

One last thing about the Ore Company before I move on. I have told how I had to let Tom Meek know how to get hold of me at any time and that included vacations. In Niagara Falls our next door neighbor had been getting ready to retire and still have some income by building a small resort on an island in a lake about 15 miles from Bala which in turn was about 150 miles north in Ontario. He would build one cabin each summer and we had rented one for two weeks when we were in Niagara Falls. We did the same one summer when we lived on Long Island. The telephone service wasn't very good up there and the nearest one was in Bala and it belonged to the Canadian Pacific Railroad. I arranged for them to let me know if I had any calls. I could call back from Bala through the railroad's line into Toronto where it would be patched into the Canadian Bell System. A few days after we arrived an old truck belonging to the railroad came rattling across the equally rattling bridge out to the island and the man driving it told me I was to call the office immediately. It was too late to call that night and I said I would come in to Bala in the morning. At seven the next morning another man came out in an old Model A Ford and gave me the same message as they had had another call for me. By that time I was beginning to think that our house had burned down or the president of Union Carbide had died and I had to take his place!! Anyway I went into town and used Canadian Pacific's hand cranked telephone which finally got me through to Tom. The conversation went something like this;

Tom: What do you want done with the rock that is down on the docks?
Me: What rock?
Tom: There is a rock down at the docks and it is drawing demurrage (storage charges) and we have to have it taken away.
Me: I don't know anything about it and besides a rock couldn't cost much to store.
Tom: The hell it couldn't. It weighs ten tons and came from Norway so you must know something about it. Virginia Mee says it's rhodochrosite from Ghana so it must belong to you.

Now Virginia Mee was a geologist that someone had hired and she wasn't either as good a geologist or as good a mineralogist as she thought she was. She was eventually told to leave. I asked Tom where it was shipped from and when he said Bergen I asked him to hold on a minute so I could think. My reasoning went something like this: The rock isn't rhodochrosite because Virginia is often wrong and also it was shipped from Bergen. If it came from Sauda it would be shipped from Stavanger and if it came from Meraker it would be shipped from Trondheim. Also the unloading cranes at Sauda and the cranes at Trondheim (where ore was unloaded for Meraker) wouldn't pick up ten tons. Ergo, it wasn't rhodochrosite!!

Since Virginia had said it was rhodochrosite it was pearl gray and I had heard that the Norwegians were looking at a taconite deposit somewhere in Norway. From my experience on the iron range with Oliver I knew that taconite (a low grade magnetite iron ore which was light gray) was so hard that blast holes had to be made with a jet piercing drill which was not a drill at all but an extremely hot flame fueled by kerosene and liquid oxygen which spalled off rock chips with the heat and made a blast hole very rapidly. It had been invented by the Linde Division of Carbide which sold all types of industrial gasses including liquid oxygen and they wanted to sell more oxygen. A ten-ton rock would be big enough in which to make a number of jet-pierced holes for a test. I told Tom this and asked him to call someone in Linde and if I was wrong to call me back. I was right and he didn't call back. I always considered that that was the greatest feat of very long distance mineralogy that anyone had ever performed!!

In about September, 1961, I got a call from a man from Bechtel. He was retired from Bechtel but had been asked to get them a metallurgical engineer and asked if he could take me to dinner that night. We talked over dinner and then for three hours in his hotel room. He told me that I was just what he was looking for and that I would hear from them within a day or two to go to San Francisco for an interview. He had gotten my name from Bill Stephenson, a very good friend of mine and the president of Allen Sherman Hoff Pump Co. The next day I talked to Tom Meek about it and he said that if he was younger he would go with me. Mr. Sneath was well up in his nineties and Tom said that as soon as he died that the Ore Company would be absorbed by either Union Carbide Metals or Union Carbide International which ran all their overseas operations except what the Ore Company controlled. I had had enough of the East anyway and after fourteen years there I kind of wanted to get back in the West. At the Ore Company I was kind of a big frog in a little pond but with either of the other companies I would be a little frog in a great big pond. I didn't hear a word from Bechtel. About two months later I was having a rather wet lunch with a friend of mine and told him about Bechtel not even having the courtesy to send me a letter telling me that they had no room for me. He said I should call the man I talked to so when I got home that night I called him at his home in southern California. I reminded him of what he said and asked if Bechtel was interested in me or not. He was very embarrassed and apologetic and said I would hear from them right away. I told myself that I had heard that one before. About forty minutes later I got a call from Bob Cheatham who was Manager of Engineering for Bechtel's Power and Industrial Division. He had very obviously been given hell by the man I talked to (I can't remember his name) and in the first ten minutes he gave me three excuses why no one had called or written to me. He said he wanted me to come for an interview as soon as possible. This was on a Wednesday night and I told him that I was leaving for Norway for a month and wouldn't be back until a couple of days before Christmas. I said I could be in San Francisco on Saturday morning and when he said that there would be no one in the office on Saturday I said that we had better forget it. He didn't want to do that and said he would call me back in an hour which he did. When he called he said he had made arrangements for me to be interviewed on Saturday and I told him I would be there. I told Tom about it the next morning and he said I had been pretty rough on Cheatham but obviously he was in earnest about it and to go ahead. I managed to get a seat on a plane on Friday (it was a nine-hour flight in those days) and got into a hotel at midnight. At nine the next morning I was in Cheatham's office. The first thing he said was how much money did I want and I told him I wanted to find out more about the job first. We talked for a couple of hours and then went to see a vice president who was in his office that day and the first thing he said was how much money did I want. I told him the same as I told Cheatham and we talked for an hour. Cheatham then took me to Woodside to see John Keily, a senior vice president. Keily was on his stomach by the swimming pool with his head and arms down in a concrete box fixing the pool pump. Keily's first words were also the same. He had several acres and a magnificent house. He also kept a couple of horses, three or four dogs, some cats and a billy goat. Cheatham and I were standing by the box and Keily was asking me questions when the billy goat walked up to me and began pushing his head against my leg. I put my hand on his head between his horns and tried to push him away. That was the goat's favorite way of playing and he pushed me harder than I could push back. I backed away in a circle around Keily answering his questions for twenty minutes and Cheatham just stood there and laughed.. Finally he finished with the pump and we went in to the house to talk. After that we went to the Burlingame Country Club to talk to Bill Ness, the vice president of the Power & Industrial Division. We sat in the bar and Ness kept ordering drinks until we had had five and I was hanging on for dear life. Finally we had lunch at three o'clock and after that Cheatham took me back to his office. He said *now* will you talk about salary? I said yes and asked him what he was offering. It was exactly what I was making at the Ore Company and I thought to myself I would take it but told him I wanted to talk it over with Jean and asked him to confirm it in a cable to me at Sauda as I was leaving early Monday morning. He wanted an answer right then but I wouldn't give it to him.

When I got home on Sunday I talked it over with Jean and we decided I would take the job. I didn't know anything about engineering companies but I thought I would give it a try and if I didn't like the work at least I would get a free move back to the west coast. I would give it a year and if I didn't like it I figured I could go to work for some mining company in the west. Then I called Tom and he was pleased and encouraging. I left for Norway early Monday morning and when I got there a cable was waiting for me confirming the job and offering me $1500 more per year than I was offered in San Francisco. I cabled Cheatham back saying I would report for work on January fifteenth, 1962. Christmas and the following two weeks were busy, mostly getting packed up but also saying good-bye to our friends.

BECHTEL CORPORATION
JANUARY, 1962

I flew out to San Francisco on a Saturday and stayed at the Californian Hotel which Bechtel had put me up in when I was on my interview trip. It was owned by the Methodist Church and was mostly filled with retired ministers and ministers and their wives. It was *very* quiet. After a couple of days I realized that I was spending a lot of money on the hotel room and moved into the Elks Club. The room was very cheap and although it was plain it was also very clean. I had stayed in many far worse places. The Club also had a swimming pool and a good library. On the weekends I rented a car and pretty well covered the Bay area. I finally settled on a house in Millbrae for which I paid $34,500 for. I almost took a custom built house in San Rafael but it was a couple of thousand more and I didn't think I could afford it. It took me about a month to get the house and I flew back to Long Island to get the family. We left the day that the movers were packing up. They promised to deliver our things in six days and I kept calling them to be sure they were on time. In eastern Nevada I found they had had engine trouble and would be several days late so when we got to Winnemucca we turned north towards Roseburg where the family would stay until the movers arrived. We stayed that night at McDermitt which was a wide spot in the road but it had one motel (poor) and a restaurant that matched it. When we got the children to bed we went to the White Horse saloon to have a drink. It straddled the Nevada-Oregon border and the state line was painted on the floor and the ceiling with the slot machines on the Nevada side. The only customers were a man and a woman at the bar. The woman wore bib overalls as did the woman bartender. The man never said a word but the women carried on a long conversation about the fight that the bartender had got into with another woman in the "ladies" room the Saturday night before. It seemed like every other word they said was a swear word and some of them I had never heard before. I'll say more about the White Horse saloon at a later time. The next day we arrived in Roseburg and the following day I drove back to San Francisco. The movers arrived six days late and after I oversaw the moving-in process I went back to Roseburg and brought the family to their new home.

At Bechtel they were very busy and hadn't even got a desk for me and for the first week I had a stool and a corner of a drafting table that a draftsman was working on. Just in front of the table was Alan Taylor who I had worked with at the Champion mine in Oregon. He had stayed out of school for ten years but finally went back to the University of Minnesota where he had got a Metallurgical Engineering degree just the year before. I was the second metallurgist Bechtel had hired. He was a junior engineer and I was a senior supervising engineer but because they were paying me more than the other two supervising engineers they had I was asked not to tell anyone I was one grade up from them.

Bechtel had got into the mining and metals business in 1953 when they built the nickel plant in Riddle, Oregon for Hanna Mining Co. Riddle was just 25 miles south of Roseburg and the same place that Hanna wanted to send me to when I applied to them for a job. After that they built two aluminum plants, two iron ore concentrators for Hanna, a fiberboard plant and at the time I arrived they were designing an iron ore plant for Cleveland Cliffs Iron Co. They were also just starting the design of a large copper plant for Palabora Mining Co. in South Africa and realized that they needed more metallurgists. They were doing the Palabora plant as a joint venture with Western Knapp Engineering of San Francisco.

The Power and Industrial Division was in and old four-story building at 101 California St. and they also had one-story buildings at 105 and 107 California St. I had been put to work on the Cleveland Cliffs job in 105 and about 10 days later Cheatham told me to join a meeting in 101. There were about ten people standing around a drafting table, none of them I knew. The Bechtel people thought I was with Western Knapp and vice versa. They were having the opening discussions on Palabora and the next day I was given a desk in the bull pen with about fifty engineers and draftsmen where all the people on the Palabora job were grouped. Quite a comedown from a private office and my own secretary.

Newmont Mining was a 30% owner in Palabora and Frank McQuiston showed up the next day. From then on we worked on several projects and became close friends. Also there was George Beals who was to be smelter superintendent at Palabora. I later consulted for him when he was General Manager there, Managing Director of Rio Tinto Minera in Spain and then when he was a Director of RTZ Corp. in London, the largest mining house in the world.

About three months after I had started at Bechtel I got a strep throat and was off work for three days. About ten days later I got my paycheck and it was short some money. I went to Cheatham and asked him about it. After some research he told me it was because I had been sick and they didn't pay sick leave until I had been there for six months. I told him that no one had told me that when they hired me and besides they were paying me by the year, not by the hour. As an engineer I expected to be treated like an engineer, not like an hourly employee and I wasn't going to cash the check until I received the rest of my money. He wasn't very happy about it but he said he would see what he could do. Three months later I got paid for the three days and his secretary told me later that he had had to go to the Bechtel board of directors and get them to give me a retroactive leave of absence.

In early 1963 Cheatham called me in to his office and introduced me to some people from the Hanna nickel plant in Riddle, one of which was Emmons Coleman the General Manager. He said I was going to be our project engineer for the expansion of their plant. This was news to me!! They had four 14,000 kilowatt ferronickel furnaces and wanted us to install a third ore dryer, a large fine ore bin, one multiple hearth roaster and an inclined tramway to transport the hot roasted fine ore to the top of the furnace building where it would be distributed to the four bins that fed the furnaces. The first thing they wanted us to do was to order a new 16,000 kW transformer that they would operate one of the furnaces on to see if it could take the extra power. If it wouldn't, we were to build a fifth furnace. A couple of days later after I had got my electrical, mechanical layout and civil group supervisors together we all went up to Riddle. We spent two days going through the plant and studying drawings. We stayed at the Hanna guest house in Myrtle Creek, about ten miles closer to Roseburg. The second night we were discussing the project and the fact that the new transformer would take a year to build and a couple of months to test. I said that I might be able to borrow one from Union Carbide Metals Co. if they had one of the right size and it I could it would speed up the project by over a year. I had remembered that Carbide had a lot of spare transformers and that they had loaned one to Republic Steel one time when one of their transformers had blown up. The next day I suggested this to Emmons Coleman and he said I could call Carbide if I wanted to but he knew that it would be impossible to borrow a transformer.

I called Bill Lewis who I had known well when I worked for the Metals Company and he said I could borrow one if they had one of the right capacity and that he would have Art Redfern, their chief electrical engineer who I also knew, and Art would call me back. Art called a couple of hours later and told me that they didn't have a single 3-phase transformer of the size I wanted but he could get me six single-phase units that could be hooked up to give the 18,000kW and he would send me drawings of them by airmail special delivery. He also told me that the coils in the transformers were connected in parallel and that we would have to connect them in series, a simple job that was done by opening the access plate on the top and reconnecting the taps inside. He said this would double the voltage and halve the amperage but they would work. We got the drawings the next afternoon and that night Marv Mohler, my electrical engineer, and I were trying to figure how we could fit six smaller transformers into the vault that one large one was sitting in. We were aided by a bottle of bourbon and about midnight he said if we could double the voltage on the borrowed transformers we might do the same with one of the Hanna's transformers and with only half the amperage it would operate cooler and we could overload it to give 17,000kW! That way we could have the test done in a month instead of fourteen months. I called the plant electrical engineer, got him out of bed and had him go to the plant and bring the drawings of the plant's transformers to the guest house. At two in the morning Marv said it would work.

The next morning we went in to Coleman's office with the plant electrical engineer and laid our suggestion out for him. He used every swear word he knew and then said he wasn't swearing at us but himself because he hadn't thought of the idea (he was an electrical engineer himself) They reconnected the taps in one of their transformers that day and the furnace operated better at 17,000kW than it had before. We canceled the order for the 16,000kW unit and ordered two new ones of 20,000kW and when they arrived they paralleled two of the old transformers with the other two old ones and those operated at 24,000kW. Needless to say Coleman and Hanna Mining were very pleased.

Russ Troy, my layout supervisor, and I also figured out how to us two used roasters and install them 40 feet in the air over their two existing rotary kilns which saved them a lot of money and was much better than a single new roaster. Our estimate for the job was $3.5

million and we brought it in for $2.75 million. The time for both engineering and construction was eleven months and the plant is still operating today.

There was a man working there named Abe Dor. He was half Egyptian and half French. He was extremely brilliant and I think they had hired him because he was a good friend of the director of research for Hanna Mining. He was very good at designing iron ore concentrators and although I have forgotten what his title was it was kind of a meaningless one. He was very excitable, not good at handling people so he had no one working for him and he couldn't stand to have anyone disagree with him.

At the end of the Hanna Nickel job Cheatham came into my office (project engineers had offices and secretaries) and said that they were going to establish the title of Chief Metallurgical Engineer and I would have the job. I would have all the metallurgist under me and at that time there were nine. Eventually, as our metallurgical work increased, I would have thirty-five working for me. When the change was announced Dor called me into his office (he had a project engineer there also who was one of his yes-men) and called me a traitor to him and used every swear work he could think of. His tirade at the top of his voice lasted about fifteen minutes. The reason behind this was that he had wanted to be Chief Metallurgist. I kept my mouth shut and just grinned at him which made him madder. Finally when he was about to run down I got up and walked out of his office. The project engineer told every one he could and the word got back to Cheatham. He came into my office and asked me why I hadn't hit him right in the mouth. I said that Dor had made a fool of himself and everyone knew it and that was enough. Dor was around for a couple of more years and he never spoke to me during that time. He left and went to work for Hanna.

