

Regional Oral History Office
The Bancroft Library

University of California
Berkeley, California

Noel Kirshenbaum

A METALLURGIST'S PERSPECTIVES ON CHANGES
IN THE MINING INDUSTRY: 1952-2009

Interviews conducted by
Eleanor Swent
in 2003

Copyright © 2011 by The Regents of the University of California

Since 1954 the Regional Oral History Office has been interviewing leading participants in or well-placed witnesses to major events in the development of Northern California, the West, and the nation. Oral History is a method of collecting historical information through tape-recorded interviews between a narrator with firsthand knowledge of historically significant events and a well-informed interviewer, with the goal of preserving substantive additions to the historical record. The tape recording is transcribed, lightly edited for continuity and clarity, and reviewed by the interviewee. The corrected manuscript is bound with photographs and illustrative materials and placed in The Bancroft Library at the University of California, Berkeley, and in other research collections for scholarly use. Because it is primary material, oral history is not intended to present the final, verified, or complete narrative of events. It is a spoken account, offered by the interviewee in response to questioning, and as such it is reflective, partisan, deeply involved, and irreplaceable.

All uses of this manuscript are covered by a legal agreement between The Regents of the University of California and Noel Kirshenbaum, dated January 30, 2003. The manuscript is thereby made available for research purposes. All literary rights in the manuscript, including the right to publish, are reserved to The Bancroft Library of the University of California, Berkeley. No part of the manuscript may be quoted for publication without the written permission of the Director of The Bancroft Library of the University of California, Berkeley.

Requests for permission to quote for publication should be addressed to the Regional Oral History Office, The Bancroft Library, Mail Code 6000, University of California, Berkeley, 94720-6000, and should include identification of the specific passages to be quoted, anticipated use of the passages, and identification of the user.

It is recommended that this oral history be cited as follows:

Noel Kirshenbaum, "A Metallurgist's Perspectives on Changes in the Mining Industry: 1952-2009" conducted by Eleanor Swent in 2003, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 2011.



Noel W. Kirshenbaum at his home, 2224 Baker Street, San Francisco. The house was purchased by his grandparents (Willard) in 1908.

TABLE OF CONTENTS—NOEL KIRSHENBAUM

PREFACE	ix
INTERVIEW HISTORY	xxiii
Interview 1: January 21, 2003	
Audio File 1	1
Family background—Schooling—Choosing Stanford—Courses at Stanford—Summer job with Selby—Summer job at Bunker Hill—History of environmental concerns—Bunker Hill, continued—Senior year at Stanford—Peru, summer 1956.	
Audio File 2	26
Peru, continued—People in Cerro’s research department—Changes to Stanford teaching during those years—The trip to Peru—Labor and race relations at Oroya, Peru—Meeting Sandy and finishing at Stanford—Starting a Ph.D. at Cal—Beginning work at Asarco—Companies involved in mining and metals R&D—Laid off from Asarco—Comparison of salaries, and Sandy’s education and work—Working at Alloyd Corporation—Boston as a center of mining finance; firms moving out—Family life in Watertown, Boston—Taking a job with General Electric.	
Interview 2: January 30, 2003	
Audio File 3	49
Employment at General Electric, in Massachusetts—Applying for teaching position in Argentina—Arrival in Argentina—Universidad Catolica de Córdoba—Housing in Córdoba—Facilities at the university—The mining industry in Argentina and Peru—Teaching and research at the university—Frustrations of living and teaching in Argentina—Return to San Francisco—Studying for Engineer of Mines degree at Stanford—Industry interest in thesis; transport and handling in general—Talks with Copper Range and Kennecott.	
Audio File 4	70
Research materials for thesis—Talks with Kenecott—Deciding for Copper Range and moving to New York—Relocation of head offices of mining companies in general—Technology changes in copper mining at that time—Alloy research at Copper Range—The Dashoveyer—Copper Range’s White Pine smelter—Interviewing for job at Marcona—The Anatread process.	

Interview 3: February 4, 2003

Audio File 5 94

Lake Copper—Mining Club of New York, and other professional networks—Accepting a job at Marcona.

Audio File 6 98

History of Marcona—Working for Marcona in San Francisco—Development of the Marconaflo System and the Marconajet—Manager, Commercial Development, of Marconaflo—International opportunities arising from the success of Marconaflo—Marcona’s financial and management structure—Making contacts and getting a job offer from Placer Amex—Consulting for Soros Associates in Chile—On assignment for the U.N. Development Program in the Andes.

Audio File 7 117

Organizing international conferences on the transport and handling of materials—Consulting for Mikimoto in Mexico—Background and history of Place—History of Cortez—Working for Placer—Beluga Coal, Alaska—The search for alternatives to oil.

Interview 4: February 24, 2003

Audio File 8 133

Marcona’s U.S. tax status—Environmental concerns for gold mining—Clean-up processes used by Placer and other gold-mining companies—Recent research regarding biological systems and gold deposition—Metal detection using organisms, dowsing—Investor scams.

Audio File 9 154

Investor scams, continued—The career and publications of T. A. Rickard—Placer’s interest in non-metallics—Movement of mining company offices from San Francisco—Effect on the mining industry of technical changes and the environmental movement—Effect on the mining industry of mergers and acquisitions.

Interview 5: February 27, 2003

Audio File 10 177

Review of Bud Wilson’s oral history—Placer’s Pipeline project in Nevada—Technical papers written by narrator—Some observations on corporate culture—Value of historical

records—Some observations on mining education—Extraction and processing techniques—Importance of Bureau of Mines and the U.S. Geological Survey—Value of different viewpoints and interdisciplinary studies—Effects of new technology on demand for metals—Overview of how mining developed as a business—Conclusion.

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 eighteenth year the series numbers sixty-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 twelve volumes, including eight Knoxville District McLaughlin Mine volumes with several interviews each. The remaining four volumes contain the interviews of William Humphrey, Hugh Ingle, Patrick Purtell, and James Wilder.

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 follows.

Interviews were conducted by Malca Chall, Fredric L. Quivik and Eleanor Swent.

Eleanor Swent, Project Director, Western Mining in the Twentieth Century
January 2003
Regional Oral History Office
University of California, Berkeley

Western Mining in the Twentieth Century Oral History Series

Interviews Completed, November 2009

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

Frank F. Aplan, *Mineral Education Generalist, Professor of Metallurgy and Mineral Processing, 1951- 1998*, 2003

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

William E. Colby, *Reminiscences* (California mining lawyer), 1954

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

Hedley S. "Pete" Fowler, *Mining Engineer in the Americas, India, and Africa, 1933-1983*, 1992

Douglas W. Fuerstenau, *Mineral Processing Engineer and Scientist: In Education, Research, Industry and International Cooperation*, 2011

James Mack Gerstley, *Executive, U.S. Borax & Chemical Corporation; Trustee, Pomona College; Civic Leader, San Francisco Asian Art Museum*, 1991

Robert M. Haldeman, *Managing Copper Mines in Chile: Braden, CODELCO, Minerec, Pudahuel; Developing Controlled Bacterial Leaching of Copper from Sulfide Ores; 1941-1993*, 1995

Guy Harris, *A Career in Mining Chemicals*, 2003

John F. Havard, *Mining Engineer and Executive, 1935-1981*, 1992

Wayne Hazen, *Plutonium Technology Applied to Mineral Processing; Solvent Extraction; Building Hazen Research; 1940-1993*, 1995

George Heikes, *Mining Geologist on Four Continents, 1924-1974*, 1992

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

Homestake Mine Workers, Lead, South Dakota, 1929-1993, interviews with Clarence Kravig, Wayne Harford, and Kenneth Kinghorn, 1995

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

William Humphrey, *Mining Operations and Engineering Executive for Anaconda, Newmont, Homestake, 1950 to 1995*, 1996

Hugh C. Ingle, Jr., *Independent Small Mines Operator, 1948 to 1999; Corona Mine*, 2000

James Jensen, *Chemical and Metallurgical Process Engineer: Making Deuterium, Extracting Salines and Base and Heavy Metals, 1938-1990s*, 1993

Arthur I. Johnson, *Mining and Metallurgical Engineer in the Black Hills: Pegmatites and Rare Minerals, 1922 to the 1990s*, 1990

G. Frank Joklik, *Exploration Geologist, Developer of Mt. Newman, President and CEO of Kennecott, 1949-1996; Chairman, Salt Lake 2002 Olympic Winter Games Committee*, 1997

Evan Just, *Geologist: Engineering and Mining Journal, Marshall Plan, Cyprus Mines Corporation, and Stanford University, 1922-1980*, 1989

Robert Kendall, *Mining Borax, Shaft-Freezing in Potash Mines, U.S. Borax, Inc., 1954-1988*, 1994

Noel W. Kirshenbaum, *A Metallurgist's Perspectives in Changes in the Mining Industry: 1952-2009*, 2011

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 Moskowitz, "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"

The Knoxville Mining District, The McLaughlin Gold Mine, Northern California, Volume VIII,
2002

Dean Enderlin, "Mine Geologist, Reclamation Manager, McLaughlin Mine"
Susan Harrison, "McLaughlin Natural Reserve"
Raymond Krauss, "Environmental Manager, McLaughlin Mine"

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*
- Donald H. McLaughlin, *Careers in Mining Geology and Management, University Governance and Teaching, 1975*
- 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*
- Paul Schipke, *Mining and Environmental Engineer for Utah-BHP Company, 1972-1997, 2004*
- 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

Roy Woodall, *Australian Geologist, 1953 to 1995: Success in Exploration for Gold, Nickel, Copper, Uranium, and Petroleum*, 2006

Interview in Abeyance

Milton Ward, mining executive

ADVISORS TO THE SERIES, WESTERN MINING IN THE TWENTIETH CENTURY

Professor Emeritus Douglas Fuerstenau, Principal Investigator,
Plato Malozemoff Professor, Department of Materials Science and Mineral Engineering,
University of California, Berkeley

Robert W. Bartlett, Dean Emeritus,
College of Mines, University of Idaho

Robert R. Beebe, Senior Vice President
(retired), Homestake Mining Company

Michael Bickers, President, CEO
(retired), Davy-McKee Corp.

*Philip R. Bradley, Former Chairman,
California State, Mining and Geology
Board

Mrs. Philip R. Bradley, Honorary Life
Member, WAAIME

Gray Brechin, Historical Geographer

George Brimhall, Department of Earth
and Planetary Science, University of
California, Berkeley

Henry Colen, President, San Francisco
Mining Associates

*Professor Neville G. Cook, Department
of Materials Science and Mineral
Engineering, University of California,
Berkeley

Kenneth R. Coyne, Principal Vice
President-Mining and Metals, (retired)
Bechtel Corporation

*J. Ward Downey, Engineering and
Industrial Management Consultant

Professor Emeritus Richard Goodman,
Department of Civil Engineering,
University of California, Berkeley

Professor Roger Hahn, Department of
History, University of California,
Berkeley

Joseph Hanzel, Facilities Safety
Manager, NASA-Ames Research Center

*John Havard, Senior Vice President
(retired), Kaiser Engineers, Inc.

*Clifford Heimbucher, C.P.A.
Consultant, Varian Associates, Inc.

William A. Humphrey, President, CEO,
Vice Chairman (retired), Homestake
Mining Company

*John R. Kiely, Senior Executive
Consultant (retired), Bechtel, Inc.

Noel Kirshenbaum, Manager, Mineral
Products Development (retired), Placer
Dome U.S.

*Plato Malozemoff, Chairman Emeritus,
Newmont Mining Corporation

Joseph P. Matoney, Vice President
(retired) Coal, Kaiser Engineers, Inc.

Mrs. Donald H. McLaughlin, Founder,
Save San Francisco Bay Association

Professor Malcolm McPherson, Massey
Professor of Mining Engineering,
Virginia Polytechnic Institute and State
University

*Professor Emeritus Charles Meyer,
Department of Geology, University of
California, Berkeley

Professor H. Frank Morrison,
Department of Materials Science and
Mineral Engineering, University of
California, Berkeley

*Professor Joseph A. Pask, Department
of Materials Science and Mineral
Engineering, University of California,
Berkeley

*Professor Emeritus Rodman Paul,
Department of History, California
Institute of Technology

*Langan W. Swent, Vice President
(retired), Homestake Mining Company

*Deceased during the period of the project

The Regional Oral History Office
would like to express its thanks to the organizations
and individuals whose encouragement and support have made possible
The Western Mining in the Twentieth Century Series.

DONORS TO
THE WESTERN MINING IN THE TWENTIETH CENTURY
ORAL HISTORY SERIES 1986-2004

Organizations and Foundations

American Institute of Mining, Metallurgical, and Petroleum Engineers,
San Francisco, Southern California, and Black Hills Sections
Woman's Auxiliary to the AIME, Southern California and Northern California
Bechtel Foundation
California Mining Association
The Cleveland-Cliffs Foundation
The Jackling Fund of the Mining and Metallurgical Society of America
National Mining Association
South Dakota School of Mines and Technology
The Hearst Foundation, Inc.
Plato Malozemoff Foundation
Public Resource Foundation
Rosenblatt Charitable Fund

Corporations

ASARCO	Hecla Mining Company
Bechtel Group Incorporated	Homestake Mining Company
BHP Minerals	Kennecott Corporation
Chemical Lime Company	Krebs Engineers
The Clarkson Company	Magma Copper Company
Cleveland-Cliffs, Inc.	Newmont Mining Corporation
Cyprus Amax Minerals Company	Pacific Gas & Electric Company
Cytec	Phelps Dodge Corporation
Dow Chemical Company	Royal Gold, Inc.
EIMCO Process Equipment Company	United States Borax & Chemical Corporation
E. M. Warburg, Pincus & Co., Inc.	Wharf Resources, Limited
Freeport-McMoRan	WMC Limited
Hazen Research, Inc.	

The J. Ward Downey Bequest Fund

Patrons

<p>Dr. Patrick M. Afenya Frank F. Aplan Charles and Lois Barber James Boyd Arthur C. Bradley Catherine C. Campbell Curtis Clarkson J. Robert and Edna M. Clarkson Norman Cleaveland Rosemary and Harry M. Conger Barbara H. and James T. Curry, Jr. Stanley Dempsey Donald Dickey Wayne Dowdey J. Ward and Alberta P. Downey Mr. & Mrs. Warren Fenzi Bryant and Gertrude Fischback Douglas and Margaret Fuerstenau Launce E. Gamble James M. Gerstley Robert M. Haldeman Mrs. Paul C. Henshaw, in memory of her husband, Paul C. Henshaw</p>	<p>William A. Humphrey James H. Jensen Arthur I. Johnson G. Frank Joklik Arthur H. Kinneberg Mrs. Lois B. Lippincott John S. Livermore J. David Lowell Dean A. McGee Mrs. Frank W. McQuiston, Jr., in memory of Frank W. McQuiston, Jr. George B. Munroe Gordon B. Oakeshott Thomas and Margaret O'Neil Vincent D. Perry Carl L. Randolph Joseph and Evelyn Rosenblatt Berne Schepman Mr. and Mrs. Richard J. Stoehr Langan and Eleanor Swent Adele and Milton Ward Mr. and Mrs. Alexander M. Wilson</p>
--	---

Individuals

<p>Claude J. Artero David L. Bauer Rebecca Bender Bruce A. Bolt Clemence DeGraw Jandrey Boyd James Brown Boyd, Harry Bruce Boyd, Douglas Cane Boyd, and Hudson Boyd, in memory of James Boyd Philip and Katherine Bradley Albert T. Chandler David J. Christie William B. Clark J. R. Clarkson, in memory of Edna Mae Clarkson Dr. and Mrs. Theodore Craig</p>	<p>Mr. David Crouch Nancy S. and James T. Curry, Sr. Stanley Dempsey Edward C. Dowling Elisabeth L. Egenhoff Christine Finney H. S. Pete Fowler Maurice and Joyce Fuerstenau Louis R. Goldsmith Donald L. Gustafson Jayne K. Haldane Kenneth N. Han Elsie Harris Guy H. Harris Bonnie, Russell, and Steve Harford</p>
--	---

A.C. and Elizabeth Helmholz
James H. Hickey
Mason L. and Marie J. Hill
Gael Hodgkins
Sylvia Hochscheid, in memory of
Robert E. Hochscheid
Mrs. Bruce S. Howard, in memory of
Henry Harland Bradley
Lewis L. Huelsdonk
Ruth B. Hume
Howard Janin
Jack M. Jones
Alfred Juhl
Evan Just
Sheila Kelley
James C. Kimble
Kenneth Kinghorn
Noel W. Kirshenbaum
Mr. and Mrs. John T. Knox
Nancy H. Landwehr
Carl F. Love
Plato Malozemoff
Sylvia C. McLaughlin
Sylvia C. McLaughlin, in memory of
Jay Kimpston Swent
Frances B. Messinger

D. R. Nagaraj
L. Arthur Norman, Jr.
Patrick O'Neill
K. Osseo-Asare
George F. Reed
John J. Reed
Richard W. Rees
Jane A. Rummel
Robert S. Shoemaker
Joseph H. Siino
Simon D. Strauss
John R. Struthers
Virginia Bradley Sutherland, in
memory of Helen R. Henshaw
Jack Thompson
James V. Thompson
Twyla J. Thompson
John J. Trelawney
William I. Watson
Barbara A. Whitton in memory of William
B. Whitton
William B. Whitton
Sheldon Wimpfen
Roy Woodall
Judy D. Woodward

In Memory of Catherine C. Campbell

Mr. and Mrs. E. W. Averill,
Jr. Richard Friedlander
Fenelon F. Davis
Richard M. Stewart

In Memory of Langan W. Swent

Marjorie D. Bjorlo
Christine W. S. Byrd
John and Dagmar Dern
Sylvia C. McLaughlin
Eleanor H. Swent
Jeannette F. Swent
Richard L. Swent
Regional Oral History Office Staff

In Memory of William B. Clark

Fenelon Davis
Lowell Dygert
Mary G. Freedman
Marilyn Glover
Virginia Goldsmith
Barbara Henderson
John Matschek
Hilda Schramm
George Shutes
Barbara Vollmer
Mary Witt
Mary Woods

In Memory of J. Ward Downey

Willa Baum
Douglas Fuerstenau
James Jensen
Eleanor H. Swent

In Memory of Phillip R. Bradley, Jr.

Mr. and Mrs. John P. Austin
Gail and Heath Angelo, Jr.
Earl Beistline
The Claremont Book Club
Judge and Mrs. John S. Cooper
Professor Emeritus Gregory Grossman
Marilyn and Thomas Johnson
Remington and Jean Low
Sylvia C. McLaughlin
Ruby C. Reade
Mr. and Mrs. Thomas B. Shaw
Judge and Mrs. John Sparrow
Eleanor H. Swent
T. M. Tobin
Dr. and Mrs. Edward E. Waller, Jr.

Interview history by Eleanor Swent

Noel Kirshenbaum's oral history is important for its breadth and historical sense, as well as its technical information. Trained at Stanford and the University of California at Berkeley as a metallurgist, he worked in various parts of the United States, as well as Argentina and Peru, and retired as North American project manager for Placer-Dome, a Canadian company. As an advisor to the oral history series on Western Mining, he was instrumental in facilitating the interview of Evan Just and was an important source of background information for several others.

Noel Kirshenbaum was a founder of the Mining History Association and thinks in an international and historical framework, making him an ideal interviewee. He tells what he did in his day and furthermore places these experiences in their historical context. His particular interest is in transportation of materials; he is also informative about mining practices now practically obsolete, like smelting and dredging.

The letter of invitation was sent on 8 November 2002. After planning, the first interview was conducted on 21 January 2003 at Kirshenbaum's office at 12 Geary Street in San Francisco, an old downtown building, with a small, old-fashioned elevator, grey marble floors, and wrought-iron stair banisters. The office is high-ceilinged, crowded but orderly. He came to the interviews well prepared, and verified his statements by referring to some of the hundreds of books which lined the wall behind him. He is a serious collector of mining history books and documents, including ephemera on mining scams, in which he is an acknowledged expert.

Subsequent interviews were conducted on 30 January, 4 and 24 February in the San Francisco office, and on 27 February in the Strauss Press Room at The Bancroft Library. Portions of the interviews were videotaped.

The tapes were transcribed, lightly, edited, and sent to the narrator for review.

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. A major focus of the office has been the history of mining in the Western states. The list of completed oral histories documenting the history of mining is included in this volume. Many of the interviews in this and other subject areas can be found online at <http://bancroft.berkeley.edu/ROHO/>. Copies of all interviews are available for research use in The Bancroft Library and in the UCLA Department of Special Collections. Interview tapes are available for listening in the Bancroft Library. The Regional Oral History Office is a division of The Bancroft Library and is under the direction of Richard Candida-Smith.

Eleanor Swent, Interviewer
Berkeley, 2005

Noel W. Kirshenbaum: A Reflection by His Daughter, Lisa Kirshenbaum September, 2011

To really understand Noel Kirshenbaum, it helps to take a look at his many collections. Forget vintage firearms and autographed baseballs; my father collects things like bottled drinking water: "They flew this water in from Fiji" he will exclaim. Or old "church key" style bottle openers: "With twist-off bottle caps, they won't be making too many more of these!"

Of course, with a long time interest in mining and metallurgy history, he also collects plenty of rocks, minerals, and artifacts. They're on shelves next to his book collections, or in boxes alongside his many maps, and even on his front steps. These specimens are notable for their origins, or inherent properties, or for their sentimental value: a bit of gilded mosaic debris from the pre-1906 earthquake church of Stanford University, or perhaps some slag from a favorite smelter.

Of all his curios, my father probably enjoys examples of illogic the best. Badly copy-edited headlines, rambling religious tracts, books on dowsing (map-dowsing lets you seek ores or even buried cash from the comfort of your own desk!) and patent medicines have all made it into his pockets or flight bag to save for amusement later. That same fascination is what motivated him to enjoy a special hobby in mining scams. Noel Kirshenbaum: hero to the unwitting investor who would otherwise have lost everything to a sham platinum brine scheme of unimaginable value.

Some of these schemes bring him the most fun. There was the time he treated a geologist and a mining engineer to a "health mine" visit in Montana for an underground session to breathe mine air laced with radon. They weren't ill or in need of a cure, but he tried to convince them of the prophylactic value of the visit – and all for a cost of a fraction of a doctor's fee. My father once had a colleague act as a shill in the audience during a tongue-in-cheek paper he gave on a bogus mineral bonanza. Too bad not everyone in the mining community shares his sense of humor.

My father grew up in San Francisco, in the same house on a steep hill his grandparents bought. His earliest career plan was to become a streetcar conductor. Perhaps so he could have a ready supply of transfers – an early collection of his. Clearly, this was the beginning of his interest in transportation, though now those interests are in minerals transport and resource logistics. As a college freshman, he started working summers in the mining industry, with jobs at smelters in California, Idaho, and Peru.

His degrees from Stanford University were in metallurgy and mineral economics, and he recalls his years there as a golden time (he returns there frequently for reunions and lectures). From there, he took research positions on the East Coast and then seized an opportunity to establish a metallurgy department and teach in a Cordoba, Argentina, university as part of the United States AID Mission.

Returning to Stanford for another degree and then more work in metals research in the East, my father came back to San Francisco to finish out his career, except for some

consulting assignments, mainly in Chile and Argentina. Along the way, he obtained patents in fields as varied as smelting and mineral exploration. He enjoyed having my brother Kent's help on patents involving gold-binding proteins. He wrote and gave many papers on shipping and handling minerals – an area that became his professional specialty – as well as on mining history.

My father has followed news headlines since he was a little boy, when he raced to bring in the morning paper with its war news before heading to school. He similarly kept an eye out for mining history, seeking out abandoned mines and outmoded mining artifacts. An icon of his has long been the noted mining engineer, consultant, editor, and mining historian, T.A. Rickard, well-known as publisher of the Mining & Scientific Press of San Francisco. As my father's presentations have moved away from technical papers and more towards mining history, his collection of Rickard's publications (he possesses Rickard's two volumes of personal scrapbooks) have become ever more precious. Besides his affinity for unusual collections, my father has an avid appreciation for nature, travel, and of course his family.

Noel W. Kirshenbaum: A Reflection by His Son, Kent Kirshenbaum October, 2011

My father was born a skeptic and he remains one today, particularly when confronted with the conceit of “progress”. He is acutely aware that many of our finest technical and cultural achievements lie in our past, not in our future. When he requests that you place something in the “ice-box”, you sense his wish that the ice-man would still make his rounds, preferably by horse-drawn cart. Because of his familiarity with California history and geography, it is possible that his experiences unfold in a temporal continuum unshackled to the present day. A beautiful panoramic map of San Francisco graces the wall of his living room, depicting the City as it prepared for the Panama-Pacific International Exposition of 1915. That landscape may be a semi-tangible tableau or scrim upon which he carries out his life.

Our family vacations often resembled sojourns by time-machine, in which we followed tourist routes as recommended by Baedeker guides many decades old. While other families ambled from amusement parks to beach-side bungalows, our family skittered from mine head-frames to ghost-town cabins. We never stopped for fast food, but our road trips were frequently punctuated by sudden braking to read every roadside historical plaque.

Noel Kirshenbaum is the person least likely to fall victim to flim-flam, but most likely to be entertained by it.

My father is not averse to seeming anachronistic or contradictory, and he enjoys having established an idiosyncratic set of values and aesthetics. There probably aren't a lot of mining professionals who have been ardent supporters of the Sierra Club and the Save the Redwoods League. Nor, I imagine, have many other fathers advised their sons to conduct their nuptials at the Forest Lawn Memorial Park and Mortuary.

As a youth, my father's family life was rather circumscribed. He was an only child raised by a single mother, who was herself an only child. He is perhaps less comfortable in the company of acquaintances than in the company of ideas. He is very cerebral, in that the inter-personal interactions he most values are information exchanges. In summer-camp or college, while other students were receiving care packages stuffed with edible treats, my sister and I received envelopes from him bursting with clippings from *The Wall Street Journal*. The volume of his paper-based clipping service has diminished with the advent of digital media, but the instinct remains. I still receive a bevy of useful links to various strange repositories of information around the internet.

Among the attributes I most admire of his is the certainty he had in pursuing his career path at such an early age. I stumbled into my professional life fairly late after exhausting other options. By contrast, my father was on track towards a career in minerals by the time he entered University, where he pursued degrees in Metallurgy, or what would now

be called Materials Science. Whence did this interest originate? I can't imagine that he received any guidance towards his career from any family member or school counselor.

But the essence of my father's spirit is his unslakable curiosity. Nothing pleases him more than dashing down to a seminar at Stanford one day and then to a lecture at the Bancroft Library the next. I have witnessed much of his lifelong passionate quest for knowledge, and I am inspired.

Interview 1: January 21, 2003
[Audio File 1]]

1-00:00:02

Swent: This is beginning an interview with Noel Kirshenbaum in San Francisco, California, at his office at 12 Geary Street, on January 21, 2003. [chuckles] Hard to believe, isn't it? We've been looking forward to this interview for a long time, and I'm delighted that it's finally coming about. Noel has been interested in our mining oral histories for fifteen years.

1-00:00:59

Kirshenbaum: Since the beginning. And I remember being so pleased to write the foreword to the very first one—Phil Bradley's oral history.

1-00:01:00

Swent: Since day one. So now we're finally getting at it. So let's begin, Noel, by your giving us your background on your family and so on. Your mother, I know, had a particularly interesting background, and maybe your father, too. I didn't know him, but I met your mother. She was a delightful woman. So tell us where and when you were born and something about your family.

1-00:01:24

Kirshenbaum: All right. I was born in 1935, and my parents later divorced. I don't remember or don't know what year that was, but obviously I was young enough that I didn't know, so it was in my very early years. My mother's parents: her mother was a native San Franciscan, and her father had come from France in the 1860s.

1-00:02:02

Swent: What was her name?

1-00:02:03

Kirshenbaum: Her name was Beatrice Willard. Her father was here in California's early days and spent time—he came from Lorraine in France, which about that time was about to be turned over to Germany after the Franco-Prussian War. He was a person who lived a long life. He died in 1939 at the age of eighty-eight. My mother was actually born when he was fifty-seven. So we go back a long time in just a couple of generations. I mentioned my mother's mother was born in San Francisco. I grew up in a house, which I still live in, that was my grandparents' house, which had been purchased shortly after the earthquake, about 1908.

1-00:03:26

Swent: It's on Baker Street.

1-00:03:30

Kirshenbaum: On Baker Street.

1-00:03:31

Swent: What's the number?

1-00:03:34

Kirshenbaum: 2224 Baker.

1-00:03:37

Swent: So your grandparents lived in the same house. Isn't that wonderful?

1-00:03:40

Kirshenbaum: So, perhaps because of some of these old relationships, I have long had an interest in history. I used to hear my grandmother talking about the earthquake of 1906, and it fascinated me, and maybe that's why I started getting a little interested in geology at an early date, too.

1-00:03:59

Swent: No doubt.

1-00:04:04

Kirshenbaum: My father—he was born in New York and came here just before the Depression. My parents were married in 1930. I have a good memory for many things, and I guess that helps when you're interested in history. I was fascinated by World War II. I used to keep maps and used battle tacks during the war to keep track of the battle lines. At an early age I became interested in geography, which I think is something that people can easily teach themselves.

1-00:04:55

My mother had traveled extensively when she was a child, lived in the Orient, and went to school there, so I became imbued with the travel bug maybe by inheritance.

1-00:05:15

Swent: How did that come about? I remember that your mother—

1-00:05:17

Kirshenbaum: Her father was in the import-export business and imported things from France, and some of his business was in the Orient. At one point, they were in Vladivostok for quite a while. This actually was during the time of the Russian Revolution.

1-00:05:37

Swent: But they weren't there as refugees.

1-00:05:38

Kirshenbaum: No, but they were there when the Revolution actually came, without their U.S. passports, which had been sent to Tokyo for renewal, and they were able to get out, to Japan, without passports.

1-00:05:55

Swent: Oh, my!

1-00:05:58

Kirshenbaum: I used to hear that story quite a bit. And my mother went to school—her father, being French, put her in a French convent in Kobe for some time, and she was fluent in French with a perfect French accent I enjoyed listening to. I went to elementary school around the corner, the old Grant School, which is no longer there, but it was an eight-grade school, and then I went to Lowell High School for four years and took a lot of math courses and science and became particularly interested in chemistry.

1-00:07:02

The high schools, for some reason in this area—this is still true—do not teach geology, so I didn't have any direct exposure to that in school. I think it's strange that schools in New York City seemed to have geology in their curriculum, but schools in California, which obviously is an important mineral state and also an important state in terms of seismic problems, earthquakes and faults, doesn't teach geology. Maybe this is not true universally in California anymore, but it was then.

1-00:07:46

Swent: Huh! That *is* surprising, isn't it? With the earthquakes such a part of the history here, you'd think there'd be curiosity about—

1-00:07:55

Kirshenbaum: You'd certainly think so.

1-00:07:59

Swent: Did you have any teachers that you were particularly influenced by?

1-00:08:02

Kirshenbaum: Certainly by one chemistry teacher. A lot of students didn't like chemistry, and in particular, I think they didn't like this teacher, but I found him fascinating. He had had some background in industry, and I thought that added to his teaching because he could tell us how things that we learned in chemistry were actually applied in what I would call real life. It wasn't just the academic side of a science, which frankly is of interest to me also and obviously very important, but I enjoyed the mixture of applying science to practical problems, industrial problems, and so forth.

1-00:09:01

Swent: What was his name?

1-00:09:04

Kirshenbaum: Donald Jamison. In terms of selecting a profession, I was not interested in going into my father's business. He had a business,

wholesale distributing of goods like lighting parts, but I was not interested in selling. In later times, I became interested in technical marketing, but that's a big difference from selling or having a business where you have to go out and call on customers and so forth.

1-00:10:01

Swent: Did your father stay here in San Francisco?

1-00:10:04

Kirshenbaum: No, he moved to Los Angeles. We had a good relationship until he died in 1982.

1-00:10:13

Swent: So you were in contact with his career then.

1-00:10:17

Kirshenbaum: Right. I think he was disappointed that I didn't follow him.

1-00:10:23

Swent: Really?

1-00:10:26

Kirshenbaum: But he didn't put up an argument or anything. He was enlightened, and I think eventually became proud of the fact that I had done some worthwhile things on my own.

1-00:10:40

Swent: Did you have siblings?

1-00:10:43

Kirshenbaum: No, I was an only child.

1-00:10:48

Swent: Okay. How did you choose Stanford [University]?

1-00:10:52

Kirshenbaum: Well—

1-00:10:53

Swent: Or are we ready for Stanford?

1-00:10:53

Kirshenbaum: Probably not, because—

1-00:10:54

Swent: No. Okay, don't let me rush you.

1-00:10:56

Kirshenbaum: I wanted to figure out what I was going to do. Maybe I didn't want to waste time or I'm not sure exactly, but I was interested in engineering and so forth, and one time, I went to an annual event, Engineers Day, which was held out at San Francisco City College. They had about

four or five disciplines there. Most of the students, not surprisingly, crowded into the classroom, where they had someone from industry talk about civil engineering—or maybe there was more than one person speaking—electrical engineering, and mechanical engineering, certainly, and maybe there were a few in chemical engineering, but I went into an almost empty classroom, where the speaker spoke on mining engineering, and that was Donald McLaughlin.

1-00:12:06

Swent: Wow. This would have been what, 1951 or '2?

1-00:12:13

Kirshenbaum: About '51, I would think.

1-00:12:14

Swent: I'm trying to think. That was before Sputnik, but there was still a big interest in science and engineering at that time, wasn't there, after World War II?

1-00:12:25

Kirshenbaum: There was an interest, but you're right: Sputnik really raised—

1-00:12:39

Swent: Right. That was '57. That was when America really began pushing science education, because they didn't want the Russians to get ahead of us.

1-00:12:49

Kirshenbaum: Actually, it was—

1-00:12:52

Swent: But earlier there was some—

1-00:12:55

Kirshenbaum: Yes, but mining was something that was not in great favor.

1-00:13:07

Swent: But this was also before the environmental movement made mining a really dirty word.

1-00:13:11

Kirshenbaum: Right. But I can't remember just what Don McLaughlin said, but of course he had a very charismatic personality.

1-00:13:24

Swent: Yes.

1-00:13:27

Kirshenbaum: And I think that helped. Basically, I think the reason that I chose metallurgy was because it's a combination of a number of things that I enjoyed: chemistry, geology—even though I didn't know much about

geology, but I could imagine—and the mining industry, which was a field that I was somewhat aware of, just living here in California and knowing about how mining had developed here. And metallurgy, as distinct from mining, was something that I could practice, I thought, closer to centers of, well, culture or where I wouldn't be so isolated—in the middle of South America, for example—and get to civilization, so to speak, only once in a great while. Metallurgy, I realized, had a lot more chemistry in it than mining, so I think those were the reasons.

1-00:14:46

You asked about Stanford. I had a pretty short list, including Colorado School of Mines, but as I recall, I guess I took the risk of only applying to one or two schools, and the one I really selected for top of the list was Stanford. I had visited the Department of Mining and Metallurgy, and had spoken to people there. I was aware of Stanford's history, partly thanks to a good course in U.S. history I had at Lowell. Herbert Hoover was one of my heroes. Still is. Of course, I knew about the very close association of Hoover and Stanford.

1-00:15:56

Swent:

He was actually still there at that time, wasn't he? Living on the campus?

1-00:16:05

Kirshenbaum:

His house, I guess, that he donated to the university and which has become the house of the president of the university, I guess was still in his possession. He would come out to Stanford maybe once or twice a year, and I suppose maybe stayed there, but basically he was living at the Waldorf-Astoria [in New York City], and I don't know for how long a time that had gone on. He died about 1964 or '65.

1-00:16:28

Actually, maybe we'll talk about this later, when we talk about books, but when I was working near New York, I had a copy of *De Re Metallica* [by Georgius Agricola; translated by Lou Henry Hoover and Herbert C. Hoover] that I took to a Stanford meeting in Manhattan where he spoke, and I had it autographed by him.

1-00:16:59

Swent:

Good!

1-00:17:02

Kirshenbaum:

There was bit of continuity there.

1-00:17:08

Swent:

Yes. And, of course, I was just going to point out that at that time, too, there were still major mining corporations headquartered here in San Francisco, a number of them.

1-00:17:24

Kirshenbaum: Right.

1-00:17:24

Swent: So there was perhaps more awareness of mining as an industry in San Francisco then.

1-00:17:32

Kirshenbaum: Very definitely. There was also the smelter, the Selby smelter across the Bay. Because of that, Asarco [American Smelting and Refining Company] had an office here. I'll probably get into that more later also. But there were several mining companies, and I think we'll get into that later. Anyway, as I say, I visited Stanford a couple of times, was very impressed with it. Many of the other students who visited during a high school day, I remember, were most interested in visiting the athletic facilities. I was more interested in the engineering facilities, and I remember going to the Ryan electrical lab and being very impressed. There wasn't any tour through Mineral Sciences or Earth Sciences that day. There probably wouldn't have been enough students to justify their staying open, and it was a small department.

1-00:18:52

Swent: Did they call it Earth Sciences at that time?

1-00:18:54

Kirshenbaum: Yes. The name has changed back and forth, and, again—so anyway, I was delighted when I received notice of my admission to Stanford. I still remember it was a Saturday morning, because on Saturday when the mail came I was home, and I remember taking the envelope out of the mailbox that had my acceptance to Stanford, and being quite delighted.

1-00:19:51

Swent: I was thinking your mother had gone to Stanford, but it was Mills [College]?

1-00:20:02

Kirshenbaum: Yes, she spent two years at Mills, and then transferred to UC. I might mention something that she rarely talked about, but she was the youngest graduate at that time of UC. She graduated in the Class of 1926 when she was eighteen. Then she went on to art school, and most of her activities had something to do with art for quite a few years.

1-00:20:47

Swent: So you graduated from high school, then, in?

1-00:20:50

Kirshenbaum: In '52.

1-00:21:01

Swent: Fifty-two. Stanford was '56.

1-00:21:03

Kirshenbaum: Right, I was in the Class of '56 at Stanford. I took lots of courses in, well, obviously in metallurgy but certainly also in chemistry.

1-00:21:14

Swent: Was Encina Hall still the freshman dorm?

1-00:21:21

Kirshenbaum: It was, but I was housed in Toyon Hall because Encina was filled. There was kind of a lottery system, I guess. I guess my first course related to metallurgy in welding and foundry, which I took the first quarter I was there. It was very difficult for me, because there were strange words like eutectic, which is spelled e-u-t-e-c-t-i-c, and the course was taught by a Scotsman, whose burr was so strong, I had great difficulty in understanding almost everything he said. I had no metallurgy before that, didn't know what eutectic was or a lot of other things. Between the intense heat of a welding and foundry lab in October in Palo Alto and the difficulty in understanding some of these words, I didn't get too much out of the course in terms of a lecture, but—

1-00:22:39

Swent: What was his name?

1-00:22:41

Kirshenbaum: His name. Offhand, I don't remember. [Simpson]

1-00:22:44

Swent: We can fill it in later. That's okay. Were you actually doing welding?

1-00:22:48

Kirshenbaum: Exactly. Yes, that's why the heat was a bit oppressive, and also when we were casting. It was fun casting and welding, but—

1-00:23:00

Swent: What was the rationale behind learning to do that?

1-00:23:03

Kirshenbaum: Well, it's important in metallurgy. I probably would have had gotten more out of it, but it was a course that didn't have much—probably it should have had some prerequisites for it, but it was a two-unit course, I remember, and it fit into my program, and I was anxious to get going in my field. In fact, as I recall, I think I was disappointed that I couldn't take a course in what was really sort of basic metallurgy until I was a sophomore, in the sophomore year. But meanwhile, I was taking chemistry and geology.

1-00:23:39

Swent: Was welding something that came in handy later, to know about welding?

1-00:23:43

Kirshenbaum: It could have. Of course, welding is a metallurgical—

1-00:23:51

Swent: Challenge. [chuckles]

1-00:23:54

Kirshenbaum: Yes! It relates directly to metallurgy, but I can't say that I did any—well, I did both arc welding and gas welding, and I guess I did a little bit of gas welding at a later date, preparing some things. It's actually not too far a step from soldering.

1-00:24:14

Swent: I was just thinking that in earlier years, mining engineers had to take courses in blacksmithing—

1-00:24:24

Kirshenbaum: Oh, everything, including surveying. Actually, I guess metallurgy and mining weren't so far apart in the early days because I think surveying had just been eliminated as a requirement in metallurgy. I recall petitioning out of taking a course in surveying, because that wouldn't have—I mean, there are a lot of things that are interesting, but you just don't have time for them.