As Chief Metallurgical Engineer I had to supervise all of my metallurgists who were working on the many metallurgical plants we were building. The metallurgical work soon became larger than the power plant work in the Power and Industrial Division and Bechtel formed the Mining and Metals Division..Within about four years we became the largest engineering firm in the mining and metallurgical business and had over a thousand people in our division. Copper and iron ore was our largest business but we also built nickel, aluminum, molybdenum, gold, lead, zinc, bauxite and rare earth (cerium, lanthanum, yttrium etc.) plants all over the world. In addition to my metallurgical work I also did a lot of business development and brought a lot of business in for Bechtel. Much of this was due to my acquaintances in the AIME and to the papers I had published.

One of the interesting jobs we did was to build a rare earth concentrator for Molycorp at Mountain Pass, CA about sixty miles southwest of Las Vegas and right alongside the main highway from Las Vegas to Los Angeles. Molycorp had been looking for uranium and found a bastnasite deposit (rare earth fluocarbonates) because it contained a small amount of thorium which is radioactive. They had converted an old 100 ton per day gold mill which was on the site to a hot flotation plant to concentrate the bastnasite. This mineral had several of the rare earths in it but the predominant one was cerium. Cerium was used in lighter flints and as an oxygen getter (remover) in steel making and in radio tubes.

There was not a great market for the cerium and they employed only nine men to run the mine and the mill. They would mine ore for five or six days, run the mill for ten days and then take the rest of the month off. Even so they made more concentrate than they could sell and stockpiled the excess in large holes in the ground lined with gunnite (concrete) and covered to keep the small amount of rain off. Color television in those days was kind of washed out because although they had bright blue and yellow phosphors they had to use them sparingly because they had no bright red phosphor. Someone found that one of the rare earths in bastnasite, europium, was a bright red phosphor that made the colors in color television what it is today. Our Refinery and Chemical Division built Molycorp a small solvent extraction plant to produce a pure europium material which sold for $1000 per pound, more than gold in those days. They quickly began to use up their stockpile of crude bastnasite and came to us to build them a new concentrator. The manager's name was Harold Bailey and he was not only a curmudgeon but a tightwad. When he found out how much steel and concrete we were going to use because the plant was in earthquake zone 3 he went to the county commissioners and had them move the zone line so the plant would be in zone 2. He was married but his wife lived in San Bernardino. One of the plant chemists was a woman also his mistress and we had to build a special chemistry laboratory for her and paint it pink! Molycorp knew about this but as long as the plant made lots of money they didn't care.

One day I had to go to Mountain Pass and got the morning flight to Las Vegas. The airport there is closed only about one day a year and that was the day. After circling an hour to wait for the fog to clear and it didn't they overflew to Albuquerque. When we arrived there the airline put me on a plane to Los Angeles with a connecting flight back to Las Vegas. On arriving at Las Vegas the airport was still socked in and they overflew to Chicago. I finally arrived in Las Vegas twenty-three hours after I had left San Francisco.

When we got about three quarters through with construction Molycorp told us they didn't have enough money to pay for the plant. Bechtel carried them while we finished the plant and they made so much money selling europium that they paid us off in three months.

About a year after we finished the plant I took some men from another mining company down to Mountain Pass to see the plant. I felt very sick after I got there but managed to finish the tour with them and get the first plane home the next morning. I went to the doctor and found I had tachacardia, an extremely fast heartbeat. The doctor tranquilized me for a week and told me I had been working too hard. The result was that I ended up with an arrhythmia or uncontrolled heartbeats and I have been on medication for it ever since. It rarely bothers me now but if I get overtired it returns for a day or sometimes two.

I talked to Cheatham about it and he replaced me as Chief Metallurgist with Leo Abell, who I had hired and who had been Mill Superintendent at Phelps Dodge Morenci mine in Arizona. He made me Consulting Metallurgist with the direction to look into anything I wanted as well as doing business development as I had been doing before. Because people in the industry knew me and generally didn't like to talk to salesmen I had been bringing in more business than the business development department did. I had become well acquainted with Paul Queneau who was Vice President for Metallurgy of International Nickel and occasionally did some consulting for him. It was through him that I got for Bechtel a contract to build a very large nickel concentrator in Sudbury, Ontario called the Clarabelle mill.

One day he asked me to come to a meeting in Minneapolis and I flew there the next morning. When I got to the hotel there was a message waiting for me that the meeting had been moved to New York and scheduled for the next morning. I went back to the airport and flew to New York where I stayed at the Waldorf Astoria. I had just got up to my room when I got a call from Cheatham saying that he wanted me in San Francisco the next morning for a meeting with another client and that he had asked International Nickel to delay their meeting for a day. I went back out to the airport and got a red-eye special to San Francisco where I arrived about six in the morning. I went home, got a shower and went in to the office. The meeting was over at eleven so I went to the airport and got a flight back to New York and the Waldorf where I had left my bag. I got about six hours sleep, went to the meeting and got the afternoon plane back to San Francisco.

Another time I went to Mauritania with another Bechtel engineer and two men from Homestake Mining Co. I had to fly to Paris and then to Dakar, the capital of Senegal. For some reason I can't remember I got to Dakar two days ahead of the other three but I put it to good used contacting equipment suppliers The airport was about 25 miles north of Dakar and I stayed at the Angor Hotel five miles closer to town. It wasn't a bad hotel as it was a resort for mostly French people on their vacations. Dakar had about a million people and there was a business district with three-and four-story buildings. Outside of the business district there was no sewage disposal and the people lived in shacks and huts.. We could smell Dakar 15 miles away! When the other three got there we chartered a two-engined DeHaviland Heron, which would hold about eight people, and flew to Nouakchott, the capital of Mauritania. The pilot was a young Frenchman who had been the world champion glider pilot the year before. Mauritania had been a French possession until after World War II but had become independent after the war. The United Nations had given them some money to build some government buildings. The government was controlled by Arabs who were in the minority, the rest of the people who did all the work were black. The country was very sparsely populated as it was mostly desert composed of rock and a great many huge sand dunes in rows many miles long. The people subsisted mostly on goats and their milk although along the coast they grew some fruit and dates. The airport was just a gravel strip and the terminal was a corrugated iron building about 40 feet wide and 100 feet long. There were three or four chest-high counters behind which were the immigration, customs and police people. They had no regular air service. The population of Nouakchott was only 5,000 and the only hotel was two stories and made out of concrete. The rooms were about 8 by 10 feet and had a single light globe hanging from the ceiling. There was an iron cot and at night the cockroaches, which were about two inches long, were all over the floor. There was a restaurant in the hotel but the food wasn't fit to eat so we ate at a restaurant run by some Canary islanders. The food was either fish or goat and was so highly spiced it almost ate out the inside of your mouth.

Homestake was interested in a copper deposit at Akjoujt, about 150 miles northeast of Nouakchott which was on the seacoast. They had hired an agent who had supplied their geologists who had done the exploration and shipped their ore samples out of the country. Both he and his wife were French and spoke good English. The Arabs were fine silversmiths and she took us to a place where they worked. It was just a tent and there were four or five men making all kinds of things out of pure silver which was imported. Each one had a small hole in the dirt floor that was filled with coke and each one had a goatskin bellows that he held between his arm and his body. They pumped the bellows with their arms and blew air through a small pipe down into the coke. For an anvil they had pieces of old railroad rail and their tools were a couple of pairs of pliers a small hammer and some files. They sat on the floor while they heated the silver and pounded and filed the hot metal into the shape they wanted it. They made beautiful filigree necklaces and bracelets and many other things. I bought six cocktail forks about four inches long and which we still have. The owner of the place weighed each piece with a crude set of scales which he carried in one of the voluminous sleeves of his long robe. Everything was sold by the gram and the agent's wife saw that we got a good price for what we bought.

We were there a couple of days and then flew to Akjoujt. There was an airstrip there and the remains of an old French Foreign Legion fort which was not at all like Fort Zinderneuf in the Beau Geste movie and it had a few tumble-down adobe buildings surrounded by two rows of barbed wire entanglements. A French company had set up a pilot plant to test out what is called the segregation process to recover the oxide copper in the deposit. They must have had at least twenty Frenchmen plus a couple of hundred Mauritanians working there for a couple of years. The pilot plant processed about 100 tons per day and there were two or three large corrugated iron buildings besides the pilot plant building and about 15 houses made out of adobe. Homestake had a French caretaker there and we stayed in the manager's house which was barely habitable. We had brought a lot of food from Dakar as there was no place to eat out there. There were about a hundred people there and also a kind of civil governor for that region who called himself Commandante. He spoke a little French and Homestake's caretaker translated for us. I had had a couple of quarters of French at Wisconsin so I could understand and speak a little. He invited us to dinner at his house which was one of the French-built houses. It was like a pig sty and rats were running across the floor while we ate. The food was foul and it was a wonder that we were not poisoned by it. We ate as little as possible.

We spent three days there looking at the ore deposit and going through the pilot plant. The place looked as if suddenly one day they blew the whistle and loaded everyone on busses to leave. The manager's suitcase was on a table only half packed and he had even left his passport. There was a very expensive microscope and much equipment in the laboratory plus all the machine and hand tools in the maintenance shop. There had been no caretaker there for five years and yet there was nothing stolen. I found a brass and silver letter opener that was intricately carved with the owners name, Mohammed Klil Atar on it which I still have and use all the time. The only damage done to the place was by sand blowing in under the eaves of the buildings and collapsing the ceilings and also sand that had drifted up against buildings causing them to lean.

From Akjoujt we flew northeast to Fort Gouraud which had been another Foreign Legion outpost but was then a large iron mine built and operated by the French. It was the only source of income for Mauritania. They had built a railroad south and then west along the Spanish Sahara border to a port called Nouadibou or Port Etienne The railroad was 350 miles long. Spanish Sahara had also got its independence after the war but a few years ago Mauritania and Morocco to the north divided up Spanish Sahara and it no longer is shown on maps. We looked over the iron mine and had lunch with the manager and then flew to Port Etienne to see the ship loading and railroad facilities as any copper produced at Akjoujt would have to be shipped from there. We stayed at a small motel which was owned by an American. It was clean, had good food and he also made chocolate ice cream sodas that were like manna from heaven.

I should mention the bread that they made in Mauritania. It was about 2 1/2 inches in diameter and four feet long. It was extremely good. The first time I had some I noticed quite a few black specks in it and on closer examination I found they were fleas. However they were dead and maybe that was why the bread tasted so good.

We then flew back to Nouakchott and stayed one more night at that foul hotel. The next morning we were packing up to leave when the agent came rushing in and said that because of the Six Day War, as it was called, between Israel and the Arabs, Mauritania had declared war on the United States and the army was coming to arrest us. We threw all our things in the agent's car and drove out one driveway of the hotel as the army came in the other. Fortunately they didn't see us but we knew they would find out from the hotel where we had gone. When we got to the airport I took all the passports into the terminal to get exit stamps while the others loaded up the plane and the pilot got it warmed up. We had to have exit stamps in our passports as Mauritania and Senegal didn't get along very well and the pilot said we wouldn't be allowed in to Senegal if we didn't have the stamps. There wasn't a soul in the airport so I looked over the high counter of the immigration counter and saw the three stamps on a shelf. I climbed over the counter and since I didn't know what the stamps were I stamped our passports with all three. As I was climbing back over the counter the army came in the entrance. I ran for the other door out to the plane and dove through the door. The pilot had the plane rolling as one of the men pulled the door shut. We got to the Dakar airport in plenty of time to catch our plane to Paris.

I had broken a tooth when I was in Nouakchott and it had a sharp edge that had made my cheek and tongue sore as could be. We got into the Paris hotel about eight in the evening and I immediately went out to find a drug store (apothecary) to buy some emeryboards. I found one that was open, got my emeryboards and was in my room in front of a mirror filing down the sharp edges of the tooth when Art Clifford, the other Bechtel man came into my room. He asked me what I was doing and when I told him he ran for the bathroom and threw up.

We had a little work to do in the Bechtel office in Paris but we had time to go to the Follies Bergere and see the Eiffel Tower, Napoleon's tomb, the Sacre Coeur and the Cathedral of Notre Dame.

Another time I was sent to Sierra Leone with Peter Davies, our Chief Mining Engineer to study why a rutile and ilmenite plant wasn't performing as it should. Rutile and ilmenite are both titanium minerals and they needed a source of titanium oxide which is the prime ingredient of their paint. It was owned by PPG (Pittsburgh Plate Glass). They had built it with a loan from the World Bank and it wasn't making any money so they could pay back the loan. PPG had never been in the mining business before and there wasn't a thing that they had done right. They had a cutter head dredge instead of the bucket line dredge that they should have had. They staffed it with young people from their chemical business and all the houses they built had been prefabricated in Florida. The houses were built of double wall aluminum panels with three inches of corrugated cardboard in between as insulation. The high humidity and high temperatures in Sierra Leone caused the panels to expand and lose their seals and they swelled and leaked. The natives there would steal anything that wasn't nailed down and were very difficult to train. The plant was in the jungle about 150 miles east of Freetown, the capital.

We stayed in Freetown the first night at a fairly decent hotel. Freetown is very old and was founded during the slave trade. Later it became quite a large port as a stopping and refueling place for ships coming and going from Europe to Africa and beyond. It was fairly modern except that the sewer were open ditches on both sides of the streets and the people threw all their garbage out into the streets. Consequently, thousands of ugly vultures lined the peaks of the roofs waiting for more garbage to be thrown. We flew to the plant in a chartered plane and landed at the company's airstrip.

That afternoon I was on the dredge and found some maintenance people burning with an acetylene torch on a side plate of one of the vibrating screens that screened out the big chunks of rock that the dredge brought up. The vibrating mechanism was bolted on to the screen side plates and the bolts had come loose and the holes in the side plates that the bolts went through had become enlarged. Instead of drilling the holes larger so larger bolts could be put in they were using a cutting torch to enlarge the holes. I went to the manager and told him that the heat from the torch would cause stress in the plates and they would crack. He said I didn't know what I was talking about. That night after they had reinstalled the vibrator and run the screen for a while the side plate developed a three foot long crack. It weighed a thousand pounds and they had to fly a new one in from the States.

The dredge didn't have enough flotation tanks under the front end and it wasn't very stable. Shortly after we left, the operator left his station to help his assistant do something on the rear of the dredge. One of the two winches that swung the dredge back and forth as it was digging had a bad clutch that hadn't been fixed and instead of turning it off he left it in neutral. While he was on the rear end of the dredge the clutch engaged and pulled the dredge over on its side. It took them four months to get it turned upright and repaired.

We were there about ten days and on the seventh day some of the natives broke into the guest house we were staying in and stole my briefcase with my passport and immunization card in it. They arranged by radio to their Freetown office to have the US consul issue me a new passport and I was taken by land rover to Freetown the next day. The consul was very obliging but when I wanted to pay for it I had only travelers checks and their policy was to accept only cash. He said, however, that I could get a check cashed at the Lebanese bank just down the street. I went to the bank and talked to a greasy Lebanese cashier behind a very ornate brass grill. He spoke English and I explained that my passport had been stolen and I would like to cash a travelers check. He said he would be most happy to cash a check and asked for my passport for identification. Twice more I explained that my passport had been stolen and that I had to have cash to pay for a new one and each time he said he would be very happy to cash a check and asked for my passport. I finally demanded to see the manager and when I finally got in to see him I went though the story again and he also asked to see my passport. At that I lost my temper and said if he didn't cash my check I would punch him in the nose. At that he wrote a note for me to give to the cashier who finally cashed the check.