1-00:24:50

Swent: No.

1-00:24:56

Kirshenbaum: So at the end of my first year, I was very anxious to get a job having something to do with my profession. I had hoped to go away, get a job someplace where mining operations were being conducted. I had actually tried this, I guess, the year before, but my age and lack of any experience precluded that. I was a bit young for my class. I was just seventeen, which was less than the legal age to work in some places, and in 1953, that first summer, I had tried to get a job at Bunker Hill—

1-00:25:50

Swent: That was in Idaho?

1-00:25:54

Kirshenbaum: In Idaho. I had not started early enough, I guess, but I finally wound up with a laborer's job over at the Selby lead smelter and had to join the infamous International Union of Mine, Mill and Smelter Workers, which had been so pinko that it had been expelled from the CIO [Congress of Industrial Organizations].

1-00:26:26

Swent: The Selby smelter was in—

1-00:26:29

Kirshenbaum: The Selby smelter—it was shift work, and I worked all three shifts, rotating, of course. And I roomed in Crockett, which was just a fairly short distance away.

1-00:26:49

Swent: When you say you roomed, you rented a room in a house?

1-00:26:54

Kirshenbaum: Right. Well, no. It was a place called the Crockett Club, and they had rooms. It wasn't a private residence. Right across from the C&H sugar refinery. The trains going back and forth—I had real difficulty in trying to sleep during the daytime when I was on the night shift or on the graveyard shift. But anyway—

1-00:27:29

Swent: How much were you paid?

1-00:27:34

Kirshenbaum: I still have the stubs, so maybe I'll fill that in later. [\$1.72 per hour]

1-00:27:41

Swent: Okay. Do you recall how much you paid for a room?

1-00:27:42

Kirshenbaum: No, I don't.

1-00:27:44

Swent: Did you have a car? Did you drive at all?

1-00:27:45

Kirshenbaum: Yes, I did. I had a car some of the time that enabled me to go back and forth.

1-00:27:53

Swent: What kind of car?

1-00:27:54

Kirshenbaum: It was a Chevy [Chevrolet]. My first car had been a 1930 Model A Ford, but I guess for safety reasons, my father insisted that I get rid of it when I went to Stanford.

My job at Selby—I was called a wheeler because, I think, historically people had wheelbarrows and they had shovels, and they picked up the material that fell off the conveyor belts or fell off—this probably goes back to before they had conveyor belts, but it was quite a job to clean up spillage of lead concentrates and heavy sinter and so forth. Selby received a lot of high-silver concentrates from overseas.

1-00:28:57

Swent: Let's see, Selby is right on the—

1-00:29:06

Kirshenbaum: It was right on the bay, and it was a custom smelter belonging to the American Smelting and Refining Company. They received raw materials from overseas, and I was fascinated by the names I'd see on the bins. Some of these were from sources in Australia. I remember Read-Rosebery, a mine in Australia. And from Peru they received very high-grade silver material, as well as from a few domestic sources. Part of my job was to clean out what were called wind boxes in the Dwight-Lloyd machines. The Dwight-Lloyd machine in a lead smelter is where the lead concentrate is roasted into sinter, which is a hard substance. Some of this material—a lot of lead, as it is a volatile material—lead and some of the sulfide sticks to the very hot sides of these flues that carry the gases from the roasted material. I had to use a heavy bar to scrape off the sticky material that adhered, which then was reprocessed. It was good for my muscles.

1-00:31:43

Swent: Was it hot also?

1-00:31:44

Kirshenbaum: It was hot and dusty, and with the dust was sulfur dioxide, and it was dirty.

1-00:31:55

Swent: What sort of protective clothing did you wear? Or what sort of clothing did you wear?

1-00:31:59

Kirshenbaum: I'm trying to remember.

1-00:32:05

Swent: What kind of boots?

1-00:32:09

Kirshenbaum: I think safety glasses. And I don't recall that I had to buy any special clothes.

1-00:32:17

Swent: Did you wear a hard hat?

1-00:32:22

Kirshenbaum: Yes, I recall the hard hat and probably some safety glasses, but I think that was it.

1-00:32:27

Swent: No mask.

1-00:32:29
Kirshenbaum: I don't recall a mask.

1-00:32:31
Swent: You would remember if you'd had one, I would think.

1-00:32:35
Kirshenbaum: I agree.

1-00:32:38
Swent: Gloves?

1-00:32:41
Kirshenbaum: Yes, definitely gloves.

1-00:32:46
Swent: What kind of clothes did you wear?

1-00:32:48
Kirshenbaum: I think jeans and—old clothes, that's for sure.

1-00:32:53
Swent: T-shirts? Were they in yet, or were you wearing a shirt?

1-00:32:58
Kirshenbaum: If I was wearing a shirt, I know it was long-sleeved.

1-00:33:00
Swent: Probably a long-sleeved khaki or something maybe?

1-00:33:04
Kirshenbaum: I think just some old clothes, nondescript.

1-00:33:07
Swent: I was just wondering. Jeans had come in by then, I guess, denim.

1-00:33:14
Kirshenbaum: The old jeans had. They were—

1-00:33:18
Swent: Were you wearing blue jeans?

1-00:33:20
Kirshenbaum: I think so. Or what we used to call wash pants.

1-00:33:26
Swent: What did you do about your laundry?

1-00:33:34
Kirshenbaum: I don't have great recollection for that, but I'm sure there was a Laundromat close by in Crockett.

1-00:33:46

Swent: You were probably doing your own?

1-00:33:48

Kirshenbaum: Yes.

1-00:33:53

Swent: What about eating? Food. Did you pack a lunch bucket?

1-00:33:57

Kirshenbaum: I bought things at the grocery and had a bag. I guess both my lunch—whatever time of the day or night it was—came out of a bag and probably much of my dinner came out of a bag, too, even though I did get home probably at least once a week and had food that I was fortunate enough to be able to take back from home that lasted a while, too.

1-00:34:33

Swent: Were there any benefits that you recall? If you'd been injured or sick, were there health benefits?

1-00:34:41

Kirshenbaum: Oh, I suppose there would have been some kind of benefit. Some of these probably didn't go into effect until one had been on the job for a certain length of time. I was not too happy having to pay dues to a union that I didn't have too much respect for, and I didn't go to any union meetings, and there were some pretty vociferous people around at that time. Told me I ought to be proud to be paying dues and all this, but unfortunately, there weren't any other students at Selby at the time. The person who hired me knew I was a student and would only be there a certain length of time. But anyway, that summer passed and—

1-00:35:30

Swent: Did they give you a hard time, being a student?

1-00:35:32

Kirshenbaum: Not too bad, but, well, there were a few jokes and so forth.

1-00:35:41

Swent: What about the safety procedures? You were working with lead.

1-00:35:46

Kirshenbaum: Yes. That did not enter into too much consideration that I was aware of.

1-00:36:00

Swent: No. Was there some sort of orientation?

1-00:36:02

Kirshenbaum: No.

1-00:36:02

Swent: You were just handed your shovel and that was it?

1-00:36:05

Kirshenbaum: That was pretty much it, yes.

1-00:36:08

Swent: You were there, what, probably two or three months?

1-00:36:17

Kirshenbaum: Yes, probably about that time. Then I went back to school, and I was able to take courses in metallurgy and more chemistry, in which I did very well. And then I guess a year rolled around, and I was looking for a more interesting and more educational type of job. I visited people at Bunker Hill's office. I remember I had bought five or ten shares of stock in Bunker Hill.

1-00:37:04

Swent: Did they have an office here?

1-00:37:05

Kirshenbaum: Oh, yes, their headquarters were in San Francisco. That goes way back. I don't know just how far back, because I know Bunker Hill had been originally owned by Simeon Reed, who founded Reed College. He was out of Portland. But Bunker Hill had been in the Bradley family of the San Francisco area for decades, and there were close connections to the Crockers and the Crocker Bank, and their office was in the Crocker Building.

1-00:37:41

I somehow got through my shyness enough to be able to speak to Phil Bradley, who was not one of the executives of Bunker Hill, but his family was connected, and he was involved in many of their activities because his office, as I recall, was either adjoining or maybe had a separate room in the Crocker Building.

1-00:38:15

But anyway, thanks to Phil, I got a name of someone in Kellogg, Idaho, where the operations were, and with a great deal of enthusiasm, I was off that summer to Idaho. I remember on the Fourth of July weekend going for a busman's holiday up to Trail [British Columbia], which wasn't too far away. It was a beautiful drive, beautiful country all around there. Of course, around Kellogg, too.

1-00:39:03

But I wanted to immerse myself in metallurgy and the industry and that was the reason to go up to Trail. Dominion Day was the holiday that is now called Canada Day, and the day I left. So I was probably able to go through and take a tour of the Cominco [The Consolidated

Mining and Smelting Company of Canada] smelter at Trail on July fourth.

1-00:39:28

Swent: Were there other students at Bunker Hill, too?

1-00:39:34

Kirshenbaum: There were some students, but the ones I met were not mining students. My job was in the research lab at the smelter. Some of the students were there just to get a summer job. One of them I became quite friendly with was John Bradley, who was Jack Bradley's son. Jack was the president of the company. After I got to know them a bit, I spent some weekends at their summer home in Hayden Lake, which was near Coeur d'Alene. That time was a lot of fun.

1-00:40:37

Much of the work I did at this research lab had to do with analytical chemistry and assaying and things like that, as well as some work—Bunker Hill had good people on their staff. They were innovative and had put in new processes over the years.

1-00:41:10

Swent: What were they mining?

1-00:41:13

Kirshenbaum: The ore was high in tetrahedrite, and that is lead and zinc with a significant amount of antimony and silver. It's a sulfide. There was also some arsenic. You could actually smell the arsenic not infrequently, in places like Kellogg and Smeltonville. Had sort of a garlic smell.

1-00:41:48

Swent: Oh, really?

1-00:41:53

Kirshenbaum: Yes. That's all been cleaned up now.

1-00:41:57

Swent: Again, were there any safety procedures?

1-00:42:04

Kirshenbaum: Yes—

1-00:42:08

Swent: Or health?

1-00:42:09

Kirshenbaum: Well, health—I remember the company subsidized the purchase of milk. They would sell milk for five cents a pint. Milk, I guess because of its calcium content—and I do not know if there is any biochemistry behind this; I know it's not very complicated—but I guess the calcium

is supposed to offset or replace the lead that might get into your system.

1-00:42:46

Swent: Were you urged, then, to drink milk?

1-00:42:50

Kirshenbaum: Yes. I took advantage of the subsidy.

1-00:42:51

Swent: Sure. Of course, in those days people did drink lots of milk, didn't they?

1-00:42:55

Kirshenbaum: Yes. But as far as other precautions, being in the lab, conditions of employment weren't terribly dangerous, even though we were handling very hot things. I did enjoy going, when I could, through the operations, and some of the work did require that.

1-00:43:27

Swent: What about the air pollution at that time?

1-00:43:32

Kirshenbaum: The Kellogg area had a notable lack of trees, from the smelter smoke, and only now—

1-00:43:46

Swent: There were other smelters there, as well as the Bunker Hill one, weren't there?

1-00:43:50

Kirshenbaum: Bunker Hill actually had both the lead smelter, where I was, as well as a zinc plant. The zinc plant was an electrolytic process smelter, but it did have a roaster before the electrolytic process commenced, so there was a lot of sulfur dioxide from both those two sources. Now, to alleviate some of that—and this was also true at Selby—they manufactured sulfuric acid. At Selby, they shipped sulfur dioxide out in railroad tank cars; as a compressed gas or liquid. Both Selby and Bunker Hill had Cottrell plants, which took dust out so they could make sulfuric acid. A lot of the acid went into fertilizer use. Bunker Hill actually put in a fertilizer plant later on which was to use phosphate rocks from deposits in Idaho and Montana.

1-00:45:27

Swent: This might be a good time to mention this report that you have.

1-00:45:36

Kirshenbaum: Yes, and maybe some other background about the environment, because a lot of people are unaware that environmental legal decisions and legislation and so forth have been with us for quite some time.

1-00:45:54

Swent: It didn't just happen in 1970.

1-00:45:56

Kirshenbaum: Right. The first instance that comes to my mind is the Sawyer decision of 1884 in California, which prohibited hydraulic mining on any river or stream that was tributary to the Sacramento or San Joaquin River systems. That had a tremendous effect on gold mining in California.

1-00:46:31

Swent: But it was still allowed on other rivers.

1-00:46:35

Kirshenbaum: It was still allowed on other rivers in California, and also there was the Caminetti Act that followed. [Anthony] Caminetti was a U.S. representative from Jackson in Amador County. He had this act passed—well, it was a House bill, of course—not many years after the Sawyer decision. That act enabled or allowed hydraulic mining to be permitted even on the tributaries of the Sacramento and the San Joaquin, provided there was a debris dam downstream that would catch the debris and all this material that would have flowed on down into the Central Valley. One or two dams were built, one on the—let's see, one on the Yuba River, called the Englebright Dam. But there really was never any large resumption of hydraulicking after that, even after the Caminetti Act passed.

1-00:47:44

So that was an environmental, judicial decision from an early date. And then we were talking about Selby. In my collection of mining literature, I have a Bureau of Mines report, Bulletin 98, published in 1915, entitled, "Report of the Selby Smelter Commission." I think the Bureau of Mines had only been established in 1910, so this was an early report of the bureau's. It has 528 pages. Even at that time, it had color illustrations of plants—

1-00:48:50

Swent: Oh, look at that!

1-00:48:52

Kirshenbaum: For example, a plate that shows "Natural Injury by Sulfur Dioxide to Leaves." And then there's a report also on animals, because that was an agricultural area.

1-00:49:17

Swent: Nice illustrations.

1-00:49:19

Kirshenbaum: Actually, when the Selby smelter was finally closed in the early 1970s, I believe it was attributed in part to the death of animals such as horses.

- 1-00:49:36
Swent: Horses were—
- 1-00:49:39
Kirshenbaum: Exactly. Horses grazed in that area.
- 1-00:49:46
Swent: But in 1915 they were mainly concerned with the leaves. That's interesting.
- 1-00:49:53
Kirshenbaum: I think this was a very thorough study.
- 1-00:49:58
Swent: At least the pictures are leaves. They don't seem to be worried about the horses at that point.
- 1-00:50:03
Kirshenbaum: I believe—it's been a while—
- 1-00:50:08
Swent: No, the pictures are all plants.
- 1-00:50:10
Kirshenbaum: You're right. You're right.
- 1-00:50:13
Swent: And nothing about people or horses. That's interesting!
- 1-00:50:14
Kirshenbaum: I don't think [it dealt] much about people, but—
- 1-00:50:18
Swent: Huh!
- 1-00:50:24
Kirshenbaum: Yes. Well, there are three pages, "The Effect of Sulfur Dioxide on Man," on barley and—maybe it's a different report that I remember seeing some pictures of pathology.
- 1-00:50:51
Swent: Yes. Well, that's interesting. But this didn't result in any legislation at that time, though, did it?
- 1-00:51:02
Kirshenbaum: No legislation, to the best of my knowledge. But, well, "Occurrence of Roaring in Horses in the Selby Smoke Zone." "Livestock Conditions in the Selby Smoke Zone." It's toward the end.
- 1-00:51:23
Swent: Right.

1-00:51:25

Kirshenbaum: But I agree that most of it does have to do with flora or plants.

1-00:51:32

Swent: Yes. Oh, there's a picture of horses.

1-00:51:43

Kirshenbaum: Yes. Roaring. And roaring is defined here as "hemiplegia or diplegia laryngis, observed by veterinarians of the University of California." So anyway, that goes back some time. Now Bunker Hill was way out in the forest, which frankly had already been greatly damaged by a tremendous forest fire, I believe, in 1910, that started just east of there, near Wallace. So because of its remoteness and the fact that there were plenty of trees in the rest of northern Idaho, at least, I guess some of the effects of the smelter smoke for a long time were not considered to be anything very serious.

1-00:53:01

Swent: And, of course, memories of the Depression were still fresh, and jobs mattered a lot.

1-00:53:07

Kirshenbaum: Exactly.

1-00:53:07

Swent: What was the population? How big a community was there at Kellogg at the time you were there?

1-00:53:13

Kirshenbaum: Kellogg probably had about five or six thousand, and Wallace was not quite so large. Wallace is the county seat. There were mines all up and down. I remember going up to Burke, when Burke still had some active mines. The Hecla [Star Mine] was still operating, and Burke was a fascinating town because it was so narrow, the road up Burke Canyon, there were railroad tracks even on part of the pavement. There was one place where the railroad track went through a building—I think a hotel! And I remember there was a gas station in Burke where the gas pump line was on the sidewalk because there wasn't any room for cars to pull in and park.

1-00:54:03

Swent: Now, that was the Hecla Mine, wasn't it?

1-00:54:08

Kirshenbaum: That's right. The Star Mine of Hecla, Hecla Star Mine. It was all lead-zinc-silver.

1-00:54:16

Swent: That was called the Silver Valley, that area, wasn't it?

- 1-00:54:20
Kirshenbaum: Yes, the Silver Valley and the Silver Belt.
- 1-00:54:24
Swent: Yes, so it was probably pretty flourishing at that time.
- 1-00:54:33
Kirshenbaum: Yes. And silver, despite its use as a monetary commodity, was very important, of course, during World War II. In some cases—
- 1-00:54:46
Swent: Well, so was antimony, too, wasn't it?
- 1-00:54:48
Kirshenbaum: Actually, everything was. I remember learning that silver, which was not as essential as copper during the war—silver was used in some places to replace copper where electrical systems were involved, despite the cost. Silver actually is a better conductor, but that isn't the reason; they just needed the copper so badly.
- 1-00:55:29
I went back to Stanford after that summer and had learned a lot at Bunker Hill and had a very enjoyable time there.
- 1-00:55:50
Swent: Okay. Where did you stay?
- 1-00:55:52
Kirshenbaum: There was a place called Pat's Boarding House that was in Kellogg.
- 1-00:56:06
Swent: So you got your meals as well as your room.
- 1-00:56:10
Kirshenbaum: Right, right.
- 1-00:56:15
Swent: What about benefits, health care? Did you ever have an accident?
- 1-00:56:17
Kirshenbaum: I didn't have any accident that I recall, certainly nothing serious.
- 1-00:56:22
Swent: Special clothing? Special clothes of any kind?
- 1-00:56:31
Kirshenbaum: Just for heat protection when I got close to something that was molten. I enjoyed that after work sometimes I was able to actually go underground in the Bunker Hill Mine.
- 1-00:56:50
Swent: Were you working shifts again?

1-00:56:56

Kirshenbaum: No, I had a day job. The research lab was only daytime work. So I went back to Stanford, and the next summer, which would have been the summer of '55, I returned to Bunker Hill. Again, after that summer, I recall a friend of mine from school came through or was dropped off—I forgot just what—but anyway, I had a car there, and then he and I went east to visit another friend, who lived in Deer Lodge, Montana. We had dropped down into Anaconda and had a tour of the smelter, which was the Anaconda copper smelter. Then we went over to Butte, my first time in Butte, then came back probably through Salt Lake City.

1-00:58:14

Since he had never seen Bingham Canyon, I'm sure I didn't mind going on another visit of Bingham Canyon with him. I had seen it a few times already.

1-00:58:28

Swent: Do you want to name him?

1-00:58:30

Kirshenbaum: Yes. He was Jerry Crow. I think he was from Piedmont [California]. In my last year of Stanford, before I graduated—

1-00:58:58

Swent: Let's talk a bit more about that summer job the second summer. Was the job the same as you had had the previous summer?

1-00:59:03

Kirshenbaum: It was similar. Too long a time, despite a good memory, has passed so that I can separate the different things that I had done.

1-00:59:14

Swent: I was wondering why they hired students in the summer. Were you doing things, taking the place of people on vacation? Or were you doing extra things?

1-00:59:20

Kirshenbaum: I think there were extra things that—

1-00:59:27

Swent: They sort of put off until the summer?

1-00:59:27

Kirshenbaum: Yes, short-term tests. Tests could be conducted over the period of a summer, and I guess some of it was maybe to replace a couple of the engineers who were on vacation. Also, they were looking for possible future staff.

1-00:59:46

Swent: What did you learn particularly from it?

1-00:59:52

Kirshenbaum: I got experience in chemical metallurgy, assaying and so forth, because there were tests that were being run—I remember arsenic being of considerable interest. I do not recall whether—they were doing some work, actually, I think, on arsenic for a Bradley property at Stibnite, Idaho. Some of those samples came to us at Bunker Hill. And then there were some other experiments in making lead shot. They didn't have a shot tower there, but I recall we were trying some innovative techniques.

1-01:00:55

Swent: Such as?

1-01:01:01

Kirshenbaum: Well, to be honest, I just don't remember.

1-01:01:04

Swent: Okay. But shot was still—I guess it still is—an important product.

1-01:01:07

Kirshenbaum: Yes. One of the fascinating things about nonferrous metallurgy is that in the processing of the ores and concentrates, you can wind up with many byproducts. That was always something that fascinated me, because it added to the complexity and all the things that one can learn in a job.

1-01:01:59

Swent: How were they shipping their products out at that point? Did you get interested in shipping at this time?

1-01:02:08

Kirshenbaum: I guess my curiosity was piqued a little bit because I was aware that the Bunker Hill smelter was actually smelting concentrates that had come in from overseas, and here is a smelter where obviously you had to pay for rail transportation to get it to the interior from the coast, and there was already a lead smelter on the coast at Selby.

1-01:02:49

Swent: So they were doing custom work at Kellogg as well?

1-01:02:53

Kirshenbaum: Some, yes. Not too much, but this gets into a discussion that we'll pick up later, I'm sure—

1-01:03:02

Swent: Right.

1-01:03:04

Kirshenbaum: —not only about transportation but about where things go, the logistics and so forth.

1-01:03:10

Swent: So they were shipping then—

1-01:03:12

Kirshenbaum: They shipped concentrate into Kellogg from afar as well as from the nearby mines. There were still many mines in the area. Hecla. Sunshine had its own plant. That was largely silver. And Asarco had mines there—its Northwest Mining Department. And Day Mines. There were many, what are commonly called in Canada—junior companies. The Coeur d'Alenes were full of these junior companies, and there were stockbrokers in both Kellogg and Wallace who specialized in these mining stocks. One of them, I'm happy to report, from when we were up there last summer, is still there, called Pennaluna. They still specialize in mining stocks.

1-01:04:19

Of course, in those days, the Spokane stock exchange was a big player. But the regional mining stock exchanges have all closed down. I forgot which was the last. It was either Spokane or Salt Lake. But those were very interesting—

1-01:04:42

Swent: You mentioned earlier that you had bought—I think you said five shares of Bunker Hill?

1-01:04:46

Kirshenbaum: Five or ten shares of Bunker Hill, then called the Bunker Hill and Sullivan Mining and Concentrating Company. Quite a name to grace a letterhead!

1-01:04:50

Swent: So you were not only an employee but a stockholder.

1-01:04:52

Kirshenbaum: Yes, albeit an insignificant one, though it added to my interest in the company.

1-01:05:07

Swent: So they were shipping out of that area, then, what? Bars?

1-01:05:15

Kirshenbaum: Yes. Bunker Hill would get the concentrates in hopper cars or gondola cars, I guess mostly gondolas, and the products from there were ingots, lead ingots, I believe about a hundred pounds, and then they made caulking lead that I guess went mainly to the plumbing industry. Those were much smaller, not bars but angular disks. And then there were many byproducts, most of them not refined. Some of the byproducts would be sold too—for example, they had a copper dross that would come out of the smelter, and be sent to the Tacoma smelter of Asarco.

1-01:06:15

Silver was a major product in terms of value. The silver was extracted with the Parkes process, whereby zinc is mixed in with the molten lead and the zinc preferentially combines with the gold and silver—there's an affinity between silver and zinc. The zinc is not soluble in the lead, and this insoluble zinc-silver alloy then floats to the top of the ladle, where it is then skimmed off, and the silver is separated very efficiently from the lead. The zinc is then volatilized off, as I recall, in a retort, from the silver, and silver bars were then a product of that.

1-01:07:34

For that purpose, the small amount of zinc which was required could come right from the electrolytic zinc plant that was around the hill, around the mountainside from the lead smelter.

1-01:07:48

There were a number of other things that came off in the flue dust but Bunker Hill didn't recover those. But those would be sent to other places. I remember in the lab, I became aware of the increasing importance at that time of gallium. Gallium is mainly obtained as a byproduct of aluminum and certain zinc ores, but we were looking at the possibility of gallium being in the flue dust at Bunker Hill.

1-01:08:31

Swent:

And what is that used for?

1-01:08:33

Kirshenbaum:

It's used as a transistor material, and today its value has gone way up because very small amounts are used in the large numbers of cell phones. So gallium is worth quite a bit.

1-01:09:03

Swent:

Yes. So then you went back.

1-01:09:07

Kirshenbaum:

Back to Stanford for my fourth year.

1-01:09:07

Swent:

For your senior year. By now you've declared your major, I guess.

1-01:09:14

Kirshenbaum:

Unlike a lot of students, I essentially had declared it when I started.

1-01:09:22

Swent:

Early.

1-01:09:24

Kirshenbaum:

Yes. And I guess it was good I did because, trying to make up courses that I hadn't had yet, if I decided on metallurgy in my last year, it would have been trouble.

1-01:09:38

Swent: You did probably have to take other things, though. Stanford required some—

1-01:09:42

Kirshenbaum: Oh, definitely, yes. And I'm glad for that. History and courses in the humanities. I took some French.

1-01:09:56

Swent: I was going to ask about a foreign language.

1-01:09:57

Kirshenbaum: Yes, French.

1-01:10:01

Swent: Which you'd grown up with, of course.

1-01:10:06

Kirshenbaum: Right. I've forgotten what some of the other electives there were that were of a non-technical nature.

1-01:10:17

Swent: You met Sandy somewhere along the way.

1-01:10:20

Kirshenbaum: Yes. That wasn't actually until after I had graduated. In, I guess, my last year, I was fortunate. The extractive metallurgy professor there—his name was Ken Schellinger—had been in industry. I guess his father had gone to Stanford, and he had been up in the Yukon for the early part of his life, up in the mining country up there. Ken Schellinger had a Ph.D. and had been in research for a number of companies. One of them was Cerro de Pasco [Peru]. He had been director of research at Cerro. Ken approached me and asked me if I would maybe be interested in going down to Cerro.

1-01:11:24

At the same time, he thought I should come back for a master's, and it resulted in my doing both. This was my first experience outside North America. It was an interesting experience, being away like that. The day before I left for that summer in Peru was when I met Sandy at a graduation party. The time I spent in Peru was largely at the Oroya smelter, which was at an altitude of over 10,000 feet—10,800 feet, I believe. To get there you either took the highway or—I frankly enjoyed the train more—from Lima. I arrived in Lima, I remember, during a period of martial law, so I had—

1-01:12:28

Swent: This was what, the summer of '56?

1-01:12:31

Kirshenbaum: This was the summer of '56, and there was a change in the presidency at that time, from Manuel Odria to Manuel Prado [Ugarteche]. But anyway, the railroad was a fascinating—I was always interested in railroads. This one was built by a renegade San Franciscan named Meiggs—Henry Meiggs or Enrique Meiggs. He left San Francisco in the 1850s and went to Chile, where he built the railroad from Valparaiso to Santiago. At that time, the mineral resources of Peru were really very difficult as far as accessibility—

1-01:13:36

Swent: Let's see, that's M-e-i—

1-01:13:36

Kirshenbaum: M-e-i-g-g-s. And there's a biography of him called *Henry Meiggs: Yankee Pizarro*.

1-01:13:49

Swent: [laughs] Well, he was, wasn't he?

1-01:13:52

Kirshenbaum: Yes. I was going to say he did more good for Peru than Pizarro did, but it depends on your point of view, I guess.

1-01:14:11

Anyway, the railroad is interesting. The summit is somewhere over 15,000 feet, or about 15,000 feet, and the attendants on the train had big bladders of oxygen that they would go around to resuscitate people who had passed out from the altitude. I believe the summit is in a tunnel, which is under Mount Meiggs.

1-01:14:52

The railroad also is notable for its switchbacks. There are—

[Audio File 2]

2-00:00:00

Swent: You were just telling about the train going up to La Oroya.

2-00:00:27

Kirshenbaum: A little bit about the engineering on this fantastic railroad that went over the crest of the Cordillera, maybe three hours or four hours out of Lima. You already hit the crest of the continent and the rest all slopes to the east, all the way to the Atlantic [Ocean].

2-00:01:11

The railroad had—I forgot whether it was thirteen or fifteen—literal switchbacks; not just sharp, horseshoe, hairpin bends but switchbacks where there wasn't enough room to have a curve in the track, so the train would go up as far as it could on the side of the mountain and then there was a switch, and the train would then back up to the next

switchback and then go forward again as it progressed its way up the mountain.

2-00:01:28

This meant that at the switchback there was only a limited length of track for the train to be on, between the switch and the end of the track, so the number of cars that could come down or up the mountain at one time was quite limited, probably—well, I don't remember the exact number, but obviously it had a greater effect on freight traffic than it did on passenger trains.

2-00:02:05

Swent: These were mixed trains?

2-00:02:07

Kirshenbaum: No, they were not. But the reason I say that is because there was much more freight traffic than there were passenger trains. The freight trains could not be very long. I remember hearing that the terrain was so rugged that they did not allow trains to come down at night.

2-00:02:29

But I think I started mentioning something about being in Peru during the change of presidency. I went down to Lima on a train to watch the ceremonies for the change. There were parades and so forth. The new president was Manuel Prado. It's interesting to me that he is the grandson of another Prado, who was president of the country during the War of the Pacific [1879–83], which Peru had with Chile and Bolivia. Chile was the victor, with both Peru and especially Bolivia losing territory. Bolivia lost its access to the coast.

2-00:03:28

But the president, President [Mariano Ignacio] Prado—the old President Prado—had been given funds to buy armaments in Europe. I believe he went to France, took the money, and did not come back. And yet his grandson became president of Peru in 1956.

2-00:03:59

Swent: What does that prove?

2-00:04:04

Kirshenbaum: Something perhaps about the oligarchy in that country, or the old oligarchy.

2-00:04:13

Oroya was a fantastic place for a metallurgist. They had essentially four smelters there: a lead smelter, a copper smelter, and two types of zinc smelters at that time, plus a tremendous number of byproducts. It was the world's largest source of bismuth. They had tin, and these metals were all extracted during the processing of the raw material. Cerro had many mines in the mountains there.

2-00:05:04

Labor conditions were not very attractive. I remember the housing conditions for the ordinary workers. There was a trough in front of these buildings, and this is where I think some of the—well, sewage went into that, and washing was done in some of these trenches. Also I remember the Mantaro River. One would always see clothes on the rocks along the river, where they were drying their laundry.

2-00:05:54

Swent:

Now, the river was lower. Was the river going through Oroya?

2-00:05:59

Kirshenbaum:

The river went through Oroya, plus a lot of the effluent from the smelter, effluent from the towns and so forth, on its way down eventually to meet up with the Amazon.

2-00:06:18

Swent:

How were *you* housed?

2-00:06:26

Kirshenbaum:

In a guest house. It was not primitive, but it wasn't luxurious, either. The metallurgy there—I mentioned something about the byproducts. Probably more metals come out of the Oroya complex than [from] any other single location in the world. An exaggeration, but you could almost cover the periodic table with all their products.

2-00:07:11

Swent:

It was a mature operation by that time, wasn't it?

2-00:07:21

Kirshenbaum:

Yes. As you know, it started—I believe the Incas were probably using some of the minerals for various purposes. Spaniards in the early days recognized—and the main mine was at Cerro de Pasco, which was at about an elevation of 14,000 feet and reached, of course, by railroad. I think the highest elevation of a mine was about 17,000, near Huancavelica, which was a major source of mercury for the Spaniards and actually didn't have anything to do with Cerro.

2-00:08:15

As you might gather, I had an appreciation for minerals transportation, just being up there. It was of interest to me to see that trainloads of concentrates or ores, some of them very high-grade ores, would roll through on the railroad, right through the smelter, and wouldn't stop. These ores and concentrates were on their way down to the ocean at Callao, where they would be shipped to smelters, be they Selby or maybe Bunker Hill or somewhere else. But I started to become interested in the logistics and why people would pay freight on ores that could have stopped at Oroya, been smelted, and then shipped out as finished metal products.

2-00:09:25

Swent: Were these for mines that were not owned by Cerro de Pasco Company?

2-00:09:28

Kirshenbaum: Yes, and I think some of them were from the Benavides, owned by the Benavides family, Minas Buenaventura.

2-00:09:43

So it was a fascinating opportunity to see the operations and become acquainted with people in Cerro's research department.

2-00:09:58

Swent: How would you characterize their research department?

2-00:10:05

Kirshenbaum: They had people from all over the world there, not just in research but working in operations also. Cerro, it seemed to me, was something of a place where a lot of refugees from different countries would come to because of political problems in their native lands. There were Yugoslavs there that I think were partisans of Tito and partisans who were allied with Tito's opponent, and there were I think a couple of people who had gotten out of the Soviet Union and some Europeans. It was certainly a multinational community.

2-00:10:57

Your question about the research, some of these expats were in research. I remember a couple of people from Switzerland. One, George Amstutz, a well-known mineralogist. Many of these people would come for a certain period and then go back, the ones who weren't refugees, of course. I guess the refugees probably spent their time there. And some of these refugees weren't only political but they had left a wife for example in Australia and had a whole new life in Peru.

2-00:11:49

Swent: Domestic refugees. [laughs]

2-00:11:51

Kirshenbaum: Exactly.

2-00:11:57

Swent: It was also sort of a training facility, wasn't it? Didn't a lot of people go there—

2-00:12:03

Kirshenbaum: Exactly, because of the technology, the things they could see.

2-00:12:07

Swent: What about the social life?

2-00:12:13

Kirshenbaum: There was the Inca Club. Obviously, there was not mixing of the laborers and the help—the foreign community would usually go to the Inca Club, where they had bowling and, of course, a large bar. Typical mining community.

2-00:12:41

Swent: I wonder how typical it was. It was sort of special, too. Wasn't it unique in some ways?

2-00:12:48

Kirshenbaum: I saw some of these types of, well, places, the Inca Club, and I forgot the name of the club that Anaconda had at "Chuqui" [Chuquicamata] in Chile. But the social life was somewhat tough, I guess, for a single person, who might be there for any long length of time. But there were other people, for example, from the U.K.[United Kingdom] who would come out, not necessarily highly skilled technically but they were the sort of people who would manage an operation without having to know much technology.

2-00:13:45

Times were still tough in the U.K. at that time, which was '56. And these people very often would come out with the main purpose of accumulating some funds and go back to the U.K. and I guess live better than they had before. Of course, these people were able to hire maids to take care of their children, and for them it was an enhanced life style.

2-00:14:25

Swent: Were there many Peruvians in upper staff positions at that time?

2-00:14:30

Kirshenbaum: There weren't many yet, but there were a few, and some of them, obviously, were graduates of San Marcos University or a technical university, and quite competent.

2-00:14:51

Swent: I was wondering whether there were Peruvians who had gone to, say, Golden and Colorado School of Mines or Arizona School of Mines.

2-00:15:04

Kirshenbaum: Good question. To the best of my recollection, there were none.

2-00:15:12

Swent: At that time.

2-00:15:13

Kirshenbaum: At that time.

2-00:15:15

Swent: There has been a big change, then, I think.

2-00:15:16

Kirshenbaum: Oh, definitely. And, of course, the situation now in Peru is far different. Peru had what was very unusual in the 1970s: they had a left-wing military government. The result of that was actually expropriation of Cerro de Pasco. It became known as Centromin. Obviously, this was a terrible—this was a catastrophe for the U.S.-based Cerro de Pasco Company. It managed to stay alive partly in metal trading, but I think their remaining extractive operations were pretty meager.

2-00:16:08

But Centromin carried on, and now, just fairly recently, the mines were auctioned off, and also the smelter complex, and I believe most of the operation is in the hands of what was Doe Run, a company more or less spun off from St. Joe Minerals. And Doe Run is actually now a privately-owned, New York-based company, owned by someone living on Long Island [New York]. So there's been a real change of corporate ownership over the years there.

2-00:17:25

When I left after that summer at Cerro, I had arranged that I would do some research for them during my subsequent graduate year at Stanford. The research involved trying to establish or determine some relationships between the composition of lead smelter slags from Oroya and the retention of lead in those slags, because sometimes they would find that the slag contained as much as—I think even over two percent lead.

2-00:18:08

There are many reasons that this can happen: composition of the slag, the temperature of the slag, because the temperature obviously affects the viscosity greatly, and the main way that lead is separated from the slag is strictly by gravity. The lead, being heavy, of course goes into the ladle, the slag going off the top.

2-00:18:55

I guess when I came back to Stanford, things at Stanford were starting to change or were already changing. My department, which was metallurgy, was in the School of Earth Sciences. There have been some name changes. The school had been the School of Mineral Sciences and now it's known as the Department of Geological and Environmental Sciences.

2-00:19:34

But the significant thing is that metallurgy—a couple of young professors who had received doctorates at M.I.T. [Massachusetts Institute of Technology], saw some opportunities, both, I think, for the department as well as, perhaps, for themselves. They approached Dean Terman from the School of Engineering and he agreed that the School

of Metallurgy should reenter the School of Engineering and become the Department of Material Sciences.

2-00:20:23

At this time, there was a lot of work being done on materials. They weren't necessarily metals; they were also high-temperature ceramics that were of interest for things like the rocket programs. Also, probably even more significantly, some of the work that was being done in terms of electronic materials such as transistors and so forth came into play here. William Shockley had come out from Bell Labs in New Jersey and tried to establish a company on the Peninsula and then wound up as a professor of electrical engineering at Stanford. Shockley was one of the three inventors and Nobel Prize winners for the transistor. Thus material science became really what was the foundation of the Material Science Department, and much of what came out of Silicon Valley.

2-00:21:33

I should mention that the department I was in was very small. I may have given that impression before, but there were three of us who graduated in metallurgy in 1956. The other two went on for a Ph.D. in physical metallurgy. I studied both physical metallurgy and extractive metallurgy, as one would normally do at Stanford, but my interests were almost entirely in extractive. There was much more chemistry and much more involvement with the mining and the raw materials operations, which really interested me much more.

2-00:22:22

Swent:

I did want to ask, going back to your summer at Oroya, how did you go down there?

2-00:22:30

Kirshenbaum:

I flew down. There were some other students that had gone down there, but I think I was the only one from the U.S. The others were from Queens University in Ontario [Canada]. As I mentioned, I arrived in Lima during a period of martial law and was delayed from going up to Oroya because of that. But it gave me a chance to see a little bit of Lima before—

2-00:23:12

Swent:

What about the flight? How did you get there?

2-00:23:16

Kirshenbaum:

I had never actually been in the South of the U.S., so I took advantage of that. I flew to Nashville and then took buses so I could see the South. This was still in the Jim Crow days. Went by bus from Nashville to Chattanooga and then to Atlanta, stayed in Atlanta overnight, and then from Atlanta to Montgomery, Alabama;

Montgomery to New Orleans via Meridian, Mississippi. So I left the country via New Orleans.

2-00:23:55

Swent: What airline were you on?

2-00:23:59

Kirshenbaum: Pan American [Airlines] or Panagra [Pan American-Grace Airways], as it used to be known when the W.R. Grace still had a piece of that company.

2-00:24:07

Swent: What sort of plane was it? Do you remember?

2-00:24:14

Kirshenbaum: I think it was a DC-6. It flew from New Orleans to Panama. I spent—I forgot the exact details, but I got a call from the airline that, because of a weight problem in the plane I was scheduled to leave Panama on, I was entitled to either to stay there overnight or go on another plane to Lima. The flight to Lima landed in Cali, Colombia, then Quito and Guayaquil, and finally in Lima. So, many stops.

2-00:25:23

Swent: It took a while.

2-00:25:26

Kirshenbaum: Yes.

2-00:25:29

Swent: How did you happen to go from here to Nashville? I'm trying to think. That was before Southwest [Airlines] went to Nashville. [chuckles]

2-00:25:38

Kirshenbaum: By what line?

2-00:25:39

Swent: Right.

2-00:25:41

Kirshenbaum: I think it might have been TWA [Trans World Airlines].

2-00:25:49

Swent: Maybe, yes. Well, that was interesting. So you did some good sightseeing in the United States before you went down.