Then I had to go down to the dock area where there was a clinic that gave immunization shots, mostly to sailors. I couldn't get back into the US without proof that I had been vaccinated for smallpox and yellow fever. They gave me a new card and told me to go to a building, (more of a shack) where I lined up and finally got my smallpox vaccination. I had to go to another shack to get the yellow fever shot and stood in a line with about twenty men who seemed to be of all different nationalities. When I got to the doctor, (he was black but spoke some English) he said I would have to wait three days after the smallpox vaccination before he could give me the yellow fever shot. I protested that I had to have the shot because I was leaving in two days and he finally said he would take me to see another doctor. The other doctor was just as black as the first one and when I explained to him that I had to have the shot that day he told the first doctor that it was perfectly all right and he did it in perfect American-type English. He was from Chicago and was in Sierra Leone for the World Health Organization. I went back and got in line again and when I got to the head of it I saw that the doctor was using the same needle on everyone! I thought to myself here is where I get hepatitis again but there was nothing I could do about it so I took the shot. Fortunately I didn't get hepatitis.

When I returned home I had to go to Washington D.C. to report to the board of directors of the World Bank. I guess they didn't loan PPG any more money because a few months later they closed down the operation. About a year later Peter resigned from Bechtel and went to work for Nord Resources. They bought the mine from the World Bank, installed a new dredge and operated the plant for 15 years with Peter Davies as President of Nord Rutile. A couple of years ago Sierra Leone had a revolution and the government fell into anarchy. The rebels killed the manager and the mine superintendent, Nord pulled out and the whole operation has gone back to the jungle. There was also a diamond mine and an iron ore mine in Sierra Leone and the same thing happened to them.

We got a job to design and construct a 40,000 ton per day copper concentrator on the island of Bougainville, one of the Solomon islands to the east of New Guinea, for CRA, a large Australian mining company. They had drilled out the deposit, driven two long adits into the ore body and were operating a flotation pilot plant on the property. The deposit was located on the southern side of the ridge that went east and west on the island but access to it was from the small town of Kieta on the north coast. We had to build a road over a 4,000 foot ridge and down to the deposit at an altitude of 2500 feet. CRA had been operating a conventional grinding circuit (rod and ball mills) at the pilot plant but wanted to try autogenous grinding which is a mill that uses the ore to grind itself. Our construction people were on the site building temporary construction facilities and they installed the autogenous mill. I took two of my people with me and flew to Sydney, Port Moresby in New Guinea, Rabaul on the eastern tip of New Britain (the reader will recall I was on the western end of New Britain during the war) where we stayed overnight and then on to Kieta. Both Port Moresby and Kieta were still using airstrips made out of steel landing mat that were installed during the war. At the mine site we were quartered in prefabricated dormitory trailers with two men to a room about eight feet square. There were two active volcanoes about four mile to the west of us and they were both smoking all the time and we had earthquakes at least twice a week..

In five weeks we were about finished up with our work and I was talking to Lyle Cantwell and Charlie Markase, our two construction superintendents in their office which was a temporary building for the construction people. Cantwell's swivel chair had metal wheels on it and they had cut deep ruts in the concrete floor. When I kidded him by saying he didn't know how to make concrete he said that the aggregate plant for producing crushed rock and sand for concrete had been washed overboard from a ship coming from Australia and he was behind schedule because of it. He was making concrete from crushed copper ore and the sulfides in it caused the concrete to be so extremely week that he couldn't make any permanent concrete until another plant was shipped to Bougainville. I laid out a way to make aggregate from quarry rock in our autogenous grinding pilot plant which save him three months in construction time. I got a nice bonus from Bechtel for that.

While we were there some agitators from Indonesia came to the island and stirred up the natives. A couple of hundred of them came to the construction site with their spears and bows and arrows and were shouting and shaking their spears at us. Fortunately, CRA had heard about the plans for the demonstration and had asked the New Guinea government to send some troops. They arrived just at the natives started throwing rocks and put a stop to it. After the plant was built and had been operating for several years the Bougainville people wanted their independence from New Guinea and this time they had guns and killed several of the Australians at the mine. The government couldn't seem to stop them and the company abandoned the plant. It was one of the lowest cost copper producers in the world and paid an enormous amount of taxes to the government beside the 20% ownership that the CRA had given the government of New Guinea.

Other mines have gone into New Guinea and although all of them have had a lot of trouble and have had to pay exorbitant fees and taxes plus 20 to 30% of the mine ownership to the government they so far are still operating. Africa has been far worse as all the countries there which had been foreign (British, French, Spanish and Italian) protectorates have gotten their independence and are far worse off today than they were under foreign rule. Before World War II all the African countries were self supporting and peaceful but when the blacks took over the various tribes have been continually at war with each other. None of them grow enough food to feed their people and industry that was there before has been expropriated and run into the ground.

Another example is Zambia which used to be called Northern Rhodesia. They have some of the largest and richest copper mines in the world but they were nationalized and from extremely profitable mines which paid large taxes, built schools, hospitals and furnished tens and thousands of jobs they have been turned into money losing mines that are only operated in order to get hard currency for their copper and cobalt. Corruption is rampant and only a few of the blacks who have gotten rich through their power rule all the rest of the people who are desperately poor.

Anglo-American and Roan Selection Trust each operated several copper-cobalt mines in Zambia when they were nationalized with promise for payment over thirty years but no payments were forthcoming. After a year or so the mines and smelters were in such desperate shape that Zambia hire Anglo and Roan to come back as consultants and they would be guaranteed payment from sales of copper. This didn't solve the problem because the companies were stuck with the thousands of people that had been hired just to give them jobs but at least the production of copper went back up, but not to the former rate. Copper is still costing Zambia about 50% more than they can sell it for but it does bring in hard currency. I had worked for Anglo several times and one time they asked me to come to Zambia to help them assess the feasibility of reopening a mine that was located at Kansanshi in the far north of Zambia on the Congo border. It hadn't been operated in twenty years but they had a caretaker there and he kept it locked up and nothing had been damaged or stolen.

It was an underground mine but some very narrow high-grade copper oxide veins outcropped on the surface of a low hill. These vein had been mined to a depth of about thirty feet and were so narrow that children must have been used to excavate the ore. The Anglo people said that their archeologists were convinced that this was the Queen of Sheba's mine. It had been rediscovered in 1925 by an Englishman who had sunk a shaft and mined the high grade that he found. He built a small blast furnace about four by five feet at the bottom and smelted the ore in it. He was 200 miles from the nearest railroad so he cast the copper into wheel rims about a yard in diameter, six inches wide and two inches thick. Then he used the natives to roll these copper wheel rims across country to the railroad. That Englishman certainly was ingenious Anglo had one of them in their museum in Kitwe. He operated the mine for about two years. The blast furnace was still there and there were a thousand or so tons of slag down the hill from the furnace. The caretaker showed us a piece of copper splatter about a quarter inch thick and two inches in diameter that he had found in the slag. That was all he had found in all the years he had been there and he was very proud of it. I walked up the slag pile and looking down found another piece of splatter about twelve inches long and four inches wide at its widest point. The caretaker was quite miffed.

On one of my trips to Zambia I entered the country from the north and expected to go home that way. When my work was finished the Anglo people wanted me to go to Johannesburg for a one-day meeting at their research laboratory to discuss some of the suggestions I had made. When I told them I didn't have a visa for South Africa they said it would be all right as they could take care of it when we got there. Zambia had been Northern Rhodesia before it got its independence and did not have diplomatic relations with South Africa or Southern Rhodesia which then became simply Rhodesia and which eventually became Zimbabwe when it got its independence. At times they allowed people to walk across the railroad bridge connecting Zambia with Southern Rhodesia at Victoria Falls which I had visited but that had been stopped. The three of us had to fly from Lusaka to Blantyre in Malawi, get another plane to Salisbury in Rhodesia and then another plane to Johannesburg. When we arrived at the Johannesburg airport the immigration people wouldn't let me in the country without a visa and said I would have to get right on a plane that was leaving for London. The Anglo people protested and made some phone calls and I even called the U.S. ambassador. He told me that the United States had recently sent some black Peace Corps people to South Africa without clearing them with the South African government and that I didn't have a hope in Hell of getting in without a visa even for a one-day visit. The telephoning took a couple of hours and by that time the London plane had left. The Anglo fellows said they would cancel the meetings and said good-bye. The immigration people told me they had some rooms upstairs and said that when I wanted to eat I could come through immigration and eat in the terminal. (They had taken my passport). I went up to my room and then went out to eat. When I got back to my room there was nothing to do so I went down and told them I was going for a walk which was all right with them. The next morning I went down to breakfast and the same immigration people were on duty so I just waved at them. When I got back to my room I thought to myself that those people weren't watching me or checking up on me so I went downstairs, waved at the immigration man, went out to the taxi stand and went to the Bechtel office where I got the meetings set up. I met with several Anglo people, had lunch at their head office and at four o'clock got a cab back to the airport. I waved at the immigration people, went up to the room to get my bag, got my passport and got on the plane to London. Later I told the story to the South African Consul in San Francisco who I had gotten to know very well and he got a big laugh out of it.

When I first went to South Africa gold, which had been selling for $35.00 per ounce since President Roosevelt had devalued our currency by raising the price from $20.60 in the early 1930's, was permitted to rise somewhat. South Africa, which depended heavily on its gold sales had the idea of minting Krueger Rands which contained one ounce of gold (the Rand is their currency base like the dollar is in the United States. Anyone could buy them at a bank there for $39.00 each. I was always going to buy some but it seemed that I never had the time and I told myself I would buy some on my next trip. The price of gold was then allowed to float and it slowly rose to about $100.00 and I still didn't buy any. Then the Hunt brothers, a pair of Texas billionaires tried to corner the silver market and as silver rose to $50.00 per ounce from $2.00, gold rose to $800.00. It didn't stay there long and quickly fell to $300.00 and today (July 20, 1996) it is about $384.00. I have bought some American Eagles and some Canadian Maple Leafs at around $350.00. I sure could kick myself for not buying those Krueger Rands.

Another interesting trip I made was to Ok Tedi in New Guinea. Ok means river so the project which was called Ok Tedi was on the Tedi river. It was a gold and copper project and one of our competitors had done an engineering study on it but the owners, Broken Hill Proprietary (BHP) the largest mining company in Australia, didn't like it so they gave the engineering and construction contract to Bechtel. I went to Melbourne first and had some meetings with BHP management and in particular with one of their vice presidents, Colin Kaiser. Colin started out to be a pretty tough man to deal with but I became one of his best friend because of his shirts and I will tell the story now.

When I returned from Ok Tedi he and I had to attend a meeting with the BHP management. He didn't like those meetings because when he went to them he had to have his necktie tied. He was a big man and he was cursing while he tried to get the top button of his shirt fastened. I asked him why he didn't buy shirts with bigger collars and he said he couldn't buy shirts with 22 inch collars on them. Now I wear 17 inch collars and I have bought them for many years at Rochester Big and Tall. The only customers in their stores are football and basketball players and wrestlers and of course, me. I told him I would send him some shirts and I did upon my return. He had me send him some more and later when he came to the States on visits bought his own.

Anyway, I flew to Port Moresby and got a charter plane to take me to the Ok Tedi camp which was on the west coast of New Guinea at an altitude of about 200 feet. It was also at the base of the 7500 foot mountain on the top of which was the ore body. It had already been drilled out and ten adits had been driven into the ore. An adit, by the way, is like a tunnel but has only one open end. A tunnel daylights at each end. The adits also had raises (vertical adits) to explore the ore above them. The next day they took me and Michael Noakes to the top of the mountain. I had met Michael on Bougainville where he was running the flotation pilot plant. We went into every adit and climbed all the raises so I could find out what the ore looked like. It was quite soft and I could pull pieces of it off the walls and backs (ceilings) of the adits and raises. It rains 400 inches a year at Ok Tedi but you really cant tell the difference between that and the 200 inches it rains at Bougainville. The helicopter was supposed to pick us up at four o'clock but the clouds came in and we had to stay in one of the adits all night. We were soaking wet and almost froze to death by morning. In the morning there were still a lot of clouds around but we heard the helicopter coming up a very steep canyon and ran down the hill to a place where the pilot could see us. The clouds were coming towards us and we got in the helicopter as quick as we could and the pilot took us down the canyon with the trees only a few feet away from the rotor blades. For the next two days I looked at thousands of feet of drill core which confirmed my opinion that the entire ore body, after blasting, could be fed directly to an autogenous grinding mill without being put through a crusher first. The other engineering firm had designed two primary crushers into the plant and deleting them would save BHP about eight million dollars.

When I got back to Melbourne I met with Colin Kaiser to tell him that the crushers were not needed. He ranted and raved for fifteen minutes and I finally told him if he didn't believe me that he should go to Ok Tedi and see for himself. When I left for home he left for Ok Tedi and a few days later I got a cable telling me that he agreed with me. We have been the best of friends ever since.

Some of these experiences are not in chronological order as I never kept a diary. I referred earlier to my getting hepatitis. Homestake Mining gave up the Akjoujt project in Mauritania and Anglo American took over the property. They wanted Bechtel to do the engineering and construction and asked me to come to London for a one-day meeting. I flew to London and arrived at six in the morning. After having a bath and breakfast at the Savoy Hotel I went to the meeting at nine. I was feeling fine but at ten I suddenly got extremely sick. I managed to get through the meeting which lasted until four and went back to the hotel and laid on the bed. The next thing I knew it was seven o'clock the next morning and I was even worse. I called the hotel doctor and he said I had the flu but I could get on the plane at one o'clock if I felt up to it. I didn't die on the plane but I sure felt like I would and when Jean met me at the airport I had her take me to the doctor. As we came in the door to his office he was walking down the hall towards us and when he was twenty feet away said "You are going to the hospital". He saw my eyes were yellow and knew right away that I had hepatitis. I was in the hospital for a week and then had to be flat on my back for six weeks. He said I had a very bad case and that if I didn't have complete rest that I would die. A fourteen-year-old boy and a woman died of hepatitis when I was in the hospital.

In November of 1979 I casually mentioned to Jean that we might look around for another house now that the children were all gone. That was a few days before Thanksgiving and I went on a trip the next day. I returned the day before Thanksgiving and she had made arrangements to see three houses on Thanksgiving day. She showed me two that were dogs as far as I was concerned but the third one was very nice. It had been built the same year as our house in Millbrae but it was a custom design with a swimming pool in Burlingame, not a tract house like our old one. We made an offer of $225,000 on it and then found that the owners already had an offer. The other people couldn't come up with the money as soon as we could so we got it. We sold our old house for which we had paid $34,500 for $149,000 in a matter of days! Property values had really gone up. When we sold the Burlingame house in 1984 we got $355,000 for it! A young couple in their twenties bought it. Her parents lived in Turkey. They went to Switzerland to pick up the money and brought the cash in a suitcase to California to buy the house for the daughter and her husband.

I had mentioned that I had had a heart problem and an ulcer in about 1977 and Bechtel had made me Consulting Metallurgist. A couple of years later they made me Manager of Division Metallurgy and I was in charge of all metallurgical plant design for the San Francisco, Toronto and Melbourne offices. They also gave me nine senior specialists who were chemical and metallurgical engineers. They were kind of consultants who would be assigned to various jobs to solve special problems. I also had to look after four or five outside consultants who we had on retainers.

This is a good time to mention that when I was made Chief Metallurgical Engineer I was put on executive purview. Executive purview was not publicized and no one knew of it except the Directors and those who were selected for it. There were quite a few benefits; my salary was reviewed three times a year, I was given a share of the profits as a bonus, the twenty percent of my and the family's medical benefits that our medical plan didn't pay for was paid, the whole family had their dental care paid for and they even paid for eye glasses. There were 130 of the non-officers allowed on purview but all the time I was on it there was a maximum of only 117 actually on it. There were only three of us in the Mining and Metals Division on purview and the other two were the Manager of Engineering and on Project Engineer. My bonus started at a third of my salary and the last five year I was with Bechtel my bonus was 100% of my salary. My salary at the time I left was $100,000 per year. Unfortunately income taxes were high at the time and my bonus put me in the fifty percent bracket. Even so, I was making extremely good money for the time.

In about 1970 Jean and I decided that we had better look toward retirement and another place to eventually live. I had been in Tucson, Arizona a lot and liked the area so one Sunday Jean and I flew down there to look at property. We found two lots on the northwest side of town and bought them. Shortly afterwards IBM announce they were going to put in a plant that would employ five thousand people in Tucson and other companies followed. Three years later I realized that Tucson was getting too big for me and we sold the lots for three times what we paid for them. We then bought 7 1/2 acres near San Andreas, California and a couple of years later we bought five acres near Placerville, California. Finally in April of 1977 we bought our fifteen acres where we built our house in 1984. We sold the other two parcels and made a profit on each. Our fifteen acres are in two lots (6 1/2 and 8 1/2 acres each) and we paid $24,500 each for them. The larger lot was a buffer in case someone developed the land on the other side of it and this is being done at the present time. Over the years I have cleared out all the dead and fallen trees and the underbrush as well as trim the branches of the trees up to about 15 feet and cut out the ones too close together. It looks much like a park. On the north end of the lots they abut a Nevada Irrigation reservoir which is about ten acres in size.

I just thought of another interesting job that I did for Anaconda Copper in Butte, Montana. I had become acquainted with Anaconda's Chief Engineer through the Mining Club in New York and we used to have lunch together quite often. He called me one day and asked if Bechtel would like to do an engineering study of the tailings pipeline and pumping system at Butte. When I got to Butte I met their new General Manager, Frank

Monninger who had just taken over the job after working for Anaconda in Chile for almost twenty years. We became good friends and every time I would go to Butte he would insist that I stay at his home instead of a motel.

The tailings pond was located two miles from the plant, 600 feet above it and the tailings were pumped to the pond through two, 20 inch pipelines. Each pipeline had three pump stations with a total of ten pumps per pipeline. The pipelines followed a fairly constant slope except for two flat areas each about 500 feet long. When there was a power failure the tailings slurry (finely ground rock and water at about forty percent solids) would run back down hill but the slurry would move faster on the slopes than on the flat areas. This would cause a vacuum for several seconds in the line on the flat area. When the slurry from the next slope caught up it would hit the slurry going down hill with a sound like a 105mm howitzer. This is not an unusual problem and it is called water hammer. The line would jump several feet in the air and some times rupture. At times one of the pumps would blow up sending pieces of steel through the side of the pump station. This had been going on for years. I brought up an excellent hydraulics man and at the expense of about $20.000 for some automatic valves solved the problem. Needless to say, Monninger was very pleased.

The next thing he did was ask me to take a look at the crushing plant and concentrator and give him a report. It had been built about seven years before with a lot of publicity about it being the world's first fully automatic plant. Unfortunately, the instrumentation that was supposed to run the plant didn't work very well and the plant was no more automatic than any other one in those days. The plant was supposed to have been designed to treat 33,000 tons per day but it was operating at 39,000 tons per day and the superintendent said he couldn't put another pound through it. My report said that if they would merely tighten up the primary and secondary crushers to make them work instead of loafing and use steel balls in the grinding mills instead of using coarse ore as grinding media they could substantially increase their throughput. Monninger put these suggestions into effect over the objections of the mill superintendent and the production promptly went up to 54,000 tons per day. Besides the extra tonnage, the copper recovery from the ore increased and the costs went way down.

I continued to be active in the AIME. While I was in New York I became chairman of the chemical processing committee of the Mineral Processing Division of SME. I was talking one day with Ed Malouf of Kennecott who had made quite a name for himself in the field of leaching low grade copper ores with sulfuric acid and recovering the copper by cementing it out as a precipitate on scrap iron from tin can manufacturing. We decided that we could put on a short course for the MPD on leaching and recovery of copper from ores. We talked the MPD program chairman into it and also the Executive Director of SME. It was held in the Brown Palace Hotel in Denver and the SME annual meeting. It would be the first short course that SME had ever put on. We expected about thirty people would attend and hoped for fifty. Three hundred people registered for the two-day course which we taught in the two days before the meeting started. SME made a lot of money off that course and it was the start of the many short courses that SME has held. Four or five are now held at every annual meeting.

I moved up through the chairs in the MPD until in 1970 I became Chairman of MPD and also a director of SME. It had been a tradition for many years that MPD held a Scotch Breakfast at the annual meeting. It was started by four or five members who were kind of hung over one morning and decided to have some scotch in their breakfast oatmeal to help cure their hangovers. It had grown each year and the past chairmen acted as chefs who wore chefs hats and aprons and stirred large tureens of oatmeal to mix in the butter and scotch that was served to those in attendance. Everyone wore a plaid paper hat and marched into the room behind a bagpiper dressed in full Scotch regalia. After breakfast there was (and still is at this writing) a dirty joke telling contest and the winner and loser won a full bottle of scotch and the one telling the worst joke got a bottle with a bout an inch of scotch in it. I had won the contest when I attended my second AIME annual meeting in 1954. As Chairman in 1970 I decided that we would also serve a real Scotch haggis which is a horrible concoction of oatmeal, meat and other things cooked in a cow't stomach. To top it off I got the SME staff to hire a girl who would wear a kilt, high heels and a Scotch tam to bring in the haggis right behind the bagpiper and serve it to all the men. The meeting was in New York and topless girls hadn't got to that city like they had in San Francisco. One of the originators of the Scotch Breakfast was Don Scott who always recited a Robert Burns poem in a wonderful Scotch accent before the joke telling started.

My good friend Frank McQuiston was asked to prepare a chapter on precious metals in a new Mineral Processing Handbook which was to take the place of the old handbook written by Professor Taggart of the Massachussets Institute of Technology. Frank, or Mac as he was called, asked me to help him out as I had the facilities at Bechtel to draw the flowsheets that were needed and to get all the typing of letters that we wrote to people to get information. We collected far more information than we were allowed space for in the handbook and I suggested that we ought to use it all in a monograph on Gold and Silver Cyanidation Practice to be published by the SME. The SME publications committee agreed to the idea and we went to work. It took about nine months to put it together and then we had the problem of how many to print. We thought that 300 would be sold and hoped to sell 500 so SME printed 750. It was published in 1975 when the interest in gold and silver was being sparked by the rise in their prices and the first edition was sold out in a few days. It went through four printings and eventually over 7000 were sold. No other book that SME published sold so many copies and the Society made a lot of money.

Mac and I were both very much interested in primary crusher plant design and agreed that virtually all of them installed were too expensive. At the Similkameen copper plant in British Columbia, which Bechtel disigned and built for Newmont Mining, Mac and I worked together on a new design for their crusher which saved Newmont a million dollars

[Photo not included]

over what a crushing plant of conventional design would have cost them. We had had so much enjoyment out of our first book that we decided to publish a book called Primary Crushing Plant Design. SME published it in 1978 and it sold 2500 copies.

The metallurgy of gold and silver extraction changed rapidly in the late 1970's with the use of heap leaching for low-grade oxide ores and the introduction of carbon-in-pulp treatment in the treatment of slightly carbonaceous ores. Consequently, Mac and I decided to write a second volume of Gold and Silver Cyanidation Plant Practice and it was published in 1980. It sold 5000 copies.

At the annual meeting of AIME in February of 1974 I was presented with the Richards Award. It was named after Robert Richards, a professor of mineral dressing at MIT. He is looked upon as the father of modern ore dressing and wrote a four volume text on ore dressing which was published in 1903 and 1909. The award is the highest honor that is given by AIME and is not given every year. Arthur Taggart, another professor at MIT, who published his classic Handbook of Mineral Dressing was presented with the first Richards Award in 1950. The award is in the form of a vanning plaque (a laboratory type of gold pan) made of sterling silver and is about twelve inches in diameter. The citation engraved on mine reads;

The Richards Award

TO

ROBERT S. SHOEMAKER

For Proficiency as a Leader of Technical

Innovation and its Application to The

Engineering Design of Many Major Mineral

Processing Facilities

1974

It was presented at a black-tie banquet with 500 people in attendance and a table of my South African friends started a standing ovation which lasted a full minute. Next to getting married that was the proudest moment of my life.

As incoming chairman, chairman and past chairman of the Mineral Processing Division I was a director of the Society of Mining Engineers. The Society had four divisions, MPD, Coal, Industrial Minerals and Mining and Exploration. Membership was about 20,000. I was then made a director at large of SME, Treasurer for a year and finally President Elect, President in 1978 and Past President. For these last three years I was also a dirctor of AIME. In 1988 I was asked to be President of AIME but I turned it down as I was too busy consulting and all the traveling for AIME would have substantially cut into my consulting time. One last thing about AIME and SME, I wrote 28 technical papers that were printed in several technical journals.

In 1975 Bechtel got interested in the possibilities of doing business in Russia and arranged an exchange program where Bechtel and Russia would send engineers to each other's countries for visits. Bechtel sent ten people on the first visit and I was one of them. The only other one from the M & M Division was John Neerhout who was a construction man who later became our division manager and then a senior vice president of the corporation. While he held that position he was loaned to the consortium of engineering firms who were building the tunnel between England and France. They were in trouble with their cost overruns and schedule and John was made general manager of the entire project until it was finished. The other eight men were from the Power, Pipeline, Refinery and Chemical and the Hotel Divisions. We didn't know what our schedule was until we got to Moscow where we met a number of people from the Interior Ministry including the Director.

We were put up in an older but first class hotel where the Russians put all their foreign dignitaries. When we checked in our passports were taken and once in the morning and the afternoon someone would bring out a wastepaper basket of passports and dump them on a table in the lobby. Anyone could have stolen them but fortunately that didn't happen to ours.

We were in Moscow three days seeing prefabricated apartments and other civil engineering projects being built and some of their civil engineering research facilities. The also took us to see Lenin in his tomb. They would bring hundreds of busloads of people and children from schools from many miles to see Lenin and we estimated that there were 5,000 people in line waiting their turn. The tomb is built into the front wall of the Kremlin facing Red Square. We were taken to the head of the line. There was a partial glass cover over his body and we could see him from the waist up. He was looking a little scrofulous and it was probably about time for his yearly refurbishing job. We had a fair amount of time to ourselves and John and I rode the very ornate and rococo subway system all over which was quite easy because of the very good map which was given us. John and I gave some English pocketbook the travel lady in the hotel and she managed to get us tickets the Moscow Circus which was magnificent. It had only one ring with a seats for a couple of thousand people around it. It was not the show-girl extravaganza type of circus like in the United States but was composed of many wonderfully trained animal acts of bears, horses, elephants and even cows! The clowns were funnier than any I had ever seen here.

The interpreter assigned to us was a KGB man who was in charge of all the interpreters for foreign dignitaries and John and I got to know him very well. He was pretty stern at first but he warmed up in a few days.

The food was uniformly pretty poor. For breakfast there was a large round table of bowls of boiled eggs and plates of very fatty sausage, cheese and bread. You took a chance with the eggs as you never knew what kind you would get, hard boiled soft boiled or raw. At dinners we were invited to they served vodka throughout the meal and the Russians took the opportunity to get as drunk as they could. The bars in the hotels seemed to open and close at any time they pleased. Whiskey was prohibitively expensive, even for us, and much of the beer was foul.

We paid a visit to the GUM department store which was across Red Square from the Kremlin. It was compose of three, 4 or 5 story buildings connected together. Each one was about 500 feet long and 150 feet wide with a sixty-foot-wide atrium in the middle covered with glass. There was a ten-foot-wide walkway around each of the balconies and the stores or shops located along the walkways. A couple of examples will tell you how the Russians did their shopping. Of particular note was a ladies' shoe store. It had a counter about thirty feet long at the edge of the walkway behind which stood several clerks. Behind them was a wall on which about ten different style shoes were displayed. Shoes came in only one width but several lengths. A woman would select one of the shoe styles on the wall and then wait in line in front of one of the clerks. When she got to the front of the line she would tell the clerk the style and length she wanted and the clerk gave her a chit. The customer would then take the chit to a cashier several stores away on the balcony and after standing in line again would pay for the shoes. The she would go back to the shoe store, stand in line to give the receipt to the clerk, and then the clerk would go in the back room and bring out the pair of shoes and hand them to the customer. The customer would then stand on first one foot and the other while she tried on the shoes. If they didn't fit (and they often didn't) the customer couldn't take them back to exchange them but had to see if she could find another customer to trade with. There was also a photography and camera store. Foreign-made cameras were not imported into Russia and the Russian 35mm film was not packaged in metal cassettes but sold in rolls wrapped in paper. The store had a three-foot-square box on a table and each side had two holes in it to which was attached black cloth sleeves. The Russian would buy a roll of film, put his arms (with his camera and the film) through the sleeves, unwrap the film, wind the film onto the reels in the camera, close the camera and then bring the camera out into the light. He would reverse the process when he wanted the film developed. Of course he could take the film home and crawl under the bed covers to do the job but he couldn't do it in a closet with the door shut because the prefabricated concrete apartments that most people lived in didn't have any closets.

From Moscow we took the overnight Red Arrow train to Leningrad, now St. Petersburg. It was supposed to be a deluxe train but we slept four to a compartment with four very hard bunks. The toilets at the end of each car were pig sties like all Russian toilets. In Leningrad I talked our interpreter into arranging a visit for John and me to the Mechanobr

Institute which was a huge laboratory and equipment and plant design facility that did all the design of equipment and plants for the nonferrous metals industry. There were about ten of their metallurgists plus the Director of the Institute in a meeting held for me and they had all read several of my technical papers. I had brought along several copies of our first volume of Gold and Silver Cyanidation Plant Practice and gave them three copies which they were delighted to have. After about an hour of talking through the interpreter they began talking in English which wasn't too good but adequate. We stayed there all day and had a really interesting time.

In Leningrad got to tour the Hermitage (the winter palace) which was a tremendous museum filled with the Tsar's treasures, the summer palace which had been destroyed during World War II but rebuilt magnificently, the cruiser Aurora where the Russian revolution started in 1917 and a cathedral which was supported by 48 granite columns forty feet high and six feet in diameter that had been turned and polished on lathes back in the 1500's. We were also take to the Kirov ballet where we saw Swan Lake and as I recall it took three and a half hours on a wooden chair.

From Leningrad we flew to Kiev in a Tupolov two engined jet which could be converted to a bomber in war time. The navigator sat ahead of and below the pilot in a plastic enclosed bubble where the bombardier would sit. In Kiev we were shown public works buildings which I wasn't interested in and an old cathedral where we went underground to the catacombs where the old priests were interred in glass covered coffins in the walls. From Kiev we flew to Irkuksk in a jet copied from the British which had four jet engines mounted two on each side of the fuselage near the tail. The seats on all Russian planes were small and the upholstery was thin and generally ragged. There was a piece of loose carpet down the aisle but only an aluminum floor under the seats. There was no air conditioning when the plane was on the ground and the men passengers took off their shirts and the women took off their blouses, wearing what I would call a camisole top. Since we were VIPs we got to board first and get off first which the other passengers didn't like. The plane smelled of unwashed people and the restrooms again were filthy.

Irkuksk is only a few miles up a river from Lake Baikal, the largest fresh water lake in the world. It is also about 250 miles north of Ulan Bator, the capital of Mongolia. We were driven to Bratsk, a few miles away, where we stayed for two nights. The hotel was ten stories high, made out of concrete, and had rooms on both sides of corridors running the length of the building. We were on the fifth floor and I noticed a crack going from floor to ceiling and each of the end walls of the corridor. The crack was about five inches wide at the top, narrower at the bottom and was crudely filled with mortar. John and I went up to the tenth floor where the crack was almost a foot wide. The entire building was splitting apart! At Bratsk we went through a very large aluminum plant and also toured a dam and power plant which produced more power than Grande Coulee dam. I watched a cycle meter which showed the cycle (Hertz) varying from 47 to 53 cycles per second when it was supposed to be steady on 50 cycles which is used in Russia and many other countries. Electric clocks in Russia must not keep very good time.