2-00:25:53

Kirshenbaum: Yes. I wasn't back in the South for quite a few years. That was an interesting bit of my trip.

2-00:26:02

Swent: I'm sure. You said it was Jim Crow days. You were riding buses.

Kirshenbaum: Yes.

2-00:26:11

Swent: This was your first contact with that, I suppose.

2-00:26:12

Kirshenbaum: It was.

2-00:26:13

Swent: How'd you feel about it?

2-00:26:17

Kirshenbaum: Well, I talked to a number of southerners. In fact, I remember one of them was from Alabama, and he was in Peru. He told me that people in the North didn't understand the South, that the people in the North liked the blacks as a race but not individually. He said, "We like them individually. We have many of them who we're close to and friendly with, but by and large," he said, "they haven't attained the status that we can like them as a race."

2-00:27:02

Swent: Hmm! Was the situation kind of similar with the Peruvians at Cerro, at Oroya?

2-00:27:14

Kirshenbaum: I think so. That reminds me of one time when I went down to Huancayo on a weekend and stayed at the hotel. There was only one good hotel at the time in Huancayo. That Saturday evening—by the way, generally the work at the smelter was on a five-and-a-half-day week. I took the train down to Huancayo on Saturday afternoon, and that evening—Huancayo was the capital of the—I'm not sure if it's the province or department, but anyway, it is 99-plus percent natives, indigenous Indians.

2-00:28:09

Swent: Quechuas.

2-00:28:11

Kirshenbaum: Right. They had a political meeting there at the hotel that night, a dinner. I found it sort of interesting that the people at the dinner and all the delegates and people congregating around looked like they could have been from New England. They were just absolutely white people. Obviously it was Spanish heritage, but these political leaders of this area of the country was not reflective of the local population. In other words, it was virtually entirely a native area.

2-00:28:53

Swent: But no representation.

- 2-00:28:56
Kirshenbaum: Exactly. Thanks for stating it succinctly, yes. No representation.
- 2-00:29:04
Swent: Now, the workers at Oroya—were the workers Quechuas also, or were they mestizos?
- 2-00:29:11
Kirshenbaum: Oh, they were pretty pure, I'm sure, Quechua-speaking.
- 2-00:29:21
Swent: And then the staff were all the Spanish-speaking.
- 2-00:29:25
Kirshenbaum: Yes.
- 2-00:29:26
Swent: Or English.
- 2-00:29:28
Kirshenbaum: I think a lot of these workers—they could speak Spanish also. But, of course, the managers couldn't speak more than one or two words of Quechua. At that time, something that's probably changed since transistor radios came in a long time ago, but they had a loudspeaker, in fact a series of loudspeakers down the street in the commercial area of Oroya. This was instead of a radio which were still too costly for individuals to own. The loudspeaker played music, and they had ads, and it got to you after a while if you were standing in that particular area for very long. The loudspeaker was quite loud.
- 2-00:30:18
Swent: And what language was it using?
- 2-00:30:21
Kirshenbaum: I think that was probably all Quechua, maybe some Spanish.
- 2-00:30:30
Swent: Now, you mentioned the people who had maids. The maids would have been Quechua, then, probably.
- 2-00:30:40
Kirshenbaum: I don't recall, but I think that they probably had been Hispanicized.
- 2-00:30:48
Swent: Maybe.
- 2-00:30:50
Kirshenbaum: Because their first names, I think they were Spanish names. Probably that was part of the job the Spanish did in the religious conversions. Maybe they had saints' names for their first name. I would suspect so. I'm sure there were lots of Juans and—

- 2-00:31:22
Swent: What about, well, the Inca Club? Were the Peruvians as well as the Anglos there?
- 2-00:31:28
Kirshenbaum: I think the highest-level Peruvians, some of the engineers would be there, but—
- 2-00:31:36
Swent: There were a few engineers that were Peruvian?
- 2-00:31:40
Kirshenbaum: Right. Yes, the ones that had graduated from San Marcos. It was the beginning.
- 2-00:31:47
Swent: I was wondering—I once knew—this was back in Lead, when I was a child—there was a man who had worked at Cerro, who had married an Indian woman—I mean, a Quechua—and came back up to Lead with her, and it was pretty pitiful. She had a terrible time adjusting. I don't think she adjusted at all. But he was sort of interesting. I doubt this happened very often.
- 2-00:32:23
Kirshenbaum: Not that I would expect. Now, I did know, in fact I have had some good friends who were from other countries, and married Peruvians, but one good friend, actually from Australia, had married a Peruvian nurse. But obviously—she was an educated person.
- 2-00:32:50
Swent: Right. And was she working in Oroya?
- 2-00:32:54
Kirshenbaum: She was working for Cerro, and then they both came back to the U.S., and he was in the New York office and became prominent in some other mining companies.
- 2-00:33:07
Swent: The ones I've known who married Peruvian girls married girls from Trujillo or Lima.
- 2-00:33:11
Kirshenbaum: Yes.
- 2-00:33:15
Swent: They weren't from Oroya.
- 2-00:33:16
Kirshenbaum: Of course, I think the nurse—I remember her name, Rosa—I don't know specifically, but I'm sure she was either from Lima or one of the other cities and was working up there.

- 2-00:33:42
Swent: There must have been schoolteachers, maybe?
- 2-00:33:43
Kirshenbaum: Yes, definitely.
- 2-00:33:46
Swent: Secretaries? Were some of the secretaries—
- 2-00:33:47
Kirshenbaum: Sure. These were all what you might call imports to Oroya from other places.
- 2-00:33:57
Swent: But they were pretty, young women that a young engineer might fall in love with.
- 2-00:34:02
Kirshenbaum: Sure.
- 2-00:34:12
Swent: Well, we got kind of off the subject there. I sidetracked you. I was asking about the flight down because I was interested in that, but that's been a big change, of course. And in earlier times, people took ships, but that was—
- 2-00:34:30
Kirshenbaum: Yes. I remember before I came back, someone tried to persuade me to take a ship back. He said it would be something we wouldn't be able to do too much longer.
- 2-00:34:49
Swent: There were still Grace ships running?
- 2-00:34:52
Kirshenbaum: Yes, Grace was still doing that, but he said, "Take a freighter." Well, of course, I think some of the Grace ships were freighters, besides the passenger liners they had. But he said, "Take a freighter." And he said it would be something I'd never regret. My concern was that I'd get back quite a bit after classes had started and I'd be at a big disadvantage, but I've often wondered how that trip might have been.
- 2-00:35:27
Swent: Okay. So you did go back to Stanford, then.
- 2-00:35:33
Kirshenbaum: Right.
- 2-00:35:35
Swent: And worked on this project.

2-00:35:37

Kirshenbaum: Yes. And then I guess I had met my wife, Sandy, or Sandra, shortly before I left—actually, it was my twenty-first birthday party in June of '56. I think I left about two days later. Well, maybe a week later, right after graduation.

2-00:36:13

Swent: She was at Cal.

2-00:36:17

Kirshenbaum: Yes, she was at Cal. We dated quite a bit that year that I received my master's, and then I thought—Schellinger was leaving Stanford then, and there really wasn't much going on in terms of extractive metallurgy because materials science had started. I thought I might go on for a Ph.D., so the obvious thing was to enroll at Cal, which I attended for two years, and then, frankly, got a bit tired with—because I was interested in practical applications and not in doing long-term academic research.

2-00:37:13

I did work on some projects while I was at Cal, some very interesting ones, actually, one involving calorimetry, which is very important in terms of determining thermodynamic properties.

2-00:37:47

Swent: Who were you working with?

2-00:37:50

Kirshenbaum: Immediately under someone named Ray Orr, and the work was under Ralph Hultgren. Is that name familiar?

2-00:38:00

Swent: Yes, it is.

2-00:38:03

Kirshenbaum: Did you know him?

2-00:38:04

Swent: I didn't know him, but I've heard it a lot.

2-00:38:09

Kirshenbaum: He was really a thermodynamicist. The extractive professor was Fred Ravitz. I took some courses there, and the most interesting course of all was one that was a quasi-university course. At that time, the Hearst mining building had, you might say, a station of the U.S. Bureau of Mines in it. There was a man there, who had actually received his Ph.D. at Stanford, K. K. Kelley. He was the man in charge of all the thermodynamic work for the Bureau of Mines. This is why I believe there was a connection or there was an emphasis on thermodynamics in the Metallurgy Department under Ralph Hultgren.

2-00:39:29

But Kelley taught this course in thermodynamics. He taught it only every two years. It was something that fascinated me. He would use these measurements that Hultgren's group had made in making estimates of which reactions might go forward or would be impossible, which chemical reaction, which metallurgical reactions, I should say.

2-00:40:12

He had these rules that you could use to make these various estimates. It was interesting that these calorimetric measurements were made to such precision and accuracy, and Kelley would take this information and compile it in publications of the Bureau of Mines, as research reports, and yet, in his class, he would make these estimates using good assumptions rather than precise data. He was very informal—he wore a windbreaker each time in class. The informality of making these estimates seemed like sort of a contrast between the precision—but it was all very useful kind of information, which I suspect is not used as raw data anymore, because you can probably get this all off computers now. So anyway, I was getting anxious to get into industry. Sandy was graduating in '59 from Berkeley, and I was impatient and wanted to maybe go East, in spite of the fact that mines are in the West, but I had a chance to take a job with American Smelting and Refining Company at their research lab in South Plainfield, New Jersey.

2-00:42:17

Of course, I had the laboring experience at Selby, but a company like Asarco I thought was fascinating, as they produce such a diversity of products, and I remembered that at Selby I could see that there were these circulating loads. You'd have co-products that were skimmed off the top of ladles at Selby and would be shipped to another Asarco plant. Eventually, some of the components no doubt came back to the lead smelter.

2-00:43:00

But anyway, all these complex logistics fascinated me, and I thought that maybe at the research lab I would have an opportunity to get involved in figuring out how to minimize some of these problems.

2-00:43:36

The project I remember working on when I took this job, the one that occupied most of my time, was doing some work in fluid-bed roasting. It was relatively early days for fluid-bed processing, which had been developed by the Dorr Company. Dorr was in Westport, Connecticut. John V.N. Dorr, was a real pioneer in metallurgy. I think he developed thickeners and so forth.

2-00:44:27

Swent:

Classifiers.

2-00:44:30

Kirshenbaum: Yes, classifiers. And I know some of his early work was either done or put into practice at Lead for Homestake [Mining Company]. You know, Dorr thickeners, classifiers. But Asarco's interest was actually to take some ores that they had and concentrates from the north Idaho area, where they had a lot of antimony, and see if one could take the fluid-bed roaster and make some separations of these materials by thermal means, which of course fit into my pyrometallurgical background.

2-00:45:27

There were other things I did there. I met a lot of interesting people. But I learned that much of the laboratory really didn't put out as much as one might expect from a facility of that size. Much of it was used for routine analysis, and I think probably to impress visitors and potential customers who might buy Asarco products, even though they were just pretty much commodities, that Asarco was on the forefront of R&D [research and development].

2-00:46:15

At that time, the mining and metals industry did indeed have a good bit of research going on. There were major laboratories some of these companies had. I remember notably International Nickel. I guess their extractive work was done largely in Canada, of course, where their operations are. But the alloy development—much of it was done in the United States.

2-00:47:02

Kennecott about that time, under [Frank R.] Milliken, who was an M.I.T. graduate and a metallurgist—Kennecott really went overboard in R&D. They had a research lab on the University of Utah campus in Salt Lake City. Not too much later, they put a lab in—I forgot which suburb of Boston it was. It was called the Ledgemont Laboratories. I think it was in Lexington, Mass. That was for more esoteric development. I don't remember some of the projects they were getting into. Oh, I think physics of metals. Unfortunately, things that never saw the commercial side of development. And the lab, which no doubt cost quite a bit to staff and maintain, didn't last too long.

2-00:48:37

Swent: As you said, a lot of the other companies—Anaconda had a lot of research labs—

2-00:48:43

Kirshenbaum: Oh, Anaconda, definitely. Yes, their lab was in Tucson. I'm trying to remember—well, Nat Arbiter was the person who wound up as director, and then actually Bob Bartlett was the last person. I remember one time calling the lab. I knew Bob from California. I called down to Tucson, and instead of a telephone operator, the person

who picked up the phone was Bob Bartlett, and the place was closing down. Unfortunately, a lot of labs—

2-00:49:32

Swent: Well, the Bureau of Mines.

2-00:49:36

Kirshenbaum: Exactly. You mentioned Anaconda. Union Carbide had a lab. I think one of the last companies that has a significant laboratory along these lines is Newmont. Newmont had a well-known lab in Danbury, Connecticut. Later, that moved out to Salt Lake City and, I believe, was relocated to Denver, where the company's headquarters are now. So anyway, after something like a year, the metals business was not in good shape, metals prices being low, and Asarco had a major cutback in personnel, and there were several of us at the research lab who were lopped off.

2-00:50:54

Swent: When was this, then?

2-00:51:01

Kirshenbaum: This was in 1960 or '61. Then I was—

2-00:51:16

Swent: Do you remember what you were paid at any of these places?

2-00:51:20

Kirshenbaum: Yes.

2-00:51:21

Swent: I didn't ask how you were paid at Cerro, either, and I should have asked that.

2-00:51:25

Kirshenbaum: Yes.

2-00:51:29

Swent: But Asarco?

2-00:51:31

Kirshenbaum: Asarco, the starting salary was \$600 a month.

2-00:51:34

Swent: By now you had a master's degree?

2-00:51:35

Kirshenbaum: With a master's degree. And I received a three percent increase during that time, so I came out of there with \$618 a month.

2-00:51:46

Swent: How were you paid at Cerro?

- 2-00:51:56
Kirshenbaum: I believe it was in dollars. Actually, I guess I'd like to defer that until later also.
- 2-00:52:06
Swent: Okay, right. Okay, but you were making a magnificent amount of \$600 a month now.
- 2-00:52:08
Kirshenbaum: Yes.
- 2-00:52:12
Swent: And in '61 that was attractive.
- 2-00:52:17
Kirshenbaum: Well, not all that attractive, but it was certainly something that one was satisfied with. They had a good medical plan—I remember that, because someone told me that Asarco didn't pay all that well, but they gave you a good medical plan so that they could essentially—and a good pension plan—so that people would stay there, and yet they wouldn't have to pay them very high salaries, even after they had the experience.
- 2-00:53:10
Well, because the primary industry was not in good shape, I made some inquiries. Some of my inquiries were made for another job in the New England area, an area that, frankly, my wife and I were interested in spending some part of our life or our time in.
- 2-00:53:40
Swent: Were you married by now?
- 2-00:53:41
Kirshenbaum: Yes.
- 2-00:53:44
Swent: Didn't mention that. When you went off to Plainfield.
- 2-00:53:47
Kirshenbaum: Yes.
- 2-00:53:50
Swent: You were married before you went there.
- 2-00:53:52
Kirshenbaum: We were married, right.
- 2-00:53:55
Swent: I see, okay. Okay, so on \$600 a month you were supporting a wife as well.

2-00:53:58

Kirshenbaum: Right. Well, she had a degree. When we went to Plainfield, she had a chance to get a degree in library science at the Carnegie Library School in Pittsburgh. She took that up, and basically we saw each other on weekends for a while. While I was working at Asarco, she had a job at the Plainfield Public Library, which I gather was a nice place to work.

2-00:54:44

Subsequent to that, I applied to some companies in the Boston area. One that had at least a semblance of chemical metallurgy, extractive metallurgy was one in Cambridge. It was a start-up company called Alloyd Corporation. The president was the professor of metallurgy at M.I.T. I soon came to learn that every professor except one, Morris Cohen, of the Metallurgy Department, had his own company. That might have been fine for the company, but I felt sorry for the students. I remember one student I met at an AIME [American Institute of Mining Engineers] dinner in Cambridge, saw that I was from Alloyd, and he said, "Can you give me any suggestion"—this was a Ph.D. candidate—"on a good time to try to see" this professor. He said that he makes appointments weeks in advance and then he's gone. The result was—this was during the early years of the Kennedy administration, and all these professors—I think, no doubt, from Harvard [University] as well—were not only off to Washington, doing consulting—but of course, the ones at M.I.T.—these people had their own companies, and teaching was the lowest on the priority list. After that, I heard that there was some real concern on the part of the school about what was going on, and they put in some strictures that limited—didn't prohibit, but limited—some of these other activities.

2-00:57:17

The project I was working on at Alloyd was high purification of metals, using vapor-phase technologies. The company had some clients—well, the high-purity metals program was largely, I believe, for the Defense Department. Purification was—well, the first paper that I wrote was on preparation of high-purity molybdenum. That was about 1961 or '62. We produced some other high-purity metals as well, using vapor-phase technology, and then the company started to get into electron-beam technology for melting metals. They became a manufacturer of electron-beam equipment after that.

2-00:58:29

They had other, private, clients. I remember one was the S. D. Warren Company, which was a well-known paper company out of Maine. They are now part of a much larger—there's been a tremendous consolidation in the paper industry as well. But they produced specialty papers, among other things. We had some interesting work, trying to put metal coatings on paper.

2-00:59:00

One of them we wanted to use was aluminum. I did not have a background in organic chemistry, but one of the other fellows from M.I.T. did, and it was a very interesting project. We used ether and made some extremely dangerous—well, working with ether is dangerous in the first place, but we made some compounds that were dangerous because of toxicity as well as because of explosive problems. We made some of these products, which were really very attractive.

2-00:59:54

Swent: Why would organic chemistry—

2-00:59:58

Kirshenbaum: Oh, because the compounds were organic compounds. Because the substrate was paper, we had to use low temperatures. We could not evaporate, obviously, at a high temperature onto paper. You can evaporate if you're evaporating onto metal, but we had to use these—I don't remember which substances that we created, but this fellow knew how to synthesize these compounds.

2-01:00:45

And some other things we used that were a little bit easier for me to understand were putting nickel onto paper and other materials, and we used nickel pentacarbonyl, which, again, is extremely toxic because it decomposes at a low temperature. It's a nickel atom with a number of carbon monoxide groups in the molecule. The carbon monoxide was not the dangerous part, the nickel was, because, as I say, it decomposes at a low temperature, and if you got this in your lungs, it would decompose and you would have a plating of nickel.

2-01:01:35

Swent: Oh, my!

2-01:01:37

Kirshenbaum: Yes. So that was something that took some caution.

2-01:01:41

Swent: Yes. Were you working with masks, then?

2-01:01:48

Kirshenbaum: Oh, yes.

2-01:01:48

Swent: Wearing a mask all the time?

2-01:01:51

Kirshenbaum: And hoods. But I remember the smell of ether very well. I guess that's detectable in very small quantities. Unfortunately, I guess some of these other things don't have a smell, like the nickel pentacarbonyl.

Copper Range [Company] was another client of Alloyd. They had recently moved down to New York City from Boston. It's interesting, historically speaking, that Boston in the old days was a real center of mining finance. You know that from—

2-01:02:36

Swent: Hecla was there, and Copper Range.

2-01:02:40

Kirshenbaum: Just a visit, for example, to the Upper Peninsula of Michigan, Houghton—so many Boston names: Houghton, Harvard. The city of Houghton. And Quincy Mining.

2-01:02:58

Swent: Agassiz did the geology, didn't he?

2-01:03:03

Kirshenbaum: Yes.

2-01:03:07

Anyway, there was a real connection between Boston and mining. About this time, in the early sixties, I think Copper Range was one of the last to move out of Boston, and that was when they had—Jim Boyd became president about that time. I'm not sure if it's in his oral history, but I was told that he agreed to accept the presidency if the company would move out of Boston. I'm not sure if he had any dislike for Boston, but I guess he wanted to be in New York.

2-01:03:48

Swent: Wanted to be in New York.

2-01:03:51

Kirshenbaum: Yes, and he moved the office to Rockefeller Center. Many of the other mining companies that were by that time in New York were still all down in lower Manhattan: Asarco and Anaconda and, well, all the others. Inco was down there, too.

2-01:04:08

Swent: National Lead? Where were they?

2-01:04:11

Kirshenbaum: National Lead.

2-01:04:15

Swent: They were a New Jersey company, weren't they?

2-01:04:18

Kirshenbaum: Yes, but I don't remember exactly where they were.

2-01:04:22

Swent: Well, Phelps Dodge.

2-01:04:30

Kirshenbaum: The mining firms had already started to move to midtown Manhattan. Phelps Dodge and Newmont and Cerro were all in 300 Park Avenue, and St. Joe was in 250 Park Avenue. But they had moved out of downtown. There were still some downtown, and I guess we'll probably get to that later, too. But anyway, Copper Range was next to the last mining company, I believe, in the Boston area, the last one being U.S. Smelting—U.S. Smelting Refining and Mining Company, I believe on Federal Street in Boston. But by that time, it was being picked up, I think, by one of those takeover artists who put some of these assets into Sharon Steel. I can't remember his name, but he wound up in Florida and, I think, in a bit of legal trouble.

2-01:05:45

Swent: It wasn't [T.] Boone Pickens.

2-01:05:46

Kirshenbaum: No, it was not. Pickens was, I think, mainly in oil. Yes, I think the other fellow put his daughter on the payroll and had quite a reputation.

2-01:06:01

Anyway, Copper Range, probably because of some residual connections in the Boston area, had a contract with Alloyd to do some development, some alloy development work, and I was involved in that. To me, this was a very interesting time. Boston was a wonderful place, a lot of technology around there. Of course, much of the electronics development came out of Silicon Valley, but there were transistor companies on Route 128. We were literally within walking distance of M.I.T. and the library.

2-01:06:56

Swent: Where were you living?

2-01:06:59

Kirshenbaum: We first lived in Watertown. We took advantage of a lot of the activities in the Boston area. My wife took a course—I remember it was a summer course at Harvard in Portuguese, from the head of the Romance Language Department, and she was able to speak Portuguese amazingly in that short time. Of course, she had some background in Italian and later in Spanish, but it was really very impressive.

2-01:07:51

She was pregnant at that time, so she couldn't do too much beyond that. But before that first winter, our first child was born. On one side, at least—I'm third generation—we wanted our first child to be born in San Francisco, so she went out to San Francisco and maintained that lineage.

2-01:08:14

Swent: This was your son?

2-01:08:23

Kirshenbaum: No. Our daughter, Lisa. Who has unofficially changed her name to Daniela—most people who know her, know her today as Daniela.

2-01:08:39

Swent: Okay.

2-01:08:48

Kirshenbaum: For one reason or another—I forgot just why—I think there were several reasons, but I wanted to take another job in the area, and I took a job with General Electric [Company] at their West Lynn plant, West Lynn, Massachusetts. I was the only metallurgist in the department. This was in '63, I guess. I was at Alloyd a couple of years. I'm not sure I said this was the instrument department of G.E., which had two units in Lynn. The other was the so-called River Works, where they built aircraft engines. I was anticipating that I'd have a good bit of opportunity to be sort of a liaison with G.E.'s wonderful research lab in Schenectady [New York], from the place that I was working, but, to my disappointment, I didn't.

2-01:10:15

Swent: What were you hired as? What was your job?

2-01:10:18

Kirshenbaum: I guess plant metallurgist. But it turned out that this was—they were proud of the fact that—I think the longevity at this plant was the greatest in G.E.'s empire, which is nice from a historical point of view, but it certainly wasn't a match for what you think of, or I thought of, in Boston as new technology—companies like Polaroid at that time were just booming and so forth. But we moved from Watertown to Marblehead, and I think maybe Marblehead was a place that we enjoyed living the most in my career. I'm sure you're familiar with that coast. It was nice to be able to bicycle down from our house to the wharf and buy lobsters we could have for dinner a few minutes later.

2-01:11:31

Swent: Mmmm, yes. Are we getting to a good place to stop?

2-01:11:43

Kirshenbaum: Sure.

2-01:11:45

Swent: Why were you talking about Copper Range?

2-01:11:47

Kirshenbaum: Oh, I think it got on the tape—because it took me a while to get there, but I did say at one point, I believe, that Alloyd had some contracts with Copper Range to do some work in alloy development, and I was working on them.

2-01:12:02

Swent: I see. I was thinking that—you worked for Copper Range, then, later.

2-01:12:04

Kirshenbaum: Later, yes.

2-01:12:11

Swent: I see, okay. But not yet. Okay.

[End of interview]

Interview 2: January 30, 2003

[Audio File 3]

3-00:00:06

Swent:

All right, we're continuing the interview with Noel Kirshenbaum. This is January 30, 2003, and we're in his office in San Francisco. Our first interview was a week ago, and we had gotten up to your employment with G.E. [General Electric] at West Lynn, Massachusetts, in the instrument department. I don't think we talked about how you got that job, and I'd be interested in knowing how you happened to get that job. You had been at Alloyd.

3-00:00:37

Kirshenbaum:

Alloyd was right in Cambridge, Mass., right on the river, next to M.I.T. The G.E. position was actually the one time, I believe, in my life, that it was through an employment firm. I forgot how I had the contact with the employment firm, but anyway, I became aware of this job opening at G.E., and after the fellow had spoken to me for a while on the phone and at a couple of meetings, I took that job in Lynn at the instrument department. This was in 1963, I believe.

3-00:01:37

In previous conversation, I discussed, I believe, the fact that it was something of a disappointment to me. We were very happy being able to live in Marblehead, but the job itself wasn't all I had hoped for. So when I saw an advertisement that fall (1963) in a journal for a position in Argentina to teach at a university, I followed that ad up and communicated with the dean of engineering at Bucknell University. Bucknell is in Lewistown, Pennsylvania. They have an engineering department, but they didn't have any metallurgical staff or department or faculty.

3-00:02:41

Bucknell had a contract with AID, the Agency for International Development, which had been set up by then-President [John F.] Kennedy. Bucknell had furnished, on loan, some of their professors to the Argentine project. I remember there was one in electrical and one in mechanical engineering. They wanted to supplement that with someone in metallurgy.

3-00:03:19

Metallurgy was—well, I'll get into the details later, about Argentina. Anyway, the dean came out to our house in Marblehead. I suspect he really wanted to see more than just me. Especially because in a position like this—it's important to know that family members would get along with the locals.

3-00:03:57

Actually, at that moment, my mother was there visiting and staying with us in Massachusetts, and she met Dean Eckberg. His visit

happened to be on the weekend immediately following the assassination of Kennedy in Washington, so that was a weekend I remember very, very well.

3-00:04:30

Anyway, the dean approved me, and after a trip to California to say goodbye for a couple of years, we were on our way to Argentina in January for a two year assignment.

3-00:04:48

Swent: You had one baby.

3-00:04:49

Kirshenbaum: We had two.

3-00:04:52

Swent: Oh, by then you had two.

3-00:04:54

Kirshenbaum: Yes, two children, one a real baby, and the other was I guess two years old.

3-00:05:02

Swent: Okay. You hadn't mentioned number two yet, so let's get—

3-00:05:06

Kirshenbaum: That was our son, Kent, who was born also in San Francisco in January of '63, so he was exactly one year old when we left. We left a New England winter and flew out of New York, and the plane landed in Rio [de Janeiro, Brazil], which was a real change of temperature.

3-00:05:42

Swent: Did it go nonstop New York to Rio.

3-00:05:52

Kirshenbaum: Yes. It was a brief stop in Rio before the plane continued on to Buenos Aires. We were there in Buenos Aires, mainly meeting people in AID and the State Department. AID was attached to the State Department. Of course, their headquarters in Argentina for their various operations or missions was at the U.S. Embassy. We were there for I forget how long, quite a few days, maybe a week or ten days, and then we went by train to Córdoba, which is where the post was.

3-00:06:43

The entire country did not really have anything in the way of extractive metallurgy. I don't want to disparage Argentina because I have the highest respect for the quality of people who are educated there and for their educational system. They have a literacy rate which I believe exceeds that of our own. They have educated their wonderful people in all kinds of fields: diplomats who have been leaders in the

United Nations, and I've been impressed with their engineers, nuclear engineers and marine architects—I'm sorry, naval architects, designing ships. It's really a very well-educated country.

3-00:07:43

But unfortunately, something about it or maybe Latin America has prevented them from having a great deal of success, especially—in fact, it's gotten a lot worse. At one time, Argentina was the equivalent of a European country in many respects. They had investments from all over Europe. Besides the original Spanish immigration, there were waves of immigration from Italy more recently, and then quite a few came from Germany.

3-00:08:43

Swent: What was the name of the university?

3-00:08:51

Kirshenbaum: Universidad Católica de Córdoba. Córdoba is an industrial city. It and Rosario tie for second-largest city in Argentina. Córdoba actually has, I believe, the oldest university in Argentina, the Universidad de Córdoba. I guess partly because it was a public university, it had all kinds of political problems, so this was probably the main reason why the U.S. was interested in working with a Catholic university, which did not have those problems.

3-00:09:57

It was a fairly new university. It was Jesuit. I remember the person with whom we worked with mostly was not director but I guess he was a vice director, who was a Belgian. Of course, we didn't approach him on engineering matters, but there were a lot of things besides engineering that were involved in working there.

3-00:10:32

Swent: Were you teaching?

3-00:10:36

Kirshenbaum: I did teach some courses—well, a couple of courses, and I had a couple of Argentines, one in particular, whom I'll never forget—his name was Alberto Guzmán. I was going to say that we never felt close or casual with him—it was a very formal relationship. He was my age, young. He was not a metallurgist; he had a degree in physics. But he came from a family—I don't know what his father did, but they are very status conscious, so much so that it was quite a revelation to me. I think it can be illustrated by the fact that we didn't address each other by first name. I was always Kirshenbaum, and—I forgot what I called him. I think I just used to call him Ingeniero.

3-00:11:52

Anyway, very aware of status. He would not be the first one to walk into a room where the lights were not on, because it was beneath his dignity to turn on the light switch.

3-00:12:21

Swent: Oh, my!

3-00:12:25

Kirshenbaum: Yes. I think he did not want me to know that he could type. Sometimes it became obvious that, to get something done, he was the one who did it.

3-00:12:46

Swent: Were you ever invited to his home?

3-00:12:48

Kirshenbaum: Never. Yes, that's something I forgot over the years, but he was frequently at our home. I suspect it may have been because his house—I don't even remember if I saw the outside. I think I must have seen it, but I suspect he maybe felt he lived beneath his dignity—or he felt that in order to present himself properly, he needed to have a large home.

3-00:13:28

We were quite fortunate, actually. It was difficult to find housing in Córdoba. Most of the Americans lived in one area. It wasn't quite a suburb, but it was certainly out from the center of the city. Córdoba had—I mentioned it was an industrial city. One of the largest industries was IKA, which was Industrias Kaiser Argentina. This was I guess a subsidiary or somehow it came out of the original Kaiser automobile unit of Kaiser Industries. They had a plant in Córdoba.

3-00:14:29

Swent: Did you know Jim McLeod?

3-00:14:31

Kirshenbaum: Right, yes. He was in Buenos Aires at the time. Didn't see him very much, but I remember we did get together a couple of times.

3-00:14:52

Swent: Tell me, I've read about your living—

3-00:14:54

Kirshenbaum: We decided we didn't want to live way out, where the Americans were. We chose a place closer to the center of the city. We were very fortunate to find that. I'll mention the details in a minute, briefly. Actually, within a block or so, the vice consul of the U.S. consulate lived.

- 3-00:15:38
Swent: What was his name?
- 3-00:15:40
Kirshenbaum: Martinez, Ed Martinez.
- 3-00:15:42
Swent: He was an American?
- 3-00:15:48
Kirshenbaum: He was an American. I don't think his Spanish was all that great, either.
- 3-00:15:56
Swent: I was going to ask, did you know Spanish?
- 3-00:15:59
Kirshenbaum: I had taken Spanish at Stanford, and I picked it up after—I studied French. Spanish, I found a lot easier. Especially technical Spanish wasn't too difficult for me.
- 3-00:16:18
Swent: Did Sandy know Spanish?
- 3-00:16:21
Kirshenbaum: No, but her Italian—she was fluent in Italian, and very quickly picked up Spanish, to the detriment of her Italian. And not only picked up Spanish but people would be surprised not too many months after we were there that not only she was not a native but they thought that she was a Córdobaes.
- 3-00:16:49
Swent: Really!
- 3-00:16:51
Kirshenbaum: Yes. I can't describe what the Córdobaes accent is, but the people there could recognize the difference between a Porteño, which is a person from Buenos Aires, and a Córdobaes.
- 3-00:17:06
Swent: And your children, of course, learned Spanish.
- 3-00:17:14
Kirshenbaum: They did. One thing I found fascinating was to tell our daughter, who could speak better English than our son—I would tell her something in English, and she would do almost a simultaneous translation into Spanish.
- 3-00:17:37
Swent: For him?

3-00:17:39

Kirshenbaum: For him. All done with a straight face. She was the translator for him.

3-00:17:47

Swent: Tell a little bit about your living arrangements then.

3-00:17:58

Kirshenbaum: The house we moved into had been occupied by an executive of Fiat. Fiat also had an automobile plant in Córdoba, and the family that was there had been killed in a plane crash. They were on their way to Iguazú for a vacation, and the house remained empty for quite a few months. The person who was in charge of it, for the estate or for the family—they did not want to sell it, so they were seeking someone to lease it, and they liked the fact that we might pay in dollars. We did pay in pesos, but I don't think it had to be escalated for inflation. No, I guess we did pay in dollars, but I just don't remember the details.

3-00:18:57

But anyway, quite a few insects, including some big cucarachas, had moved into the house in the absence of the family, especially in the summertime. We moved in in the summer. It took a good bit of work to get it ready for our things. Meanwhile, before our belongings came down on the ship, we were living in the Hotel Crillón in downtown Córdoba.

3-00:19:33

The university was only a few blocks away, mostly in old buildings, and did not have much in the way of laboratories. That was one of the tasks that I had, was to use AID money to purchase equipment for them. Actually, I think, unlike my salary, which came through Bucknell, the equipment was purchased with so-called counterpart funds. These were funds in Argentine pesos which the U.S. had provided to Argentina over the years, and instead of remitting payment in hard currency, which Argentina was always short of, the Argentine pesos were kept in the country and used for purposes such as buying local items. But some of the equipment had to be imported, so those funds were not used in that manner.

3-00:20:53

Argentina has tremendous resources. However, when I was there, there was little in the way of mining, mostly because of the fact that the mineral land was a government reserve. The one entity that did have operations was actually Fabricaciones Militares, which was part of an instrumentality, I guess one could say, of the Argentine military, of the Argentine army. They manufactured such things as: sulfuric acid. They had chemical plants and aircraft plants. I imagine some of this was expanded during the [Juan] Perón administration.

3-00:21:58

But this whole system put a damper on utilization of their minerals. Part of the fact was the Argentines—they have some beautiful cities, the main one, of course, being Buenos Aires—and the people like to live in the cities and enjoy the culture. Other people, many of them wealthy, live on the pampas, on these large estancias and raise cattle and grains, from which the country grew very wealthy at one time. But that wealth was squandered by many administrations, one of them, of course, was during the Perón era.

3-00:23:04

Swent:

I was trying to relate this to Perón. What—

3-00:23:09

Kirshenbaum:

Nineteen fifty-five? No, I'm sorry. He was there from '45 to '55.

3-00:23:18

Swent:

So this was post-Perón.

3-00:23:20

Kirshenbaum:

Post-Perón. But the Perónist party, called the Justicialistas, which still exists—they were still very strong when we were there. There was a radical president, Illia, a president from the radical party, not to say that he was radical. In fact, he was what we would probably call a liberal. He was actually a medical doctor and relatively non-controversial because he wasn't a politician. But he may have been what, in that respect, Argentina needed, but he unfortunately didn't accomplish very much. I'm afraid that few people could, with the problems they had.

3-00:24:16

The country has, as I mentioned, an enormous wealth of minerals. Uranium, which was one of the few things that had been exploited—as you may recall, Argentina tried to have its own bomb at one point, under Perón.

3-00:24:42

Swent:

I'd forgotten that.

3-00:24:44

Kirshenbaum:

I think they had a German scientist who was leading the effort and had a huge establishment, or at least a large one, at Barriloché. They did have a nuclear energy organization, which was very competent in metallurgy, not only for their own resources but also in building plants and so forth. I believe they bought a CANDU reactor from Canada.

3-00:25:24

Argentina had manganese, which we do not have in the United States, and I think it was rich enough that if anyone wanted to work the property, the ore would be hand sorted. Mica, lots of industrial

minerals, and one of the few nonferrous operations was operated by Saint Joe up in the north—almost to Bolivia, in the province of Jujuy. Way up near the border of Bolivia at about 14,000-foot elevation.

3-00:26:19

That was Mina Aguilar. I think I recall that Saint Joe carried that on their books at one dollar, because of, I guess, the risk of expropriation or something. It was a very prosperous mine: lead-zinc and I think with a lot of silver.

3-00:26:49

Swent: So Saint Joe actually owned Mina Aguilar?

3-00:26:53

Kirshenbaum: Yes. I do not know if they owned it 100 percent. I just forgot. Certainly, I'm positive they had the majority interest. There may have been some local group that also had a share of it. Saint Joe—I guess it was a little bit later, but they were also over in Peru.

3-00:27:21

Kirshenbaum: Homestake also had a mine in Peru. I forget the name of the Homestake mine.

3-00:27:26

Swent: Madrigal?

3-00:27:28

Kirshenbaum: Madrigal. That was Homestake's.

3-00:27:30

Swent: That was Homestake.

3-00:27:31

Kirshenbaum: Yes.

3-00:27:33

Swent: I think Southern Peru Copper had—Saint Joe, I think, was one of the companies.

3-00:27:38

Kirshenbaum: Well, the big owner in Southern Peru Copper was Asarco and then Phelps Dodge and Newmont. I'll try to recall the name of Saint Joe's mine in Peru.

3-00:27:49

Swent: But this was Saint Joe alone, at Aguilar.

3-00:27:52

Kirshenbaum: Right. St. Joe's mine in Peru was Santander.

3-00:27:59

Kirshenbaum: I visited Aguilar later on, in the 1970s. So, anyway, I think I covered—

3-00:28:15

Swent: What was your charge, then?

3-00:28:17

Kirshenbaum: To develop a metallurgical department and to try to provide some background for a person like Guzmán to pick things up and teach. He had a good education. I think his main problem was just one of being—“stuffy” is an understatement. But quite frankly, I was very concerned that he wanted to take advantage of an opportunity to leave for the United States and stay there. This is not what our program was meant for. Part of the program involved sending students to U.S. universities.

3-00:29:05

The students were fairly good. I think metallurgy had a problem in Argentina for a couple of reasons—the main one being, again, the problem of, I guess, “status.” The main professions that people would aspire to were medicine, law, and architecture, because one could have your own practice in any of those three. It was not status building to go to work for a company.

3-00:29:54

Of course, in today’s mining world, there are few people who can do that, have their own mining company unless they’re very wealthy and buy a company, but these people, of course—

3-00:30:17

Swent: The metallurgy emphasis was just on mining, then. Is that true? Or did they have a petrochemical—

3-00:30:23

Kirshenbaum: Thanks for bringing that up. My background—I may have mentioned it before, and maybe this was one of the things that came out during my meeting with Dean Eckberg of Bucknell, was that from Stanford I did have the background in both physical as well as extractive metallurgy. My work in Massachusetts actually was a combination of both, although my personal interest was really on the chemical, extractive side. So I did have a background in Córdoba to get both sides of metallurgy going.

3-00:31:13

The extractive side probably wasn’t of as much interest to students, for the reasons I gave, because mining at that time didn’t seem to have much near-term opportunity. But Argentina over the years had developed quite a bit of industry. In metallurgy, they had a couple of

steel mills. They also had an aluminum plant, although they didn't have any bauxite or raw materials.

3-00:32:13

Swent: They were importing bauxite and processing it there?

3-00:32:16

Kirshenbaum: I believe they were importing alumina. The smelter was in the southern part of the country, where they had a supply of hydroelectric power. With the students, I visited the steel mill in the interior, which was in the northwest province of Salta. The name of the operation was Altos Hornos, which means blast furnace in Spanish—Altos Hornos Zapla—and owned by the military.

3-00:32:55

One of the problems in Argentina is the lack of coking coal or even coal of any type. This is one thing they are deficient in. The inland plant that's in Salta did what had been done in Brazil. They were using charcoal, and they grew eucalyptus forests for that purpose. Eucalyptus grows fast, and it's a strong wood. It was used it both in Brazil as well as at this plant in Argentina.