We returned directly to Moscow for a day of meetings to arrange for the Russians to visit the States and then flew home. I was sure glad to get home too!

Before I tell more about the Russians I want to put in here an interesting incident that happened in the early 1970's. We were in the new building that Bechtel had built and I was called down to the conference room on the third floor along with Peter Davies, our Chief Mining Engineer, and John Dasher, a very fine chemical engineer. Two men introduced themselves as agents from the United States Counter Intelligence Agency (CIA) and had us sign a secrecy areement. They then pulled the window drapes closed (as if anyone could see in the room from across the street) and laid out about a dozen four-by-five-foot aerial photographs of the Murantau gold mine and recovery plant in Russia which had been taken from a U-2 spy plane from an altitude of 90,000 feet. They also had a couple of photos that had been taken inside the plant but they weren't to scale as the larger ones were. They were smuggled out by someone but they didn't tell us who. The CIA had the grade of the ore and wanted us to tell them how much ore the mine and plant were producing and treating. At that time the Russians were very secretive about their gold production and it would be of help to the CIA to know how much gold they were getting from their largest gold mine.

The aerial photos were amazingly clear and you could see people and fenceposts. There was one fenced-in area where they said that criminals were held and that they did the construction work..Some of the photos were taken at an angle and others were taken vertically over the plant and mine. We could count the trucks in the open pit mine and the ones that were waiting for repairs outside the truckshop. We also could calculate the amount of ore each truck would carry. In the plant we could measure cyanidation tank sizes and heights, thickener diameters and even the diameters of the pipelines we could see. By making asssumptions on slurry densities and counting the number of thickeners down for repair we could calculate very accurately what the plant was treating. Our figures showed that the plant was designed to treat 75,000 tons per day but was actually operating at only 50,000 tons per day. This was typical of Russian plants because equipment parts were hard to get, much of the equipment was of poor design, and maintenance people and operators were poorly trained and didn't work very hard. In our later trips to Russia we found that they used twice as many people in a plant than was required just to keep all the people working. Since the plants didn't have to show a profit or loss no one cared.

About three months after we returned from Russia the Russians sent over ten of their people to look at various project we were building and I was chosen to show them around the Pinto Valley plant of Miami Copper Company in Arizona. It was a 40,000 ton per day plant which we had about 75% complete. They had brought the same interpreter and guide as we had had before. They took literally thousands of pictures (we had not been allowed to take any photos of the plants of buildings we saw in Russia) and were amazed at some of the construction equipment we used. They had never seen a mechanical pipe threading machine and watched one work for twenty minutes. They closely examined an aluminum five-ton chain hoist and didn't believe it would pick up five tons until we demonstrated it. After the plant tour we laid out a lot of drawings of the plant and had the gall to ask, through the interpreter, if they could have copies of them. I told them that we were not allowed to take any photos of plants in Russia and could not even find out the time it took to build a plant as they were so secretive. I told the interpreter that they had a lot of guts to even ask for the drawings and that they could go to Hell. He laughed and told them exactly what I had said. The interpreter told me they were quite embarrassed. We took them to lunch in a Mexican restaurant in the town of Miami and when I saw one of them pouring some extremely hot sauce on his food I told the interpreter to tell him that it would eat out the stainless steel crowns on his teeth. The Russian replied that we Americans were too soft and that he liked his food with hot peppers in it. He took one bite and tears were running down his face for an hour. He couldn't eat any of the rest of the meal. The interpreter thought it was very funny and kept telling him that he wasn't as good a man as the Americans were. He could get away with razzing them because he was KGB and they were all afraid of him.

My second visit to Russia occurred in June and July of 1977. This trip was arranged by the Society of Mining Engineers as a technical exchange program and there were only five of us who went. Bechtel paid all my expenses. The others were Nathaniel Arbiter, who was retired after being a professor at Columbia School of Mines in New York and later director of research for Anaconda Copper Co., Wilson Blake, a mining consultant, Charles Fairhurst, a professor of mining engineering at the University of Minnesota and Galen Wadell, of the U. S. Bureau of Mines. Arbiter was an old friend of mine who had been crippled by infantile paralysis when he was young. He walked with braces on his legs and with two canes.

We flew to Moscow and were met by the same KGB interpreter who I had known on our and the Russian visits. We stayed in the Hotel Rossia (Russia) which was the largest hotel in the world, however, it was far from the best. Our first stop was at the Ministry of Non-ferrous Metallurgy where we received the itinerary the Russians had prepared for us. The meeting lasted about two hours and at the end of it I said that we would like to have permission to take all the pictures we wanted at the mines and mills we were to visit. Of course the answer came back that photos were not permitted. I said that on the Russian visit to the state they had taken thousands of pictures and had even asked to have copies of the drawings of a copper plant we were building. The answer was again no and I said that as far as we were concerned if we couldn't take pictures that we would call the visit off and go home. Arbiter, who was the nominal head of our delegation, was sitting next to me and tried to shut me up but I told him that we should be treated just like we treated the Russians had been. The KGB man grinned and winked at me. The Russians couldn't let us go home because they would lose face and were thrown into an almost panic. They got up and went to the corner of the room to whisper to each other because they were afraid one of us might speak Russian. Finally they sat down at the table and said they would send a photographer along with us and he would take any picture we wanted and they would send them to us. knew that we would never receive any pictures and said that that was not a satisfactory arrangement and the only one suitable to us was for us to take our own pictures. The Russians went back to the corner for a while and then said that we could take our own pictures but they would develop them for us and send them to us. I again said no and back to the corner they went for about fifteen minutes. This time they came back to the table and agreed to my proposal. Then I told them that I wanted them to tell the KGB man that if anyone objected to our taking photos that the KGB man was to tell the person objecting that it was all right and they agreed to that also.

We first flew to Tashkent, which is in Kazakhstan, east of the Caspian Sea and north of Afghanistan. We arrived there on Friday and were put up in a mediocre hotel. On Saturday morning our KGB man had arranged for us to fly to Samarkand in Uzbekistan which was the home of Tamerlane, a great Cossack who had conquered a lot of territory but I have forgotten my history about him. We visited a couple of old mosques which were being rebuilt and also an observatory which the son or uncle of Tamerlane's had built. That night we flew back to Tashkent. Sunday we rested and walked around Tashkent.

On early Monday morning we were driven about a hundred miles from Tashkent to the Almalyk copper plant which was their largest and newest copper mine and plant. The mill had a capacity of 80,000 tons per day and was being expanded to 110,000 tons per day. Even with its being a new plant it was many years behind the technology being used in the States. That night the plant manager had us to his dasha, about twenty miles from the mine, where we had dinner and stayed overnight. The next morning all of us but Arbiter were extremely sick and we found we had been drinking water from a stream which went through a cow pasture. The ride back to the Tashkent airport was torture and when we got to the airport we found out that the so-called toilet was in a small building outside the small terminal. It consisted of a concrete floor with about twelve holes in it. Even worse was the fact that the Russians couldn't aim very well and threw the paper anywhere but down the hole. We were put in a VIP room on the second floor of the terminal but all it was was a room with a couple of ratty couches and a few chairs. The KGB man got us a woman doctor and she gave us some pills which probably didn't have time to dissolve in our stomachs before we got rid of them down the hole in the toilet house. We spent most of six hours running to or being in the toilet house. Fortunately, Arbiter didn't get sick because we would have had to hold him over a hole.

We finally got on board a large biplane that held about twenty people. It had folding canvas seats in it that could easily be removed because it was used as a crop duster also. We flew about a hundred miles north to Chimkent and then to Kentai where we were to look over a lead-zinc operation. They had another female doctor waiting for us who gave us some more pills and were pretty much all right the next morning except we were weak. The underground mine there produced 9,000 tons per day of ore so low grade that it wouldn't have been mined in the States but the Russians needed the lead and zinc and never counted their costs. Kentai was a company town and everyone lived in apartments that had been built to house the mine workers. They pumped 60,000 gallons of water a minute from the mine and it was used to irrigate a huge valley below it. Again, although the mill was new it was poorly designed and had many extra workers. We were given a banquet and I was presented with an acetylene miner's lamp for my collection. We were there a couple of days before flying back to Tashkent and then to Moscow for another two days of meetings. We thoroughly covered the Kremlin and toured St. Basil's cathedral which you always see pictures of in Red Square. It is said that it was built for Ivan the Terrible and that after it was finished he put out the architect's eyes so he couldn't build anything else. I can remember us pushing and pulling Arbiter up a spiral stone staircase only two feet wide and with steps two feet high. For the second time I returned home from Russia and was very happy to do it.

I should mention that I had been nominated for membership by Frank McQuiston in the Mining and Metallurgical Society of Americal, a rather elite group of about three hundred mining people. I became President of MMSA for two years in 1975-76.

I was also given the professional degree of Metallurgical Engineer, Honoris Causa by the Montana College of Mineral Science and Technology in 1975. On the next page is a photo of me at the graduation ceremony receiving the hood which signifies the honorary degree.

In the late 1970's Bechtel's Mining and Metals Division had changed pretty much. Bob Cheatham had become a corporate vice president and Bob Shurtz, who had taken his place, was in turn replaced with a more construction oriented man. He wanted to increase profits by raising fees just when the competition was getting stronger. For me it became quite frustrating and my old heart problem and the ulcer returned. The day before Christmas of 1981 I went home tired and not feeling too well and after a couple of drinks said to Jean, "What would you think if I quit Bechtel"? She replied, "I'll believe it when I see it". I asked her if she wasn't worried about me getting another job and she said I could get one without any trouble.

On Monday morning after Christmas dictated my letter of resignation to my secretary and while she was typing it I went to see Cheatham and told him what I was going to do and why. He hadn't been too happy with the way that the Mining and Metals Division had been going either but he had been overruled by the board. He wished me well and told me if he were in my place he would do the same. I took the resignation down to Bill Bennett, who was Manager of Engineering, and he was stunned to say the least. He said he would give me more help but I said that had been promised before and it never showed up. He then asked me to stay on for at least six months and then four and then two but I stuck with the two weeks notice I had given in the resignation. I finally agreed to a consulting agreement for forty days for the next year. Even then I had to go to see Steve Bechtel Jr. who tried to make me stay on. I told them all that I was going into consulting on my own but the only one who really believed me was Cheatham. The rest of them thought I was going to work for one of Bechtel's competitors.

About a year before I left Bechtel two geologist friends of mine, (Henry Colen and Joe Wargo, who had worked for Homestake Mining) had quit and formed their own consulting company called San Francisco Mining Associates. At that time they had asked

[Photo not included]

me to come in with them but I declined. The day I gave my resignation to Bechtel I went to their office in the Russ Building on Montgomery street and asked them if they would sub-lease their spare office to me. They were happy to do it and on my last day at Bechtel I had all my personal things moved to their offices.

Jean and I left for a two-week vacation and went to the Grand Canyon for about four days and then after seeing Zion National Park traveled through Nevada where I stopped at several mines to see friends of mine. When I got back to San Francisco I had three consulting jobs waiting for me! I was prepared to spend two years consulting and if at the end of that time I was breaking even I would stay with it; if not I would look for another job in the mining industry.

Before I leave the subject of Bechtel I should tell about AgAu Exploration and Tuscarora Associates. Frank McQuiston had retired from Newmont but still looked after their Carlin Gold mine and one of their geologists told him about a good-looking silver prospect on Rock Creek, about twenty miles by four-wheel drive west of Tuscarora which was in turn about 50 miles northwest of Elko, Nevada. Mac,a friend of his named Ed Hewitt and I formed AgAu (the chemical symbols for silver and gold) and he got a mining friend of his to drive a 900 foot adit into what was supposed to be the ore body for a fifty percent interest in the property. (An adit is a roughly horizontal hole with only one open end. A tunnel has two open ends.) The adit intersected a shaft where some high grade ore had been taken out in years past but what was left wasn't worth mining.

To get to Rock Creek we had to go through Tuscarora which had had both silver and gold mines in the late 1800's. There were about a million tons of of waste rock in dumps around the old shafts and we took samples for assay that ran about two ounces of silver and 0.01 ounces of gold per ton. I did some cyanide leaching tests and we decided that we had the makings of a heap leach operation. Mac raised a half million dollars from some mining investors and I designed the plant. We got some old equipment from an old mine at Tombstone, Arizona and added some new equipment. The plant was very simple and easy to operate. We had only three items of automatic control and instrumentation in it, a level control for the pregnant solution deaerator, a magnetic flowmeter which was calibrated to tell the tons of solution we had put through the plant and a thermometer on the wall. We hired as manager a man who we both knew who had retired from Newmont and I took some of my vacation time and a lot of weekends helping build the plant. We also hired our son Scott and had the retired chief chemist from Newmont to teach him fire assaying. The price of silver was on its way down from its $50.00 per ounce high but our first shipment to the refinery was sold at $38.00 per ounce. We operated the plant for about a year and leached about a half million tons of old dumps before we shut down the operation when the price of silver reached $10.00 per ounce. We sold the plant and our leases on the claims to a small mining company that operated an open pit mine for gold but after a year they folded up. Our investors got their money back and a small profit and Mac and I made a little money. It wasn't the bonanza we hoped it would be but we had a lot of fun.

SAN FRANCISCO MINING ASSOCIATES
JANUARY, 1981 TO JULY, 1984

Both Henry and Joe wanted me to become a partner in their business and we had a number of discussions about it. I talked with both my attorney and my accountant about going into consulting and in order to set up a retirement plan I had to become incorporated. My attorney asked me what I wanted to call my company and I said R. S. Shoemaker Inc. but he suggested that it be R. S. Shoemaker Ltd. which means the same but has a better sound to it. I became the President and only employee. My accountant told me not to pay myself any salary for at least six months because he wanted to do some income averaging for tax savings. Since I was working but not making any money he said that made me eligible to receive food stamps! Of course, I didn't apply for them even though our benevolent and stupid government bureaucrats would have been happy to give them to me. Anyway there were too many problems in joining Henry's and Joe's company becaause they had some mining claims that had to be kept separate but they had me get business cards showing I was a Vice President of San Francisco Mining Associates. Just by doing so I brought them in quite a bit of business. They didn't bring any business in for me but that was all right because I had more business than I could take care of right from the very start. I never made any announcements in the technical journals or put my business card in them because the mining fraternity is a very small one and the work got around very fast that I was available and limiting my practice to the research, design and operation of plants for the extraction of gold and silver from their ores. At that time there was only one other consultant in that business, George Potter who was a good friend of mine and who had retired from the US Bureau of Mines. Later there were others but they were all younger and did not have the experience that I had. I was the most expensive by far at $100.00 per hour plus expenses. Later I gradually raised my fees to $140.00 per hour although when I was doing expert witness work I charged $250.00 per hour.

One of my first consulting jobs was most interesting in that it turned me into a geologist. Kennecott Copper had a large silver and gold refinery to refine the substantial gold and silver byproduct that they produced in their electrolytic copper refinery tankhouse as slimes. Copper is smelted from copper sulfide concentrates and cast into impure anodes. In turn the anodes are put into an electrolytic cell where pure copper is deposited on pure copper starter sheets as cathodes while the impurites fall to the bottom of the cell as slimes. The silver was dissolved from the slimes with nitric acid precipitated as crude metallic silver and refined in electrolytic cells. The remaining gold slimes were smelted into crude gold and also electrolytically refined in hydrochloric acid. Spilled and leaked acid solutions had eaten into and through the concrete floors and penetrated into the many wood tanks and tank supports. Many pipelines were partly clogged with gold and silver. Kennecott neede $16 million to build a new and more modern refinery and they asked me to find out how much money they could recover from the old refinery. This is where I became a geologist because I had to lay out a drilling program to sample all the likely places where gold and silver had been deposited. I had Kennecott hire a concrete drilling company to drill twelve inch diameter core holes in the floor and into the underlying soil. I also had holes drilled into wooden tanks and tank supports. We even took some of the pipes and reamed them out. All of the concrete, soil, wood cuttings and scale in the pipes were assayed. Unfortunately I turned out to be a failure as a geologist as I found only $9 million dollars worth of gold and silver and Kennecott figured they could get along a few more years with the old refinery with the hope that gold and silver prices would go up so they could build a new refinery and make a profit in doing so.

Another early client was the DuPont Company who was the only manufacturer of sodium cyanide in the United States. The cyanide process for extracting gold from ores had been invented in 1877 and is today the only major chemical process that has not basically changed and is still in use. I had got a job for Bechtel to build a cyanide repackaging and distribution terminal for DuPont in Carlin, Nevada They wanted to put it in either Elko or Mina, the latter being in about the center of Nevada and close to Round Mountain Gold, one of their largest consumers. I thought Elko might cause public relation problems and Mina was too far away from their other customers. Carlin was a very small town and there was a railroad siding there with land that could be bought very inexpensively. Dupont agreed and the plant was built there. The dust and broken briquets that were generated in repackaging were dissolved in a caustic solution and neutralized with hypochlorite. I suggested that instead they truck the resulting cyanide solution to nearby gold plants and give it to the gold companies as it would be cheaper than neutralizing and it would create good will. They adopted this procedure.When I went into consulting DuPont hired me to advise them on cyanide problems in the gold and silver industry. In 1998 I am still consulting for them.

Another of my old clients was Goldfields Mining Corp. which was a wholly owned subsidiary of Consolidated Goldfields of London. Consolidated Goldfields was one of the largest gold producers in South Africa and also had other mines and quarries worldwide. Goldfields Mining was set up to explore for gold in the United States and Canada and had as it President, Bill Brown who I had worked with on that manganese venture in Australia for Union Carbide Ore Company. Bill was born in Tintagel in Cornwall the legendary home of King Arthur and the Round Table and was a graduate of Camborne School of Mines in Cornwall. We remained close friends untill he died in 1996.

The had developed a small underground gold mine in Canada and a heap leach gold operation in New Mexico. They then found a large low-grade gold deposit in southern California about fifty miles northwest of Yuma, Arizona. Bill asked me to supervise the research work on the ore and then supervise a pilot plant program on five 5,000 ton heaps. When that was successful I became Goldfields' representative at Bechtel who they had hired to do the engineering and construction. They called it the Mesquite Mine. It started off at two million tons per year but eventually got up to eight million tons per year and was one of the lowest cost gold operations in the world. Bill put me in charge of the research work on the ore and I was Goldfields' representative at Bechtel during the design. Bechtel had appointed a very good metallurgist who had worked for me as their project engineer but he had no gold experience. He became an instant gold expert and we had some terrible arguments over how the plant design should be done. After the operation started I continued to visit it and discuss metallurgical problems with the staff every two months until 1993 when Consolidated Goldfields was sold to an English conglomerate called Hanson PLC. When Goldfields discovered their Chimney Creek deposit about 50 miles northeast of Winnemucca, Nevada I performed the same functions with that operation which had both a mill and a heap leach. This plant was designed and built by Davy McKee. Over the years I consulted for Goldfields on many of their exploration projects.

Jean had always wanted to travel to Australia and New Zealand and I had built up a lot of frequent flyer miles from all the airline flights I had taken so I got her and our friend Alberta Mathews tickets to those places with a stop on the way back in Fiji. They were gone almost a month and during that time I got a consulting job in Australia. Three different times when I had been in Australia for Bechtel I had made arrangements to visit the Emperor gold mine in Fiji but each time I had to cancel the visit because Bechtel wanted me home in a hurry or because the airline to Fiji was on strike. This time I arranged to land in Fiji the day after Jean and Alberta had arrived there. I landed in Nandi a six in the morning, rented a car and went to the hotel where they were staying. Jean was really surprised to see me to say the least. I had reservations at a much better hotel and moved her there. The next day we drove about 75 miles to the mine and had a very nice visit. It had been built in the 1930's and was pretty well run down and wasn't making very much money. Leo Abell, who had taken my place as Chief Metallurgist and later as Consulting Metallurgist at Bechtel had been mill superintendent there for seven years which included World War II. A few months later they asked me back to do some consulting work for them and I stayed in their guest house for a week.

George Beals had left Palabora in South Africa and had been transferred to Panama where RTZ was thinking about opening up a copper mine. He called me one day and said he was being transferred to the original Rio Tinto mine in Spain which had been purchased in the 1870's. That was the start of what became the RTZ corporation, one of the largest mining houses in the world. The deposit had been mined by Spaniards, Romans and the Phoenicians. George was to be the Managing Director of Rio Tinto Minera (RTM) as it was called and wanted me to meet him in Rio Tinto in four days time. I flew to Seville and the company had a car waiting for me to take me the one hundred miles west to Rio Tinto. During a period of Nationalization RTZ had been forced to sell 51% of the mine to Spain's Central Bank and the management had been transferred to the Spaniards. They had pretty much run the operation into the ground and RTZ had been pouring money into it to keep it afloat. Finally RTZ had told the Spanish government that they would not put up more money unless the government allowed RTZ to take over management again and be allowed to get rid of about a third of the workers who had been hired by the Spaniards and did nothing to earn their pay. The government agreed as the mine was a large source of revenue to them.

RTM had installed a gold plant in 1970 to treat the gossan (oxidized material with the copper leached out of it) ore which overlay the copper ore beneath it. Much of the gossan had been removed over the many years and was in dumps that could be reclaimed. It was designed to treat 1.5 million tons per year and later expanded to 1.9 million tons per year although there was no instrumentation to tell them how much the plant was actually treating. George wanted me to survey the plant and make recommendations on its operation. My report recommended the installation of magnetic flowmeters and density meters so they could tell how much they were putting through the plant. (I suspected that the tonnage treated was substantially less than they thought it was). I also recommended that studies be made in several parts of the plant which I thought were not performing well.

I went back about three months later when the meters had been installed (at a cost of $50,000) and the studies were done. I took Jean with me on that trip. The meters showed that the plant was treating only 1.5 million tons per year! The studies showed that much of the equipment was not operating up to capacity and that by making some minor changes at a cost of another $50,000 we could substantially increase the plant throughput.

With some simple improvements in operating practices and some changes in equipment that were fabricated in RTM's shops within a year the plant was treating three million tons per year with thirty percent less people and making a higher recovery. RTM then decided that they wanted to expand the gold plant to six million tons per year and I worked with Wright Engineers of Vancouver, Canada during the design and construction and with RTM to get the new section of the plant started up and running. Altogether I made sixteen trips to Spain in a little more than four years.

Rio Tinto Minera had a copper smelter and refinery at Huelva. They also had a gold and silver refinery there and I was asked to look it over because it was producing only half as much as it should. The refinery treated gold-silver anode slimes from the electrolytic copper cells at the Huelva smelter but the major feed was a gold-silver-copper bullion produced at the RTM gold recovery plant. The bullion contained about 20% gold, 45% silver, 5% zinc and 30% copper and that amount of copper was the trouble. Both the bullion and the slimes were melted in an electric furnace and cast into anodes about 18-inches square and an inch thick which were put into electrolytic Moebius cells. The cathodes were made of stainless steel and as the silver was dissolved from the anodes it was deposited on the cathodes in beautiful crystals which were scraped off and drop to the bottom of the cells. Gold sludge is retained in the cloth bags which cover each of the anodes. The electrolyte is silver nitrate and copper nitrate (the latter carries the electric current) and for maximum efficiency the copper content must not exceed 2%. To control the copper content some of the electrolyte is periodically drawn off and the silver is precipitated out as silver chloride so the copper nitrate can be discarded to the copper refinery. The silver chloride is filtered and dried and sent back to the electric furnace for remelting into anodes. When the copper content of the electrolyte is high the recycled silver increases markedly and thus reduces the amount of new bullion that can be treated in the Moebius cells. By precipitating the silver with formaldehyde it is produced as pure metallic silver which can be melted and sold instead of having to recycle it. The end result was a 100% increase in cell capacity. While I was there I also detected one of the employees stealing silver chloride which he was getting past the guards by putting it in his shoes. He wasn't wearing any socks (none of the workers did) and the silver chloride had turned his feet and ankles coal black which was what tipped me off.

On the second trip to Rio Tinto (when Jean was with me) I hadn't yet been paid for my time and expenses incurred during my first trip and the Spaniard who was assistant manager called me into his office and apologized for the delay which was caused because they hadn't yet received approval from the government to pay me. He said that it would take another three or four months to get the paperwork done but if I didn't want to wait that long he could pay me in Spanish pesetas. There was one problem, however, and that was it was illegal to take pesetas out of the country. He did say that although the customs people might check my bags going out of the country they most probably wouldn't search me if I carried the money on my person. The pesetas could be exchanged outside the country but a person just couldn't take them out legally. I said I would take the pesetas and the day we were to leave he called me in and counted out one and a half million pesetas. They made a package about six inches high. I took them back to the guest house where Jean was and laid the packets out on the single bed which they completely covered. Spanish currency is about one and a half times larger in each direction than our currency. What I needed was a money belt and Jean went to the store and bought some cloth which she sewed into a money belt with six pockets in it.

Jean was well entertained by some of the Spanish ladies and they took her to Huelva on the seacoast to have lunch and see the church where Columbus went to pray before he left on his first voyage to the new world. After a week at Rio Tinto we went to Seville to stay at a magnificent hotel for a couple of days while we saw all the sights. Then in a rented car we went to Cordoba, Granada, Malaga, La Linea where we could look at Gibraltar but not cross the border to tour it, Cadiz and then back to Seville. We stayed at Paradors which are magnificent one-and two-story government owned and wonderfully operated tourist hotels. Most of them are built next to or a part of old Moorish castles and are very reasonably priced. We visited the Alhambra at Granada and a Catholic cathedral built in the middle of Moorish mosque that must have been five hundred feet square. The mosque's floor was covered with six or eight layers of large Persian rugs. Then the top rugs got dirty they had just covered them up with new ones. The Parador north of Cadiz was built on the edge of a five-hundred-foot vertical cliff and from our balcony we could look straight down into the valley below. I paid for everything in cash and still had over a million pesetas left when we flew from Seville to Madrid and then on to Frankfurt, Germany.

In Frankfurt I finally got rid of the money belt (which was very uncomfortable to wear) and got a check for over ten thousand dollars. I had a couple of meetings with people from Metallgesellschaft, who I had been doing some work for, and we toured the city for a couple of days. A pamphlet in our hotel room offered free guided walking tours of the old part of the city so we called them for a tour. The man who showed up that evening turned out to be a senior vice president of the Deutches Bank, the largest bank in Germany. Among other things we saw the house that Goethe, the German philosopher, lived in. We stayed at the Frankfurter Hof, the same hotel I had stayed in when I made my first trip to Norway. I had had to go there to see about some equipment that we were buying. At that time most of the city was still in ruins and the Frankfurterhof had only thirty rooms that were habitable. When Jean and I went to Frankfurt the whole city had been rebuilt.

Cullaton Lake was another interesting project. It was located about three-quarters of the way up Hudson Bay and a hundred miles to the west in the Northwest Territories of Canada. There was no road into the mine and I had to fly to Thompson, Manitoba, then to Churchill on the western side of the bay and then to Cullaton Lake. The mill was built by a Canadian company who didn't know what they were doing and there was a lot of problems. My first trip was in the middle of the winter and it was fifty below zero when I got there. The walk from the bunk house to the mill building was only seventeen steps but you counted every one of them. The mine was underground and the miners and mill operators worked twelve hour days for two weeks and then flew out to Thompson for two weeks. The food was wonderful and we often had caribou steaks which were great. The country was very flat with a lot of lakes and streams and in June I borrowed a fishing pole to fish a stream a short distance away. On my first cast I caught an 18 pound trout which was served that night. I made about eight trips up there until the mill got running well.

R. S. SHOEMAKER, LTD.
GRASS VALLEY, CALIFORNIA
1984

In January of 1984, I decided that I didn't have to work in San Francisco as I could consult from any place that was not too far from a good airport. I rarely had any clients come to my office so there was no need to stay there. We went to Grass Valley and through a friend of mine found a good architect to design a house for one of our lots there. Construction of the house started in June and I realized that we should be in Grass Valley while it was being built so I could keep an eye on things when I wasn't traveling. We put it up for sale and it sold in three or four days. The new owners wanted us out by the tenth of July and we really had to scramble to get our things packed up to move. Jean drove up and finally found a duplex to rent and we took both apartments so I could have my office downstairs while we lived upstairs. Half of the double garage and two of the bedrooms were full of boxes that we didn't unpack. We had planned the house very carefully and made only one small change during construction. When it came time to move in, just before Christmas of 1984, we had a big snow storm and a power failure that lasted four days. The mover's truck was frozen in and we had no heat. After two days of us freezing I loaded two single beds onto my pickup and we stayed in the new house which we could heat with the wood stove and heat our meals on the stove which had propane fueled burners.

I have a nine-hundred-square-foot office with its own wood stove, gas furnace and air conditioner. The rest of the house is heated by another wood stove and also has a gas furnace and air conditioner. We burn wood most all the time because there is plenty to cut on the property as trees die or fall when they get too loaded with the heavy snow which we have about every four years. The most snow we have had has been four feet but the normal snowfall is a foot or eighteen inches in two snows. One year we had only a quarter of an inch. We have only one spare bedroom as Jean uses the other one for a sewing room. We have a ten by forty foot swimming pool enclosed in glass, a small workshop and a double garage. The entire building covers 5000 square feet with the outside being gray stained Canadian cedar and the roof covered with copper shingles. About four years ago I designed and built myself a double garage in which I keep my pickup and my John Deere tractor. It is also cedar with a copper roof and is situated between our house and the street. The tractor is used to mow the weeds and brush which grows on both lots every fall and also it has a snow blower that I use for the eight-hundred-foot driveway and the 1.2 miles of road in our development which has 39 lots that average five acres each.

In my office I have my grandfather's rolltop desk and chair, a drafting table, my own desk and credenza, a drawing file, a wall of bookshelves, a nine-foot curved computer table I had built, a copy machine and a couch. It is a very comfortable and pleasant place to work. Our 15 acres are covered with black oak, fir, cedar, pine and madrone trees. The oaks shed an enormous amount of leaves in the fall and it keeps me busy at that time with a gasoline powered leaf blower cleaning the leaves away from the house and the shrubbery around it. Rhododendrons grow extremely well here and we have a number of them with blooms as large as ten inches across.

When I am traveling, I drive the 65 miles to the Sacramento airport where I can get many direct flights and connections to anyplace in the world. Grass Valley and Nevada City are only three miles apart and with 9000 and 2500 people each. Grass Valley is the shopping center for about 40,000 people and we live three miles from it and about 700 feet higher than its 2450 foot elevation.

The first lawsuit I got into as an expert witness was in Elko, Nevada for John Miller who was our attorney on the Tuscarora venture and who became a close personal friend. A promoter named Warren Hunt had filed some mining claims on a small gold deposit north of Carlin, Nevada and had got a company by the name of Universal Gas (Montana) Inc. to build a small mill on the property in exchange for 51% of the stock. They built a very nice carbon-in-leach mill with mostly used equipment at quite a low cost and were making money. Hunt had a son-in-law who was a drilling contractor and Hunt wanted Universal to give the son-in-law the contract to do all their drilling. The son-in-law wasn't much good and Universal refused. Hunt then sued Universal claiming their mill was badly run and inefficient and asked that the operation be turned over to him. John hired me to study the mill operation and if it was satisfactory to testify so in court. I spent a day a the mill and found that it was very well run. About three months later the trial started in Elko and John asked me to visit the mill again in the morning before the trial. Hunt had also hired an expert and he was to look over the mill that afternoon. The attorneys were very careful to keep us experts apart. At eight o'clock on the morning of the trial I met with John, his partner David Hoy and the litigator from San Francisco they had hired by the name of Greg Wilson. John went over to the court house and came back with the name of the other expert, Sam Cretzer. Sam had been in Bechtel's M&M Division instrumentation group and then had been made project engineer when we built the heap leach operation for AMSELCO (American Selection Trust. He hadn't been to college, was not a metallurgist and his only gold experience was the AMSELCO job which was not a milling or carbon-in-leach plant but a heap leach operation. I quickly wrote out a bunch of question for Greg to ask him.