3-00:33:40

The larger plant in Argentina, I believe is in the province of Santa Fe—offhand I forgot the name of it, but the name of the city is San Nicolás. Their coal came from the southernmost part of Argentina, the mines of Rio Turbio, which I visited on my own. It was very, very poor coal. But to avoid spending hard currency, they made do. I forgot the sulfur content. It certainly wasn't a good coking coal. It was brought out on a railroad to the port of Rio Gallegos. Not only was it far in the south, but it was also almost on the Chilean frontier. I believe all the miners were Chilenos. These were underground mines. It wasn't only because Chileans had much more experience in mining, but, again, it related to a matter of status. I forgot the exact conversation, but I was informed when I was there that there weren't any Argentines working in the labor force underground. The management certainly was Argentine, of course. This, again, was one of the government-owned operations. Government-owned, government-run.

3-00:35:51

The coal was brought out by rail—well, I guess I said that already. And from Rio Gallegos, it was shipped up the Atlantic coast and up the big river, the River Plate, the Rio de la Plata, to San Nicolás, which was on the water.

3-00:36:23

Swent: What sort of laboratory were you building and equipping at the university?

3-00:36:26

Kirshenbaum: Actually, basics. Even though some of this equipment might be found in the civil engineering laboratory, testing equipment to make physical tests that obviously relates to the physical metallurgy side of the curriculum. I was trying to cooperate with one of the Argentine professors of chemistry for the other part. He was very cooperative and interested in not only helping me, but I think he saw that chemistry might well benefit from a successful group of extractive metallurgists, because there are many areas of overlap.

3-00:37:32

Swent: Had you just signed up for a two-year term?

3-00:37:37

Kirshenbaum: Exactly.

3-00:37:41

Swent: It was a contract.

3-00:37:42

Kirshenbaum: Yes, it was a contract.

3-00:37:44

Swent: And they paid you in dollars.

3-00:37:46

Kirshenbaum: Paid in dollars, right.

3-00:37:53

Swent: Would you have had the option to stay on?

3-00:37:58

Kirshenbaum: Perhaps. It was a wonderful experience, but certainly, as you can appreciate from your time in foreign countries, many frustrations.

3-00:38:11

Swent: Yes. Yes. What were they?

3-00:38:17

Kirshenbaum: I'm sorry?

3-00:38:20

Swent: What were some of the frustrations?

3-00:38:22

Kirshenbaum: I think the lack of facilities, the fact that a lot of things took a long time to accomplish. The pace was very slow. There were just inevitable slownesses in the process of ordering things and accomplishing things.

3-00:38:56

Oh, another thing I was going to mention about status was that I think the word metallurgy might have had what we would call a bad rep[utation], which wasn't the same as it was for other engineering disciplines. As I mentioned, there were very accomplished engineers in Argentina, but all over the country, one would often see signs saying: "Taller metalúrgico." This was like a body shop in the U.S. They were not the nice kind of a body shop that you might find here, but they were usually just places—the Argentines were very adept at making repairs out of whatever, to make a car run—

3-00:40:12

Swent: Or oil drums [laughs] or something.

3-00:40:13

Kirshenbaum: Pardon?

3-00:40:14

Swent: Oil drums?

3-00:40:14

Kirshenbaum: Yes, whatever. I think the word was associated with what a metallurgist or a metallurgical engineer does.

3-00:40:25

Swent: I see.

3-00:40:37

Kirshenbaum: In this status-conscious country, I think it permeated some of the thinking.

3-00:40:43

Swent: I thought maybe it was because of some of the remnants of the medieval alchemists aura about it, but you don't think that was it.

3-00:40:55

Kirshenbaum: Well, anything could be.

3-00:40:58

Swent: Probably not anything that erudite. What was your feeling about the AID program?

3-00:41:06

Kirshenbaum: I think it varied. There were some good projects. Offhand, I don't remember—there were agricultural projects. I think I had a greater difficulty with metallurgy than the other disciplines in engineering because it wasn't known or even appreciated, for the reasons I've already mentioned.

3-00:41:40

I'd just like to finish with a comment about the frustrations I had in teaching. One of books. There were some texts available in Spanish, mainly from Spain, but I didn't think they were anywhere near the equivalent of books that were available in English, and the students had a very poor knowledge of English, for the most part.

3-00:42:35

One other frustration of mine in teaching was that—I guess I didn't find this out until we had some tests, but the students were accustomed to memorizing, and if they had a question where they were asked why something happened, it was very difficult for them to explain why, and they protested that I shouldn't be asking them such things as that.

3-00:43:13

Swent:

Oh, my. How did you benefit from this experience? Did it come into play later in your career?

3-00:43:26

Kirshenbaum:

Well, it was a good rounding-out background, I suppose, in some respects. I have a fondness for Latin America. I have returned there a few times. But anyway, maybe it's time to get on to—

3-00:43:51

Swent:

I think so. We should move on.

3-00:43:56

Kirshenbaum:

We returned in January of 1966 to San Francisco, and took advantage of the fact that our things weren't going to be arriving for a while to stop off in Bolivia and in Peru, and visited places like Machu Picchu. We went up to Oroya and also went to Bogotá and Medellín in Colombia and a couple of places in Central America.

3-00:44:40

The question was what would I do next. I had not written any letters seeking jobs. I thought I would take a little bit of time to see what I wanted to do. I soon had an interview with Kennecott in Salt Lake City. Not long after we got back, we were on the San Francisco peninsula, and my wife said, "Gee, you should stop in at Stanford." I did. It was late in the afternoon. But I went into my old department and met Professor Evan Just.

3-00:45:34

I had heard of Evan and knew some of the things he was doing, but a conversation which lasted well into dinnertime convinced me that maybe I should seriously consider enrolling in his program for an Engineer of Mines degree. He had come to Stanford after metallurgy had essentially disappeared, and had tried to resurrect a program of mining and metallurgy. There were a couple of professors in metallurgy. These were not people who had been in the materials

science group, which had gone over to the School of Engineering, but these were extractive metallurgists.

3-00:46:37

But my interest really was not in metallurgical research but in doing practical things. The program that Evan Just had set up involved taking courses in the Stanford Business School, which was really an almost unbelievable accomplishment for him because the business school was very strict that students from outside the business school could not take their prestigious courses.

3-00:47:19

That was very appealing, so I enrolled for the Engineer of Mines degree program courses in my own department there and I really enjoyed the courses I took in the business school.

3-00:47:29

Swent:

What were they?

3-00:47:31

Kirshenbaum:

Accounting courses and a course in logistics. The accounting courses really changed my impression of a lot of things. In engineering, I always felt that an answer was either right or it was wrong. But in accounting, to my surprise, there could be more than one answer, depending on how you look at a situation. I think this was very important. The significance of this has lasted with me.

3-00:48:07

Swent:

Of course, it's been a lot in the news recently, with accounting procedures.

3-00:48:16

Kirshenbaum:

You're absolutely right.

3-00:48:17

Swent:

There's a lot of gray area there.

3-00:48:22

Kirshenbaum:

A lot of gray area, but the important thing is that even if you abide by all the famous, well-known principles of accounting, there are still—as long as you can defend your reason, you can have different results without compromising one side or the other.

3-00:48:58

At Stanford, to receive an engineer's degree, it required writing a thesis. Unlike a Ph.D. thesis—well, it's similar to a Ph.D. thesis, but you're not interrogated. You don't go through the orals.

3-00:49:16

Swent:

A defense process.

3-00:49:18

Kirshenbaum: Sorry?

3-00:49:21

Swent: Defending it? You don't have to defend it?

3-00:49:22

Kirshenbaum: Right. It has to be approved by a committee. I wasn't really sure what I wanted to do, but a few things sort of fell into my lap. Anyway, I found an area that I had a great interest in but did not know very much about. It seemed to me to fit me very well. It was a practical kind of investigation, and it was on the commercial side, and certainly involved minerals and mining and metallurgy. It resulted in the work entitled, "Transport and Handling of Sulfide Concentrates."

3-00:50:21

That thesis—extra copies were printed by the department at Stanford, and announcements were made in some of the journals, and Stanford sold out of those copies. Subsequently, the firm that I went to work for, Copper Range, sponsored publication of a revised edition of several hundred copies.

3-00:51:01

Swent: So it was a commercial success.

3-00:51:05

Kirshenbaum: Yes. While I was completing this work, of course I was wondering what I would do when I left Stanford. I had returned there in spring, in March of '66, and I was in a hurry to get out, even though I enjoyed taking these courses and the work. But I had another interview, as I recall, with a different group at Kennecott in Salt Lake City.

3-00:51:53

Then on my own, I went east to New York and talked to a number of firms that I thought should be interested in the investigation that I had done. I was considering not only mining companies but some of the companies that were involved, literally, in shipping. I don't mean just the marine shipping companies, themselves, but there were many trading companies involved in these activities. Many of them would either purchase ores and concentrates at the source and sell them immediately, or they would own the commodities and then arrange for sale at the other end, delivering to smelters.

3-00:52:46

What I came up with in this investigation, to the surprise of someone as knowledgeable as Evan Just, was that there are many problems involved in these shipments, and there are losses—well, physical losses.

3-00:53:23

Swent: You had certainly pointed that out in your thesis.

3-00:53:26

Kirshenbaum: Yes. And then I wrote a couple of articles that summarized much more briefly what those problems were: the risks of spontaneous combustion of certain minerals. Certainly, sulfides are combustible, but certain minerals in this group of nonferrous sulfides actually have set railroad cars on fire and damaged large cargos on ships and even corroded out some of the holds of the ships that they were being carried in.

3-00:54:13

Swent: And then the shifting of the cargo. Just the shifting.

3-00:54:16

Kirshenbaum: Oh, yes. That was of great interest, because many ships have been lost. I remember there was a program that was printed that was on the BBC. The program was entitled, "Lost Without Trace." I had corresponded with Lloyd's in London, their marine department, and obtained statistics on many of these cargoes and ships that were lost. The basic problem is that the concentrates are a fine material. They are a product of a wet process. Even after filtering, there is free water. Many of these stockpiles are outdoors in the elements, and not all ports are like those on the west coast of South America, where they're very dry and you can have dust losses.

3-00:55:23

For example, in Canada, there's a high rainfall, and these stockpiles of concentrates are rained on, and the precipitation is added to the moisture in the filtercake. The Canadians were the first ones, after losing a number of ships, to establish regulations and require some test procedures before these cargoes could be loaded. Until then, the shippers and the coast guard in various countries, including the U.S. or Canada, would require that shifting boards be installed to separate the holds longitudinally so that the cargoes wouldn't shift. But the shifting boards proved to be unsuccessful. Tremendous weight and forces are involved when these ships are on the sea, and then rolling seas and storms would burst a cargo through these boards.

3-00:56:50

Anyway, I had correspondence with many countries that were involved in export. I mentioned Lloyd's of London. The Norwegians would ship a lot of pyrites from their coast down into Germany to manufacture sulfuric acid. And I went to Vancouver, which was a major center of sulfide exports to Japan, where there are some large terminals built specifically for this export business.

3-00:57:21

So I became quite acquainted with the jargon of a whole new industry here. I was really a neophyte when I started out. I didn't understand what the people were talking about. The shipping world has its own nomenclature. It's—somewhat like the mining industry—a conservative industry that hasn't changed much.

3-00:57:57

One of the things I had proposed was—especially for valuable cargoes—that containerization, which was just beginning at that time, might be effective to avoid losses of some of these high-value materials. There was containerization of some of the highest-value concentrates, where values were way up in the hundreds of dollars a ton. But the type of container was bags, much like what coffee used to be shipped in. But bags are inefficient, require a lot of labor—

3-00:58:53

Swent:

Were these burlap?

3-00:58:57

Kirshenbaum:

Burlap bags, yes. I remember my professor at Stanford, Ken[neth] Schellinger, when he was way up in the Yukon, where, I had mentioned, he worked at the United Keno Hill Mines—that was a very high-grade silver deposit. They bought bags that were made in India—jute—and he was surprised one day when he looked into the jute bag and awakened a snake. I think he told me it was one of it was a more dangerous kind, but I think the Yukon temperature had cooled its ardor for moving very rapidly.

3-00:59:51

Swent:

Wow.

3-00:59:58

Kirshenbaum:

These bags—they were heavy when loaded, and stevedores commonly have a sharp hook in one hand. When I saw some of these materials being unloaded at smelters—I visited specifically for this purpose the Tacoma copper smelter, the Asarco smelter there, and also I went to Selby—I saw many instances where contents of the bags were spilled.

3-01:00:28

Swent:

Sure. You had some good photographs there in your thesis.

3-01:00:41

Kirshenbaum:

Yes. Virtually all of them I took myself. I think there were only a couple that I didn't take. I got those from a person, a British student who had worked around the world. He had been in Australia, and he had some pictures of a mine at Peko, in Australia, which was way in the middle of that huge place. There was a lot of transshipment. As they had a number of rail transfers—they had to bag their concentrate. It was just copper concentrate, but because of all the transshipping and

changes of gauge, when it finally did get on the railroad, they found it expedient to use bags.

3-01:01:42

I think in one or two of those pictures, you can just see the enormousness of those bags, and they were all filled manually. So there did seem to be a lot of opportunities for improvement, even in Australia.

3-01:01:58

Swent: Yes, indeed.

3-01:02:00

Kirshenbaum: But to the best of my knowledge not a great deal of improvement has occurred. One of the few things that has taken place is that, for a few commodities, they have used what are called jumbo bags, which can contain in excess of a ton. These are lifted by forklifts and ship's gear.

3-01:02:31

Swent: What are they made of?

3-01:02:34

Kirshenbaum: Reinforced flexible plastic, fiber reinforced, very tough, reusable. But I was always interested in the possibility of using larger steel containers. I remember one of the objections at that time—as I say, it was the beginning of the container revolution in shipping, which has really run its course. But one of the objections was that these containers—are you going to send them back empty? Well, today, many times they are. Nevertheless, that problem has not impeded this revolution in shipping.

3-01:03:34

Swent: Of course, that's just a general problem in shipping. It has nothing to do with containers, does it?

3-01:03:40

Kirshenbaum: It really doesn't.

3-01:03:41

Swent: Ballast was always a problem.

3-01:03:44

Kirshenbaum: Right.

3-01:03:51

Anyway, we were talking about where I would go from there. I thought there should be people in these trading companies or in mining companies who would be interested in having someone take care of problems which I thought should be more than just relegated to a clerk. Many of these problems, including the one of spontaneous

combustion and ones that relate to chemistry did have technological aspects to them.

3-01:04:34

I found one company—it was actually the Hochschild Group. There were really two Hochschild Groups at that time. One was in South America and the other, in New York. They were connected through the family, but they were independent. They did have a mining engineer, originally from Germany, who looked after such matters. But they told me they didn't need any more help.

3-01:05:16

I talked to companies like Philipp Brothers. As I say, there were many trading companies. Associated Metals. Philipp Brothers, I believe, at that time had merged with Engelhard Industries. Anyway, I won't try to remember all the others. Essentially, I was unsuccessful. Many of these companies looked upon me with suspicion. The trading companies often didn't have technical people at any level. They were business people. Traditionally, they employed people who were young, I think sometimes not even necessarily out of college. They just wanted people who would be loyal, and they knew—or assumed—that they could trust. The fact that I had dug up all these things seemed to make them suspicious.

3-01:06:53

Swent:

One of the things that came across to me in your thesis, too, was the whole thing was so segmented and nobody had responsibility for the whole process. Each one had a little piece and didn't care what happened to the other piece.

3-01:07:11

Kirshenbaum:

I somehow got in to talk to an executive vice president, or, I should say, the executive vice president of Philipp Brothers, of the Engelhard Philipp Brothers group in New York. I think his first words to me were, "How did you find out about us?" It was probably the largest trading company in the world. It so happened that shortly afterwards, there was a trial in San Francisco that was involved with Grace Brothers. I'm sorry, not Grace Brothers, Grace Lines. It was in federal court, and it involved the carriage of some of these concentrates out of the west coast of South America. It was really very revealing, and I learned at that time how much information that one could never come up with through conventional means was available through court proceedings, because those are almost all in the public domain.

3-01:08:19

I learned such things, for example, that this trade would do devious things. For example, the United States had an embargo from certain countries—

3-01:08:57
Swent: This was the Cold War period?

3-01:09:01
Kirshenbaum: Yes, it was the Cold War and then later it involved South Africa. Well, it was very ironical, I thought, that some strategic materials that the United States wanted from South Africa would be shipped to us via Russia. This was—

3-01:09:26
Swent: This would be chromium?

3-01:09:30
Kirshenbaum: Chromium.

3-01:09:31
Swent: Probably, yes.

3-01:09:36
Kirshenbaum: Yes. And such devious things were done as to rename ships en route so that things could not be traced so easily.

3-01:09:46
Swent: But the people at each end didn't know.

3-01:09:51
Kirshenbaum: Right. Couldn't connect.

3-01:09:54
Swent: Yes. Oh, my.

3-01:09:56
Kirshenbaum: So it was really fascinating.

3-01:10:00
Swent: But nobody wanted to hire you because you knew too much. [laughs]

3-01:10:02
Kirshenbaum: I guess that was it.

3-01:10:04
Swent: They didn't want someone who knew all about it, maybe.

3-01:10:10
Kirshenbaum: Yes, or "just as much as we'll tell you."

3-01:10:11
Swent: Yes.

3-01:10:12
Kirshenbaum: "And you keep that to yourself."

3-01:10:14

Swent: Oh, that's interesting.

3-01:10:19

Kirshenbaum: But anyway, while in New York I also went to see Copper Range. I had done some work when I was with Alloyd in Cambridge, Massachusetts that had been sponsored by Copper Range. Copper Range, of course, was still an important copper producer in Michigan at that time. They had a subsidiary, wholly-owned subsidiary, called Hussey Metals in Pittsburgh, as did most of the copper companies. It was interesting. I thought that all of these subsidiaries—few of them made much money. They seemed to be mainly used by the mining companies to chew up their copper production. But one would never find an executive at the parent company that came from the fabricating subsidiary, for example, subsidiaries being Anaconda—

3-01:11:37

Swent: Revere?

3-01:11:43

Kirshenbaum: Revere? I believe that Revere was owned in part by Asarco. Anaconda had Anaconda Wire and Cable and American Brass. Kennecott had Chase, and Phelps Dodge had its own wire and cable and rolling mills. Copper Range had Hussey. The work I had done at Alloyd for Copper Range was physical metallurgy: new alloy development and so forth.

3-01:12:40

So I visited Copper Range. I knew one of the vice presidents, who had been involved with the work at Alloyd. His name was Harry Croft. He had been at Kennecott with Jim Boyd, and he wasn't interested in retiring at 65, and Jim Boyd brought him into Copper Range when Boyd became president and moved the company to New York.

3-01:13:13

There was a new vice president of research. Harry Croft had been VP-R&D. The new vice president was Walter Finley, who is an exceedingly bright person, very imaginative. He offered me a position working for him in New York. It was indicated that I probably could do a lot of liaison work between Hussey and the people at the smelter, which would have involved work on the extractive side. Working for Finley looked like it would be a very challenging position and challenging to my intelligence, so I accepted that some weeks later.

3-01:14:35

Meanwhile, through Hochschild, at one of their units, I had an opportunity to take a job in Chile at the Mantos Blancos property. I could have been interested in going back to South America. Ultimately, it came down to taking a job with Copper Range in

Rockefeller Center, New York or way out in the desert far from Antofagasta, Chile, with Hochschild.

[Audio File 4]

4-00:00:03

Swent:

Okay, we've had a slight break to put in a new disk here. Noel was just showing me this book, *Stevens on Stowage*, which he used for his dissertation. Go ahead.

4-00:00:17

Kirshenbaum:

At the Stanford Library doing some research, I was looking in an area dealing with maritime activities. I was in the stacks, looking at some books. I happened to spot an old book that I'm sure I would never have bothered with if I had seen its title in a card catalog or on a computer screen. The binding appealed to me on the book's spine. It was an encyclopedic work and must have been the bible of every ship's master 150 years ago. I found it was put out in many editions. It tells the ship's masters how to stow cargo, gives them all the information they need on how to load and stow things from elephant tusks to tea to granite blocks.

4-00:01:44

Swent:

And the horrible example that you use—

4-00:01:46

Kirshenbaum:

Oh, right. It's a quotation out of—when you look up the entry for copper, the previous entry is for something else, not inanimate cargo but live human beings. It's the entry for coolies. And I'll read the sentence in this one entry here: "Many coolies are shipped at Swatow in China for Havana. A master should carefully inspect them at the depot and accept the healthy only. He generally receives a small gratuity for those landed alive and not blind."

4-00:02:46

Swent:

Mmm!

4-00:02:50

Kirshenbaum:

As I mentioned in the foreword or the preface to the dissertation, fortunately we have come a long way since those days in treating human beings, but many of the problems that are described in the other entries by Stevens, at least for mineral cargoes, are still with us today. And I used many excerpts, at the headings of each of the sections, that I took out of Stevens to illustrate that many of those problems are still with us today.

4-00:03:29

So it was a lesson to me that people should not just stop at the computer screen when they're looking for interesting things. You should engage in a little serendipity and go into the stacks of a library.

- 4-00:03:54
Swent: There's still something to be said for books, isn't there?
- 4-00:03:56
Kirshenbaum: Absolutely.
- 4-00:04:02
Swent: So you were talking to Kennecott at the New York office, you said? Or in Salt Lake?
- 4-00:04:07
Kirshenbaum: Salt Lake and in New York. Yes.
- 4-00:04:09
Swent: Both.
- 4-00:04:12
Kirshenbaum: Both with—two Michaelsons, “Big Mike” C.D. Michaelson in New York, V.P. Mining, and Stanley Michaelson. Stanley Michaelson head of engineering at Salt Lake, and I also spoke with Rush Spedden, head of research in Salt Lake. I guess there was a shortage of projects at that time, but they were being hammered, I guess, with a copper project in Puerto Rico that never took off, and it looked like things were not going ahead for them in British Columbia, on the BC Moly[bdenum] project.
- 4-00:05:45
In Salt Lake City, I had spoken to three people, and with one, there was an opportunity—I had an offer to work in their computer department. It was just getting going at that time. That could have been interesting, but I think the position would have involved something a bit abstract for me, as I saw it. In speaking with “Little Mike,” Stan Michaelson, who was chief of engineering, and also to Rush Spedden, Director of Research, I became aware quite rapidly that there was some friction within the organization between those two. They were actually in the same building, but one of them had the building modified so that he had his own entrance.
- 4-00:06:50
Swent: Oh, no! [laughs] This was in Salt Lake?
- 4-00:06:57
Kirshenbaum: In Salt Lake.
- 4-00:06:52
Swent: Of course, that's an old tradition there, to have one house with two doors, for each wife.
- 4-00:07:02
Kirshenbaum: [laughs]

4-00:07:04

Swent: Maybe it was easier there.

4-00:07:06

Kirshenbaum: Yes, there was of course the Lion House, I guess for a dozen inhabitants.

4-00:07:9

Swent: [laughs] Right.

4-00:07:14

Kirshenbaum: Spedden happened to be a short person, but I think it was his personality more than anything else that led to something others have commented on, and that I noticed, that visitors' chairs were very low. It gave one the impression, when speaking to him, when you were sitting in his office, that he was up on the podium, speaking to the congregation or certainly looking down at you.

4-00:07:53

I remember each of them asking me if I had spoken to the other. There was no doubt about some competition between them.

4-00:08:17

Anyway, I have mentioned, I believe, about making the decision for Copper Range. I did not wait around at Stanford to receive my engineer of mines degree, which I believe is probably an unusual degree these days.

4-00:08:48

Swent: I guess so.

4-00:08:47

Kirshenbaum: I believe it's still awarded by Colorado School of Mines.

4-00:08:49

Swent: Might be.

4-00:08:50

Kirshenbaum: But I don't know. Someone one time asked me, when they saw E.M. after my name—I'm not sure if she was being facetious or not, but she had majored in English, and she thought it meant English Major. Anyway, in January, 1968, we left California for the East Coast via rail. We drove to Vancouver and put our car on the Canadian National, which had a special system at that time called car-go rail to transport cars, and went across Canada during the winter, and got off in Montreal and drove down from there to New York.

4-00:09:48

Copper Range was headquartered in Rockefeller Center. Jim Boyd was the president who—I believe, I mentioned before—had moved the company from Boston to New York.

4-00:10:01

Swent: You were right. I looked in his oral history, and he had talked about this, that he moved it there because that was where the action was; there weren't any other companies in Boston, so he moved it to New York.

4-00:10:20

Kirshenbaum: I should read that, just to reinforce—

4-00:10:22

Swent: I brought those pages with me, I think. I'll put this on pause for a moment. [tape interruption] Okay, let's go on now. Right, in Jim's history, he spoke of moving. Please repeat what you just said.

4-00:10:37

Kirshenbaum: I think in mining history, which we're engaged in, it's important to recognize some of these events, like the evolution of the center of mining in the United States from Boston, as a finance and headquarters center for mining, to New York and then, as you mentioned, to Denver. At one time, when copper was just going through the roof, Tucson was a mining center, even though no major companies wound up in Tucson. Phelps Dodge, of course, moved out of 300 Park Avenue [in New York]—a building shared with Cerro Corporation and Newmont—to their headquarters today in Phoenix. Newmont, of course, is now in Denver, as are a number of other companies.

4-00:11:45

Swent: Yes. Well, there used to be four major mining companies in San Francisco, and there isn't a one now. We'll get to that. What Jim said, briefly, was that when he joined Copper Range [reads], "It was the last mining company left in Boston. The rest of them had moved into other places, mainly New York, and it was quite obvious to me that it was no place for me to operate from. I said to the board, 'I'll come with you on the condition that I move the office to New York, where I can work with the rest of the industry.'"

4-00:12:21

Kirshenbaum: Yup.

4-00:12:24

Swent: So he was very forthright about that.

4-00:12:25

Kirshenbaum: Yes, and he had, no doubt, some people to contend with. Some of the directors and owners of Copper Range were certainly from New England: the Paine family and—I remember—

4-00:12:40

Swent: PaineWebber.

4-00:12:42

Kirshenbaum: Of PaineWebber. A very old Boston family, of course. There was at least one director from Maine, and I forgot right now who the other directors were, but there was certainly a Boston influence that remained even after the move to New York.

4-00:13:09

Swent: What was the title of your job with them?

4-00:13:12

Kirshenbaum: The title of my job was technology analyst.

4-00:13:17

Swent: Sounds impressive.

4-00:13:19

Kirshenbaum: Yes. Someone told me that that was one of the best titles he ever heard. I enjoyed it. It described the kinds of things I like to do, not only analyzing technology but also, from the commercial point of view, seeing whether technology that might be proposed by someone like Walter Finley or elaborated upon by myself or others would fit and would work and would be economically viable.

4-00:14:01

Swent: What were some of the technological changes that were coming in at that time?

4-00:14:06

Kirshenbaum: In the copper industry—which, of course, Copper Range was exclusively interested in—heap leaching. The oxide ores had been utilized by companies like Anaconda and Kennecott. I think the first was in Chile, at Potrerillos. This was the Salvador Mine, for vat leaching. Yes, vat leaching was something that—

4-00:15:01

Swent: That's where Bill Humphrey was born.

4-00:15:06

Kirshenbaum: Really?

4-00:15:10

Swent: Yes. Pronounced porter-REE-ohs.

4-00:14:23

Kirshenbaum: Oh, boy.

4-00:14:23

Swent: I mean, that's the way the Americans pronounced it.

4-00:14:23

Kirshenbaum: Yes.

4-00:14:23

Swent: But I do know how to spell it. [laughs] Excuse me, I interrupted you. Vat leaching.

4-00:15:28

Kirshenbaum: Yes. This came about, I believe, in the 1920s. Actually, it might have started in Chuqui[camata]. I think it probably started at Chuqui, another Anaconda property and a much larger one. Until that time, the oxide ore, much of which occurred in overburden, was not treated because smelters could treat only sulfide concentrates. And then the practice spread to the United States. Inspiration, Arizona, which was controlled by Anaconda, had vat operations.

4-00:16:16

And then Kennecott put in some at Ray in Arizona, which really did not work very well. The reason it didn't work well was because the siliceous ore—it was oxide, but it was siliceous oxide, and this was not easily recoverable.

4-00:16:55

Swent: S-i-l-i-c-e-o-u-s.

4-00:16:57

Kirshenbaum: Yes.

4-00:16:59

Swent: Right.

Kirshenbaum: I probably told you—I was telling you some of my stories about the secretary I had who put “salacious”—

4-00:17:06

Swent: Okay. [laughs]

4-00:17:11

Kirshenbaum: Also, this was nothing to do with me, but I one time received a letter from someone I was talking to at the National Cargo Bureau, on some shipping matters. The letter he wanted to “illicit” everyone's support, i-double l.

4-00:17:35

Swent: [laughs] Okay. Well, we do get these things. So, vat leaching.

4-00:17:46

Kirshenbaum: Oh, yes, changes in types of ores and their processing. So there were oxide ores that had been treated for their copper content, where the copper was produced by electrowinning of the copper solution coming from the vat and, in some cases, off the dumps. With the amount of sulfuric acid that was starting to be produced by the smelters at this time, to avoid polluting the atmosphere, there was a lot of sulfuric acid

that had started to become available in places like Arizona, and heap and dump leaching became common.

4-00:18:40

Swent: Now, what's the difference between heap leaching and dump leaching?

4-00:18:45

Kirshenbaum: Well, dump leaching would generally apply to the overburden. It's somewhat similar in practice. Dump leaching would dissolve copper from dumps that had been left there, and heaps were deliberately stacked to enable efficient leaching.

4-00:19:17

Swent: Okay.

4-00:19:21

Kirshenbaum: So copper was electrowon. But, of course, in places like Bingham [Utah], where there's a considerable amount of copper, you're not going to wind up recovering gold from that portion of the ore that would be treated by heap or dump leaching because the gold and some other metals would not be dissolved by the acid. Thus pyrometallurgy—smelting—has advantages for recovery of precious metals.

4-00:19:58

In the early seventies, the first plant that used solvent extraction came into production in Arizona. And I think it's significant to relate that this was not an operation that was put in by one of the majors. It was Ranchers Exploration, Bluebird [Mine], near Miami, Arizona.

4-00:20:37

Swent: Maxie Anderson.

4-00:20:40

Kirshenbaum: Right.

4-00:20:43

Swent: And I think Hazen. Didn't Wayne Hazen work on it?

4-00:20:48

Kirshenbaum: Could well be.

4-00:20:51

Swent: I think so.

4-00:20:53

Kirshenbaum: This was a real step ahead. Fortunately it worked well. Ken Power was man who was really running the show down there. He was a great fellow and the general manager. He had an outstanding handlebar moustache.

But the real development of solvent extraction, which the uranium industry, of course, developed, was brought about through General Mills, and a person named Joe House. Joe was a great person, and it would have been great to have him tell his story.

4-00:21:43

Swent: I talked to him, but unfortunately he died quite young, didn't he?

4-00:21:47

Kirshenbaum: No, I don't think he was that young, but he—

4-00:21:52

Swent: Well, anyway, he died.

4-00:21:53

Kirshenbaum: Right. I saw him not all that many years ago, and he still seemed to be in good health. [He died in 1998.]

4-00:22:01

Swent: He wrote an introduction to Wayne Hazen's oral history. That's how I happened to meet him.

4-00:22:06

Kirshenbaum: Anyway, it was interesting to hear Joe House—this is where I got it from. His story of trying to get the metals industry to accept and use his or this process, which had already worked well, I forgot how many years before—maybe you remember—in uranium.

4-00:22:39

Swent: No, I don't.

4-00:22:43

Kirshenbaum: But anyway, it took a company like Maxie Anderson's to be the innovator, and I believe the second one was way off at Nchanga—it was probably still Northern Rhodesia or maybe Zambia by that time. It wasn't one of the big U.S. majors that took the first step.

4-00:23:08

Swent: That so often happens, doesn't it?

4-00:23:10

Kirshenbaum: It certainly does.

4-00:23:12

Swent: A cautionary tale.

4-00:23:15

Kirshenbaum: It happens in the steel industry in this country, too. To digress from my own activities, until after the [Second World] War, the steel industry in the United States made steel in open hearths or Bessemer converters. There were still a few Bessemer converters around, and I remember in

1959, when I was first in Pittsburgh, going out one night to see the Bessemer in operation.

4-00:23:47

The first two companies in the United States that used the oxygen process, which was developed in Austria after the war, when they had to rebuild—were two companies, one in Detroit and the other in California. The one in Detroit was McLouth Steel. And the other was Kaiser Steel.

4-00:24:21

Swent: Upstarts, both of them.

4-00:24:26

Kirshenbaum: Right. It took many years, as I recall, before either U.S. Steel or Bethlehem [Steel Co.] took the plunge. Of course, they had existing equipment, but so did McLouth and Kaiser.

4-00:24:49

Swent: Yes.

4-00:24:54

Kirshenbaum: Anyway, back to solvent extraction. Until solvent extraction came along, leaching of copper oxides was making some headway, but most of the recovery systems used scrap iron as a precipitant for making cement copper. This was practiced at a number of places; Kennecott at Bingham and at Chino, were using such systems for heap or dump leaching using cone precipitators.

At Ray, Kennecott tried to use vats. They went into heap or dump leaching later, even though recovery was not too good with that siliceous ore. Each Kennecott unit had its own design of precipitation cone; I heard there was some rivalry or competition there, but I never really heard the details.

These were enormous cones. Some of the scrap companies, I remember, had operations adjacent to these units. So much scrap was being consumed that I think Proler had an operation right outside the entrance to Bingham Canyon, to provide scrap.

4-00:27:38

Swent: This was scrap iron?

4-00:27:39

Kirshenbaum: Well, scrap steel. The ideal thing would be probably automobile sheet or tin cans, but as part of the operation to prepare it, they would try to remove whatever coating there was. You wound up with a product, the cement copper, that was about 65 percent copper, much of the rest being particles of iron from the cans that dropped down to the bottom.

Much of it was iron oxide or some insoluble, which wasn't efficiently removed by magnetic means.

4-00:28:37

Anyway, this material, which was available right at the doorstep of the smelter, be it at Garfield, Utah, or near the Hayden smelter in Arizona, just a few miles from Ray, or at Chino in New Mexico—this was fed to the reverberatory furnace which has a typical feed, depending upon the minerals involved—whether it's chalcopyrite or chalcocite—of, say, 25 or 30 percent copper, sometimes even less.

4-00:29:34

The cement copper, however, as I think I mentioned, was 65 percent, so what you are doing is taking a high-grade product and mixing it with a low-grade product, and then it has to go through the whole smelting procedure, through the reverbs to make the matte. The matte then goes to the converters to make white metal and so forth and so on. But adding cement copper to the charge to the reverbs was actually going backwards.

4-00:30:19

Solvent extraction avoided that. You would go right from dissolving the copper, and take the solution containing the copper, and it didn't have to be too high-grade either. That was the whole point of solvent extraction. You have two solvents in contact with each other, one of them pulling the copper out of the lower grade. It's a ratio of affinities here.

4-00:31:00

And then you have a stripping solution, which strips the copper out of the high-grade, higher-concentration solution, and then that will go—from the organic to an aqueous solution and to the tank house, where the copper is electrowon, just as in the electro-refineries which had been used for many years for refining smelter-produced copper.

4-00:31:40

Swent: So this also got around the smelter problem.

4-00:31:50

Kirshenbaum: Oh, absolutely.

4-00:31:52

Swent: Or especially got around the smelter problem, I should say.

4-00:31:55

Kirshenbaum: And this was the time when people were starting to talk about the environment.

4-00:32:00

Swent: Nineteen seventy.

4-00:32:02

Kirshenbaum: Yes. I think it was the Nixon administration that actually put in the EPA [Environmental Protection Agency] around '72 or so?

4-00:32:11

Swent: Well, 1970 is kind of the year when it all began. Maybe '72 was the actual year.

4-00:32:18

Kirshenbaum: Anyway, it definitely was in the early seventies.

4-00:32:21

Swent: Right.

4-00:32:23

Kirshenbaum: But the smelters were still chugging away. As a matter of fact, there was another one built. That was the Hurley or Playas smelter, in New Mexico. Many of these have more than one name as you know.

4-00:32:40

Swent: Right. I'm trying to think—

4-00:32:42

Kirshenbaum: That was an Outokumptu flash smelter.

4-00:32:42

Swent: Outokumpu. I love that word, Outokumpu.

4-00:32:49

Kirshenbaum: Right. It is a Finnish mining company that went into marketing their process technology.

4-00:32:51

Swent: That was at Hurley, I think.

4-00:32:53

Kirshenbaum: Yes, the Hurley smelter at Playas, New Mexico.

But definitely hydrometallurgy was up and coming, and so was solvent extraction, even though solvent extraction has not made much headway towards producing copper from sulfide ore bodies. And basically the reason is because chalcopyrite, the most common sulfide ore, has limited solubility in acid. You can get about 30 percent recovery, but that is certainly not enough to warrant scrapping the smelting process. Possibly one thing that can be done is to roast and make an oxide, but going directly from the sulfide into a solution with acid is something that hasn't been accomplished.

4-00:34:21

Swent: Really. I didn't know that. Just adding more acid doesn't do the trick?

4-00:34:25

Kirshenbaum: It really doesn't. The curve levels off.

4-00:34:30

Swent: For heaven's sake. I didn't know that.

4-00:34:33

Kirshenbaum: And a lot of work has been done on that, both by corporations as well as by the Bureau of Mines.

4-00:34:37

Swent: Sure.

4-00:34:39

Kirshenbaum: The late-lamented Bureau of Mines. Chalcocite, however, is much more soluble than chalcopyrite, so that lends itself to hydrometallurgy much more easily.

4-00:34:54

Swent: So this is the kind of thing that you were dealing with in your job, is it? Were you advising them—

4-00:35:06

Kirshenbaum: Yes. And Copper Range at that time started to look at a couple of deposits in the West. One was in New Mexico. That never went anywhere. But anyway, I was involved both with the extractive as well as the alloy people such as at Hussey. Finley was really a physical metallurgist, so I anticipated that he would be letting me participate in activities involving the extraction work up in Michigan.

4-00:36:00

I did get up there for a couple of weeks, I believe, or maybe it was just one week, total. But for corporate reasons, it seemed like although he would go up there—I think he was looked upon as being a physical metallurgist, and he and his unit should confine themselves to Hussey.

4-00:36:37

Swent: Uh-oh.

4-00:36:40

Kirshenbaum: That obviously had an effect on me and resulted in my being involved in alloy research. Alloyd had become a subsidiary of Copper Range by that time. Anyway, there was research being done in Cambridge and I had numerous trips to Boston to provide some liaison between the people at Hussey and the people at—I think they call it Contemporary Research. No doubt the C and the R, Copper Range—

4-00:37:56

Swent: Oh. Yes.

4-00:37:58

Kirshenbaum: And I suspect that the name was probably one of Finley's creations. He was absolutely creative. I used to think that he would be a great director of research for a company like General Motors that was large enough to absorb all his ideas. He had other people working for him, but I would often be the recipient of ideas that came from a conversation that Jim Boyd had in a—it wasn't a parlor car, but I think he traveled to Connecticut each evening in a car that wasn't the ordinary—it was a reserved car. People would bounce ideas off his head, and he was a fascinating person, who loved to—

4-00:38:45

Swent: Very creative.

4-00:38:45

Kirshenbaum: —be creative also. So he would talk to Finley, and then I would have the task of seeing whether some of these ideas might pan out. It was fun.

4-00:39:09

Swent: Can you think of an example?

4-00:39:12

Kirshenbaum: I remember one time, it was a great disappointment to him, but I think—. Well, tobacco was starting to be under the gun, and he thought there might be some copper compound that, when added to the makings of a cigarette—. I think one of the concerns at that early date was that—carbon monoxide was something that aggravated the condition in people's lungs and the copper compound would diminish the concentration. Through thermodynamics, I was able to show that the concentration of the gas that he was concerned with was not present at the temperatures that you would have in a cigarette.

4-00:40:27

Swent: He wanted to put copper something in a cigarette to purify—

4-00:40:27

Kirshenbaum: This was an example—

4-00:40:38

Swent: That's really wild!

4-00:40:39

Kirshenbaum: —of the wide-ranging—. While I, myself, explored some wide-ranging things, I shook my head, I remember, when I heard about it.

4-00:40:57

Anyway, there were other things that were interesting. Dispersion-hardened alloys had been under development by a number of companies, and Copper Range, especially under Finley, thought that

that was something they should get into. They actually were able to patent something along those lines. And it fit in with the fact that Copper Range had an unusual situation: its ores at their White Pine (Michigan) mine led to an unusual situation. The copper mineral was high grade, it being chalcocite, which produces a higher grade copper concentrate than chalcopyrite. And this ore contained significant amounts of silver. Yes, even native silver. That's beautiful stuff to see when the crystals are large enough.

4-00:41:45

The White Pine smelter was built like a western (U.S.) plant that smelted chalcopyrite. Despite the quantity of silver in the ore, because there was no electrolytic refinery, the operation did not recover silver. The copper was fire-refined, as was Kennecott's copper produced at Chino (New Mexico). So those two coppers were basically the only fire-refined coppers, as I recall, produced in the U.S. during this period of time.

4-00:42:31

White Pine's copper suffered some loss of prestige, as fire-refined didn't have the status or cachet of electrolytic, nor was it as pure, but for many purposes, it was good enough. You want a very high-grade copper, very pure copper, for electrical purposes because a little bit of impurity will affect conductivity. But power was costly up there, and they didn't build an electrolytic refinery at White Pine, [Michigan].

4-00:43:22

So the silver remained in the copper. Silver, of course, is an even better conductor of electricity than is copper, so the conductivity was not affected greatly, but the real use for the so-called Lake Copper—and that's the fire-refined copper made by Copper Range—was that the silver in the copper, being insoluble, gave this copper a higher softening temperature than other, pure coppers. This had a great advantage for making automobile radiators, which, of course, saw relatively high temperatures, and would lose their strength—their hardness—at temperatures below that at which the Lake Copper, with the silver in it, would.

4-00:44:36

So Copper Range was able to sell a lot of the silver-bearing copper to the automobile companies for radiator purposes. This was fine—

4-00:44:45

Swent:

Silver radiators!

4-00:44:50

Kirshenbaum:

In a way, yes. But—I forgot the number of ounces of silver per ton of copper. It was considerable. This was fine before silver climbed in price, when silver was worth—

4-00:45:02

Swent: Twenty-five dollars an ounce or something.

4-00:45:07

Kirshenbaum: They weren't able to get any premium for the silver, or they weren't able to get much premium.

4-00:45:15

Swent: I'm trying to remember, what was silver at that time? Gold was still thirty-five [dollars an ounce].

Kirshenbaum:

I believe the silver in coinage was at the ratio where a dollar twenty-nine was the breakeven, where it would have paid to melt down silver coinage. So silver, until that time, was worth less, like eighty cents, ninety cents an ounce. In the late sixties, silver started going up in price, at the same time that gold did.

4-00:45:57

Swent: That's when people were going around stealing silver and melting it down in the backs of vans and things.

4-00:46:06

Kirshenbaum: Yes. Well, of course, silver hit its heyday at about \$50 per ounce. I think it was the same year that gold did, 1980, and that, of course, was when the Hunt [brothers] tried to corner the silver market. So, Copper Range was essentially giving away the silver, which, as I say, didn't matter when the price was low, but when the price started climbing up, it was a different matter. It didn't take too long, as I recall, to get up to two, three dollars an ounce.

4-00:46:39

Swent: You were there at kind of an exciting time, then, when it started up.

4-00:46:45

Kirshenbaum: Right. Let me think for a minute. Oh, yes, I was talking about dispersion-hardened metals. In a way, you can think of silver as a dispersion-hardening ingredient that prevents the copper from being ductile or soft. But other additives were even more effective at even higher temperatures; they were components like oxides that you would literally disperse in the alloy during the melting phase.

4-00:47:31

Other companies came up with analogous alloys, but one of the things that I was doing and Finley saw an opportunity for was to find some potential customers for dispersion-hardened copper, and I made a number of calls to firms which were trying to develop microwave ovens at that time, because an important component of the oven was desirably copper, but it needed to have high-temperature strength.

4-00:48:12

I called on companies like Raytheon and—I forgot some of the others, but at that time—this was in the late sixties—that oven just wasn't going anywhere with consumers. Maybe you can remember.

4-00:48:32

Swent:

I'm trying to think. Amana made one of the first microwave ovens. Did you talk to them?

4-00:48:38

Kirshenbaum:

I remember—but if they were out in—

4-00:48:44

Swent:

They were in Iowa, I guess.

4-00:48:47

Kirshenbaum:

I know I didn't go to Iowa to visit them.

4-00:48:50

Swent:

Because I got my first one—

4-00:48:53

Kirshenbaum:

When would that have been?

4-00:48:55

Swent:

I know I had it before 1973. I think I had it in 1970. I got a very early one.

4-00:49:01

Kirshenbaum:

Yes. Well, they were available, but I think the people even developing it weren't that interested. When I called on them, there was a good bit of pessimism, really, that the thing would ever get off the ground.

4-00:49:29

Swent:

Isn't that something?

4-00:49:29

Kirshenbaum:

It really is.

4-00:49:30

Swent:

And now we couldn't live without them.

4-00:49:30

Kirshenbaum:

Yup.

4-00:49:30

Swent:

Twenty years—no, thirty years, maybe. It's amazing, isn't it?

4-00:49:30

Kirshenbaum:

Yes. And I think part of the problem was, from the consumer point of view, I think they were very expensive.

- 4-00:49:30
Swent: And so different. You just had to use a whole different philosophy of using them.
- 4-00:49:30
Kirshenbaum: There are certain things you obviously can't do with them, or you have to be careful, and people were worried about it.
- 4-00:49:30
Swent: Yes, people were actually afraid of them at first.
- 4-00:49:30
Kirshenbaum: Yes.
- 4-00:49:30
Swent: You shouldn't stand near them and so on. Well, that's interesting.
- 4-00:49:30
Kirshenbaum: One thing that I'd like to comment on at Copper Range was something that I guess one can perhaps credit Jim Boyd with, and that was the Dashevayer. Have you—
- 4-00:49:30
Swent: Oh, [laughs] He talked some about it. This was the mining equipment that was going to change the world.
- 4-00:49:30
Kirshenbaum: Maybe Shoemaker also spoke about it.
- 4-00:49:30
Swent: People always just pooh-pooh it and laugh about it.
- 4-00:49:30
Kirshenbaum: Yes. Well, frankly, I did too, but because of my interest in materials handling and transportation problems, I was fascinated by it, even though I thought it had some real problems. Maybe I should say—
- 4-00:49:30
Swent: Go ahead and talk about it. Yes, please.
- 4-00:49:30
Kirshenbaum: It was essentially—well, one person described it scathingly as something that was like taking some Swiss watch works into a mining environment. It was a continuous system which was intended to go up to the mine face and take ore from, for example, the cutting machine or from—well, the cutting machine would be in coal mining— drilling and blasting, would load it at or near the face, and bring it from the underground, up the shaft and out to where railcars might be loaded.
- 4-00:52:33
Swent: It was like a conveyor belt?

4-00:52:33

Kirshenbaum: Essentially it was a conveyor belt with buckets.

4-00:52:33

Swent: I mean, that's where the name came from, the Dasheveyer, or conveyor of some sort.

4-00:52:42

Kirshenbaum: The name came from Stanley Dashew, who I believe may still be alive in Southern California. One of his claims to fame is that he invented the plastic credit card.

4-00:52:42

Swent: Oh!

4-00:52:42

Kirshenbaum: I believe he became very wealthy from that.

4-00:52:42

Swent: No doubt.

4-00:52:42

Kirshenbaum: I've spoken to him. I think he is a clever person, but, again, I don't think he appreciated the difficulty involved in mining. I still have some of the literature that came out at that time from Dasheveyer Corporation, itself. There were pictures of the unit, which had just been completed at White Pine when I was up there. The people up there, I don't think, were terribly inclined to favor it. In fact, I remember one comment. Someone called it the kamikaze machine. But, of course, it wasn't intended to be a conveyor of personnel to go underground.

4-00:52:42

But anyway, some of these brochures that I still have—I remember, especially when they found it was going to be a difficult if not impossible task to get it accepted in the mining industry—this brochure had a picture of Bingham Canyon in there, not with the Dasheveyer but as exemplifying the magnitude of mining projects at which Dasheveyers might be used.

4-00:52:42

And there was another artist's rendition of an underwater situation, with a Dasheveyer unit in it. This was a huge brochure, I don't know, maybe fourteen inches high and sepia color. This one page said, "Hollywood thrill-type rides."

4-00:52:42

Swent: [laughs] Oh, no!

4-00:52:42

Kirshenbaum: I remember showing this to people, and we all agreed that that was not the way to endear an invention to the mining industry, to talk about “Hollywood thrill-type rides.” And I remember afterwards, when they finally realized that mining was not going to be one of their customers, they did actually try to get some of the components and concepts used in people or baggage-moving systems at airports. So much for the Dasheveyer.

4-00:52:42

Swent: It didn’t solve the problem in the copper industry, though.

4-00:52:42

Kirshenbaum: No. Copper Range also had some other interesting situations because of White Pine’s location and its mineralization that I referred to—its chalcocite orebody with some native copper in it. Probably not much native copper, but chalcocite produces, as I mentioned before, a high-grade concentrate. Their smelter at White Pine was put in, I guess, in the late fifties. Probably with some government loans, in return for which the government—which was trying to build up its copper stockpile—got copper for probably twenty-nine cents a pound, even after the price started to rise—

4-00:57:11

As I said, the smelter was built along the lines of western smelters that treated the lower grade chalcopyrite concentrates. So, to operate the White Pine smelter efficiently, they actually debased, you might say, their feed with iron pyrite. Thus, they wound up buying some of that material from Bethlehem Steel’s Cornwall iron mine in Pennsylvania. This was pyrite, containing a small amount of copper, which Bethlehem had to remove from Cornwall’s iron ore. Cornwall was quite a ways away, but at least it was within reasonable shipping distance.

4-00:58:04

Bethlehem’s Cornwall mine was one of the earliest and longest-lasting mines in the country; it would rank well beyond Homestake in longevity. It wasn’t all that long ago that it shut down as a source of iron ore. But it did contain some pyrite, with a bit of copper. You sure don’t want any sulfur or copper in your blast furnace.

4-00:58:56

Swent: Yes, Bethlehem wanted to get rid of the stuff.

4-00:58:57

Kirshenbaum: So Bethlehem went to great pains to get rid of the copper and pyrite. Well, that removed material was attractive to Copper Range because its pyrite lowered the grade of White Pine’s concentrate sent to the smelter, and also it was cupriferous. Bethlehem shipped that material

to White Pine in boxcars, which I thought was sort of strange, but for Bethlehem, this was a higher value material than iron ore—even though they didn't want it. When that pyrite got up to the White Pine in the winter—and I was up there in the winter—they had a devil of a time to unfreeze that stuff. They had car heaters. The railroad people hated car heaters because they burned the rubber on the hoses and so forth. So they also used car shakers, and that wasn't too good for the cars, either—to vibrate the stuff out.

4-01:00:14

Anyway, the irony was, as I mentioned, Copper Range had all this silver in the White Pine ore, and when the price of silver went up, they were able to, through some selective flotation, make a high-grade silver concentrate that would not be smelted at White Pine but could be shipped to a smelter having an electrolytic refinery so the silver could be recovered.

4-01:00:54

The one that they shipped to was in El Paso, the Phelps Dodge—

4-01:01:00

Swent:

All the way from Michigan?

4-01:01:04

Kirshenbaum:

Yes. Phelps Dodge of course for the silver, but the condition was that they would not accept it in boxcars; they wanted to be able to unload the cars easily. So to avoid dust losses, Copper Range poured oil on top of the silver concentrate. Other work that I had done showed that there are considerable losses, even of wet concentrate, a result of the train's speed.

4-01:01:54

I always have thought of the irony of shipping Bethlehem's "waste" in boxcars and White Pine's highest-grade material being shipped in open cars.

4-01:02:09

Swent:

[chuckles]

4-01:02:14

Kirshenbaum:

There's a dichotomy.

4-01:02:16

Swent:

Did the oil thing work?

4-01:02:18

Kirshenbaum:

Yes, but it was a mess, literally.

4-01:02:19

Swent:

I would think so.

4-01:02:20

Kirshenbaum: But it worked.

4-01:02:24

Swent: Kept it from blowing away, anyhow.

4-01:02:23

Kirshenbaum: Yes.

4-01:02:24

Swent: But oh, dear.

4-01:02:16

Kirshenbaum: So I guess towards the end of '69—a company that I had spoken to when I was at Stanford, with the possibility of employment, was Marcona in San Francisco. Marcona was an interesting company because they were involved in both mining and transportation. They had a fleet of ships. They were an iron-ore mining company in Peru. I became aware that they were working on a unique process, but when I first spoke to them when I was at Stanford, it had not gone very far yet.

4-01:03:37

When I was at Copper Range, Marcona was just developing and trying out this transportation process for their iron ore, and there was an opportunity in San Francisco to work in this very area that I was so interested in. So I left Copper Range—

4-01:04:06

Swent: How did that—we're going to stop in just a moment, but how did that come about? Did you approach them, or did they approach you?

4-01:04:13

Kirshenbaum: I approached them and told them that I knew that things had gone to that stage. I had an interview in San Francisco.

4-01:04:31

Swent: Who interviewed you?

4-01:04:37

Kirshenbaum: I guess it was Ray Beebe and Ken Merklin, George Henry.

4-01:04:52

Swent: Merklin?

4-01:04:54

Kirshenbaum: Yes. He was vice president, development and Ray Beebe's boss. And later he became—after [Charles] Robinson—he became president of Marcona before the company came to an end. Anyway, it resulted in the offer of a job back in California.

4-01:05:30

Swent: Where were you living in New York? You hadn't said.

4-01:05:29

Kirshenbaum: We lived in Riverside, Connecticut, which is part of Greenwich, and I commuted every day by rail. I'm not a golfer, and very often on the weekends we'd take the whole family in and did the thing that people who work in New York during the week don't do, and that is to go back to New York City. Of course, we didn't do it every weekend, but we tried to take advantage of all New York offered. Something that you unfortunately can't do very well when you're working there and commuting.

4-01:06:20

Swent: But you were happy to get back to California, I suppose.

4-01:06:23

Kirshenbaum: Right.

4-01:06:28

Now, you said something about—

4-01:06:28

Swent: Well, I think it's getting near the end of this disk. How are you doing? We can finish it up.

4-01:06:35

Kirshenbaum: Okay. I did have a chance—maybe I should finish Copper Range before I get into Marcona. There isn't too much more, but I remember there were some extractive processes that I was looking at for Copper Range. One was sort of relegated to limbo when Anaconda really got into trouble in Chile. Anaconda's nationalization started under President Frei and was completed by [Salvador] Allende.

4-01:07:32

Things were not going well for Anaconda in Chile. I think you could verify this with some of the people you've interviewed from both Kennecott and Anaconda, but I recall that Kennecott had a much better relationship with the Chilean government. I believe that if Anaconda had been less stubborn, they would have fared better, and their situation would have been better even under Allende. I don't know. Maybe that's just speculation.

4-01:08:08

But anyway there was a process called the Anatread process, Ana for Anaconda and Tread for Treadwell Corporation. Treadwell was an engineering company that had labs and engineering works right outside New York City.

- 4-01:08:38
Swent: Was that related to the Treadwell Mine in Alaska?
- 4-01:08:39
Kirshenbaum: Gee, I don't think so.
- 4-01:08:41
Swent: No.
- 4-01:08:39
Kirshenbaum: There's a possibility.
- 4-01:08:43
Swent: Was it T-r-e-a-d?
- 4-01:08:43
Kirshenbaum: Yes. I remember there was a Pete Cadwell, who was at Treadwell, who had come from Chile. His family had been with Anaconda for I guess a couple of generations, which was somewhat typical. This was a cyanide process, and cyanide, of course, will dissolve copper. I thought that it had some promise, and others at Copper Range did, too. Treadwell wound up with it. It was a joint venture, I guess, with Anaconda and Treadwell. Anaconda was looking at other things because of troubles in Chile and so forth.
- 4-01:09:44
This was a process that could have applied hydrometallurgy to a cupriferous precious-metals ore, because the cyanide, of course, would have recovered copper as well as silver and gold. Suffice it to say that the Anatread process didn't go very far, although it was interesting working with them.
- 4-01:10:28
But, as sometimes happens in metallurgy, I believe this process was resurrected by people at Newmont not all that long ago, but I think they didn't want to be reminded of its history. I'm trying to remember the name of the unit Newmont created to pursue it. It had a clever name.
- 4-01:10:54
Swent: I don't know.
- 4-01:10:58
Kirshenbaum: It was Augment Technologies. Do you know Ken Brunk?
- 4-01:11:00
Swent: Yes.
- 4-01:11:02
Kirshenbaum: He was spearheading it for a while. I believe Newmont actually was trying to not only use it themselves, but to obtain cupriferous gold

deposits where the process could be beneficial, because when you're processing gold, copper is a cyanide consumer and adds to the reagent cost. But if you have a process like this, where you could recycle the cyanide and recover copper and gold in the process, it could be worthwhile all around.

4-01:11:53

Swent: Yes. It sounds too good to be true. Was it?

4-01:12:01

Kirshenbaum: Initially it seemed so, because it didn't seem like it had gone anywhere. I think both Ken Brunk and Marc La Vier were involved in it and formed their own company. I think Newmont formed a partnership with Du Pont – which makes sense inasmuch as Du Pont manufactures cyanide. There are some aspects here related to corporate culture and philosophy, which I'll certainly get into later in connection with Marcona. If a copper producer came up with a good process, it becomes difficult for them to market that technology to another copper company, and I'd say the same applies to gold companies as well. I think this is probably the reason Newmont created a separate unit to insulate or isolate them from that.

4-01:13:12

I remember way back, when I went to some of my first annual meetings, and I'd see people there from Asarco—

4-01:13:22

Swent: This is meetings of AIME [American Institute of Mining, Metallurgical, and Petroleum Engineers], or ASME [American Society of Mechanical Engineers].

4-01:13:29

Kirshenbaum: Yes—AIME meetings. The Asarco people, at least some of them—they would cover their lips with a hand when they were talking and other people were around. Over the years, things became more casual and relaxed, and there were more plant visits as companies became more open.

4-01:14:18

So I think I've covered Copper Range. I wanted to get that in about the Anatread process.

[End of interview]

Interview 3: February 4, 2003
[Audio File 5]

5-00:00:01

Swent: All right, it's the third interview with Noel Kirshenbaum in San Francisco, and it's February 4. We're at his office on Geary Street in San Francisco. You had said that there are a couple of things that you mentioned that kind of pick up from last time. One was about Lake Copper.

5-00:00:33

Kirshenbaum: Right, I had mentioned Lake Copper in passing, I'm pretty sure, in our last meeting. Copper Range at White Pine, Michigan, produced only fire-refined, silver-bearing copper, and to sell copper it's necessary to meet certain specifications—especially to have an ASTM (American Society for Testing and Materials), designation. ASTM has designations or standards for just about every item under the sun. Perhaps it has been superseded in very recent years, by ISO [International Organization for Standardization], the international standards association. In any event, Lake Copper is very interesting, because Copper Range achieved approval from ASTM to call its copper Lake Copper, which, by definition, "must originate on the northern peninsula of Michigan". A specific ASTM number just because of its place of origin! "Lake", of course, refers to the fact that it comes from the Upper Peninsula, right off Lake Superior. With a designation stating a particular source, and no other firm in recent times producing copper from that area, Copper Range was the only company that could sell Lake Copper. It is interesting, because all of the other ASTM specifications and designations are based on actual composition and therefore not on geographical origin. The other thing that I wanted to mention about my time in New York and how the industry evolved historically is illustrated by the Mining Club in New York. After I joined Copper Range in '68, I became a member of the New York Mining Club.

5-00:03:02

Swent: What did you have to do in order to become a member?

5-00:03:06

Kirshenbaum: I guess just be a practitioner in the industry. It wasn't just a technical club, certainly. Its members included many commercial people in New York, where there were not only mining companies but also many trading companies that sold metals or concentrates and ores. Well, a point I'd like to make is that when I joined in 1968, the Mining Club had two branches, reflecting the migration of mining headquarters offices from Downtown, near the Battery, to Midtown Manhattan. The old one was down at—I forget whether it was 25 or 26 Broadway, right upstairs from the Anaconda headquarters. Instead of taking the

elevator, the Anaconda members used some kind of back stairs system to get from Anaconda up to the club. This was the downtown mining club, the original one, and then there was a newer one in Midtown. This illustrates how the mining industry, which had been in New York for a long time, and the companies that had come down from Boston, were first clustered around the Wall Street area. Then there was a movement of offices from the downtown area to Midtown Manhattan, where the new branch of the club opened. Well, it wasn't too long before there was only one club. The downtown unit closed and everything consolidated to 280 Park Avenue, in the area where there were many companies: Freeport was in the Chrysler Building. St. Joe was at 250 Park Avenue. 300 Park, I think I mentioned, had Cerro Corporation, Phelps Dodge, and Newmont. Copper Range was not far away on Fifth Avenue, and Amax was on Sixth. Philipp Brothers and many other trading companies were also in Midtown Manhattan.

5-00:05:36

Swent: Would the nearness to a train station have something to do with it too?

5-00:05:42

Kirshenbaum: Yes, it was very close to Grand Central.

5-00:05:45

Swent: So, people were commuting in?

5-00:05:49

Kirshenbaum: Sure.

5-00:05:50

Swent: This was something I had meant to ask you: How did you keep up your professional education? Was the Mining Club a source of information? Contacts obviously.

5-00:06:06

Kirshenbaum: Well, for commercial contacts certainly and, obviously, as many engineers were members, for technical information, also. It was a club where people went for lunch. You would see your colleagues there, and certainly information was discussed. Many of the people there, of course, were more on the commercial side, which was very interesting to me. As I recall, AIME was not very active in New York. The reason for that few members lived in Manhattan, so people didn't want to stay for a dinner meeting and then go home late at night on the trains. The commuter trains, of course, were probably not express or not so frequent, so, as I recall, there were few AIME meetings in New York.

5-00:07:27

Swent: They didn't have luncheon meetings?

5-00:07:30

Kirshenbaum: I don't think so, and I can't remember whether there were any joint meetings with the Mining Club. The Mining Club itself, once in a while, did sponsor a talk but they were rather infrequent.

5-00:07:48

Swent: Was MMSA [Mining and Metallurgical Society of America] a factor at that time?

5-00:07:49

Kirshenbaum: I was not yet a member of MMSA, but as I recall, MMSA did have their meetings at the Mining Club.

5-00:08:19

Swent: How important were the journals with your keeping up with things?

5-00:08:29

Kirshenbaum: Well, the journals were very important. In New York, I made good use of the libraries, which I always have. The engineering library, which I used sometimes, was over near the United Nations Plaza in the engineering society's building, but I believe that collection has been—I don't want to say dispersed, but I think it was transferred to Linda Hall Library in Kansas City. That's a tremendous technical center, and I think that Hall is connected with the family of Hallmark cards of Kansas City.

5-00:09:22

Swent: I don't know about that.

5-00:09:23

Kirshenbaum: Yeah, it's a real repository. I mentioned the downtown mining club having terminated its site there on lower Broadway. A few years later, because of the movement of companies—well, consolidations and moves to suburbs—Amax moved up to Greenwich, Connecticut, for example, and some companies moved to Denver. So, the uptown mining club—in fact, the entire Mining Club—ceased to exist. Members were entitled to use the Chemists' Club, which actually had its own building. It was not only for meals, but they also had some rooms there for members and their guests. I stayed there a few times. It was near the New York Public Library, and they had a library of their own. When I returned to California, I maintained my membership, because I only paid out-of-state dues or something like that. Unfortunately, I recall that even the Chemists' Club was struggling to exist, so there has been transition in many industries.

5-00:11:16

Swent: Well, lots of changes.

5-00:11:19

Kirshenbaum: Right.

5-00:11:22

Swent: Was there any connection with Columbia, the School of Mines?

5-00:11:30

Kirshenbaum: There really wasn't. Columbia, of course, was one of the leading mining schools back at the turn of the century—the nineteenth and twentieth centuries. Coincidentally, I recall a plaque at 300 Park Avenue, where Newmont, Cerro, and Phelps Dodge were headquartered, that this was the site of the Columbia School of Mines. But now of course, Columbia is way uptown from where it was at 50th Street. Columbia still had a mining/metallurgy department, but I think that it had become mostly a metallurgy faculty. I recall Professor Somasundaran used to write many papers. Columbia had a large endowment from the Krumb estate. I remember many years ago, talking to someone from Columbia—it might have been Somasundaran—regarding their attempts to find students for this curriculum. They had all this money for mining and metallurgy, and I really don't know what has transpired, as I think the department has trailed off—not in quality, but probably from lack of students.

5-00:12:48

Swent: Lack of jobs, probably for the students to go into.

5-00:12:53

Kirshenbaum: Right, of course that has happened across the country.

5-00:12:56

Swent: It's not a career that people dream about getting into.

So, let's go on to Marcona then.

5-00:13:10

Kirshenbaum: Right, I believe the last time, I started to mention that I had taken a position at Marcona in October of '69. It seemed like a wonderful fit for me, because it combined my interests in mining and metallurgy with the transportation of minerals. I was trying to remember another company last time that was a bit of an analog of Marcona. This was National Bulk Carriers, which was established primarily as a shipping company. To insure their ships had cargoes, they got into the mining business. At the moment, I can't recall the person who headed the company. It was privately owned, by a very wealthy man. I believe he lived in a fancy part of the Los Angeles area. I'll try to furnish his name later. After iron ore production, I believe in Africa, they went into salt production in Mexico, an operation that was later taken over by Leslie Salt Co., and now Cargill owns Leslie. They exported salt to Japan, industrial salt. He was a very shrewd person. It was a one-man company; he gave all of the orders—oh, it was Daniel Ludwig. Does that name ring a bell at all?

5-00:15:29

Swent: A little bit. I think I've heard it.

5-00:15:30

Kirshenbaum: When he died, his fortune, I believe, went to the cancer institute [he founded]. I think that he came upon a real disaster in the later years of the company, and I don't know what ever happened to the company. He constructed a huge paper plant in the middle of the Amazon. There was a tremendous source of vegetation there, of course, but I believe the disaster came because of environmental reasons—not from environmentalists, but because of the rains and the fact that the soil is lateritic, and once you cut the trees down, it creates a mess, and the vegetation doesn't grow again. Anyway, I think the whole thing was a write-off, in short order. It was a huge plant on the river, that his ships would be able to reach. But Ludwig made a lot of money in minerals and shipping. The reason I mention all this is because Marcona was the opposite – it was a mining company that got into shipping. I'll relate that story.

5-00:17:10

Swent: Well, now Marcona was a subsidiary, an offshoot of Utah—

5-00:17:19

Kirshenbaum: Right, and Cyprus.

5-00:17:20

Swent: —and Cyprus.

[Audio File 6]

6-00:00:35

Swent: I had just asked you to talk a little bit about the connection with Marcona and Utah. It was the Utah Construction and Mining Company by then. They had added Mining to the name, I think.

6-00:00:54

Kirshenbaum: Yes.

6-00:00:56

Swent: They both had their offices in San Francisco, didn't they?

6-00:00:58

Kirshenbaum: Right. I'd like to give a little history of Marcona. The history is worth describing, I believe, because there hasn't yet been any formal history of Utah written—

6-00:01:12

Swent: Well, there was the biography of—what's his name, the fellow that was ahead of you?

6-00:01:24

Kirshenbaum: Eccles.

6-00:01:25

Swent: Eccles, Marriner Eccles. There was a very flattering biography of him, but that's just about all.

6-00:01:36

Kirshenbaum: I forgot to what extent there are details, but in David Lavender's book on the history of Cyprus Mines, he gives the early background of Marcona. Marcona started as a large deposit of rich magnetite in Peru that Cyprus—I don't think Cyprus discovered it, but they acquired it. I believe it was in the early fifties. Rather than develop it on their own, Cyprus entered into a joint venture with Utah, and the resulting company wound up 50-50 in terms of voting rights for each company and 46 percent equity owned by each company, and the other 8 percent, I've been told, being a finder's fee, which went to Allen Christensen about the time that he left Utah.

6-00:03:12

Swent: You're looking at the oral history that we completed a few years ago, by [Alexander] "Bud" Wilson, who was the head of Utah. You wanted to make a few comments about—

6-00:03:30

Kirshenbaum: I will a little bit later, I think. But it was very interesting, going through the oral history you and Bud Wilson put together here, because of some comments about Marcona and its management.

6-00:03:48

Marcona started out mining ore, direct-shipping ore.

6-00:03:56

Swent: It was iron.

6-00:03:58

Kirshenbaum: It was iron ore, magnetite. The deposit was situated in—I forgot how far south of Lima [Peru], right off the coast. San Juan Bay I believe was the inlet there and the port was called San Nicolás. One of Marcona's first customers, I believe, was the steel works near Birmingham, Alabama. Was it Jim Walters? Jim Walter Corporation, their steel mill. Peru is interesting. The southern coastline is similar to that of northern Chile. It's desert right to the ocean. In the winter, you can have very wet fogs, but it's a real desert area. Lack of water. I remember hearing that in the beginning, Marcona's ships would pick up fresh water as they traversed the Panama Canal and bring it into the port of San Nicolás.

6-00:05:33

Then Marcona started shipping iron ore to Japan. I'm not sure just what year that was, but I guess it was [Edmund] Littlefield of Utah who put a graduate of the Stanford Business School in charge of the operation as general manager. His name was Charles W. Robinson. He always went by the nickname, Chuck. The company was known best for Chuck Robinson. He determined the policy and was successful for a long period of time. I think that the owners were happy. They didn't want to interfere with this kind of success.

6-00:06:47

Robinson was very ambitious, not only for himself but for the company. They went from shipping direct ore to putting in beneficiation plants and shipping sinter feed. And subsequently, they put in pellet plants, pellets being the highest value product of iron raw materials. Robinson was not an engineer by training, even though he considered that he knew as much as an engineer, I'm sure.

6-00:07:47

The pellets required a lot more beneficiation. It's somewhat analogous to the taconite operations in Minnesota, requiring a lot of grinding and high-temperature induration. These were high-grade pellets. Silica content was important, but most of the silica was removed in the process.

6-00:08:25

One concern was the bentonite because bentonite is an important ingredient to bind the pellets.

6-00:08:37

Swent:

Did they want more bentonite?

6-00:08:42

Kirshenbaum:

Good bentonite isn't found in all that many places. There's a lot of good bentonite that—

6-00:08:47

Swent:

In the Black Hills.

6-00:08:49

Kirshenbaum:

In South Dakota and Wyoming, right, and other parts of the U.S. and in volcanic areas like Greece, but I don't think Peru has what might be classified as bentonite. But Marcona made do with some kind of local clay. I remember one time during a visit by the Japanese, who love to ask questions, they wanted to go out and see the source of the bentonite that went into the pellets they were buying. They appeared to be dissatisfied, but the contracts still were maintained.

6-00:09:29

Swent: Because you said they were trying to get away from the silica. They didn't want the silica.

6-00:09:38

Kirshenbaum: Right.

6-00:09:41

Swent: But they needed bentonite.

6-00:09:43

Kirshenbaum: Yes, bentonite is added in very small amounts. It's not a harmful thing in small amounts, but you'd like it free of silica.

6-00:09:52

Swent: Were you living down in Peru?

6-00:09:59

Kirshenbaum: No, my job was working in the headquarters office in San Francisco. My first job really involved working on the iron ore—well, production and keeping track of what was going on in Peru in terms of quality. I was much involved with quality. Earlier, in connection with Copper Range, we mentioned ASTM. I remember going to an ASTM meeting in Atlantic City, in the old days, in February. And if you can imagine a dead place, it was not only Atlantic city in February but it was an ASTM meeting in Atlantic City, with people discussing minutiae of specifications. And it went on for about three days.

6-00:10:58

Swent: This was before the casinos were there.

6-00:11:02

Kirshenbaum: Absolutely, yes. A lot of old hotels and an old boardwalk.

6-00:11:06

Anyway, my job had to do with coordinating information for the Marcona sales department, selling the iron ore, and the iron production in Peru. I did go to Peru quite a few times, visiting the operations, while I was with the company.

6-00:11:36

Swent: Did you report directly to Chuck Robinson then?

6-00:11:39

Kirshenbaum: No. It's important, for the description of Marcona, that I mention something about the composition of the company. I was in the development division, which had responsibility not for mining, because there was a vice president of mining, a man named Harry Gerber. The development division was under Ken Merklin. Merklin himself was a metallurgist, I believe probably originally a physical metallurgist because I know he had worked for Boeing in the Pacific

Northwest. The metallurgical work and engineering were his responsibility. He had a lot of good people under him. He was very careful in the people he selected, as he wanted to stay on the right side of Chuck Robinson. He eventually became president of the company.

6-00:12:44

Another very important division, certainly for the profit point of view, was the marine division. I think I should return to Marcona's history, to see where the marine division originated. Anyway, Marcona was selling the iron to various steel producers, and certainly one very important area for their sales was Japan.

6-00:13:20

And at some point—this was certainly before my arrival there—Robinson, always wanting to enlarge the scope of Marcona's activities, pursued the idea that it would be worthwhile to have some ships built by the steel companies that were buying the iron ore. I don't know the financing arrangements that were made, but it proved to be very successful and many ships were built by the Japanese for Marcona. They were large ships that could carry ore, bulk, or oil, so-called OBOs.

6-00:14:22

They weren't, by any means, the largest that were ever built. In fact, I believe those became somewhat useless because they were so limited in areas of the world they could serve. Several of Marcona's were Panamax size, which, you know, means the largest ship that can get through the Panama Canal. That's about 130,000 tons deadweight.

6-00:14:56

I believe that there were a few built for Marcona that were larger. I really forget the details now. But shipping became a very, very profitable item for Marcona. Of course, they did not ship only to Japan; they shipped all over the world. And they didn't only ship iron ore. These ships had multiple uses.

6-00:15:28

To jump ahead a little bit in years, when I was with the company in '72 —was it '72 or '73 when the oil embargo came?

6-00:15:50

Swent:

Seventy-three, I think. As I recall, it was '73.

6-00:15:55

Kirshenbaum:

Yes. You're right, it was '73. Those ships were put into service, with very beneficial consequences for Marcona, to carry oil all around. Those were really glory days for Marcona.

6-00:16:20

One of the reasons, as I mentioned, I was hired and wanted to work for Marcona was because of its involvement in shipping, but also Marcona, I learned before I came to work for them—they had just started to develop a slurry shipping system, which they called Marconaflo. The idea—I have heard that various people could claim credit for the idea, but by common acceptance, I guess, Chuck Robinson was acknowledged to be the source of the concept.

6-00:17:21

Swent: You sound dubious.

6-00:17:25

Kirshenbaum: Well, I heard from people in Peru and elsewhere who told me, “Oh, So-and-so developed it.” Those stories, frankly, did seem pretty consistent. In connection with that—where credit winds up—Marcona in due course developed many inventions, which were patented, and Robinson’s name was always on the inventions.

6-00:17:56

Swent: Where did your friend, Earl Herkenhoff, come into the picture?

6-00:18:01

Kirshenbaum: Earl was with Marcona in its earlier days, before me. He was vice president—I forgot at what point. But Earl was an extremely broad and versatile person. He came from New Mexico and went to school in Socorro. He had worked for American Cyanamid, and then he worked up in the Iron Range. He had a lot of experience in iron. Later he wound up at Savage River in Tasmania, and probably because of his iron experience, he came to Marcona.

6-00:18:49

He wound up being really Allen Christensen’s right-hand man when Christensen left Utah. I don’t recall what year that was. Earl, was a very good friend of mine and of course knew Chuck Robinson very well. I’d hear quite a bit from Earl about Chuck and about Marcona’s early days. But Earl had left well before Marconaflo came along.

6-00:19:31

Well, the idea of Marconaflo was to be able to load a ship with a cargo of minerals in slurry form. Iron ore, magnetite, certainly is a dense material, which would settle out. The idea was to load it and be able to decant the supernatant liquid, or the water that would rise to the top, decant that over the side of the ship so that basically you were just shipping a wet cargo.

6-00:20:13

There were concerns, as you might imagine—we discussed last time about how cargoes can shift, and if a cargo is wet, that is one of the

concerns. Of course, in the dissertation I wrote, I had become familiar with those problems.

6-00:20:42

Shortly before I came to Marcona, they had a test cargo that was shipped to Japan, and on arrival [telephone rings]—Just a minute. [tape interruption] We were talking about unloading. At the Japanese discharge port—they had conventional equipment: grab buckets and so forth. It's a long voyage from Peru to Japan and, on the ocean—which isn't always too smooth—the cargo becomes very compacted, partly because of its density but also because of the slamming on the high seas. I was not there, of course, but the discharge equipment just couldn't penetrate the cargo.

6-00:21:55

As I say, I wasn't with the company at that time, but I spoke to people who were hired to try to see what could be done about it. I believe they considered using explosives or something.

6-00:22:15

Swent: Oh, my.

6-00:22:18

Kirshenbaum: One person, whom I became very friendly with over the years, was John Miscovich.

6-00:22:27

Swent: Oh, I've heard of John Miscovich.

6-00:22:30

Kirshenbaum: You have.

6-00:22:31

Swent: He's a friend of Jim Jensen's.

6-00:22:33

Kirshenbaum: Oh, of course, yes. Jim told me about visiting John up at his diggings in Alaska.

6-00:22:35

Swent: Yes.

6-00:22:36

Kirshenbaum: And John came from a Croatian origin. His father came to a very remote mining camp in Alaska called Flat, way back when Flat was a mining town. The population eventually left Flat, but John stayed and became a hands-on expert in dredging and hydraulic mining. He did not finish high school, but he became, in due course, an international consultant and inventor. With his know-how in hydraulic mining, he invented a new monitor

6-00:23:40

John is a clever fellow. He also invented a clever name for it, the Intelligiant, "giant" is another word for monitor. So because of his hydraulic experience, Marcona hired John to go over to Japan and try to blast this cargo with a hydraulic nozzle. Well, one thing led to another, and—

6-00:24:06

Swent: Had this been shipped originally—had it been a slurry?

6-00:24:11

Kirshenbaum: Oh, yes.

6-00:24:12

Swent: When it went in.

6-00:24:13

Kirshenbaum: It was loaded as slurry.

6-00:24:17

Swent: It was loaded as a slurry, okay.

6-00:24:18

Kirshenbaum: Yes. And what they would like to have done—

6-00:24:21

Swent: Turn it back into a slurry!

6-00:24:23

Kirshenbaum: Exactly, and just pump it off. Well, they couldn't dislodge it with any conventional monitor, so this set Chuck Robinson thinking and getting people in the development division to try to invent something that would be able to put the material into slurry form. The result was the Marconajet, which was the key—became a key—to re-pulping these cargoes. This effort took quite a few people.

6-00:25:10

And I should mention that Robinson believed in competition, not only with other companies, but within the company. He thought that was good for the company – to have people strive for promotions or recognition. But in my opinion, too much of that can create destructive situations, lack of communication and so forth.

6-00:25:50

I recall that the first or second day after I started working at Marcona, I found out where the marine department was. I thought this would be of interest to me, so I casually took a very short walk from my office around the corner to the marine department. That side of the building was all marine. I became aware a lot of people were watching me, and when I returned from my conversation in the marine department, I was asked whom I had been talking to. To my surprise, they were surprised

at my boldness or whatever. I learned that this was because marine and development were really competitors, and they spoke together very, very little.

6-00:26:50

Swent: Oh, my.

6-00:26:53

Kirshenbaum: And I wound up really looking over my shoulder many, many times. That was the way things went.

6-00:27:01

Well Marconaflo, because it really was the apple of Chuck Robinson's eye, had all kinds of people working on it.

6-00:27:10

Swent: Marconaflo.

6-00:27:13

Kirshenbaum: Marconaflo. I think I'll just continue with where Marconaflo went. As the system was developed, I became more and more involved, and ultimately a Marconaflo division was set up. I was assigned to that division, the only metallurgist in the group. They had someone from the marine division, but it was not meant to be a technical group, perhaps, as much as a development or even marketing group.

6-00:28:15

I had a fascinating job. My job title at that point was manager, commercial development. My main activities were looking for opportunities for Marconaflo. Well, I recall a passage in Bud Wilson's oral history, where he mentions that he and other people didn't think that Marconaflo was that innovative; it was just a matter of handling slurries.

6-00:29:00

But it turned out, frankly, that there were some inherent problems that couldn't be solved to keep a mineral cargo fluid across the ocean. After the first disaster in Japan, they thought, they should use agitators to keep the cargo in suspension, without draining it, without using eductors to decant the water from the holds.

6-00:29:32

But the material did settle into a hard mass soon after sailing, and the agitators were frozen, so to speak, in this concreted mass.