The entrance to the courtroom was on the side between the railing and the onlookers seats and John said that Cretzer would be sitting on one of the seats nearest to the door. He told Greg and me to enter the courtroom at exactly one minute to nine. I was to say "Hello Sam" and walk to the other side of the room. Greg would go through the gate in the railing and pretend to whisper something in John's ear (John would arrive a few minutes early). Greg would then come back to me, pretend to whisper in my ear and I would get up, walk out of the courtroom and back to John's office. When I walked into the courtroom, Cretzer was so surprised his mouth fell open and he couldn't even say hello back to me. I went back to John's office and ant ten thirty the three attorneys walked in and said the case was over!

Hunt. who was a bombastic type, took the stand first and after his lawyer had had him state his case, David asked him some questions and his answers were so long and disjointed that the judge had to keep telling him he was wasting time. Then they put Cretzer on the stand and about all he said was that he thought the plant didn't work very well. Greg, who was an absolute tiger in court, then asked Cretzer all the questions I had prepared and all Cretzer could say was that he would have to study the plant some more or that he wasn't sure. Greg really had him sweating and finally said, "Mr. Cretzer, you are supposed to be an expert in carbon-in-leach operations and yet you haven't been able to answer any of my questions. I cannot understand why you are here at all". Cretzer was so rattled by this time that he blurted out "I'm not an expert on carbon-in-leach, that fellow Shoemaker who came into court at nine o'clock is the expert". Greg then said to the judge, "Mr. Shoemaker is our expert witness, Your Honor and we move for a dismissal". The Judge said, "Granted with prejudice" and got up and walked out!

The Nevada Packard mine south of Lovelock, Nevada was and arbitration case. The promoters of the Nevada Packard were Dave and Hank Scholtz. I had not met Dave, who was a geologist and an arrogant know-it-all but I knew and liked Hank who was a metallurgist for Kennecott before he went into a partnership with his brother on the Nevada Packard which was a small silver heap leach operation. They had put some of their own money into the project and had a backer that put in the rest of what was required. The recovery plant was in a couple of semi-trailers and they had contracted with Vinnel Corporation to do the mining, build the leach pad out of clay (this was in the days before an impermeable plastic liner was required under the ore), and crush and stack the ore on the pad. The mineral was cerargerite, a silver chloride that dissolves in cyanide solution like sugar in a hot cup of coffee, and their test work showed that 50% of the silver would be leached in six hours. They had just enough money to pay Vinnel for a month's work and figured by that time they could recover and sell enough silver to pay Vinnel on time and continue the operation. Unfortunately, they didn't get enough silver and by the end of the second month couldn't pay Vinnel so Vinnel took their equipment off the job and took their claim to arbitration as was required in the contract.

Vinnel hired John Miller and David Hoy again and they brought in Greg Wilson. I spent a day with John at the shut-down operation going over the research work, the plant and the leach heaps that had been built. The leach pad was 1500 feet long and 150 feet wide and about 300 feet of its length had crushed ore piled on it. A clay leach pad has to be twelve inches thick and made out of three layers, each one brought to the proper moisture content and rolled and compacted to 95% Proctor (a civil engineering term). It also has to be kept wet with sprinklers until the ore is put on it, otherwise it will dry out and crack.

At the arbitration hearing in Reno the Scholtz brothers claimed that Vinnel hadn't crushed the ore properly and therefore it was their fault that they didn't recover enough silver to pay Vinnel. The Scholtz's lawyer wasn't very good and at every recess, at lunch and in the evening of the first day the four of us were continually making up questions for the Scholtzes witnesses and preparing answers for questions that might be put to me. I was put on the witness stand after lunch on the second day The opposing attorney asked me questions for about an hour and a half and then it went like this;

Attorney:	Do you agree that the research work had been done properly?
Me:	Yes sir.
Attorney:	Do you agree that the ore contained the amount of silver that it was supposed to and that it leached very rapidly?
Me:	Yes sir.
Attorney:	Do you agree that the ore was leached with the proper amount of cyanide and that the plant was operated in a manner so that it would recover the silver in the pregnant solution efficiently?
Me:	Yes sir:

Now came the question that we knew he would ask and we were waiting for.

Attorney:	Now Mr. Shoemaker, since you have agreed to all those questions would you explain just exactly where all that missing silver went?
Me:	Right straight into the ground beneath the clay pad. You have already heard your own witnesses state that when the wind blew there were always dust clouds over the surface of the pad. The pad was not kept wet before ore was put on it so it cracked and the silver went through the cracks and into the ground beneath.

At that, Hank Scholtz hit his forehead with the palm of his had and it made such a noise that everyone in the room turned to look at him. Then Greg Wilson stood up and said "We rest our case". Two weeks later the arbitration board ruled in Vinnel's favor and the Scholtzs and their backer had to come up with the money out of their own pockets. I felt sorry for Hank Scholtz because I liked him but he was the metallurgist and should have known that the pad had to be kept wet.

I received a call one day from a vice president of Companhia Vale do Rio Doce (CVRD), a very large mining company in Brazil which was 51% owned by the Brazilian government. I had become acquainted with him when I was with Bechtel and we helped him out on a pipeline for phosphate rock. CVRD is the largest iron ore mining company in the world and also has interests in aluminum, phosphate rock for fertilizer, a steel plant and some other things. It is the only State-run company in Brazil that makes money. The power, telephone, oil refining and other State companies all lose money. CVRD was getting interested in gold and wanted some help. Fortunately they had a large research laboratory that was well equipped but they didn't know anything about gold.

They had found a vein type gold deposit which was ten meters wide, over a kilometer long and quite deep and which outcropped on the surface. The first thirty feet of the deposit was oxidized and could be mined with a large backhoe and they hoped it might be heap leached. The sulfide ore beneath would have to be crushed, ground and cyanided. It was called Fazenda Brazileira and was located in Bahia Province about 150 miles west of the city of Salvador which in turn was an hour's flight north of Rio de Janeiro.

On my first visit (and all subsequent ones) I was met at the plane, rushed through customs and immigration and driven to one of the best hotels on Copacabana beach. This famous beach isn't at all like the pictures one sees as there are no public restrooms and the beach is used by all for that purpose. They do have large crews cleaning and raking the beach at night but you sure have to watch where you step at any time. CVRD wanted me in Brazil in such a hurry that they couldn't arrange a contract in time for me to get paid in dollars and asked if I would mind being paid in Cruzeiros on my first trip. Cruzeiros weren't any good outside the country but I said that was all right if they would pay for my and Jean's first class ticket in Rio. I would deduct the cost of her ticket from my fee. Then I told Jean that she could spend all the Cruzeiros in Brazil.

I laid out a heap leach research program, sketched out the recovery plant, and sized all the equipment at the Belo Horizonte laboratory and on my next trip checked all the drawings so the plant could be built. Jean had spent about half of my fee when they told me that they had arranged to pay me in dollars from their New York export office, (CVRD sold a lot of iron ore the companies in the United States), so I put a stop to the jewelry buying. Jean had a wonderful time seeing the sights in Rio, Belo Horizonte and Ouro Preta and enjoyed the trip very much. On one of my previous trips I had been asked by the director of the laboratory to lecture at the school of mines at Ouro Preta which I did. He also took me to the boarding house where he had lived when he was attending the school of mines to talk to the students living there and to the mineral museum at the school. The museum is probably the finest of all except that in the Smithsonian Institute.

My most interesting trip to Brazil was to see the Serra Pelada mine. CVRD geologists had discovered this gold prospect and had actually put some drill holes into it. However, before CVRD could finish the drilling the garimpeiros (independent miners) had moved in. They laid out two-by-three meter claims and started digging. Ten men would operate each claim with two digging with a pick and shovel and loading the ore into sacks, seven hauling the ore out to their treatment area and one washing the ore in a hollowed-out log to break up the lumps of clay and then recovering the gold in a rocker or cradle exactly like those that have been used all over the world for hundreds of years. There quickly became so many garimpeiros that CVRD appealed to the government to kick them off the property. The government kept setting deadlines when the garimpeiros had to be off the property but the number of miners kept growing until there were 60,000 of them and to put them all out of work would have been politically impossible. Some of the miners got very rich but the majority didn't. Some of the gold nuggets found weighed as much as fifty pounds. The government put in a tailings dam for the slime fraction of the ore which contained about half the gold and which was too fine in size to be recovered by a cradle but the miners didn't maintain it and during the rainy season it washed out and all the slimes ended up in the Orinoco river. I worked for CVRD about four years and make 15 different trips there. The Brazilian engineers were excellent and most eager to learn anything new. I really enjoyed working with them.

In the late 1980's I began consulting for Coeur d' Alene Mines silver heap leaching operation near Lovelock, Nevada. It was being managed at that time by Larry Hartzog who I had hired at Bechtel and who had left to build the Rochester operation for Coeur d' Alene and be their manager afterwards. Shortly afterwards, Hartzog was promoted to Vice President of Engineering for Coeur in Coeur d' Alene, Idaho. I continued to consult for Rochester and in early 1990, Dennis Wheeler, Coeur's President, flew to Grass Valley, took me to lunch and asked me to join the Board of Directors of Coeur. The job paid $50,000 a year for four meetings a year but in addition I thought it would be interesting to be a Director and I bought a couple of books on how to be a good one. I had persuaded Wheeler to hire a good friend of mine, Bob Thurmond, as a mining consultant for Rochester and he and I would make our consulting trips there together. Bob became convinced that Rochester was underloading their 85-ton haulage trucks and were losing a lot of money because of it. Both Hartzog and the new manager, Bob Martinez, wouldn't admit that they could be wrong but Thurmond and I kept after Wheeler and he finally had some scales brought in and equipped one truck with an electronic scale. Thurmond and I had also been after Wheeler to fire Hartzog because although he had been a very fine engineer he wasn't a good plant manager and he was a worse vice president. The scales showed that they had been underloading their trucks by eleven tons and over the three years they had had the trucks had lost about five million dollars because of it. Wheeler fired Hartzog when he found that out.

It took me a year to really get acclimated the the Coeur Board and when I did I began to see the Wheeler was an egomaniac who didn't give a damn for his stockholders and only lived for the prestige that his job and directorships in other companies gave him.. When I had been elected to the Board Coeur was in the process of developing the Kensington Gold deposit north of Juneau, Alaska and I believe I was the only one on the Board that didn't believe in it wholeheartedly. When they finally got the ore body drilled out after putting a mile long adit into it the grade turned out to be lower than they expected. As of this date, August,1996 they still haven't got all their permits to start construction and I doubt if the price of gold will ever get high enough to make the mine a profitable one.

In 1992 Coeur bought a prospect in southern Chile called Fachinal, drillled it and did an internal study that showed it would be a profitable silver operation. I didn't believe their figures and said so. Shortly after I left the Board, Coeur started designing the plant and they put it in operation in November of 1996. Coeur has been strangely quiet about its performance and there are rumors in the industry that the grade of the ore has been far lower than expected and the costs higher.

In March of 1993 there was a Board meeting in Palm Springs. The Board knew that Wheeler had been negotiating with Cyprus to buy the Golden Cross mine in New Zealand and I had asked him for a copy of the due diligence report that Coeur had supposedly done. Wheeler kept putting me off and at the time of the meeting I still hadn't received it. At the meeting he asked for approval of the purchase of the mine for $53,000,000. I asked to say a few words before the vote. I said that I had had concerns about Kensington and Fachinal and that since I had asked for the Golden Cross due diligence and had not received it I was resigning from the Board and walked out of the room and came home. There were a lot of other things that were wrong with the company and the way it was run and I'm glad I left. Last month Coeur had to write down the entire $53 million for Golden Cross because the tailings dam was moving and they had to shut the mine down.

In 1984 I got a call from the president of a very large and respected engineering firm headquartered in the United States. They had done the design for a lead-zinc plant in Peru but their client had not paid a substantial portion of the engineering company's bills when they decided not to build the plant because the price of lead had gone down. The president wanted to sue the Peruvian firm and asked me to look over all the work they had done so I could testify that it was done in a workmanlike manner and had no faults in it. I spent five days looking at all the paper that had been accumulated on the job (including the drawings) and talking the the project engineer and some of the technical group leaders. I was going through the backup data for the invoices that had been sent to the client and found that on the second month of the project someone had accidentally doubled the hourly amount that should have been charged for the man hours used on the job. Each month after that for ten months the same mistake had been made and the actual cost of the work just about equaled the amount that the engineering firm had been paid. I took my findings to the president who was extremely pleased because if they had gone to court their books would have been subject to examination and they would have looked very foolish. I invoiced them for $5,000 and when I received the check it was for $10,000 and had a nice note with it from the president thanking me for catching the error and keeping them out of trouble.

Getty Minerals, a division of Getty Oil Company, asked me to comes to their Mercur, Utah gold operation to take a look at some research work they had done on heap leaching about a million tons per year of ore that was too valuable to discard as waste and not valuable enough to put through their mill. They were crushing the material to a half-inch size before leaching it. The ore appeared to me that it would leach at a six-inch size as it was quite porous and I asked them to run some leaching tests on the ore at that size. A couple of months later I went back and the tests looked very good. Their metallurgist had designed a heap and a recovery plant that they estimated would cost $9 million which would make the project uneconomic. I was able to show them how to use a valley to leach the ore in instead of using a horizontal pad and how to recover the gold from the leach solution by putting it through their own plant instead of building a separate one all for only $1 million. I have a standing offer (in writing) from Ed Maurer, their mill superintendent, to buy me dinner any time I am near Salt Lake City.

I did a most interesting job for Lohja Corporation in Finland. Lohja was a kind of conglomerate in that they did a variety of things, one of which was to mine pure silicon dioxide, commonly known at quartz. The were drilling out a new deposit and their geologists found gold in the quartz. They asked me to come to Finland and I decided to take Jean along with me. We flew from Los Angeles to Stockholm where we found that the Finnish airline was on strike and as far as we could go was Turku on the west coast of Finland. While we were waiting for the plane to Turku we met a business man from

Finland who had his car at the Turku airport and was going to drive to Helsinki. He asked us to come with him which we did and avoided trying to get a bus.

We were put up at a very nice hotel in Helsinki and Lohja sent a car for me the next morning. I was taken to a cement plant some 50 miles away which Lohja owned and which also had their research laboratories. I spent a week at the laboratory talking with their engineers, looking at their data, designing a flowsheet for their plant and sizing the equipment that would go into it. It was to be the first gold mine in Finland. Each day they would send a car for me and return me to the hotel in the evening. One evening I was invited to a company house on the seacoast where several of the officers of the company, some of the men I had been working with and I had a sauna and then a very fine dinner. Another evening they sent a car for Jean and had a dinner for us which some of their wives attended also. At the end of the week we took a bus back to Turku and then got a plane to Stockholm. We stayed there another couple of days as Jean hadn't been there before and then flew home.

I have had a geologist friend for years by the name of David Lowell. He had discovered some very important copper deposits both in the United States and in Chile and a few years ago decided to look for gold. He and his wife moved to Chile (although they kept their ranch south of Tucson, Arizona) and he set up a company called Minera del Inca with some backing from a Canadian who owned a drilling company. David found what he thought was a good gold prospect and asked me to direct the metallurgical program for two percent of the company. The deposit was about 75 miles south of Antofagasta in the northern part of Chile. I went to Chile to look the deposit over, see the exploration pits that had been dug and look at the drill core. I then had the metallurgical work done in Sparks, Nevada. David's backer wanted his money back right away and since he controlled the company he sold fifty percent of the stock for stock in a fly-by-night company that drilled a couple of more holes in the deposit and then went bankrupt. That left me with only one percent of the company. The David found another buyer who had money and was willing to pay cash for the rest of the stock. I received $140,000 for my one percent for which I had invested only about forty hours of my time. David got a million for his stock.