6-00:29:46

Swent: Oh, my!

6-00:29:48

Kirshenbaum: So that wasn't successful. But the problem was solved through the invention of Marconajets – heavy-duty rotating jets installed in the hold bottom beneath the cargo. They expelled water under high pressure and undercut the compacted cargo. I envisioned that such a device could have considerable opportunities not just in marine transport but for in-plant handling and reclamation systems for bulk materials. Many times materials are left in stockpiles, and I thought that some of these Marconajets, could be used advantageously to reclaim stockpiles and feed raw material into a plant—actually saving on energy cost of agitation, because many plants continuously agitate material so it's immediately ready to go into the process.

6-00:30:56

Well, if you had a system that could, on demand, create a slurry at the press of a button, there would be advantages there, including in power saving. Actually, I gave a paper [“Marconaflo—Applications of the System to Mineral Processing and Extraction”]

6-00:31:17

Swent: Isn't that what this is here?

6-00:31:19

Kirshenbaum: Yes.

6-00:31:21

Swent: April 1973.

6-00:31:23

Kirshenbaum: Yes.

6-00:31:24

Swent: It was from *Mining Magazine*.

6-00:31:24

Kirshenbaum: Yes. There was a conference—where I presented this paper—in Ottawa, the Canadian Mineral Producers.

6-00:31:37

Swent: Canadian Mineral Processors.

6-00:31:39

Kirshenbaum: Canadian Mineral Processors, right.

6-00:31:41

Swent: Ottawa, Ontario, January 1973.

6-00:31:42

Kirshenbaum: Yes. I illustrated a number of applications that I thought could be appropriate and worthwhile. Hydrometallurgy was becoming increasingly popular in the copper industry. Paradoxically, because

one might think that slurry reclaim wouldn't be appropriate for something that would go into a drying operation, but spray drying has become popular for drying of concentrates. That requires a slurry feed into the dryer. Cement copper might be handled similarly.

6-00:32:45

Let's see, I remember going down to Kennecott's Ray operations in Arizona where they had a serious problem. I think I mentioned that in passing before. Because of the chrysocolla in the ore, the vats that Kennecott had built were not achieving good recovery. The Kennecott people thought that, perhaps by efficiently reclaiming a slurry within the vat and recycling this refractory siliceous ore, the recovery could be enhanced and at a lower cost. So we were talking to them about installation of Marconaflo equipment.

6-00:33:36

Fluidized-bed roasters. The Japanese had a number of installations with concentrates containing enough exothermic minerals, such as pyrite or sphalerite (zinc sulfide)— to enable their being fed to fluid-bed roasters in slurry form. There's sufficient heat evolved during the oxidation reaction that the water is vaporized right in the furnace.

6-00:34:26

So I went to Japan and spoke to a number of nonferrous smelters about the possibility here. Another important application for in-plant handling, comes about in the handling of coal. For example, at the end of the Black Mesa pipeline at the Mohave Generating Station, operated by Southern California Edison on the Colorado River between Arizona and Nevada. Before I left Marcona, a Marconaflo installation was sold there to reclaim coal they had in storage.

6-00:35:34

Swent:

So you were able to have it taken up by other processors.

6-00:35:45

Kirshenbaum:

Yes. I would like to continue Marcona's history a little bit further, but first, to complete Marconaflo: when Marcona ceased to exist, Marconaflo was acquired by McNally-Pittsburg, which I believe was out of Pittsburg, Kansas. They were a big equipment supplier in the coal industry and made crushers, dryers, kilns and so forth.

6-00:36:35

From time to time, I would see the name "Marconajet," in the literature. Actually, I spoke to someone just last year, 2002, from the University of Missouri at Rolla. He's trying to contend with some very serious problems they have at the Hanford nuclear facility in Washington state, where they have—you've probably read about some of those liquid mixes they have stored in tanks that they're afraid will erupt. They've been sitting a long time, and the contents are highly

radioactive and toxic. The tanks are corroding through, and they'd like to know how to handle it as remotely as they can and dispose of it. So he was talking to me about Marconaflo.

6-00:37:45

Marcona did have some success with delivery of cargo, using the Marconajet, but this was actually in Portland, Oregon, at Oregon Steel Mills, where the material was pellet feed, loaded at Falconbridge's British Columbia mine, Tasu. It produced an iron concentrate and a copper concentrate. The copper concentrate went to Japan, and the iron concentrate was shipped to Oregon Steel. Because this wasn't loaded wet, it didn't compact like wet-loaded cargo. Marconajets did a good job of discharging the pellet feed at Portland.

6-00:38:58

Swent:

So it didn't have to be a slurry for it to work.

6-00:39:02

Kirshenbaum:

Well, the Marconajet created a slurry to discharge the ship, but they didn't have the problem which they had with ships loaded with a slurry which then traversed the Pacific. Sometimes compacted cargo would be undercut with a wide radius and being so compacted, it just bridged across and wouldn't collapse. You really wanted it to collapse, but of course, you didn't want a huge mass to fall that would damage the hold of the ship.

6-00:39:57

The copper industry was another area where a lot of work was done and it had a lot of attraction for feeding copper ore into the leaching operations. Anyway, I think I've pretty well covered Marconaflo.

6-00:40:19

Marcona, as we mentioned, had started as just a Peruvian iron-ore mining company, but Robinson certainly intended it to grow, not only in Peru but in other areas. There were discussions with the Saudis, who were interested—. Like all countries that benefit from natural resources but didn't have any steel production, they wanted their own steel mill, and Marcona was engaged in discussions with them.

6-00:41:04

A source of the ore for Saudi Arabia was the—I forgot the name of the deposit at the moment, but in Greenland. So geologists from, the development division, which also included geologists, went up to Greenland and did quite a bit of work there to prove out the ore body, but that never went into production. The joint venture would have been with the Cryolite Company of Denmark.

6-00:41:41

To obtain the publicity which Marcona sought, there was an effective public relations department to promote Marconaflo. As a result, the company received numerous letters and telexes, many of which I responded to, at least from the mineral side, for opportunities to join with other companies in various developments. These were seen by Marcona as a means of participating in mineral projects of other companies. One reason this didn't pan out because companies do not like to be wedded to single sources – be they for supply or for transportation technology.

6-00:42:30

In connection with publicity, when news releases were sent out, there was always a picture – not just of the operation being reported upon, for example, but the release was always accompanied by an 8x10 glossy photo of Chuck Robinson.

6-00:42:59

But it was really a fun company to work for. I would go into mining companies in Canada, for example, that I knew had problems in materials handling. I'd go in there like a consultant and learn of problems I'm sure these companies would not tell a competitor. But they really wanted answers, and they thought there might be some opportunities, either using Marconaflo or another technology that our meetings might reveal. I knew many of these companies because of my published dissertation and papers.

6-00:43:50

Well, Marcona didn't do anything with the Saudis, but probably around 1972 or '73, another large development that looked like it was really going forward because so much work was done on it, was the Kudremukh iron ore project in India. That, I think has been developed by others since.

6-00:44:33

The project that Marcona did get into in a big way was in Brazil. At the moment, I forgot the name of that. That involved a long slurry pipeline from the mine down to the coast, but because of difficulties Marcona was having with the attempted slurry loading, that was not a candidate for Marconaflo.

6-00:45:11

I should mention also that the marine division had its own force of people working on trying to develop equipment to solve Marconaflo's problems. Again, this competition was another reason for the relationship between departments that I had mentioned earlier.

6-00:45:38

The Brazilian operation required financing. I recall that I had talked to some mining finance people I knew with some of the banks that came around. Marcona did not want Utah to do the financing because Marcona management felt that they would lose—could lose—some of its independence as a result. The collateral, for the large loan that was made was actually the Marcona operation, itself, in Peru and perhaps some of the ships.

6-00:46:46

There was always some concern about expropriation in Peru, but all of a sudden, after this loan was made, the Peruvians did something unusual in South America. A left-wing military government came into power and nationalizations were a result. I had actually left the company not too long before, but it was pretty evident that the Peruvians had not been too happy with foreign firms, even under preceding governments.

6-00:47:37

In the Marcona orebody it was known that there was an area with some significant copper. Besides hearing about this from Earl Herkenhoff, the subject was brought up by government officials in meetings I attended. However, Marcona management simply would not acknowledge existence of the copper; I suspect the concern was that this could have enabled the government to take an active role in the operation—as the company's concession or contract was probably limited to exploitation of the iron ore.

6-00:48:12

Swent:

I see, the contract with the Peruvian government.

6-00:48:17

Kirshenbaum:

Exactly. But the Peruvians were becoming more and more uppity, so to speak, and one could see some handwriting on the wall, which certainly came with this change in government. Very quickly, something had to be done about this loan collateral. Utah wound up—actually, Utah and Cyprus wound up with this problem. But, as related very well in Bud Wilson's oral history, Utah wound up with bailing out Marcona's debt because Cyprus refused to come up with their share.

6-00:49:18

In that connection, a little bit of background here is interesting. As we said, Marcona was a joint venture of Cyprus and Utah, and during the very heady days, especially during the oil embargo, when Marcona was making a fortune on their shipping, Marcona was much more profitable than Utah, and I used to think that maybe San Francisco was too small for both Ed Littlefield and Chuck Robinson.

6-00:49:57

To illustrate a point, here's a 1974 Cyprus proxy. In a section on their subsidiaries, it's interesting that it says under Marcona [reads] "the information pertaining to Marcona has been provided by Marcona management. The company"—which of course, was Cyprus—"had been unable to independently verify such information." Which I think is a little unusual to say for a subsidiary owned 46 percent by the company.

6-00:50:44

Swent: That's putting a red flag into your proxy statement, isn't it? For sure.

6-00:50:49

Kirshenbaum: I would think so.

6-00:50:53

Swent: Yes. "Unable to independently verify such information." [laughs]

6-00:51:05

Kirshenbaum: Well, as I'll pick up in a short time, I left Marcona in 1974—

6-00:51:13

Swent: How did that come about?

6-00:51:16

Kirshenbaum: I'll finish first with Chuck Robinson and the Marcona story. It was evident that there would be some problems with Peru. I believe Robinson left the company before the actual expropriation, but it had been apparent that he was interested in a position in Washington. He had a friend who was secretary of commerce, Pete Peterson, and I believe Robinson would like to have succeeded him. But in any event, he wound up as assistant secretary of state under Henry Kissinger. Two such egos are hard to imagine.

6-00:52:24

Another thing that Bud Wilson mentions in his oral history is Chuck's ego. And then from Washington, he went to Dillon Read in New York, and he wound up in Santa Fe, New Mexico. His wife is an aficionado of the opera.

6-00:52:49

At some point in San Francisco, at the Engineers Club or at MMSA meetings, I became familiar with Hugh Matheson of Placer Amex, as the wholly owned U.S. subsidiary of Placer Development, Ltd. was called at that time. Placer was, a well diversified mining company out of Vancouver, B.C. [British Columbia], and Placer Amex was based in San Francisco.

6-00:53:44

Actually, I recall being introduced to Hugh Matheson, who was vice president, exploration, of Placer Amex, by my old friend John Miscovich, because Hugh's father was a mining engineer and had worked in the old days in Flat, Alaska. John had known Hugh as a young child, and then Hugh went on to school at Colorado School of Mines and I believe a master's at the University of Alaska. You can say he was skilled in geology, mining engineering, and metallurgy. Probably less as a metallurgist, but he was very astute and intelligent.

6-00:54:58

Anyway, John introduced me, I believe, at a lunch that was hosted by George Argall, editor of *World Mining* here in San Francisco for gosh knows how many years. Well, George knew people from all over the world, of course, and one of the world's experts in dredging was Charles Romanowitz, who was well into his eighties and lived in retirement in Thousand Oaks, California. But he was still doing consulting, I'm pretty sure. Anyway, he was an amazingly active person. A very tall man who had to bend over all the time to hear what people would said, as his hearing was not good.

6-00:56:26

Anyway, George Argall hosted a lunch at the Engineers Club in San Francisco for Romanowitz and invited many people, including John Miscovich and Hugh Matheson. That's when I met Hugh. He was introduced to me by John. I got to know Hugh better and, over the months, it became evident that Hugh was interested in having me come to work for him at Placer.

6-00:57:08

Although I really enjoyed the position I had at Marcona, the corporate culture there was really getting me nervous, having to watch what I said and to whom. Moreover, I was concerned about what might happen in Peru. So I soon accepted an offer from Hugh, after telling him that I'd really appreciate being able to pursue some consulting opportunities first, and I asked if he would give me a bit of time.

6-00:58:02

Well, Hugh is a wonderful person in every aspect. Not only is he broad in his mining knowledge, but he's really an extremely cultured person, well-read in history and in many other fields. So he said fine, and I think that was about June of '74. I had been at Marcona for close to five years, I guess.

6-00:58:43

Through some of the contacts I had made at Marcona, I knew people who had problems with materials handling in metallurgical operations and I thought there were some areas where I could be useful. Immediately after I left Marcona, I took a consulting assignment with

Soros Associates of New York. I had known them when I was working in New York. I don't think I knew Paul Soros personally, but I believe he knew who I was.

6-00:59:40

Soros Associates has built many of the ports around the world where minerals are shipped from, and they built and redesigned, for example, the port of Narvik in Norway, where Swedish iron ore from Kiruna is shipped out. They also built many of the ports in Brazil and in Chile and ports in Canada— big-tonnage iron ore ports.

6-01:00:16

I became very friendly with one of the vice presidents, a couple of them really, the main one being Rollin Slater. Soros had an opportunity to do some work for Codelco, the Chilean copper company the Allende government formed after expropriating Chilean operations of Kennecott, Anaconda, and Cerro.

6-01:01:03

This was Soros's first entry, I believe, into the non-ferrous metals industry. The project involved a materials handling situation at the mine and smelter complex at Chuquicamata, the former Anaconda property and the largest copper mine in the world. Soros wanted to have someone helping them who was familiar with copper technology and the copper industry.

6-01:01:31

So I left for South America, meeting Slater in Lima, where I'd set up some meetings for him with people and firms I knew there. One was with St. Joe which had a mine, a lead-zinc operation in Peru. From there we went down to Santiago. This was about a year, I guess, after the overthrow of the [Salvador] Allende government.

6-01:02:20

Things were fairly peaceful by then. One thing, of course, that I'll always remember is that they have the toque de queda, which was a curfew at nine o'clock each evening. Part of the time we stayed at the Carrera [Hotel] in Santiago, which was right across from the casa de gobierno. You could see the damage that had been inflicted there by the U.S. planes. The center of Santiago was certainly a dead city at night.

6-01:03:14

Swent:

I can imagine.

6-01:03:18

Kirshenbaum:

Anyway, with Slater and people from Soros and a Chilean affiliate, we went up to Antofagasta and then flew to Calama, near Chuqui. I'm fond of Chile. I think in many aspects it's similar to California. I recall

a statue of Charles Brinkerhoff, on Avenida Brinkerhoff. It surprised me that some years after Allende had come to power, Brinkerhoff's name and statue remained. I think that Chile is unlike other countries in Latin America, where as soon as somebody is deposed, down come the statues and they rename everything. It was still Avenida Brinkerhoff.

6-01:04:43

Swent: He was with Anaconda, wasn't he?

6-01:04:46

Kirshenbaum: Yes, head of Anaconda.

6-01:04:47

Swent: Head of Anaconda, yes.

6-01:04:55

Kirshenbaum: I think that illustrates a little bit about the good-nature of—

6-01:04:58

Swent: The civility.

6-01:04:59

Kirshenbaum: —of Chilenos. Well, anyway, it was fascinating being at Chuqui. I had been in Chile before, but not at Chuqui. In various ways, you can rank the world's largest copper mines. Bingham [Utah], was first in terms of tonnage mined, including overburden. Chuqui, with its higher grade, was largest in terms of tonnage of copper produced each day, and the Braden, operation, which had been Kennecott's, was the largest underground.

6-01:05:40

Chuqui was revamping their processes. They had shortly before disposed of their vat leaching operations, which was, if not the first, one of the first in the world, put in by Anaconda in the 1920s. Soros was involved in a large of materials handling system there, for both ores and concentrates.

6-01:06:21

Swent: Was Soros interested in getting it to a port?

6-01:06:25

Kirshenbaum: Not on this project. I believe the port facilities were adequate for the time being. I was at Chuqui for a couple of weeks. Part of my responsibility was to put Soros in touch with other people—for example, specialists in drying of concentrates. Consultants and experts here in the U.S., people like Don Dahlstrom of Eimco and Pablo Hadzeriga at Hazen. Hazen was brought into some of this Chuqui work as a result of my contacting Pablo.

6-01:08:21

Swent: Did you run into Robert Haldeman in Chile?

6-01:08:23

Kirshenbaum: No, I did not.

6-01:08:34

As I mentioned, I had Placer's approval to do some consulting before starting employment with them. There was an opportunity for me to do some work for the United Nations Development Program [UNDP] in Argentina. I had visited a remote area of the country, the provinces of Salta and Jujuy, when I lived in Cordoba. Transportation was a problem in that region; there was a narrow-gauge railroad there, and UNDP was interested in how transport could be improved from this mineral-rich area. As we had discussed, Argentina had undeveloped mineral resources, partly because of transportation.

6-01:09:41

I visited Buenos Aires and obtained an assignment from UNDP which would bring me to Salta later for a couple of weeks to look at the situation there. I visited a couple of properties, including one very interesting one owned by part of the Rio Tinto Group. It was a large borax mine, although production was small. I don't think it was part of Rio's U.S. Borax unit. It was called, at least locally, Boroquimica.

6-01:10:41

It was interesting because there were really only two or three major producers of borax in the world, and two of them were Rio Tinto properties: the one, of course, here in California at Boron had originally been Pacific Coast Borax in Death Valley, the other being in Salta, in the Valle de los Muertos Perdidos.

6-01:11:50

Swent: Lost Dead.

6-01:11:52

Kirshenbaum: Lost Dead. Right.

6-01:11:55

Swent: Right.

6-01:11:56

Kirshenbaum: Yes, I of course thought of Death Valley when I was there. It was about as dry as Death Valley, but it wasn't below sea level; it was well up in the Cordillera. Transportation from there was a narrow-gauge railroad that was part of the Salta to Antofagasta line.

6-01:12:31

Swent: Went across the Andes?

6-01:12:33

Kirshenbaum: It went across the Andes, yes.

6-01:12:34

Swent: Good heavens!

6-01:12:38

Kirshenbaum: There was an interesting book I bought one time in Lima, published by a journal there, the *Peruvian Times and Andean Airmail*, evidently a consolidation of two journals. The book, which I still have, was about the railroads of the west coast of South America. Because of the fantastic escarpment of the Andes, there were some pretty amazing railroads. I already described the one in Peru —the Ferrocarril Central del Peru – that went from Lima to Oroya.

6-01:13:25

Swent: I didn't know there were any that went across the Andes, though.

6-01:13:28

Kirshenbaum: Yes. This was one, and the one that [Henry (or Enrique)] Meiggs built, of course, didn't cross the Andes; that just went from Valparaiso to Santiago. But then there was one connecting Chile and Argentina, going from Santiago to Mendoza across the Andes. The crest was through a tunnel. I believe that tunnel also served for automobile traffic when the road was first put through. Then there were some railroads in northern Chile, from Antofagasta to Bolivia, with a connection to the railroad going to Chuqui. And Iquique, Chile, also had a railroad, very steep, that came down to the coast from Bolivia.

6-01:14:48

Anyway, I wrote a report for the UN.

[Audio File 7]

7-00:00:04

Swent: Now, we're continuing the interview here with Noel Kirshenbaum. You had talked about leaving Marcona, but there were a couple of other things you wanted to say about that before you left.

7-00:00:48

Kirshenbaum: Yes. During my time at Marcona, I often went through Vancouver on business trips. I'd sometimes visit a friend of mine, Gordon Hutchinson, who was general manager of Vancouver Wharves, a major mineral-shipping and loading terminal in North Vancouver, almost right under the Lion's Gate Bridge. They shipped out concentrates and sulfur that came from the interior by rail.

7-00:01:35

We used to talk about shipping minerals quite a bit. At some point, Gordon suggested that I put together a symposium or conference on

minerals transportation, and he felt that Vancouver would be a very good place to hold it. I talked to people at Marcona about the idea, and they thought it might be good publicity. Marcona was already in the shipping business, but Marconaflo could benefit.

7-00:02:21

We wanted to make this an international meeting. International meant the whole world, so I spoke to George Argall. I think I mentioned him.

7-00:02:38

Swent:

Yes, you had mentioned him before, yes.

7-00:02:40

Kirshenbaum:

George being editor of *World Mining* in San Francisco, I asked him what he thought about putting this together between us, with *World Mining* and Marcona involved. He was quite receptive. This was probably the beginning of 1972. I became program chairman, and I think George called himself symposium chairman.

7-00:03:28

I was going to England in 1970 to give a paper, so I took advantage of being in Europe and took a busman's holiday with Sandy. We traveled to some places and met people whom I thought might be interested in participating. I visited Belgium and Holland and the huge terminal in Rotterdam. Many of these people came to the meeting, including as speakers, that we were going to have the next year. We went to Germany, Denmark and Sweden, where I met with people from LKAB, who ship their Kiruna iron ore out of Narvik, Norway. That was an interesting trip, and we returned through Trondheim, Bergen, and Oslo.

7-00:04:49

So we held the meeting in 1971 in Vancouver—several hundred people attended, and we published a proceedings—

7-00:05:05

Swent:

I've got that book here. Minerals Transportation is the name of it. [Minerals Transportation: Proceedings of the First International Symposium on Transport and Handling of Materials, edited by N. Kirshenbaum and George Argall, Jr., San Francisco, 1972, Miller Freeman Publications, Inc. The symposium was held in Vancouver, B.C., Canada; Oct. 20-23, 1971.]

7-00:05:14

Kirshenbaum:

That sold very well. It was published by *World Mining*. I think one of the most interesting entries in it is by someone from Japan who had contacted me some years before, when he had been sent a copy of my thesis by Ken von der Porten of Ledoux & Company in New Jersey, Ledoux being the long-established assay and analytical lab in Teaneck.

7-00:05:55

The Japanese person's name was Yoshio Mikimoto, as in pearls. He had studied aeronautical engineering at MIT [Massachusetts Institute of Technology] before World War II and was in Japan during the war. I met with him many times in this country and in Japan. A fascinating person who formed a surveillance company business after World War II. His employees would inspect cargoes on arrival in Japanese ports and smelters or even go to the loading ports. Cargoes would be sampled and checked for weight. Clients were generally shippers such as mining companies, rather than the trading firms.

7-00:07:13

When I was still working in New York he contacted me through Ledoux and for a long period kept telling me that he'd like me to work for him in Japan. He had been greatly impressed with my dissertation and felt I could fit into his business and attract clients. I considered this seriously, but things never came together. But we did keep in touch; I saw him in the U.S. and in Japan when I was there for Marcona and later for Placer. I did some consulting for him in 1974 when we met each other in Mexico and visited potential clients.

7-00:07:54

Mikimoto's company was there mainly at the discharge end of the transportation, when ships were unloaded. He pointed out to his clients all the areas where cargo is lost or contaminated, things that the shippers, the original shippers, didn't know because they didn't have their people on site. There are other companies in this field, but I think Mikimoto was unique as the other firms are international companies. In Japan, Mikimoto had to work with—or contend with, I should say—the trading companies that did not want to have this type of information made known.

7-00:09:09

He agreed to give a paper at the Vancouver symposium and showed some horrific examples of spillage and so forth, some illustrations appeared in the proceedings, but portions were deleted because his business actually was threatened by the big trading companies.

7-00:09:39

Swent:

Oh, my!

7-00:09:41

Kirshenbaum:

Yes. I went to some trouble to help him, but it was really a shame that we lost some of that material. Even so, some of the pictures are in there. With a couple of other papers that I've written, one can appreciate that some of these problems still exist.

- 7-00:10:10
Swent: Yes. Did you have—this is the “First International...” Was there ever another one?
- 7-00:10:19
Kirshenbaum: Yes, there was, and it was in Rotterdam, two years later. This was an ideal place for it because it is a huge port, perhaps even larger than any port in Japan. Rotterdam is where the Rhine meets the North Sea, and there is an immense amount of bulk cargo discharged as well as transferred to barges which go up the Rhine all the way to Switzerland.
- 7-00:11:01
Swent: I think there’s competition—I’ve heard the figures about whether Oakland—Oakland and Rotterdam I think compete for first place as containerized ports now.
- 7-00:11:15
Kirshenbaum: Yes. Rotterdam, of course, has containers, but Oakland, of course, doesn’t have any bulk.
- 7-00:11:18
Swent: No.
- 7-00:11:20
Kirshenbaum: There are a couple of other bulk terminals on the Bay, but—
- 7-00:11:24
Swent: Rotterdam has everything.
- 7-00:11:26
Kirshenbaum: Yes, exactly. Yes, the Dutch go after things very seriously.
- 7-00:11:36
I think that probably takes care of that insert.
- 7-00:11:44
Swent: That must have been very interesting.
- 7-00:11:51
Kirshenbaum: The two conferences.
- 7-00:11:54
Swent: Okay. So do you want to go on, then—well, you mentioned a Mexican job between—
- 7-00:12:00
Kirshenbaum: That was just a short consulting assignment with Mikimoto, when I was in between Marcona and Placer.
- 7-00:12:16
Swent: Where in Mexico was it?

7-00:12:21

Kirshenbaum: Well, he and I got together—as I recall, SME was having a meeting in Acapulco, so we went there, and I introduced him around. Then we went up to Mexico City and to San Luis Potosí and the Asarco facilities nearby.

7-00:12:54

Swent: And then you went to work for?

7-00:13:00

Kirshenbaum: Placer. My initial main assignment there dealt with coal and transportation. Perhaps I should give a little history of Placer Development, as it was called then, and its U.S. subsidiary, then called American Exploration and Mining. It was mainly a metals mining. The U.S. subsidiary had some activities in Alaska, and besides exploration, it had had some operations in California, such as an iron-ore property in Riverside County, I think called the Twentieth Century Mine. That property shipped high-grade iron ore to Kaiser Steel, supplementing Kaiser's own iron-ore supply from Eagle Mountain.

7-00:14:32

Swent: I was just thinking: Placer I think was a Canadian company, but it was headquartered here in San Francisco, wasn't that right?

7-00:14:42

Kirshenbaum: Yes. Maybe I should give the history of Placer before I go any further.

7-00:14:43

Swent: A little bit, just briefly, yes.

7-00:14:44

Kirshenbaum: I think that would be appropriate. Placer was founded, I forgot what year. It was the early 1930s and involved three countries. It was to develop a very rich gold placer property, source of the company's name, in New Guinea on the Papua side of the island. The three countries were Canada, the U.S., and Australia: Canada, I believe, for tax reasons; the U.S., mainly because the operation involved dredging and San Francisco was, I guess you can say, probably the dredging center of the world—although perhaps not to the extent that it had been twenty or thirty years earlier;—and then Australia, Sydney, because Papua, where the property was, I believe, an Australian protectorate.

7-00:16:11

San Francisco became the U.S. subsidiary's headquarters, and its function at that time was to procure the dredging equipment for the Bulolo operation in New Guinea. This was history-making for the mining and dredging industries because Bulolo was a considerable distance from the coast. Transport of such equipment was always a problem because of size and weight, but this was truly a challenge.

The dredge components were hauled to Australia by ships. It came from Yuba Manufacturing Company, a firm uncommon in the dredging industry as this California company not only operated dredges but also manufactured them.

7-00:17:21

The reason it was so historic was because—again, this was in the 1930s—I wonder, do you have the things that I had sent you? [tape interruption] Yes, I'm looking at an article that was published in the Placer house organ in 1997, when Placer finally closed the San Francisco office.

7-00:18:00

Swent:

I guess they were just about the last company to go. Did Homestake leave after?

7-00:18:11

Kirshenbaum:

Homestake left after. I think Homestake—

7-00:18:13

Swent:

Okay, but shortly after.

7-00:18:18

Kirshenbaum:

Yes. Placer left in '97 and Homestake about '99.

7-00:18:19

Swent:

Was it that late?

7-00:18:21

Kirshenbaum:

Yes, I think so. Anyway, a total of six dredges were sent out to the Bulolo gold fields. The history-making aspect was that these dredges—the dredge parts, that is —were flown, in those relatively early years of aviation, from the port to the mine site.

7-00:19:22

Swent:

Those [referring to a photograph] are huge.

7-00:19:26

Kirshenbaum:

The planes were specially designed to accommodate the large dredge components. They were Junkers 52s made in Germany and had especially powerful engines. And for this achievement, in 1938 Charles Banks received a gold medal from the Mining and Metallurgical Society of America for, quote, “the application of aerial transportation to the development of remote mining operations.” So those dredges were the foundation of Placer Development. They were in operation until World War II. Over the years, Placer expanded activities out of its Vancouver office and later merged with Dome Mines. The San Francisco office was maintained, from the company's earliest days until, as I mentioned, 1997.

7-00:21:28

Besides the iron-ore operation in Southern California, which was fairly short-lived, Placer had the two Alaskan coal properties, and, beginning in the 1960s, they had the Cortez gold operation, which had some very interesting history as well.

7-00:21:56

Swent: That's in Nevada.

7-00:21:59

Kirshenbaum: Right. Cortez came into Placer's domain in the middle 1960s. I believe its first production under Placer was about 1968. But Cortez had, as I mentioned, a fascinating history. Mining in that area went back to 1862. In 1868, Cortez shipped some silver ore to Austin for reduction. As reported in one of my old books by Rossiter Raymond, the hauling cost was \$45 per short ton, so you know the ore had to be high-grade. And the milling was about \$45 a ton more. I don't know offhand what the price of silver was in those days.

7-00:23:35

The operation was originally a partnership that George Hearst was involved in. It helped to found the Hearst fortune. Hearst was bought out in 1867. Cortez had a long history—

7-00:24:00

Swent: This was a silver property, then, primarily?

7-00:24:02

Kirshenbaum: The district had both silver and gold. Cortez has a long history. A mine was put into production at Gold Acres in the 1930s, when gold reached a high price. I believe the Gold Acres operation was even operating during World War II, when all gold mining had to cease, but I think there was some reason that, because it was operated by a Canadian company, there may have been a loophole.

7-00:24:56

Swent: Hmm! Now, that's interesting.

7-00:24:58

Kirshenbaum: Yes.

7-00:25:07

Swent: I should say that you're looking now at an article that Cole McFarland and you wrote, a paper from—what is it from?

7-00:25:16

Kirshenbaum: *Minerals and Metallurgical Processing*. This was published in 1991 and entitled "The Cortez Story: 125 Years of Evolution and Innovation". It was a 125-year history.

- 7-00:25:30
Swent: The article is.
- 7-00:25:31
Kirshenbaum: The article is. I recall this reference to [Franklin D.] Roosevelt's infamous Order L-208, to close all U.S. gold mines—. Gold Acres was the only U.S. goldmine that continued operating throughout the war years. Now, there were some others, but they had some byproduct strategic to the war effort.
- 7-00:26:02
Swent: Or the gold was considered a byproduct or something.
- 7-00:26:07
Kirshenbaum: Sure, they were able to take the gold.
- 7-00:26:09
Swent: I think Bingham [Utah] was one that kept operating, producing gold. I'm not sure about that.
- 7-00:26:21
Kirshenbaum: I would imagine that if gold was a byproduct, then you were home free.
- 7-00:26:25
Swent: Right. And some of the Idaho mines, I guess, had antimony and gold or something like that.
- 7-00:26:34
Kirshenbaum: Yes.
- 7-00:26:35
Swent: But Cortez is still going.
- 7-00:26:38
Kirshenbaum: Yes.
- 7-00:26:39
Swent: Now, what's the Pipeline connection?
- 7-00:26:43
Kirshenbaum: I recall that Cortez had been thinking for a long time that they were on their last legs. As sometimes happens, the last drill hole saves the day. This was a drill hole put in to assure that some tailings that were going to be deposited on the site didn't have any gold values underneath, so they just drilled some holes randomly. In this last hole they drilled they found gold. Because this was going to be a tailings disposal area it got the name—Pipeline.
- 7-00:27:40
Swent: Now, this was the Cortez company?

7-00:27:42

Kirshenbaum: It was Cortez, right. And Cortez was actually a joint venture. Placer was the operator, and Bunker Hill had been a joint-venture partner when operations started in '68 or '69, along with a couple of individuals or smaller equity owners in the property. Bunker Hill Company had been bought out by Gulf Resources, so Gulf Resources was one of the owning partners. I believe Kennecott came into the picture when Kennecott (now Rio Tinto of course) bought out the Gulf Resources interest in Cortez.

7-00:28:50

Swent: Now, what was the situation when you came into Placer?

7-00:28:58

Kirshenbaum: I came in '74, and Cortez was a still a relatively new operation. I don't mean the orebody, certainly, but Placer's activity there. I should mention that Placer's operation at Cortez started at approximately the same time as Carlin.

7-00:29:39

Swent: Which is near Gold Acres.

7-00:29:41

Kirshenbaum: Well, that's another interesting story. But Carlin was a complete new development, as you know, found by John Livermore and Alan Coope.

7-00:29:56

Swent: I can't think. Gordon?

7-00:29:57

Kirshenbaum: No.

7-00:30:05

Swent: Anyway, Coope. Alan.

7-00:30:08

Kirshenbaum: That resulted from the exploration by Ralph Roberts of the USGS [U.S. Geological Survey]. That developed at a very timely moment, when the price of gold was starting its trend up.

7-00:30:29

Swent: That was the early sixties, about 1960, I think.

7-00:30:32

Kirshenbaum: Well, actually, when I came back from South America and had returned to Stanford and was looking for work, I had some correspondence with Frank McQuiston about Newmont, he told me that Dave Christie was involved at the new project at Carlin. That would have been around 1966. But I think it was about '68, maybe, by the time gold was being poured there. Anyway, you've got some other oral histories—.

- 7-00:31:15
Swent: I just remember they sort of talk about the gold rush of the sixties in Nevada.
- 7-00:31:19
Kirshenbaum: Sure. Gee, I recall when the price of gold went to thirty-eight or forty dollars [per ounce], they thought that was a real boom. Of course, in Canada, they had the benefit of some government subsidy to keep the gold mines going, even when gold was still thirty-five dollars, U.S., an ounce in this country. The Canadians did get a subsidy, the gold miners.
- 7-00:31:47
But Cortez started just about the same time, or started up again. One interesting thing about Gold Acres was that—I have not seen John Livermore's oral history, but Alan Coope—
- 7-00:32:11
Swent: Alan Coope, that's right, yes.
- 7-00:32:15
Kirshenbaum: Alan and John took core samples and drove them down after dark to Gold Acres, I believe, for analysis there, by Harry Treweek. Does that name come up?
- 7-00:32:26
Swent: Right, he was the assayist.
- 7-00:32:30
Kirshenbaum: Yes. And he was just living out there, I guess, at Gold Acres.
- 7-00:32:33
Swent: Yes. A good old Cornish name.
- 7-00:32:45
Kirshenbaum: I might mention a bit of history here. About 1971, when I was with Marcona, John Miscovich and I flew to Elko and visited Carlin. We were interested in materials handling of course, and we saw Newmont's first tests on heap leaching – in the Carlin parking lot at the top of the hill. They simply had put piles of ore on the blacktop with some berms around them and they were dripping cyanide on them. Those were very early days for that type of gold extraction, and I wrote a short report on the visit. Al Horton, head of Placer's San Francisco office, was on that same small plane, no doubt going over to Cortez.
- 7-00:32:53
Swent: So when you came to Placer, Cortez was already booming again.
- 7-00:33:02
Kirshenbaum: Yes.

- 7-00:33:04
Swent: There was a lot of litigation about Pipeline, wasn't there?
- 7-00:33:09
Kirshenbaum: Oh, absolutely.
- 7-00:33:10
Swent: Were you involved in that at all?
- 7-00:33:13
Kirshenbaum: Well, I was involved in looking some things up, but I didn't testify or get involved in other legal matters. I'll have to think about that for maybe the next time.
- 7-00:33:23
Swent: Okay.
- 7-00:33:27
Kirshenbaum: The main thing Hugh Matheson and Cole McFarland wanted me to become immersed in when I came to Placer was a coal property in Alaska. Not the one Placer had mined—that was Evan Jones, which was not far from the rail line that brought coal to Anchorage—but the Beluga property that actually had been looked at first by Utah. I believe Utah didn't spend much time with it, and I think Wes Bourret was involved. Yes, I remember getting a call from Wes not long after I started, and he came over to my house. He may have been a little concerned that he might be blamed for overlooking something.
- 7-00:34:43
Swent: This was a very interesting property for logistical reasons. And for coal quality, it had the lowest sulfur content of any coal that I had ever seen in any statistics until fairly recently.
- 7-00:35:04
Swent: That's, of course, what you want.
- 7-00:35:09
Kirshenbaum: Exactly.
- 7-00:35:10
Swent: Low sulfur.
- 7-00:35:13
Kirshenbaum: Especially in recent times, when environmental concerns have become so important. The other thing, as I mentioned, was the logistics. The Beluga coal property was only roughly twenty miles from tidewater, deep tidewater, on Cook Inlet. Placer had spoken to the Japanese about this before I came. The real concern was how to transport it, presumably to Japan—or anywhere else. This was steam coal, and most coal that had been exported had been metallurgical coal.

7-00:36:01

Swent: The Japanese were the big buyers at that time, weren't they?

7-00:36:03

Kirshenbaum: They would be. Beluga is sub-bituminous coal, not high-BTU coal. It is typically about 8,000 BTUs per pound, which is not very high. It's actually very similar to coal of the same type, sub-bituminous coal that's found in Hokkaido and mined by the Japanese.

7-00:36:44

The Japanese at one point had been self-sufficient in coal, and they were still mining coal until recently, but I believe almost all their coal has been mined out. And I believe some of that was subsidized. They had some higher-grade coal that was mined by Mitsui, I believe off Kyushu and under the sea. But the Japanese, of course, with their industrialization, have gone through their domestic fuel supplies pretty quickly and import just about everything.

7-00:37:27

Placer had signed an agreement with a Japanese trading company, Nissho-Iwai—one of the many trading companies that imports everything into Japan, including minerals. There was joint funding of some work at SRI International, the old Stanford Research Institute in Menlo Park, to look at a process to upgrade this coal. By upgrading, I don't mean removing the ash, which is the most common means of upgrading coal—and that's usually a gravity separation—but to upgrade it by removing some of its moisture.

7-00:38:32

This coal has a moisture of about 20 percent, a so-called inherent moisture that is not liquid water but water bound up in the coal, like water of crystallization found in quite a few minerals. Drying could be done thermally, but there's obviously a cost involved, and new techniques to do this often turn out to be technically feasible but not economically realistic.

7-00:39:17

This was shortly after the OPEC [Organization of Petroleum Exporting Countries] oil embargo, when there was world-wide concern about fuel supplies, although I don't think oil, per se, was embargoed from Japan at that time by OPEC.

7-00:39:51

But one could have anticipated that, with oil prices going up drastically—double or triple or more—that coal would follow, at least the cost of coal on a BTU basis. So a lot of things looked like they might be feasible or at least potentially feasible. You will recall, of course, what happened with oil shale.

7-00:40:24

Swent: That's right, yes.

7-00:40:28

Kirshenbaum: I know hundreds of millions of dollars, if not many billions, were spent, once again, to investigate that. It was really interesting to me, on trips I made over to Cortez—and I always went through Elko—to learn that during World War I, shale oil was produced in Elko County.

7-00:40:59

Swent: Really!

7-00:41:01

Kirshenbaum: There were two operations, one of them owned by the Southern Pacific Company. They actually continued after World War I. I think there are some remnants of one of the old plants there.

7-00:41:15

Swent: Near Elko.

7-00:41:17

Kirshenbaum: Near Elko.

7-00:41:19

Swent: Wow.

7-00:41:23

Kirshenbaum: Oral history is always fascinating.

7-00:41:26

Swent: [laughs]

7-00:41:29

Kirshenbaum: But except for one project of Union Oil in Colorado that had a big government subsidy to produce jet fuel, as you know, the shale oil or oil shale projects just came to naught, once again.

7-00:41:52

Swent: That's right, yes. What happened to your project, to this one, then? This was Beluga.

7-00:42:00

Kirshenbaum: I worked on Beluga the duration of my time at Placer—which was twenty-three years—although not always full time. I saw many of these types of projects—one could say elusive projects. We met with the Japanese – Nissho-Iwai and the power companies— here and in Japan during this long period of time. We looked at various processes and fuels, including coal and oil, that some plants could use in oil-burning power plants. And when coking coal, used in steel making, became expensive, the Japanese developed a system for producing steel that was very expedient. They injected oil along with non-coking

coal into their blast furnaces and greatly reduced their steel production costs. Then, when things reversed and oil became expensive, not the steel mills but the oil-burning power plants wanted to see if they could replace some of their oil with coal.

7-00:44:05

There were projects in this country for coal-oil slurry fuels. I went to quite a few meetings, mainly in Detroit, of a General Motors [Corporation] program—not for automobiles but for their plants in Michigan—seeking to replace oil with coal-oil slurries. ERDA, the Energy Research and Development Administration, which not long after was put by [President James Earl “Jimmy”] Carter into the Department of Energy, was a party involved in these efforts.

7-00:44:49

A number of utilities were represented at these meetings, including some out of Canada. I think Nova Scotia was one of the most active and actually had a couple of units converted to use coal-oil slurries.

7-00:45:13

Then we had 1979 and the trouble in Iran, and oil took another hike, a big hike. We thought, well, it might be Beluga’s time, finally. I was contacted by a chemical engineer with an M.I.T. background and lots of experience. He had done a lot of consulting on methanol and similar chemicals for major companies – a man named Charles Stokes.

7-00:46:07

Swent:

A good name. [laughs]

7-00:46:12

Kirshenbaum:

Yes. He was based in Naples, Florida and was a real whiz, with contacts all over the world. I put him in touch with Cole McFarland, and he came out to see Cole and our president, Alan Horton. They were very impressed with him. We engaged him to put together what we called the Beluga Methanol Project. We soon came up with a number of companies including engineering firms. Stokes had correctly anticipated that an independent government organization—not part of DOE— would be formed. This was the Synthetic Fuels Corporation, or SFC. They were established to get things going and provide grants to companies that would produce synthetic fuels. Ours would have been one of the few projects to make methanol out of coal.

7-00:47:36

Swent:

Were you actually mining coal any of this time?

7-00:47:44

Kirshenbaum:

No. We had some samples, which were achieved at considerable cost. Actually, my background in transportation came in handy even for the samples because we took them out with some of the jumbo bags that I

thought could be used for shipping high-grade, high-value materials. Well, of course, these samples were indeed high cost by the time they were barged out. Meanwhile, I was engaged with test work on our coal, being done by Babcock & Wilcox and Combustion Engineering, from the fuel utilization side. So I got a very good education, or supplemented my education, in fuel minerals with these kinds of activities.

7-00:48:44

And then we did get a grant from the SynFuels Corporation for our project, which made us quite happy. I spent a good bit of time looking at markets. In fact, we had to do this before we got the grant because we didn't want to have an orphan fuel that couldn't be used anywhere. I was talking primarily to utilities on the West Coast. Southern California Edison was extremely interested in methanol, even before I contacted them, because of their environmental situation in the Los Angeles basin. Their concern was not sulfur but nitrogen. NO_x [nitrogen oxide] is a problem because of ozone formation, and they were under the gun to reduce nitrogen oxides. Methanol combustion has emissions low in NO_x.

7-00:49:53

Of course, in the same area, I called on the Los Angeles Department of Water and Power, which provides electricity to all of the City of Los Angeles. And I talked to San Diego Gas & Electric, and then locally here with PG&E [Pacific Gas and Electric Company], which was also interested. They have large units at their coastal plant at Moss Landing which were actually built to burn coal.

7-00:50:56

Another feature at Moss Landing is that PG&E has a delivery system so that tankers don't moor alongside the power plant. Pipelines extend out to an offshore buoy, which receives oil or, conceivably, methanol or a slurry. The buoy delivery system was installed by IMODCO, a firm I had known from Marcona as it had put in a buoy system in New Zealand for Marcona to load slurries of iron ore sand. I think that should be added to my section on Marcona.

7-00:52:01

I also spoke with Puget Sound Power & Light in Washington state and utilities in Portland. Another major market for methanol I investigated was for automotive fuel. That actually has come along in recent years.

7-00:52:23

Swent:

You hear about it now, yes.

7-00:52:27

Kirshenbaum:

The state, especially under Jerry Brown, the California Energy Commission, was really committed to make that go, to encourage use

of methanol in automobiles. I recall that the Bank of America, which had a large fleet, was very much interested, and I believe may even have equipped some of its fleet to use methanol fuel.

[End of interview]

Interview 4: February 24, 2003

[Audio file 8]

8-00:01:11

Swent: We have a few little things to pick up from last time. There was one thing that you thought you wanted to mention about Marcona. We'd actually moved on to Placer, but you wanted to bring in one more thing about Marcona, which we can put in here.

8-00:01:35

Kirshenbaum: Yes. Marcona was, as I've mentioned, an interesting company. It was unique in what it did, but in another respect, I think it had a unique character about it. It was a company that had not only a great deal of revenue from shipping and its mining operations but the profits were, I believe, not touched by the U.S. taxes. And the reason for this is that the mining operations essentially were operated at close to marginal financial results.

8-00:02:47

The Peruvians always thought that the transfer price wasn't high enough for the iron ore, and, of course, if they had made a profit on the mining, there would have been Peruvian taxes to pay. But Marcona had a sales organization that I believe was domiciled, at least nominally, in Luxembourg, and the sales were all made off shore. The reason for doing this, of course, was for tax reasons.

8-00:03:25

The ships, themselves—I think each one of them, because they got to be quite large—had its own corporation, and they had their domicile in Panama. The only real assets that Marcona had in the United States, to the best of my knowledge, was probably the furniture that was on the twenty-fifth floor of One Maritime Plaza here in San Francisco.

8-00:03:58

So one might say that in some respects, the company was a bit untouchable, and I think this ties in with some of the things that I had mentioned before and the comment that we found was in the Cyprus proxy statement about it being difficult to verify some of the financial numbers.

8-00:04:26

Swent: So the profits went into Utah and Cyprus.

8-00:04:32

Kirshenbaum: Yes. I believe I mentioned that each of those companies had a 46 percent interest, and the other 8 percent was held by Allen Christensen.

- 8-00:04:50
Swent: Himself.
- 8-00:04:53
Kirshenbaum: Yes, himself.
- 8-00:04:57
Swent: Interesting. Of course, there's been a lot of commotion just this last year about—
- 8-00:05:02
Kirshenbaum: Offshore.
- 8-00:05:03
Swent: —companies doing offshore things, but it wasn't so new then, was it?
- 8-00:05:06
Kirshenbaum: No, I guess it's gone on for a long time. Of course, there have been some very egregious examples—
- 8-00:05:16
Swent: Well, ships have always, or practically always, been registered in places like Liberia and Panama.
- 8-00:05:23
Kirshenbaum: Right, and it's not only for tax reasons but it's also because of—well, if you have a U.S.-flagged ship, that ship must have been built in the United States in a U.S. yard, and also it requires manning by a U.S. crew. The result of that is that the U.S. shipping industry has really been decimated, as is true for many other countries. There's an expression, "the flags of convenience," which goes way, way back.
- 8-00:06:06
There's one thing that the U.S. government did to try to maintain some U.S.-flagged ships. Maybe there are a few things, but one of them was to pass the Jones Act so that between U.S. ports, cargoes had to be carried and also passengers had to be carried in U.S.-flagged vessels. I believe that there have been subsidies from the Maritime Administration. Part of this is for defense reasons, to make sure the U.S. had ships that would be available in case of wartime emergencies.
- 8-00:06:48
So I guess that probably takes care of that Marcona.
- 8-00:07:01
Swent: All right. Well, very good. Then, moving on to Placer, there were some things there that we still needed to talk about. Did we touch on the environmentally safe lixivants for gold extraction?
- 8-00:07:25
Kirshenbaum: I don't recall whether we got into much detail.

8-00:07:26

Swent: I don't think we had.

8-00:07:33

Kirshenbaum: The gold industry has been under the gun, so to speak, with increased attention to environmental problems because, although they have gotten away from mercury almost completely in the last few decades, cyanide, of course, has a bad reputation because of its toxicity. Cyanide started to come in in the 1890s, and it's a very efficient lixiviant for gold and silver. It also will dissolve other metals—I think we've mentioned this—such as copper.

8-00:08:20

But having an awareness, of course, of the increased concern in the United States and other places, and, of course, there have been some incidents in foreign countries, especially, with spills and cyanide tailings having collapsed and gone into streams—

8-00:08:56

Swent: That is, the impoundment collapsed.

8-00:08:59

Kirshenbaum: Right.

8-00:09:02

Swent: Where are you thinking of in particular?

8-00:09:06

Kirshenbaum: There was a big one in Guyana. I've forgotten the name of the company. There was one in Spain, and, of course, the infamous Summitville in Colorado. And then I guess it was the year before last, there were a couple of them in Romania that got into the Danube. There was an Australian company that was doing that. It had some unfortunate results in the Danube River system.

8-00:09:58

Swent: But cyanide does biodegrade, doesn't it?

8-00:10:03

Kirshenbaum: Eventually it will. Its degradation can be speeded up, but usually these tailings—. Nothing is done to hasten that demise of the cyanide, so it can hang around. You're probably familiar with the Homestake patents that I think were eventually donated to the South Dakota School of Mines, but that biological degradation of cyanide—. Of course, cyanide is just carbon and nitrogen, so when it decomposes, it decomposes into materials that are innocuous.

8-00:11:20

Swent: You were doing research.

- 8-00:11:22
Kirshenbaum: Yes, partly perhaps because of my familiarity with historical metallurgy, but it seemed to me that there could well be some opportunities to look at some older processes and see if, maybe with the passage of time, they might have some relevance. Actually, that reminds me, maybe we could turn that off, because I want to—I think I can locate it quite fast.
- 8-00:11:58
Swent: That's okay. Don't bother.
- 8-00:12:06
Kirshenbaum: This is Dorr & Bosqui. But there's a statement—
- 8-00:12:15
Swent: How is Bosqui spelled? B-o-s-k—
- 8-00:12:22
Kirshenbaum: -q-u-i. Let me read this to you first: "A. J. Clark..."
- 8-00:12:28
Swent: Alan J. Clark? I know him well.
- 8-00:12:30
Kirshenbaum: Is that the person—
- 8-00:12:32
Swent: He was the chief metallurgist.
- 8-00:12:35
Kirshenbaum: Is he the person who interviewed your father?
- 8-00:12:38
Swent: Yes.
- 8-00:12:39
Kirshenbaum: Yes, okay. So I just want to read this—
- 8-00:12:42
Swent: He was my father's predecessor.
- 8-00:12:45
Kirshenbaum: Because you told me about how your father came out there with the Sigma Xi pin and so forth.
- 8-00:12:50
Swent: He was a Columbia [University] graduate, Clark was.
- 8-00:12:52
Kirshenbaum: Yes.

8-00:12:52

Kirshenbaum: [Reads]: “A. J. Clark, metallurgist of the Homestake Mining Company for thirty years, once made the significant remark that ‘every process, no matter to what extent it might be regarded as impractical, should be reviewed every five years, with the thought in mind that improvements in equipment and techniques might possibly justify its revival as a working scheme.’” Doesn’t that make good sense?

8-00:13:24

Swent: Yes, it does. Every five years.

8-00:13:26

Kirshenbaum: Yes, but how often do we do that?

8-00:13:29

Swent: No.

8-00:13:31

Kirshenbaum: But I just happened to think of that and fortunately was able to—yes, I’ve copied that and sent it to people.

8-00:13:47

Swent: Good idea. Nothing ever goes completely out.

8-00:14:00

Kirshenbaum: So how do we get back? I thought it might take me a few minutes to find that, but—

8-00:14:05

Swent: No, you got it immediately. So this was your philosophy.

8-00:14:06

Kirshenbaum: Are we back on?

8-00:14:09

Swent: Yes.

8-00:14:14

Kirshenbaum: Oh.

8-00:14:15

Swent: So this was your philosophy, then, at Placer, to look at old—

8-00:14:17

Kirshenbaum: Did you pick up this—

8-00:14:19

Swent: Yes.

8-00:14:20

Kirshenbaum: Oh, okay. I don’t have to repeat it, then.

8-00:14:20

Swent: No.

8-00:14:22

Kirshenbaum: Okay. So knowing that chlorination processes and other halide types of extraction had been used in the nineteenth century on gold ores, it seemed to me that it might behoove us to have another look at some of these older processes. Chlorination was quite successfully used all over the world and in the western U.S., but it occurred to me that there were some major differences between chlorination in the old days and the kind of chlorination that could be practiced these days.

8-00:15:16

In the old days, they generated chlorine on site at these remote mines, which meant hauling in tonnages of salt, sodium chloride, plus sulfuric acid and probably an oxidizer such as potassium permanganate to react with and oxidize chloride. The sulfuric acid obviously was a nuisance to ship. Many of these things probably had to come by pack train to remote locations. Dealing with acids and so forth and chlorine and materials that the people at that time had available to contain corrosive materials was obviously a problem.

8-00:16:15

Today, chlorine can be shipped in rail tank cars or in trucks, in tanks. Actually, a couple of the mines in Nevada have used chlorine not to dissolve the gold but actually to process refractory gold ores, which are not amenable to conventional cyanidation. Tanks of chlorine do indeed come into places such as Carlin, and they're trucked up from there—come in by rail, and then the chlorine is trucked up to some of these large mines. Newmont at Carlin was one of the early users of chlorine for handling these refractory ores, and Freeport also had a process that was similar.

8-00:17:28

It seemed to me that perhaps chlorine or, even better yet, bromine might have some advantages that we should look at. Bromine had been looked at, I found, back in the 1860s or 1870s, and at that time, there were no antitrust laws. It turns out that the bromine, I believe, came all from one company; even though it had some advantages metallurgically, there was great reluctance to tie one's facility for extracting gold to a single supplier of reagents.

8-00:18:22

So I think that's probably the reason why bromine never made much headway, even though there were a couple of mills in Colorado and I think one in South Dakota that operated on bromine for—

8-00:18:36

Swent: Where did the bromine come from?

- 8-00:18:43
Kirshenbaum: I think Dow Chemical was the U.S. supplier, and Dow had an agreement with a German company. I think they had a geographical agreement that certain parts of the U.S. would be supplied by Dow, and the other parts would be supplied by the German company. So under those circumstances, there could not be competition.
- 8-00:19:09
Swent: No. I think of bromine as being in the sea, a sea salt.
- 8-00:19:12
Kirshenbaum: Yes. Well, I think that probably is the origin of some of those salts. I think it was actually near Midland that Dow had some—there's a lot of salt there, and I guess there were some brines that had a higher elevation or concentration of bromine than other places. Another place that one finds bromine is in Arkansas. In the last hundred-plus years, there have been more companies—and, of course, the passage of antitrust legislation.
- 8-00:19:54
Ethyl Corporation was a company that I—well, I visited Ethyl because they were producing bromine, and they had a potential interest in seeing bromine used as a reagent. I think there were three main companies in the U.S.: Dow, Ethyl, and the other one was Great Lakes Chemical, which was headquartered in Indiana.
- 8-00:20:27
But at some point, I became aware that one company that was a producer and had a keen interest in all this was the Dead Sea Works, an Israeli company. I think now it's called Israeli Chemicals. Their source was the Dead Sea. They produce—
- 8-00:21:03
Swent: When was this, though, that you were doing that?
- 8-00:21:09
Kirshenbaum: This was in the early nineties. The test results looked intriguing. I guess Placer was unwilling or reluctant to pursue it on its own, so we formed a group with a couple of other companies. Newmont was one, and we had meetings with Freeport and I believe Goldfields. It's a little fuzzy now because I haven't thought about this particular area for some time.
- 8-00:21:55
Swent: Let's see, Newmont was American; Freeport was American; Goldfields was English.
- 8-00:22:05
Kirshenbaum: Well, it was, but it was Goldfields of the U.S., which had their headquarters in Denver. What we were trying to do—we saw that the

potential was there, but to reduce the cost of the reagent, we wanted to recycle the bromine. There was some technology that would have enabled this to have been done electrolytically. My recollection is that we were waiting for that technology to be perfected.

8-00:23:13

But I guess the participants sort of—well, Newmont started to look at other systems. I think we may have mentioned this earlier, the augment system. That's the one I mentioned with Ken Brunk and Mark LeVier, with cyanide but cyanide that could recover copper, and that cyanide would have been recycled. So I think the recycling was the thing that made Newmont—at least the potential for recycling—made them less interested in an alternative process such as bromine.

8-00:24:04

But that was probably the area that seemed to me to have some interest. Brent Hiske of the University of Arizona, Department of Metallurgy, was also interested in halides. He favored iodine, which was much more expensive than bromine. In fact, his work was on in situ leaching with iodine. I just thought that would not bode well economically because of its cost in an in situ operation, where you wouldn't be able to be assured of recovery of the iodine from underground.

8-00:25:07

Swent:

They were doing quite a lot of experimenting in Arizona with that, weren't they?

8-00:25:18

Kirshenbaum:

In situ leaching, you're right. Asarco and, I believe, Freeport had a—or maybe it was just Asarco—had a joint venture with the Bureau of Mines for a copper deposit near Casa Grande. That deposit, it always seemed to me, was an obvious target, but they wanted to run a trial or a test there that they could extrapolate to other copper deposits. But the mineral was atacamite, which is a soluble mineral in the first place.

8-00:26:01

With very few exceptions, among them being a couple of places in Chile and this one deposit—and I don't remember its name right now. But it seemed to me that you couldn't generalize on the basis of something that was started under what to me would be very favorable conditions.

8-00:26:32

Swent:

Atacamite sounds like it's from Chile.

8-00:26:38

Kirshenbaum:

Right, the Atacama Desert.

8-00:26:43

Swent: So that didn't go anywhere, then? Or where did it go?

8-00:26:56

Kirshenbaum: It went on for quite a long time, and I think it may have—I don't want to say it came to grief for one reason, but I know they had a lot of problems trying to assure the farmers in that area that their water, which was obtained from the aquifers, would not be contaminated.

8-00:27:17

Swent: Right. What about your research? Were you working with the university on this?

8-00:27:20

Kirshenbaum: No. We had some support from the Israeli company, because they saw an opportunity here to do something with bromine. Bromine, itself, had some concern for people because—well, chlorine itself, as a gas, can asphyxiate and is toxic. Bromine also is—all these halides can cause some problems, but one designs a system so that it can operate safely. Actually, you can find bromine is used in foodstuffs. It all depends what compound you're looking at. And this is something that I often tell people.

8-00:28:46

I don't think we've discussed this before, but, for example, mercury—. Cinnabar is a very, very safe substance at room temperature. It's the most stable sulfide there is, mercuric sulfide. But if you put it in a retort at high temperature and oxidize the sulfur in the sulfide, you drive off the mercury into a vapor, of course, and that's condensed, and metallic mercury, liquid mercury—obviously, at high temperature, mercury in the air is a matter of concern. But the liquid mercury, itself, has a vapor pressure, so you don't want it around. If it spills on a floor or on a desktop, it is not a safe material, unless it's enclosed in glass, such as it is in thermometers and instruments.

8-00:29:50

And then there's another species of mercury. Of course, there are many, many mercury compounds, but I'm just going to point out something, as a generalization. There is methyl mercury, which is extremely toxic, one of the most dangerous substances known. Its existence wasn't even known until a couple of decades ago. This form of mercury is created when mercury in water, for example in a lake, is acted upon by microbes and it is methylated by these microbes and gets into the food chain.

8-00:30:42

Swent: That's how it gets into the fish?

8-00:30:44

Kirshenbaum: Exactly. Well, mercury, itself, can't get into the fish, but this is one way. Fish eat some of the plants that have the mercury. Methyl mercury is a soluble material that you don't want to have in your water. The USGS [U.S. Geological Survey] is doing studies of the [San Francisco] Bay because of the mercury that has been washing down, not so much from the old mercury deposits—because that mercury was originally cinnabar, which is insoluble—but the mercury that was used in amalgamation operations in the Mother Lode, and goes out into the tailings. Over the years, that metallic amalgam, metallic mercury eventually can wash down the rivers and into the Bay.

8-00:31:54

Swent: So that's what's causing the problem.

8-00:31:58

Kirshenbaum: Yes. Now, I think there has been some mercury also from New Almaden, which is not too far from the Bay, the Guadalupe River watershed. But the point I would make is that whether you were talking about mercury or were talking about bromine or chlorine, it is extremely important to be specific as to which compound we're talking about. Bromine is used in pesticides, and I think the state—if not the EPA [Environmental Protection Agency]—is mandating that some of these very toxic pesticides will not be used in California agriculture. I don't remember what the cutoff date is, but I believe they're still being used.

8-00:33:02

But, again, we can go from seeing bromine being used in, I think, carbonated beverages. One can sometimes see brominated beverages. Or I think there are bromides that are medicines, aren't there, that you take? I forgot the commercial name.

8-00:33:34

Swent: I think you're right. So where were you doing this research? Where was it being done?

8-00:33:43

Kirshenbaum: Dead Sea Works. We sent some samples over to Israel, and they did some work, and then we were going to engage one of the labs so that we would be able to oversee it better. We were going to pursue this in one of the labs in Golden or Denver, Colorado, area.

8-00:34:14

Swent: You were sending samples from mines that Placer had.

8-00:34:18

Kirshenbaum: Right, right. And I forgot whether the other companies that we had contacted had submitted any samples, but we agreed that we would share the information.

8-00:34:31

Swent: What came of that?

8-00:34:36

Kirshenbaum: Before we put anything together, we wanted to make sure that the equipment was available for recycling the bromine, this electrochemical process to rejuvenate the bromine that would be not used up but would be oxidized in the process. We were not able to come up with that part of the process. That would have been important, of course, for the economics, even though it's quite possible—I mean, sodium bromide, which would be the raw material, is quite an inexpensive substance. It's somewhat analogous to sodium chloride, which, of course, is just a few dollars a ton.

8-00:35:46

Swent: Did you investigate any other old processes?

8-00:35:51

Kirshenbaum: I remember, at one point, cyanide became very expensive. I think there were a couple of reasons, the main one being that the gold industry had boomed quite a bit, and there was a demand for cyanide. The few companies that were manufacturing it—. At that time, I think it was probably exclusively DuPont in this country, but there was some foreign competition from Europe, both from England and from Germany. They, of course, were able to sell in this country, and did. But there just wasn't enough, so the price of cyanide just—I think it perhaps even doubled in a short time before any companies could get new plants built, which DuPont did, and other companies came along.

8-00:37:07

But I remember hearing—having phone calls—and other people in the company had heard that a couple of firms down in Arizona had come up with what they claimed was a new process to recycle cyanide. So instead of letting it go out with the tailings, you would essentially acidify the cyanide after it had been used, and the hydrogen cyanide gas would be collected and then converted back into the form where it could be used for leaching the ore all over again.

8-00:37:58

Well, I recalled, as I say, that the cyanide process came in in the 1890s in a pretty big way, and already in some old books I had, from the very early 1900s—I think it was 1902 or 1903—published by the Mining and Scientific Press here in San Francisco, this whole process was

described in more than adequate detail for anyone to copy without paying the so-called inventor.

8-00:38:41

I remember we disposed of that. There was some interest within the company to recycle, but then these new plants did come in, and the price of cyanide returned to its more normal price.

8-00:39:05

Swent: It was just an economic incentive, then. It wasn't environmental.

8-00:39:09

Kirshenbaum: It wasn't a technical benefit, no. That's correct.

8-00:39:18

Swent: There really aren't that many variations on the theme, are there?

8-00:39:24

Kirshenbaum: There aren't.

8-00:39:27

Swent: There are not that many ways to get gold.

8-00:39:30

Kirshenbaum: No. Something that I started wondering about—and this was not, by any means, historical, unless maybe historical geology—was, there had been some people in recent years who thought that there might be some connections between the biological systems and gold deposition. I found that extremely fascinating.

8-00:40:06

There was one person in our exploration department over in Reno, Vic Chevillon, who had a very open mind and had a very good background in thermodynamics and chemistry. I discussed this with him, and I said that in my opinion, ore deposition was essentially the mirror image of extractive metallurgy. In one case, you're depositing minerals, and in metallurgy you're taking them apart.

8-00:40:59

I think that analogy appealed to Vic. We thought that both metallurgically and perhaps geologically, the company might have something to be gained from pursuing some of these thoughts, so we both did a good bit of literature research and came up with some names of people that were doing work in this area, more, certainly from the geological—in fact, it was all geological; the metallurgists hadn't started to think about it yet, I guess.

8-00:41:43

The centers of this work were in on Ontario, at the University of Toronto and at Guelph University. There were a couple of people from

those universities who had come into the U.S. One was at the University of Northern Arizona.

8-00:42:16

Swent: Flagstaff?

8-00:42:19

Kirshenbaum: Flagstaff. I think that's the name of the university there. I think his name was Gordon Southworth. They had come up with some very interesting papers on how these ore bodies might have been deposited with some of these biological species. Essentially, what they were doing was finding or presumably finding that gold could be concentrated if some of these biological systems would pass over the gold and dissolve it and then, as is true in other kinds of ore deposition mechanisms, the gold is deposited in one place, in a much higher concentration.

8-00:43:32

Swent: Would these be, like, little animals that digest it? Was this the thought? Or ants, I guess.

8-00:43:42

Kirshenbaum: We got into that later—and I'll talk about that shortly—but it's really some of the compounds that these biological systems make that are the things that solubilize the gold and carry the gold in a complex. Cyanide, itself, is a complex, gold cyanide. It's a very, very simple one. It's simply Au-C-N, with the appropriate number of atoms and ions. These others tend to be much more complex, which is the reason that, no doubt, some of this work has taken a long time for people to catch onto.

8-00:44:37

But this work is continuing today, from the deposition point of view. I found one research group in Bozeman, Montana, where they were starting to have a look at how this might be done for the opposite; in other words, metallurgically process some of these ore bodies with—well, bioleach is the word that is often used by people, but it doesn't really describe things very well.

8-00:45:25

The bioleach systems that have started to be used are systems where the sulfide ores is dissolved by bacteria, but the gold, itself, is just made available for things like cyanide. So you're not really leaching with biological systems, you're attacking the host mineral and, as I say, making it available for the conventional reagent to dissolve.

8-00:46:12

But I mentioned a minute ago that I would talk a little bit more about the role of organisms. This gets into a very, very interesting area that I

was pursuing at the time that I left the company and the office was closed. I continued to do it on a consulting basis, along with Vic, who maintained his interest in this whole work.

8-00:47:01

We had, as I mentioned, talked to a number of universities where some of this work was going on, but the one that seemed most appropriate that we came across was the University of Washington. To make a long story short, we engaged—and I think this is amazing, considering where we're coming from—we engaged a professor of genetics in the Department of Medicine—

8-00:47:38

Swent: For heaven's sake!

8-00:47:40

Kirshenbaum: —who had done some work actually in the Puget Sound area, in remediating some spills of heavy metals and also some oil spills in Puget Sound. But the work that he was doing, and our conversations with him, made it evident that there might be some opportunities for us, quite possibly metallurgically. But the first thing that came up was that Vic had an idea that this might yield a good detector for gold, because the sensitivity of these biological systems is really incredible. As you can picture, we're at the far ends of science here.

8-00:48:48

Swent: Yes.

8-00:48:51

Kirshenbaum: So it turned out that my son Kent, who was at that time a Ph.D. candidate at UCSF and had worked a couple of summers—I think, three summers—for Placer, knew the jargon and so forth of the mining industry, and he could interpret the jargon for us that Professor Furlong and the people that we engaged and supported on this research contract at the University of Washington used.

8-00:49:31

This, I guess, took about a year or two.

8-00:49:35

Swent: Were you doing this for Placer?

8-00:49:39

Kirshenbaum: For Placer, right. We had a contract. Placer Dome. I guess it was really via Vancouver, the parent company. But Vic and I were the main people involved with their research there in Seattle. We have submitted, and I believe it's been accepted, a patent application for a gold sensor. The advantage is that you wouldn't have to take samples and send them back to a lab and then go back to the original site for more samples or something. Because of the sensitivity, you would be

able to have an online response with a very small amount of these materials.

8-00:50:45

Swent: How ever did you locate Professor Furlong?

8-00:50:50

Kirshenbaum: I had heard that there was going to be a seminar or I think a meeting at the university, and some of the subjects to be discussed were these heavy metals: detection and recovery, remediation. I mentioned this to Vic, and we both thought it was a good place to maybe find some people. We actually met some other people at this meeting. Prof. Furlong gave a paper there. But we decided that his was the technology that we should go and run with.

8-00:51:36

Swent: So this is still ongoing.

8-00:51:38

Kirshenbaum: Right, right.

8-00:51:39

Swent: Exciting.

8-00:51:42

Kirshenbaum: We think it may have some metallurgical implications, too, but those haven't gone as far.

8-00:51:51

Swent: Do you think this is better than dowsing?

8-00:51:56

Kirshenbaum: Well, it's not as entertaining. [both chuckle] I think some of the work I did at Placer that did not involve universities was more valuable for alerting people within the company. They would pass on to me—oh, sometimes they were obvious scams, or almost obvious, but I could smell some of these scams pretty far away. Often, they'd be repeated, the same people. I became accustomed to some of these people who would have these far-fetched things. Of course, people are familiar with gold mines or gold deposits that don't have any gold in them, but very often, I think, people are less familiar with so-called metallurgical innovations that are supposed to get gold out of ores that "couldn't be assayed by conventional means."

8-00:53:30

I really enjoyed some of these things. I accompanied a couple of our geologists on some of their meetings. They wanted to have a look at some of these things that they thought sounded very, very good. But I was often suspicious in the first place, and sometimes those suspicions were borne out.

8-00:54:04

I remember often these deposits were in an area of Clark County and adjacent areas in southern Nevada, where there were opportunities to find some gullible people who had come into Las Vegas and, instead of losing their money maybe in the casinos, they could invest in some of these land schemes.

8-00:54:35

And then, I guess, something as a hobby, I started collecting some of these—not only the literature that people would publish to try to convince potential investors and even potential companies to purchase, but they would market, oh, exploration techniques. For example, dowsing, as you mentioned. But instead of hiring a dowser to go far away and pay all his travel expenses, some of these people would teach you how to do map dowsing.

8-00:55:28

Swent: Oh!

8-00:55:29

Kirshenbaum: And that I thought was a real kick.

8-00:55:36

Swent: Just go over the map.

8-00:55:37

Kirshenbaum: Exactly, with the appropriate instrument. I always used to wonder, well, if you do this over a map of the world that is an 8-1/2 x 11 piece of paper, you probably could come up with some pretty good deposits. I always thought, what scale of map should you be using?

8-00:56:04

Swent: [chuckles]

8-00:56:08

Kirshenbaum: Here's someone who came up with a dowsing instrument called the "Sapphire S-X 500." With that piece of sophisticated machinery—well, actually, I shouldn't call it machinery; I'd call it a device, because I don't think there were any moving parts. But they claim that you could find currency.

8-00:56:42

Swent: Oh, wow!

8-00:56:50

Kirshenbaum: And some of their literature described all their claims of how people were able to do that. I always used to wonder if that was only good for silver certificates or for paper currency that wasn't backed by gold, and what country's currency it was sensitive to.

8-00:57:12

Swent: There must be enough gullible people out there to make these things profitable.

8-00:57:20

Kirshenbaum: Yes, and they'll sell anything. I remember there was one person who would sell equipment out of Tennessee, and his card read, "Teleradiesthesiologist." It was remote sensing. I think I even have his card somewhere here. Oh, yes. Yes, here it is.

8-00:58:07

Swent: "Teleradiesthesiologist." He has an M.A. degree. "Books, dowsing instruments, and map dowsing. Johnson City, Tennessee. Fred Stewart, M.A." Well...

8-00:58:27

Kirshenbaum: Some of his brochures are part of my collection, which I'd like to see someday—. I remember talking to the librarian at the Colorado School of Mines. He agreed that—

8-00:58:45

Swent: It's of genuine interest.

8-00:58:47

Kirshenbaum: It should be of interest. I mean, you'd want to maybe separate it from some of the other things they have there, but, as I say, I know I have saved some people a lot of time and trouble by spotting these things. I think it's good that—

8-00:59:08

Swent: Now, you gave a little presentation at the Mining History meeting, and some people got really angry.

8-00:59:15

Kirshenbaum: Well, I was having some fun. I think the people who knew me knew that it was tongue in cheek.

8-00:59:28

Swent: I was fooled briefly, and I began to realize it was just for fun, but you certainly—

8-00:59:36

Kirshenbaum: I even had some audience participation, from a friend, Bill Wahl, whom you might say was a skill!

8-00:59:41

Swent: You gave a presentation on scams, was what it was.

8-00:59:49

Kirshenbaum: I gave two. One was in Tonopah [Nevada]. I think it had a creative title: *Alluring Strategies in Mineral Exploration & Mine Promotion*.

Although somewhat tongue in cheek, but I think people picked that one up right away, because I went from one scam to another.

8-01:00:07

But the one that I gave last year in Wallace, Idaho, was a realistic promotion of a really bogus scam (sorry for the redundancy) that I found incredible. This concerned a dry lakebed on the California-Nevada border, near Death Valley. They claimed that during the extremely hot summer there, the precious metals-bearing brines beneath the lakebed would be sucked up by the sun's evaporation, and the company would be able to harvest from the surface of the dry lakebed not only gold, but even higher values of the platinum-group metals

8-01:01:20

That actually was a company that had sent a number of copies of a very thick prospectus to Placer Dome, I remember to the president as well as to other people. That's actually how I first heard of that company, because it crossed my desk, and I wrote a report on it. It didn't die there. The company still is—actually, now they have their own web site.

8-01:01:56

Swent: Oh, no!

8-01:01:56

Kirshenbaum: Yes.

8-01:01:57

Swent: So they're staying alive.

8-01:02:58

Kirshenbaum: Yes.

8-01:02:03

Swent: And making money. Good gracious.

8-01:02:06

Kirshenbaum: Making money for someone. It was originally a Canadian company, as is true for many of these juniors. But they have reincorporated in the U.S. now. I guess their stock is on the pink sheets. That's something that I thought I might also mention. There used to be mining exchanges all over: San Francisco, Salt Lake, Spokane, Denver. Those mining exchanges are all extinct now.

8-01:02:56

Swent: Wallace?

8-01:02:59

Kirshenbaum: What?

8-01:03:00

Swent: Didn't Kellogg and Wallace have one up there?

8-01:03:02

Kirshenbaum: Kellogg and Wallace had mining brokerages, but the center of mining finance in the Pacific Northwest was Spokane, where there were many of these junior companies. Many of them were legitimate. I remember one, Lucky Friday, when I was working in the Coeur d'Alenes, and Lucky Friday was a penny stock that got into the dollars, and then Hecla finally took it over when they made a meaningful discovery back there in the fifties.

8-01:03:45

The Vancouver Stock Exchange became infamous for some time, because of the number of scams they had with companies traded on that exchange until they put in some regulation. They became a target of a lot of articles and came under reformation from the financial circles. With reform in Vancouver, the exchange that followed in its footsteps for companies of this character was the Alberta Stock Exchange. That's where this company that I mentioned, with this scam on the lakebed—

8-01:04:30

Swent: Dry lake.

8-01:04:33

Kirshenbaum: Yes. And I believe actually that's where Bre-X was first listed, before it actually became legitimate enough, purportedly legitimate enough to be listed in Toronto and on NASDAQ.

8-01:04:51

Swent: Yes, that's a famous, famous one recently.

8-01:04:54

Kirshenbaum: Yes. And that was a scam that really went places.

8-01:04:59

Swent: Fooled a lot of experts, didn't it?

8-01:05:01

Kirshenbaum: A lot of experts and a lot of companies were really in there, trying in every possible way to be given the nod by the Indonesian government to be the mining partner of the—

8-01:05:21

Swent: Was Placer given a chance at that?

8-01:05:24

Kirshenbaum: Yes, Placer was one of the ones that tried very hard to be one. I remember one company that seemed to have some judicious—how would I put this; some judicious hesitation?—was Newmont. I

remember Mark LeVier telling me that he thought there was something fishy about it, but Barrick and—. Of course, Freeport was the one that finally wound up with the deal. Before very many days had passed, Freeport said their investigations were yielding something that didn't make any sense, and they blew a whistle, and the whole thing came to a screeching halt.

8-01:06:23

Swent:

People actually were killed over it, or died mysteriously.

8-01:06:27

Kirshenbaum:

Yes. Bre-X's chief geologist, a man named Guzmán, a Filipino. Well, all of Bre-X was implicated, of course, but Guzmán and the vice president of exploration were in Toronto at the time that Freeport found that something was wrong. They were in Toronto at the Prospectors and Developers Conference, receiving the Award of the Year. Guzmán was delegated, I guess, by Felderhof. Felderhof was a vice president of exploration. Guzmán was told to go back out there and explain what was going on. So he made a quick trip, a number of hops from Toronto to Indonesia, and the last leg, I guess, was from one of the cities in Borneo, to the mine. This was in a helicopter. He was not to be seen when they landed. He had jumped. The story was that he had purportedly committed suicide. They eventually found a body.

8-01:08:15

I was wondering about this whole thing, myself. I thought maybe someone either pushed him or he was told to commit suicide or something. And then I read in the newspapers that Guzmán had—I guess he was from the southern Philippines, which is [telephone rings] a Muslim area.

8-01:08:40

I'll get this.[tape interruption] Let's see.

8-01:08:51

Swent:

He was from Mindanao, I guess.

8-01:08:56

Kirshenbaum:

Yes. I assumed he was Muslim because I read he had five wives. And I thought, "Gee whiz, maybe this guy isn't dead after all." Maybe he got tired of the five and wanted another five, and he'd probably made a lot of money with the stock—I think all the management people had. So anyway, that was very briefly the story of the very infamous Bre-X.

8-01:09:34

Swent:

Placer did try to get in on it.

8-01:09:37

Kirshenbaum:

Yes, they did.

- 8-01:09:41
Swent: Did you have anything to do with it?
- 8-01:09:43
Kirshenbaum: No, but I observed a few things, such as letters being written about the excellent reputation Placer had. And I think letters were requested from, for example, the governor of Nevada, attesting to Placer's good credentials and so forth.
- 8-01:10:18
Swent: Trying to convince Bre-X that you should have a piece of the action?
- 8-01:10:22
Kirshenbaum: Really, trying to convince the Indonesian authorities, which was the Suharto government, because this whole thing was just loaded with friends and family. They were—
- 8-01:10:37
Swent: They were the ones to decide who were picked to—
- 8-01:10:40
Kirshenbaum: Exactly.
- 8-01:10:42
Swent: I see.
- 8-01:10:46
Kirshenbaum: Yes. And Suharto had—I remember one of his children was given some position. I think it was a type of consulting thing. But I remember reading about the payments that he was given or would be given by the group.
- 8-01:11:13
Swent: Did Placer woo these people in any way? Were they wining and dining the Suhartos?
- 8-01:11:30
Kirshenbaum: No. I'm not sure how much wining and dining there was, but these companies were certainly over in Jakarta, in a very big way. Of course, some of them I guess had gone up at some point to the mine site, and they saw the gold factory. I don't know how else to describe it. They had just an amazing amount of core that they had run through this operation. They had salted the core with some gold that they had purchased, and the values came out very attractively.
- 8-01:12:28
Swent: But you were not ever closely connected with it, yourself.
- 8-01:12:32
Kirshenbaum: No, I was not.

- 8-01:12:34
Swent: Why? Because you were only doing North American processes?
- 8-01:12:38
Kirshenbaum: Largely, but also this was exploration that needed to be confirmed. I think maybe the only people they had out in Indonesia were geologists.
- 8-01:12:43
Swent: Because you did investigate this kind of thing for Placer.
- 8-01:12:44
Kirshenbaum: Yes, that is true.
- 8-01:12:46
Swent: Project development.
- 8-01:12:47
Kirshenbaum: Yes, but I guess the only scams I investigated on site were in the U.S., because of the corporate structure.
- 8-01:12:53
Swent: At that time, were you sort of wishing you were in on the Bre-X section?
- 8-01:12:56
Kirshenbaum: I guess I was. Yes, it would have been a scam to behold. I doubt if anything like that will be repeated for a long time.
- 8-01:12:59
Swent: Not for a while.
- 8-01:13:01
Kirshenbaum: But as we just mentioned a few minutes ago, there still are scams, and I'm sure there always will be.
- [Audio File 9]
9-00:00:40
Kirshenbaum: And besides the mining companies that were shown to be gullible in the early days—at least, gullible enough that they were clambering to get in, to have a position—there were many investment houses, not only Bay Street in Toronto but Wall Street. And even some gold funds, such as the mutual funds that had gold investments. I think that's understandable when the number of ounces—I think they got up to about 75 million ounces that were claimed to have Bre-X. Any gold fund that didn't have an investment in Bre-X, their shareholders would say, "Why are you missing such an obvious bet?"
- 9-00:01:52
And I remember after things had just collapsed, on the Internet I found that, I think at the end, one of the funds—it was a Fidelity fund, the Fidelity Gold Fund, I think—had wound up with 7 percent of Bre-X.