Another interesting law suit was one in which I was working for the U.S. Attorney in San Francisco. A business man named Feezor from Tucson who had more money than sense had bought some mining claims in Death Valley from an old prospector who had filed them when it was legal to have mining claims there. The National Park Service didn't think that there was enough copper in the claims to make a valid discovery and had been trying in the courts for several years to get the claims declared invalid. The judge who had heard the case had died and a new judge who was assigned decided that he wanted to hear all the testimony himself so the case had to be started all over again. Feezor had hired a couple of geologists who were more interested in Feezor's money than they were in telling the truth and he also hired a reputable consulting firm, Pincock, Allen and Holt, to develop a process for making copper sulfate for use in anti-fouling paints and fungicides rather than making a crude cement copper by precipitating it on scrap iron as he had claimed he was going to do previously. I drove to Death Valley where they put me up in the motel at the Furnace Creek Ranch rather than the more expensive Furnace Creek Inn where Jean and I had stayed before and where we have stayed since. They did arrange for me to get my meals at the Inn rather than the restaurant at the Ranch which wasn't very good. The attorney came down also and we met with the two Park Service mining engineers. The Park Service had also chartered a helicopter from San Bernardino and the charter company had to bring a fuel truck and a maintenance truck so the whole thing cost the government about $5,000 a day. They flew us in the helicopter over the claims to the northeast of the Furnace Creek Inn and then down the eastern side of the Funeral Mountains so we could see Feezor's proposed haulage and access route. We then went back to the claims where we landed and walked all over them. It was apparent to me that even if there was good copper ore there, there wouldn't be room on the claims to heap leach it, a point that the Park people hadn't thought of before. As long as we had the helicopter the pilot flew us about 15 miles north and south of the claims to see the sights and it was one of the most interesting trips I have ever been on.

The first part of the trial was held in Phoenix, Arizona and lasted for two days. The first day was all about geology and mining and the second day the Chief Metallurgist of PAH tried to establish the feasibility of the copper sulfate process. He wasn't very good and he was poorly prepared. I got him so confused that his side had to ask for a continuance which the judge reluctantly gave them. The second part of the trial was held in Las Vegas and was mostly about the metallurgy of the sulfate process. At the end of the day the judge was so angry at the PAH testimony that he said he didn't want to listen to it any more. In about a month he handed down his decision which was highly complimentary about yours truly. The decision went in our favor and I received a very nice letter from the Park Service attorney. This led to another case for the Forest Service in which they had been trying for years to kick a marijuana grower who claimed to be a miner off some mining claims just a few miles northeast of Los Angeles. We won that one too. Altogether I have been involved in 15 lawsuits as an expert witness and I haven't been on the losing side yet. I won't work for anyone who I don't think is in the right but sometimes that is very difficult to prove.

Northeast of Hawthorne, Nevada about 75 miles is a mining district called Rawhide which supported four gold mines in the late 1890's and early 1900's. The claims were bought in the 1960's by William Denton who had made an enormous amount of money in various enterprises. He died in the 1970's and left his estate, which was administrated by two attorneys, to his two sons who were in their early twenties. The administrators had leased the Rawhide claims to Kennecott Copper who drilled out the deposit and wanted to put in a heap leach operation. Kennecott had brought Kiewit Construction as a 49% partner and Kiewit was to construct the plant (but not operate it) and mine the ore with their own equipment. Kennecott either didn't read their contract very well or figured that the Denton attorneys didn't know anything about mining because there was a clause in the contract that said that the Denton estate had to approve every thing that Kennecott did. When Kennecott decided to go ahead with the project the Denton attorneys hired two mining engineers, a geologist and me to supervise the project. The four of us met with the

Kennecott and Kiewit people a number of times and each meeting turned out to be a battle. Things finally came to an impasse when Kennecott wanted to put the ore heaps on the side of a hill that had a nine percent slope. I said the heaps would slide down the slope and they might as well put them at the toe of the slope because that would be where they would end up anyway. Kennecott didn't agree. The four of us had a meeting with the attorneys and suggested that they should propose that Kennecott buy the property for the net present value of the five percent royalty that Kennecott would be paying over the life of the mine. The amount came to $16 million and Kennecott agreed. It was a good deal for both sides as the Denton estate wouldn't have to pay the four of us for the next twenty years and Kennecott wouldn't have to get our approval for everything that they did. The end of the story is that Kennecott built the heaps where they wanted to and after six months the heaps slid down the hill just as we said they would.

RTZ Corp. of London (originally Rio Tinto and then Rio Tinto Zinc after they merged with the Zinc Corporation of Australia) wanted to expand into the United States and to do so made a tentative offer to Kennecott Copper and again George Beals gave me a call. George, by that time had been made a Director of RTZ, the first American in the history of RTZ who had held that position. He asked me to be a member of the due diligence committee which would prepare a feasibility and economic study on which the offer would be based. The only other Americans to be on the committee were Paul Hodges, a consultant in mining engineering and a former employee of RTZ, who had been a friend of mine for many years, and George Beals. The remaining thirteen were all British and I had worked with three of them previously. We spent a three weeks on the job in Kennecott's headquarters in Salt Lake City and one week traveling to the various Kennecott properties. It was a most interesting assignment and I was most honored to be selected. Our reports made up two thick volumes and resulted in the purchase of Kennecott by RTZ.

In 1987 the South African Institute of Mining and Metallurgy held the GOLD 100 conference to commemorate the hundredth anniversary of the introduction of the cyanide process for the recovery of gold from its ores. I had had lots of frequent flyer miles built up and Jean and I flew round trip, first class for free to Nairobi, Kenya which was as far as Pan American Airways went in Africa. We changed planes in London and made stops at Accra, Ghana and Lagos, Nigeria. We had to pay our own way to Johannesburg and return to Nairobi. We stayed overnight in Nairobi to rest before we went to South Africa. I had made arrangements to visit seven gold plants and hired a car and driver to take me to them which was much quicker than trying to drive to them myself. I was treated quite royally as the South African people are very hospitable and they didn't get much chance to show off their plants. The general manager always put on a sumptuous lunch and invited several of his metallurgists and the interchange of ideas was most interesting and enjoyable. Jean was kept occupied by some friends of ours and by seeing all of the sights of Johannesburg. The GOLD 100 conference started on Sunday and lasted through Thursday and I met a lot of the people I had known before.

Fred de Vries and his wife, good friends of ours from Du Pont arrived on Saturday before the meeting and when it was over the four of us flew to a private game park on the southwest side of Krueger Park. There was only about 25 people there and we had a wonderful time. They took us out every day in Land Rovers to see the animals I had seen Krueger Park on one of my trips to Palabora. The food and accommodations at the private park were excellent and we had a wonderful time for three days. We flew back to Johannesburg and got a plane to Kimberley, where I had also been before, to see the great Kimberley diamond pit and the diamond museum. The four of us then flew on to Cape Town that evening. We took the aerial tram to the top of Table Mountain, and saw a lot of Cape Town for a couple of days. We then rented a car and drove to the Cape of Good Hope which is a park and has the light house for the cape. From there we visited the wine country and went back to Cape Town. The next morning we took the Blue Train back to Johannesburg. It is the last really luxury train in the world and the service, food and accommodations were fantastic. The scenery going up the slope the 6,000 foot plateau was wonderful. We got to the top of the plateau in the evening where they switched engines from diesel to electric and arrived in Johannesburg the next morning. The next day we flew back to Nairobi for two days and visited another game park there. Finally the four of us flew home. It was a wonderful trip and both Jean and I enjoyed it thoroughly.

Another interesting trip we took was to China in July, 1990. DuPont wanted to break into the cyanide market in China even though China exported a small amount of cyanide to the United States and probably to some other countries. They arranged for four people to go to China and conduct seminars on the latest developments in gold technology. David Lowell, who I have mentioned before was to speak on geology, a man from the Canadian government was to speak on the destruction of cyanide when waters containing that compound had to be discharged into streams, a man from Australia was to speak on carbon-in-pulp technology and I was to talk on heap leaching for the extraction of gold from its ores. I had absolutely no desire to go to China but I knew that my life would be in jeopardy if I didn't go and take Jean along so I told DuPont I would go. Whenever I had to fly overseas or even in the States I always flew first class. Anyway we flew to Hong Kong where DuPont had an office and where they equipped us with various kinds of antibiotics to ward of or cure Chinese bugs. (The only time I had ever gotten sick in my travels was in Russia. The hepatitis in London I of course got some place else but I never knew where.

We stayed in a beautiful hotel in Hong Kong for two nights and then flew to Qingdao in Shandong province on the shore of the Yellow Sea to the west of South Korea. Unfortunately it was in July and daytime temperatures in both Hong Kong and China never fell below ninety degrees in the daytime and got as high as one hundred. At Qingdao, even at a hundred degrees there was always a dense fog and of course the humidity was at a hundred percent. Our hotel was Russian-built and not too bad, at least it was air conditioned and I think I only went outside once to walk the two hundred yards to the beach. The Yellow Sea is very aptly named because it is really yellow from all the silt that washes into it from the rivers. However, the Chinese swim in it. The food was edible but poor with some things in it that I didn't want to know the name of. The peninsula that Qingdao is on furnished about a third of the gold that China mines but the mines were all small, from 250 to 750 tons per day. They were all underground; none of them were open pit. At Qingdao we were supposed to hold two days of seminars but the Chinese asked that they be extended for a third day. There were 125 people in attendance, most all of them men. The four of us had to speak through an interpreter which slowed things up. I took along some copies of McQuiston's and my books on cyanidation to pass out. Our first book had been translated into Chinese and I have a copy. A copy of the cover and frontspiece are in the appendix of this volume. The book was printed on very thin paper and even all the flowsheets were copied. Of course the Chinese never got permission from SME to copy it but that is what happens to a lot of books. Anyway it was kind of a backhanded complement.

David Lowell brought his wife Edith along and she and Jean were out quite a bit in spite of the heat. After the seminar the four of us men were taken on a three day tour of the mines to the north of Qingdao and Jean and Edith flew to Beijing where they stayed at the Sheraton Hotel which was excellent.

The four of us men, two men from DuPont (one Chinese) and an interpreter were taken in a small van to a so-called hotel about 75 miles north on Qingdao. The hotel was two stories and they told us it was used for the mining people in the area when they were on their vacations. It was near a small town but certainly no place for a vacation. My room had a bathroom with an old claw foot tub stained orange with rust and a rusty shower head. There was also a toilet but it was lying in broken pieces on the floor. It didn't make any difference anyway because their generator had broken down and there was no water. There was also a fan and one light globe in the room neither of which worked because of no power. We used an outhouse built in the garden which hadn't had any attention for months and hadn't been watered for a long time. During the next two days we saw five gold mines and a smelter-refinery but there was nothing there for us to learn, just like in Russia. The mill equipment was of a forty year old design but it worked well enough because they had lots of people which were cheaper than more modern equipment and instrumentation. We had dinners at the hotel with Chinese mine managers and officials of the government agency that controlled all the gold mines. The food was pretty horrible with things like sea slugs and fried locusts. David put it very well when he said that the locusts didn't have much taste but the sure had lots of texture. We lived mostly on bread, crackers and rice with some shrimp thrown in which weren't too bad. We spent three nights in that hotel and the last night I managed to get a bucket of water to take a sponge bath with.

We all went back to Qingdao where the other three went back to Hong Kong. David's wife flew from Beijing to meet him there. I took an overnight train to Beijing pulled by a steam engine. The Chinese are very short of oil but have lots of coal and the railroad engines are all coal fired and are copies of U.S. steam engines that we haven't used here since right after World War II. I had the luxury of a sleeper which was a room with four bunks in it, an upper and a lower on each side with about a thirty-inch aisle between them. Three Chinese were in the other three bunks and all the bunks were equipped with two-inch-thick mattresses. The toilet was a hole in the floor in a small room at the end of the car. The DuPont people gave me some fruit to eat as there was no place on the train to buy food. When I got to Beijing there was suppose to be a Chinese DuPont employee at the station to meet me. I wandered around in the middle of about a million Chinese for an hour and a half before he found me. He had a car and took me to the Sheraton where I finally had a bath and a decent meal. The next day Jean and I hired a car and driver to take us to the Great Wall which was about seventy miles from Beijing and was also wall to wall with Chinese as it was their holiday season. The temperature was in the high nineties but the humidity was a lot lower than it was in Shandong province. We walked a long way on the wall up a steep hill until there were only a few Chinese and where there was a view for miles. On the way back to Beijing we spent a couple of hours going through some magnificent buildings which were tomb of past emperors. The day after that we spent several hours going through the Forbidden City in Beijing. It was the residence of the last emperor and was several blocks square. The thing I remember most was a building full of extremely old watches and clocks which one of the emperors collected. Some of the clocks were huge with all the works exposed. All were made in Europe.

Finally we flew back to Hong Kong and spent another couple of days buying some clothes for Jean and seeing the city. We took the cog railway to the top of the mountain that overlooked Hong Kong and had dinner at a restaurant up there. We were both glad to get to the airport, which was jammed with people, and onto the plane for home. I wouldn't go back, even in the cooler part of the year, for anything. In the early days of my flying I enjoyed it and I used to keep track of the miles I had flown. By 1969 I had flown two million miles but after that I stopped keeping count.

The countries I have worked in are listed below.

Australia	Brazil	British Guana	Canada	Chile
China	Costa Rica	Dominican Republic	England	Fiji
Finland	Holland	Iran	Mauritania	Mexico
New Guinea	Norway	Panama	Sierra Leone	South Africa
Spain	Sweden	United States	Venezuela	Zambia

The countries I have visited are as follows:

Angola	Argentina	Bolivia	Canary Isles	Denmark
France	Germany	Ghana	Guatamala	Hong Kong
India	Italy	Japan	Kenya	Lebanon
Malawi	Martinique	Nigeria	Pakistan	Philippines
Portugal	Puerto Rica	Russia	Samoa	Senegal
Singapore	Switzerland	Tahiti	Turkey	

I have also been in every state in the United States but Maine.

I am a registered Professional Engineer in Montana and a registered Metallurgical Engineer in California, Arizona and Nevada.

Lastly I have belonged to the following technical societies:

American Institute of Mining, Metallurgical and Petroleum Engineers, (Vice President and Director
Society of Mining Engineers of AIME, (President)
Canadian Institute of Mining and Metallurgy, (Member)
Mining and Metallurgical Society of America, (President)
Institute of Mining and Metallugy, London, (Fellow)
South African Institute of Mining and Metallurgy, (Fellow)

Now that I am seventy-one years old (today is August 11, 1996) I have cut my consulting back to about 250 hours per year. On the other hand I seem to be busier than ever. This year I have almost finished clearing ll the brush and dead trees from our 8.5 acres next door and trimming the branches of the live trees up to about fifteen feet from the ground. I am a trustee of the Senior Citizens Foundation and am in charge of building our new Senior Center which we need badly. We also need a new building for our Adult Day Care Center which takes care of and gives therapy to people with Alzheimer's disease and other with dementia and strokes. It is a wonderful program that also gives their families a break from taking care of these unfortunate people twenty four hours a day. I have also started an engineering consulting firm called Facilities Systems Advisors composed of retired engineers who lend their expertise at no charge to the county as well as Grass Valley, Nevada City and special county districts such as fire and sewer districts on their construction and maintenance projects.

To sum up my life, I have had a wonderful one. I have a lovely wife and a fine family and if I had to live it all over again I would wish the new one to be exactly the same as the old.

Hopefully, this volume and those I had made for our four children will be passed down from generation to generation of the Shoemakers to give them an idea of what one of their ancestors did during his lifetime. I wish that my ancestors had done the same thing.

Robert S. Shoemaker
August 11, 1996

INDEX

—G—

—H—

—I—

—J—

—K—

—L—

—M—

—T—

—U—

—V—

—W—

—Z—

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, 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. In 1998, awarded an honorary Doctor of Laws degree by South Dakota School of Mines and Technology.