They certainly weren't the only ones. Of course, there have been many lawsuits because...

9-00:02:23

And the question arises as to what responsibility in terms of pursuing information these investment houses should have. I mean, should they hire a geological consultant before they recommend something or not? That's really up for debate. But it doesn't stop them from getting sued, and I think these suits still have a long way to go before the lawsuits are adjudicated.

9-00:03:14

Swent:

You were mentioning your collection of ephemera on scams, which is wonderful, and we haven't mentioned your interest in Rickard.

9-00:03:38

Kirshenbaum:

Yes, Perhaps my interest in mining history comes about through him. My family was well read, and I enjoyed reading books and collecting them. I thought, not long after I was out of school, that it would be interesting to get some old mining books. A couple of the first ones I bought were published by the Mining and Scientific Press, the company which printed the weekly journal of the same name which T.A. Rickard had purchased in 1906. Rickard was its editor and publisher until it was sold in 1922 to the *Engineering and Mining Journal*. The *Mining and Scientific Press* was published every Saturday, and it's a wonderful record of mining history.

9-00:04:50

But the press, itself, published many books. One of my favorites, actually, was one that is called *After Earthquake and Fire*. It was published in 1906, an edition of a thousand. What it has in it are some selected texts from issues of *The Mining & Scientific Press* that appeared following the earthquake of April 1906.

9-00:05:34

Swent:

Was *E&MJ* published then?

9-00:05:41

Kirshenbaum:

No. *E&MJ* took it over in 1922.

9-00:05:48

Rickard is a fascinating person. I've given a number of papers on Rickard, and I have a Rickard collection. Almost all his books, I have. And I have quite a few issues of the journal, itself, that he not only edited but wrote articles for, and many of his articles are worth reading. He had a beautiful way of writing, and he was very, very outspoken.

9-00:06:26

But one thing I like about this book I had just mentioned, and I think it's typical of his clever use of words—. The frontispiece of this book shows Market Street with a few bricks on the pavement here, or on the cobblestones, and some shards of buildings in the background, and buildings that had been probably crumbled by the earthquake as well as destroyed by the fire. But the frontispiece underneath has, as its caption, "Our offices at 330 Market Street, San Francisco."

9-00:07:28

Swent:

Oh, my. Oh, look at that! What a picture! Ah!

9-00:07:40

Kirshenbaum:

There are some articles in here that—well, one is entitled, "The Misuse of Dynamite." Rickard, in sort of a typical disparaging way, comments about the fact that the fire was stopped when they dynamited areas like Van Ness Avenue so the fire wouldn't spread. He says here that, in a city where there were so many mining people around familiar with blasting and the use of dynamite, they should have used some of these people having the expertise.

9-00:08:43

He says, "The foolish doings of the amateur miners." He says that "the superintendent of the mint informs us that he offered to supply the services of experienced men, but the individuals doing the blasting claimed that they understood the use of explosives in demolishing buildings better than any miners."

9-00:10:06

Swent:

How do you happen to have this [loose] picture [of the frontispiece]?

9-00:10:18

Kirshenbaum:

Because of a friend of mine in London who is the secretary of the Institution of Mining and Metallurgy. He wrote me in 1989, thinking it might be interesting for the IMM publication to have something on our Loma Prieta earthquake that had just occurred. This fellow, Michael Jones, has a great sense of humor. I copied the frontispiece for him, and I said—I forgot just what I wrote, but that's why I made that picture.

9-00:10:55

Swent:

It is a wonderful picture. The building is completely gone. But the statue is still there today, isn't it?

9-00:11:07

Kirshenbaum:

It is. One other comment that I think is typical, vintage Rickard, about the misuse of explosives. "It is difficult to persuade a man that he does not understand what he is doing. San Francisco has reason bitterly to rue the misuse of the explosives that, properly employed, have proved so powerful an aid to the advancement of mining."

9-00:11:43

Swent: Well, it did stop the fire.

9-00:11:57

Kirshenbaum: It did, but actually in some other places—one of the things he was complaining about here, I didn't read. But they used too much, and it actually, in some cases, spread burning parts of buildings.

9-00:12:09

Swent: Oh, dear. So it wasn't so good after all.

9-00:12:21

Kirshenbaum: But Rickard went to the Royal School of Mines from a Cornish family that had generations of mining engineers and metallurgists. After graduation from the Royal School of Mines, he came to Colorado. I don't think we've covered Rickard before.

9-00:12:39

Swent: No, we haven't at all.

9-00:12:42

Kirshenbaum: He became the state geologist of Colorado, under two governors, one Republican and one Democrat. Then he had a chance to go to Australia, which he did, and came back to Colorado and ultimately was involved in a bit of a scandal that actually turned out not to be anything like a scam. One of the large mines near Cripple Creek, Colorado, was largely owned by Queen Victoria. He was involved in providing an appraisal of it. There was a lot of dispute over this appraisal. He was taken to task by some of his competition, John Hays Hammond, for example.

9-00:13:45

Rickard decided that he didn't want to stay in a situation where he was going to be vilified, and he had shown by that time that he had a real knack for writing, so he took a position with the *Engineering and Mining Journal* in New York as editor, and it turned out that he was really not a person who could work very well for someone else, so after about three or four years, he had a chance to purchase the Mining and Scientific Press in San Francisco and become editor and publisher.

9-00:14:42

And then in about 1910 or '11, Herbert Hoover and his brother, Theodore, were in London, and they wanted another mining publication to commence publication in London. There already were a couple, the *Mining Journal*, being one of them. But Rickard was induced to go over there, and he started the *Mining Magazine*, which is still published today.

- 9-00:15:21
I might mention that the masthead, the banner of each issue after Rickard started publishing the *Mining and Scientific Press*, in a typical supercilious tone, across the top was: “Science Has no Enemy Save the Ignorant.”
- 9-00:15:45
Swent: [chuckles]
- 9-00:15:47
Kirshenbaum: The *Mining* magazine, published in London, had those same words, except that the words were in Latin. [laughs]
- 9-00:15:59
Swent: Ohh! [laughs]
- 9-00:16:04
Kirshenbaum: Yes, Rickard was quite a supercilious person.
- 9-00:16:08
Swent: So *Mining* magazine was published in London, or in England.
- 9-00:16:12
Kirshenbaum: Right.
- 9-00:16:14
Swent: And he worked there first?
- 9-00:16:15
Kirshenbaum: Well, he took a leave from his activities in publishing in San Francisco to go to London, and then World War I broke out, and meanwhile, the person who was handling matters in San Francisco—I forgot which person that was—he had a number of excellent people providing reports to the *Mining and Scientific Press*, among them Herbert Hoover and, oh, a list of notable people.
- 9-00:16:48
But the publication, itself, suffered from his absence. He intended to stay in Europe—he was a British citizen—until the war was over, but he left about 1915, I guess, returning to San Francisco to manage the *Mining and Scientific Press*.
- 9-00:17:30
So Rickard, I guess, was the center of my early collecting. I found collecting old books on mining to be fascinating.
- 9-00:17:41
Swent: You have a fine collection.

9-00:17:52

Kirshenbaum: Yes, and it's fascinating to—well, as I mentioned a little bit earlier today, pointing out where many things that are purported to be new inventions—sometimes people aren't aware that they existed before. And, of course, the history of mining is far different from the history of something like computer technology because things go out of date immediately in some of these areas of so-called technology.

9-00:18:29

But geology doesn't change, and people are well aware that the best place to find a new ore body often is right next to the old ore body, at an area that might not have been explored sufficiently, and old publications are very, very valuable. The McLaughlin Mine, mention made of the Manhattan Mine in—I can't ever—

9-00:18:56

Swent: Becker?

9-00:19:03

Kirshenbaum: Becker, right, yes. His monograph on mercury.

9-00:19:10

Swent: Yes, 1888, I think it was.

9-00:19:11

Kirshenbaum: Yes.

9-00:19:15

Swent: Yes, right. And Homestake had a report on it from the twenties, in their files, also.

9-00:19:22

Kirshenbaum: I didn't know that.

9-00:19:29

Swent: Yes. You never throw anything away. [laughs]

9-00:19:36

One thing that we haven't mentioned yet—I see you have here mention of industrial minerals and non-metallics.

9-00:19:47

Kirshenbaum: Oh, that reminds me. That's an area, going back to Placer, we didn't cover. With Allen Born, who had come to Placer as president from Amax, a man with lots of charisma and ideas.

9-00:20:41

This was, I believe, in the mid eighties, and gold had had its peak in price, but the company had been committed to push into gold in a major way. It just seemed like it was worthwhile being a bit cautious. Well, what might happen if Placer had put all its eggs in one basket?

So Born put together a long-range planning group. One of its main responsibilities was to draw up what was called a contingency plan, I think for obvious reasons.

9-00:21:51

I was the delegate, so to speak, from the U.S. We had meetings in Vancouver and discussed a variety of things that the company might pursue, mainly related to minerals, even though the chair of the group was Jack Butterfield, who was vice president of marketing in Vancouver. Jack was actually a metallurgist who had gone to the Harvard Business School, but he was really a marketer. He didn't get involved in technology, but he loved marketing.

9-00:22:37

I guess I've always been interested in water. I think water is a resource, natural resource, that we only have a certain amount of, and we may—well, I think it's become evident that the world needs to pay more attention to water. Anyway, I mention that because Jack at one point thought that maybe the company should get into the water business. He came down to California, where he knew water was a little bit scarcer, a lot scarcer than it was in British Columbia. He thought that some contacts he had in B.C. might provide a very attractive source of water. We went down to Southern California and spent a few days talking to people in the potential water market down there.

9-00:23:40

But anyway, one of the things that a number of us thought had some real merit for a mining company in terms of diversification, were non-metallics. Another term for non-metallics is industrial minerals. One or two of us were the leads in that. I think it fell to me because the real markets for industrial minerals are in the U.S. Canada has a lot of metallic minerals, but in industrial minerals, you usually don't want to ship these materials too far, so it makes good sense to have your source of supply where the markets are.

9-00:24:42

Two-thirds of U.S. mineral production are in non-metallics, and this is the opposite of the way it is in Canada. I pointed out, for example, that there were a few companies that had done very, very well in non-metallics. These were originally metal mining companies, Rio Tinto being an obvious one that was predominant in a non-metallic, which was borax. They really had a dominant opportunity in that, with their sources not only in California but also in Argentina. I think I mentioned that briefly when we were talking about my return to Argentina in '74, at which time I was doing some work for the United Nations.

9-00:26:02

What is seen in modern times or in my time is that metals have a proportionately less—there is less demand for metals, for various reasons. One is that people are getting by with less material than they had because materials are stronger. They're made stronger, so there isn't so much that has to go into a member that's used in construction, for example. Automobiles—there's a demand for lightweight automobiles, for reasons of gas mileage economy.

9-00:27:06

Plastics have really made a tremendous inroad into automobiles. Plastics have become stronger. They're called "engineered materials" for good reason. One interesting thing about plastics is that plastics actually use a lot of minerals, but they're not metals; they're industrial minerals. They're used as so-called "functional fillers." If you use the word "filler," it sounds like it's just some waste material that you're throwing in there to occupy the volume, but a functional filler lends strength and engineering qualities to many of these plastics.

9-00:27:53

Everyone knows how tough it is sometimes to open a bag, for example, a common bag or Teflon, which has, I believe, quite a bit of fluoride in it, and fluoride comes from fluorspar. A lot of minerals, even if you aren't using the definition of petroleum products as a mineral. We're talking about calcium carbonate, limestone, many clays. And the sophistication in these non-metallics is really growing by leaps and bounds.

9-00:28:51

Swent:

I hear the term "rare earth," and I guess they're really not rare at all, are they?

9-00:28:54

Kirshenbaum:

Well, they are pretty rare.

9-00:28:58

Swent:

Are they?

9-00:28:59

Kirshenbaum:

Yes. One of the largest deposits is in California. That's down at Mountain Pass, Molycorp. China has come up with quite a few of these rare earths. But they are not common, and they're used for some exotic purposes. For example, I think it's europium, which has, as one of its major uses, the red phosphor in color TV, in screens. I think until that market came along, europium was quite rare, rare to be used as well as not commonly found, but I think that's taken a lot of the production. And there are several of these: samarium and gadolinium, used in magnets. But those are used as metals, for the most part, these magnetic rare-earth metals.

9-00:30:21

Swent: Of course, that's something that's entirely new, these terribly strong little magnets that are on everything now.

9-00:30:30

Kirshenbaum: Yes.

9-00:30:32

Swent: And that's just within a relatively few years that we've had those all over the place.

9-00:30:37

Kirshenbaum: Yes, I was looking because I have a bunch of them. General Motors and the Japanese, I think, were the ones that really pursued those. One reason they wanted those is because there are so many motors in automobiles these days, to lower the windows, and if you have a stronger magnet, you can have a smaller motor. Smaller motor, less weight. So it all comes around to that.

9-00:31:16

But I found that European companies have been the ones that really seem to be pursuing these non-metallics much more than American companies.

9-00:31:32

Swent: Did you convince Placer to pursue them?

9-00:31:37

Kirshenbaum: Well, interesting. Al Born, I think, often did things to deflect people's opinions and so forth. The company was indeed concerned about having too many eggs in one basket; namely, in gold. But he went on his merry way sometimes. I'm trying to remember. There were a couple of projects that he pursued. Never came before the long-range planning group. But ultimately the company hired a high-powered consulting firm to issue a report about when it was that Placer should put into effect some of these recommendations that this long-range planning group was making from time to time.

9-00:32:57

They came up with essentially a list of three reasons, at which time the company should take some action. It would be if and when the price of gold was seen as having a long-term or sustained fall, with little prospect for recovery. (How one would know that is somewhat difficult to know, of course.) Another was when the central banks might start or be seen to start unloading gold. And the third was when the price-to-earnings ratio of the gold-mining stocks might be seen to be coming down.

9-00:34:15

Because at that time, the P/E ratios, price-to-earnings ratios of these stocks was enormous. You might remember that. One might say that in a way, the industry was trapped. If they decided, well, gee, we have a chance to get into this wonderful copper mine and make a lot of money, that they had just discovered or something—well, if these gold-mining companies started to diversify, their price-to-earnings ratio would come down because the gold-mining companies had this unique, at that time, very high P/E ratio. And a company didn't want to jeopardize the price of its stock by doing something that was foolish. So any or all, of course, of those three things would be the trigger to get the company to do something.

9-00:35:29

The interesting thing is all three of them happened more or less at the same time.

9-00:35:39

Swent: Who was this consulting firm?

9-00:35:41

Kirshenbaum: I do not remember.

9-00:35:43

Swent: Maybe it doesn't matter.

9-00:35:46

Kirshenbaum: Yes. The company engaged a lot of these financial seers to—

9-00:35:56

Swent: Well, anyway, that's not too important. So all three of these triggered—

9-00:36:02

Kirshenbaum: All of them happened. The price of gold, as you know—

9-00:36:06

Swent: Had a sustained fall.

9-00:36:08

Kirshenbaum: Sustained, right. Only recently has it gone up, but even now, compared to what it was when we were discussing these things, it's still down. And central banks—of course, most prominently the Bank of England—eliminated a lot. But they were the big ones. They had these regular auctions.

9-00:36:33

Swent: The Russians—

9-00:36:35

Kirshenbaum: I forgot which countries. I think you're right. Russia and—

9-00:36:37

Swent: —and South Africa.

9-00:36:42

Kirshenbaum: But some of the smaller European countries—I think Belgium and I think Australia, and even Canada—even Canada, Placer's home country—sold off a lot of gold, and that was seen by the Canadian mining industry as being a bit unpatriotic. But the U.S. never did, in spite of the fact that there are a lot of people that don't give gold much credence in terms of putting some stability behind the dollar.

9-00:37:22

And then last but not least, of course, when the price of gold really started coming down, the price-to-earnings ratio also plummeted. So all three things happened, but the company didn't make any moves. That was about the time that I left the company and the office in San Francisco was closed. So my contact with the company after that was primarily, as I mentioned, in this research area, pursuing this work at the University of Washington.

9-00:38:08

Swent: Placer closed here in, when was that, '97?

9-00:38:18

Kirshenbaum: In '97.

9-00:38:22

Swent: And that was when just about all the other companies left, too, didn't they?

9-00:38:26

Kirshenbaum: Yes. In terms of things that I've seen in mining history, San Francisco, of course, not only had a mining exchange but it had a number of mining companies located here. There were the three that were here for quite a long time. Originally, of course, most prominently was Homestake.

9-00:38:51

Swent: Now gone.

9-00:38:56

Kirshenbaum: I think in 2000. I thought it was a real shame they moved out. I think it was in—2000?

9-00:39:00

Swent: Yes.

9-00:39:02

Kirshenbaum: To Walnut Creek. Of course, as an independent company, it doesn't exist anymore, which, again, is another shame. And then Utah [Construction and Mining Company] was headquartered here for many

years, even after it was purchased by General Electric and then subsequently by BHP. BHP—I believe they have an office in Houston.

9-00:39:35

Swent: I think you're right, yes.

9-00:39:36

Kirshenbaum: But they certainly closed down this large office in San Francisco that was so important in so many things that were done in the West, not only in the West but even worldwide. Australia—I mean, perhaps one reason BHP bought Utah was because of their Australian coal, but Utah was the one that went after that.

9-00:40:03

Swent: Queensland.

9-00:40:05

Kirshenbaum: Queensland coking coal. And then there was our company, originally American Exploration and Mining. The name changed a number of times. Placer-Amex, Placer U.S. And now there are none in San Francisco. And even the engineering companies. I think the mining center of Bechtel is no longer here.

9-00:40:40

Swent: They've moved to Australia, I'm told.

9-00:40:42

Kirshenbaum: Yes, and I think some of it moved to Denver.

9-00:40:46

Swent: Denver first, but then somebody told me the other day they'd moved to Australia.

9-00:40:51

Kirshenbaum: Yes. And Kaiser, across the Bay.

9-00:41:01

Swent: There were small companies that even had their offices here.

9-00:41:10

Kirshenbaum: Yes, they've been gone a long time, though.

9-00:41:12

Swent: Weren't they out of San Francisco office?

9-00:41:13

Kirshenbaum: Oh, yes.

9-00:41:15

Swent: They've been gone. The assay companies that were here.

9-00:41:18

Kirshenbaum: Yes.

9-00:41:19

Swent: It's all gone. Well, the Engineers Club. That was a center of—

9-00:41:23

Kirshenbaum: Yes, even though in its last years the Engineers Club—a small proportion of their members were mining people. I'd like to think that they were important to the club, but there just weren't enough mining people to make a big difference. I think the Engineers Club really ceased because of the lack of patronage or membership from other—perhaps some of it was companies moved to suburbs and so forth. I think that happened—well, PG&E. They moved a lot of people over to San Ramon. And Chevron as well.

9-00:42:22

Swent: Yes. Lots of changes.

9-00:42:41

Kirshenbaum: Speaking of changes, we've discussed a lot of them, I think, as we went along here.

9-00:42:50

Swent: We've covered the main things.

9-00:42:55

Kirshenbaum: Maybe in terms of summarizing things, it would be interesting. I know we've talked about many of the technical changes. For example, in metallurgy, changes from smelting non-ferrous ores, especially copper, to hydrometallurgy, and the reasons for that. And the effect of environmental concerns—even though, as we said, the environmental concerns really didn't originate in recent times, but they've certainly become much more pronounced.

9-00:43:41

Swent: They've affected the economics a lot more—

9-00:43:46

Kirshenbaum: Definitely.

9-00:43:48

Swent: —in the last thirty years, yes.

9-00:43:53

Kirshenbaum: But an important early ruling that most of today's public isn't aware of was, of course, the 1894 Sawyer decision in the San Francisco federal court. The environmental movement has affected mining—it has affected everything, of course, but I think it has affected mining and subsequent processing of ores more than other industries. Also the effect it has had on small mines. Small-mine owners couldn't manage

to take all the steps that are needed. I think the person who was the real spokesman for the small-mine owner was Phil Bradley, of course.

9-00:44:40

Swent: Yes. Right.

9-00:44:44

Kirshenbaum: In resources, mineral resources, there's something like a pyramid where at the top you have a small point that has high-grade ore but there isn't much of it, and as you get down, you have more and more lower-grade ores. The result of that is you have much more material that goes out to tailings. In the old days, you had direct-shipping ores. Today, of course, when you have heap leaching of gold ores, you're moving mountains and extracting very little, but the environmental people see these tailings which are left on the surface. These are not underground mines, and you can't backfill.

9-00:45:54

Another ramification of changes in technology, is the equipment itself, which today is so massive. Just the haulage trucks and the shovels and even things within the mills, the size of the mills, the flotation cells, themselves. I mean, they've gone from being the size of a home washing machine to being the size of swimming pools. And, of course, this is done because one achieves economies of scale, which is absolutely important when you're dealing with low-grade ores.

9-00:46:47

Apart from technical changes, there have been a lot of changes on the corporate side of things, the takeovers. Of course, there are always companies buying and selling each other or merging and acquiring, but I think something new came in, maybe at the end of the sixties. I forgot just when it was. But mining companies were always operated—as were many others, but I think especially mining companies—with very conservative management. Few, if any, companies had preferred stock. They didn't like to have debt. They had a lot of cash.

9-00:47:46

Well, people on Wall Street saw this cash, and they thought it might be a clever way to finance their own ventures, and I think it was Gulf & Western, which was the first—I think it was a new word at the time—“conglomerate,” which was a real buzz word of the day. Eventually you didn't want to call something a conglomerate because after it had its heyday, those went into the dumps, themselves.

9-00:48:33

But Gulf & Western took over New Jersey Zinc, which was a company—I think remember it was founded in 1848.

9-00:48:47

Swent: An old company.

9-00:48:49

Kirshenbaum: An old company. But they sure had a pot of money that Gulf & Western—or these people that created Gulf & Western—saw, and they were going to use it to buy things like Paramount. I think it was Paramount Pictures.

9-00:49:07

Swent: The movie company?

9-00:49:09

Kirshenbaum: Yes.

9-00:49:10

Swent: Really!

9-00:49:10

Kirshenbaum: Yes. These companies really were diversified, but that's where the word, "conglomerate," came from. And then—

9-00:49:18

Swent: Of course, the oil companies—

9-00:49:20

Kirshenbaum: Yes, that came a little bit later. And I remember—I think it was in the sixties, when Bunker Hill—it had a lot of cash, and companies—I think Homestake was looking at Bunker Hill, but then they were bought out by Gulf Resources, which, in its way, was something of a conglomerate. They were into oil and sulfur and industrial minerals. They took over Bunker Hill, and Bunker Hill really didn't survive that acquisition very well. For Gulf Resources, they used Bunker Hill's cash to their best advantage, to the best advantage that they saw.

9-00:50:20

And, as you just mentioned, the oil companies. Well, as I say, these first acquisitions by outside companies I think were in the sixties, but then in the seventies the oil companies had all this money that they made, thanks to OPEC [Organization of Petroleum Exporting Countries] raising the price of oil and so forth, and what to do with that money?

9-00:50:49

Well, they thought that natural resources—it didn't matter whether they were fuel, liquid or gas fuel minerals or other kinds of minerals, and they really bought into the industry, as you remember. It really was a disaster for both. There was hardly a sizeable oil company that didn't have a mining department. One of the few, I guess, was Texaco. Texaco did happen to have some coal, but they never really pursued it.

9-00:51:42

Chevron made an offer for Amax which was refused, which was an interesting tale in itself, very interesting, but I think Chevron had a policy that they never wanted to have a hostile acquisition. And since Amax turned them down, they weren't going to go into a bidding war. But Chevron did pursue some mining operations on its own. They were involved, in a fairly strong way, in Chile, and I think they were one of the three companies involved in the Stillwater platinum operations, platinum metals, palladium, in Montana. They also—well, it's more by way of hydrocarbons, but they had the Gilsonite property, American Gilsonite in Utah.

9-00:53:15

Swent:

Yes. Of course, for them to go into coal and uranium was sort of a natural extension into the energy field.

9-00:53:25

Kirshenbaum:

Sure.

9-00:53:27

Swent:

But something like platinum wasn't—

9-00:53:29

Kirshenbaum:

Yes. Well, Occidental Petroleum [Co.] and—Exxon, I think, was the one of the few exceptions that didn't acquire because—the story that was told was that Exxon was so big that the government wouldn't want them make an acquisition. But they certainly did go into mining, again in uranium, and they went into coal in a big way in Colombia, and they were looking seriously at copper, but I think those days are all gone for Exxon as well as for most other companies.

9-00:54:29

But then—I don't know if you want to say ironically, but things, as we keep saying, change. I was rather surprised when Exxon and Mobil [Oil Co.] were allowed to merge. I mean, two of the largest and, I forgot what rank Mobil was, but it must have been one of the top five. The government just let them go ahead. There may have been a couple of things that had to be sold off in the process, but...

9-00:54:59

Things do change.

9-00:55:02

Swent:

And no crying about monopoly.

9-00:55:06

Kirshenbaum:

Right.

9-00:55:07

Swent:

Yes.

- 9-00:55:12
Kirshenbaum: So I think the results of these changes in corporate strategies have left us with a tremendously changed mining industry. In copper, there are so few companies left today, compared to what they were just three or four decades ago.
- 9-00:55:38
Swent: Phelps Dodge.
- 9-00:55:42
Kirshenbaum: That's the one surviving publicly-owned American company in the non-ferrous metals industry. There's Kennecott, but that's foreign-owned.
- 9-00:55:50
Swent: There's BP [British Petroleum].
- 9-00:55:54
Kirshenbaum: Rio Tinto. BP started to do what the American oil companies were doing—acquiring mining companies. BP bought Sohio, the original Standard Oil Company, because they wanted Sohio's Alaskan oil holdings. BP's acquisition of Sohio brought with it Kennecott Copper, as Sohio had already acquired Kennecott. Then BP decided to get out of mining—they had previously bought Selection Trust, so they wound up selling that plus Kennecott to Rio Tinto.
- 9-00:56:39
Swent: Rio Tinto, which is a fascinating company.
- 9-00:56:42
Kirshenbaum: It sure is.
- 9-00:56:44
Swent: So Phelps Dodge is the only remaining American company.
- 9-00:56:48
Kirshenbaum: Yes, in the non-ferrous mining industry.
- 9-00:56:50
Swent: Asarco was bought by Grupo Mexico.
- 9-00:56:53
Kirshenbaum: Right.
- 9-00:56:55
Swent: And it all happened without any public notice.
- 9-00:57:00
Kirshenbaum: Probably the most troubling one of all, by way of acquisition, was—and maybe the most illustrative of all—was Arco's acquisition of Anaconda. And Anaconda was such a huge company. Its ticker tape

symbol was the letter "A", whereas most companies have three letters. Illustrative of today's business environment, the letter "A" on the New York Stock Exchange ticker tape is now Agilent Technologies, a Hewlett-Packard spin-off. Or we don't have tickertapes now, do we? [laughs]

9-00:57:42

But Anaconda was bought by Arco, and they had assets all over the place.

9-00:57:50

Swent:

All over the world.

9-00:57:52

Kirshenbaum:

All over the world, yes. Their slogan was "From mine to consumer" because they were in the manufacturing business, made cable and brass and sheet and aluminum. They had a big aluminum smelter up in Montana. They had iron ore deposits in Canada, which they never put into production. But when Arco decided to throw in the towel, I went, with other people from Placer—we went to the Anaconda Tower in Denver to look over their portfolio of assets, to see what things—again, this was part of what might Placer be interested in.

9-00:58:45

Swent:

This was the corporate garage sale, hmm?

9-00:58:48

Kirshenbaum:

That's a good way to put it. It was Anaconda Tower, and I remember counting how many floors they had in, I think it was a thirty-six-story building, and how many were still being used by Anaconda in those last days. The most sorrowful part of the things was when these assets were being listed, there wasn't a single Anaconda asset, with one exception, that was in production. Butte was shut down. Everything was shut down.

9-00:59:36

The one exception was the Black Thunder—well, actually, it wasn't called Black Thunder yet. It was the Anaconda coal mine in Wyoming that Arco had put into production. And that still was an Arco property.

9-01:00:01

Swent:

Black Thunder.

9-01:00:04

Kirshenbaum:

Black Thunder. Yes, Arco changed it. They don't want any Anaconda legends or anything else.

9-01:00:21

Swent:

So was Placer thinking to pick up some pieces of Anaconda?

9-01:00:26

Kirshenbaum: Yes, we looked at a number of things, both non-metallics—I remember looking at zeolites and I think some other non-metallics, sulfur. Yes, Anaconda had a position in Texas Sulphur. But nothing was pursued. Again, I think we were still only going after gold.

9-01:00:57

And then Placer not only, as I said a little while ago, ignored the trigger to pursue some of these other ideas, but they even had, for example, the Endako molybdenum mine, which was the largest molybdenum property in Canada and one of the few, very, very few in the world other than Climax in Colorado that had a molybdenum mine, rather than producing moly as a byproduct of copper.

9-01:01:43

But the Endako mine was a very profitable operation, and I think in either '95 or '96 was the largest source of profits for Placer. Well, it wasn't a gold mine, so Placer sold it. And they sold it on the cheap, about 1996, or maybe '97.

9-01:02:14

So let's see, I was talking about Anaconda. Not only did Anaconda have all these properties that weren't in operation and therefore couldn't be sold for what you might think should be their real value, but they incurred an obligation at Butte. They sold Butte to Montana Resources, which is Dennis Washington, as you know, and they got a very good deal, because Anaconda retained the environmental liabilities. They had lawsuits of hundreds of millions of dollars filed against them by both the state and federal governments, and they have really spent—and with the Berkeley Pit, who knows if ever those will be ever ended, terminated?

9-01:03:49

Swent: That's just a nightmare, isn't it?

9-01:03:51

Kirshenbaum: Of course, it's been a great deal for Montana Resources: the right place at the right time at the right price, and even Asarco came in and bought 50 percent of it. They bought 50 percent from Montana Resources for many times what Montana Resources paid for the whole thing. They don't have the union problem that Anaconda always had.

9-01:04:27

Swent: They always had labor troubles, didn't they?

9-01:04:31

Kirshenbaum: They sure did. But I guess Washington approached them, and they trusted him, the labor force. It became a different operation.

- 9-01:05:10
Swent: Did you have any dealings with mining in Missouri, any of those Missouri—
- 9-01:05:16
Kirshenbaum: No. I've been there.
- 9-01:05:20
Swent: I was just thinking that's still kind of—
- 9-01:05:21
Kirshenbaum: Lead.
- 9-01:05:23
Swent: —viable, isn't it?
- 9-01:05:27
Kirshenbaum: Yes. Doe Run.
- 9-01:05:29
Swent: It's not really in the west but it is west of the Mississippi, anyway.
- 9-01:05:31
Kirshenbaum: St. Joe was a big company there, of course. And then there was the lead belt over toward Oklahoma, but when St. Joe, another fine old company that I guess came apart, Doe Run was the company that succeeded them. I believe that's privately held. They bought into Cerro de Pasco, the metals operations in Peru. The smelter at Herculanum in Missouri—I believe it's still in operation, but—either it's in operation or Doe Run is having to—well, I'm doing this anyway—they have some very serious environmental problems that are afflicting them.
- 9-01:06:48
But there aren't many survivors. We were talking about Homestake, and we were talking about—well, Newmont, by today's standards, is a survivor. I talked about New Jersey Zinc a few minutes ago, St. Joe. I don't know how old that is, but it's an old company.
- 9-01:07:18
Anaconda goes way back. Just to add another comment about Anaconda—most of these others, when the oil companies came to see that they didn't want to stay in mining, they either sold them or they spun them off to stockholders, such as Cyprus. But Anaconda, perhaps because there wasn't anything operating—they just sold off the individual assets, and there wasn't any continuity, such as Cyprus had. Of course, Cyprus has had several—I mean, Cyprus Amax and now into Phelps Dodge.
- 9-01:08:06
Swent: But, I mean, they like to go all the way back to the—.

9-01:08:10

Kirshenbaum: The island of Cyprus, right, right. Yes, I was speaking about continuity. That was, of course, the origin of—

9-01:08:17

Swent: That goes way back.

9-01:08:19

Kirshenbaum: —our Cyprus mines. So I'm not sure. Maybe today Newmont is—well, Phelps Dodge, of course—

9-01:08:33

Swent: Is the big one.

9-01:08:34

Kirshenbaum: And it goes back a long ways, older than Newmont. I think Newmont goes back to the twenties.

9-01:08:40

Swent: It's relatively new.

9-01:08:47

We had talked off tape about the corporation or the enterprise bearing the stamp of, the character of the man—well, it's always a man—the person at the top. Of course, Phelps Dodge had fine old people at the top in the beginning. An old tradition of—

9-01:09:20

Kirshenbaum: Crusty.

9-01:09:23

Swent: And sort of a New England Puritan ethic that went with the family, I think. I'd like to think that that's what has made them survive. Some of these companies, I think it's interesting to speculate on. These aren't really mining companies, but the six companies that were the construction companies that built Boulder Dam and what's come of them.

9-01:09:55

Kirshenbaum: Yes. Well, some companies have tried to diversify. Phelps Dodge—I know they got into carbon black, bought Colombia Carbon. I think they got into some manufacturing besides processing. But at some of these meetings in Vancouver with this long-range planning group—I mentioned Rio Tinto and the fact that they were so successful in straddling both metals as well as non-metallics, because they're in, I mentioned, borax. But they're a major world producer of talc, both in North America and in Europe.

9-01:10:50

When Rio Tinto was mentioned to this group at Placer, as I say, some of them were very even enthusiastic about non-metallics, but others—

they were much more traditional, and they said, well, Rio Tinto is such a large company, they should be in non-metallics as well. Well, Placer had become, by that time, large enough that they didn't have to think twice about their size, and other companies—and I'd point out Hecla—I don't think we talked about—

9-01:11:41

Swent: No, we haven't.

9-01:11:42

Kirshenbaum: Hecla was very interesting. Unfortunately—that's another fine old company, over a hundred years.

9-01:11:52

Swent: It went back to Boston, I think, didn't it? Boston money?

9-01:11:55

Kirshenbaum: I assume. Well, Calumet & Hecla definitely was Boston. C&H was Boston.

9-01:12:05

Swent: Right, I was thinking of Calumet & Hecla.

9-01:12:06

Kirshenbaum: But Hecla might well have been—

9-01:12:09

Swent: Maybe not. But anyway, it's been around a long time.

9-01:12:13

Kirshenbaum: But the Hecla mine—they were, of course, big silver producers. They had some gold properties, too. But when Maxie Anderson—I think we talked a little bit about this, but when he was killed and Ranchers [Exploration & Development Co.] was up for—well, they were looking for someone to take them over—

9-01:12:37

Swent: That's Ranchers Development—

9-01:12:42

Kirshenbaum: Wasn't it Exploration & Development?

9-01:12:41

Swent: Exploration & Development Company. That was his company.

9-01:12:45

Kirshenbaum: Right, out of Albuquerque, I think. They had the Escalante silver in southern Utah, and I think it was that, more than anything else, that prompted Hecla to pick up Ranchers. Well, Anderson was a real—

9-01:13:10

Swent: Go-getter?

9-01:13:14

Kirshenbaum: Go-getter, yes. And he had picked up the Kentucky-Tennessee Clay Company, and I used to point out to Placer that here is little Hecla that was doing so well with a clay company that they had come into by accident, because for years, the price of silver was not attractive, and their gold mine at Republic was playing out and wore out. It was really the non-metallics that kept them going. They picked up kaolin. Cyprus had a very nice industrial minerals department, too. I think Hecla picked up Cyprus's Georgia kaolin.

9-01:14:22

You look at the financial results of these non-metallic companies, and they're pretty attractive. Sometimes they're difficult to see because many of them are privately held. Huber is one of the largest privately-owned companies in the United States, J. R. Huber. And they're huge in kaolin and other clays.

[End of interview]

Interview 5: February 27, 2003
[Audio File 10]

10-00:00:00

Swent: Okay, we're continuing here. This is, I think, our final interview, the fifth interview with Noel Kirshenbaum. Today is February 27th. We're interviewing in the Strouse Press Room of the Bancroft Library, instead of at his office, where we were before. This is kind of a wrap-up session, Noel. There were several items that we wanted to pick up. One was that I think you—and you don't have it with you to go into detail, but we'll mention later—you said there were some things in [Alexander] "Bud" Wilson's oral history that you thought should be corrected, matters of—

10-00:00:55

Kirshenbaum: Yes, exactly. You had kindly loaned me a copy of Bud Wilson's oral history, I think partly because of the fact that Utah was prominent and the co-owner of Marcona Corporation, which we discussed earlier, and there were a number of references to Marcona. Interesting that some of his comments about the management and specifically about Chuck Robinson, pretty much coincided with my opinions.

10-00:01:40

However, the reason I want to just get back to Bud Wilson's oral history is because there were a few places where he had mentioned some dates, and I just thought it would be worthwhile, for the record, to correct those dates, which I was familiar with, and I'll be filling that in in due course.

10-00:02:13

Swent: Thank you. That's always appreciated. There was one other item which I had wanted to ask you about in connection with Placer, and that was the Pipeline project in Nevada, which has been in the news a good deal. You didn't have any direct connection with it.

10-00:02:35

Kirshenbaum: By any chance, would you have—maybe it's in your folder there—the paper I wrote on Cortez? I just happened to think of this now.

10-00:02:44

Swent: Oh, no, I don't have that with me, no.

10-00:02:47

Kirshenbaum: That paper was written in the early nineties and was published in *Minerals & Metallurgical Processing*.

10-00:02:51

Swent: It's not in this folder, I'm sorry

10-00:02:58

Kirshenbaum: It was a paper on Cortez, but I always like to put in history along, as a background to a mine, especially if a mine has some real history. There was some historical information about that mine that—

10-00:03:19

Swent: Cortez is a very old mine.

10-00:03:21

Kirshenbaum: Exactly, and in this paper, "The Cortez Story: 125 Years of Evolution and Innovation", I had pointed out that the early days of Cortez went back to George Hearst in the 1860's. In the final paragraph I wrote that with recent exploration having confirmed additional ore deposits, the (then) new roaster operation is not likely to be the last phase of activity at Cortez.

10-00:04:11

Little did I know that—I had no way of knowing—that I guess within a year, a year and a half after that paper was presented, actually by Cole MacFarland at a meeting Reno, that—

10-00:04:35

Swent: You were co-authors.

10-00:04:34

Kirshenbaum: Yes, I wrote the paper which Cole presented. That the so-called Pipeline—or maybe I shouldn't say "so-called" anymore because it is called Pipeline—discovery would be made. It's rather interesting. Cortez was seeking to ensure that an area that would potentially be used for some tailings didn't have any gold underneath. This was just a matter of due diligence, to make sure they didn't cover something up that might conceivably have some worthwhile mineralization in it. It was one of those cases—I think it was the last drill hole that they found very good indications of gold. Ultimately, it didn't take very long for them to pursue it, and this is the Pipeline deposit that Placer Dome is mining very advantageously, has been mining very advantageously for the last few years.

10-00:05:54

Swent: But there's been a tremendous amount of litigation over it.

10-00:06:02

Kirshenbaum: Well, actually, you're correct. I believe there still is some pending litigation, and it had to do with the boundary area that was controlled on the other side by Goldfields. Even though I did some background work or literature research on this, I was not directly involved in the litigation, so I'm reluctant—without giving myself a refresher in what was going on—to make any specific comments about that at this time. But there indeed was a lawsuit with Goldfields, which Placer

persevered in and essentially, at least on that initial phase, Placer won the lawsuit.

10-00:07:11

Swent: Okay.

10-00:07:15

Well, that might lead us into a mention of the papers, other papers that you've written, because you have enjoyed doing that, I think.

10-00:07:29

Kirshenbaum: Yes. The first paper I wrote was for, I believe, The Metallurgical Society of AIME, back in the early sixties, when I was working in Cambridge, Massachusetts.

10-00:07:44

Swent: Is it the MMSA?

10-00:07:45

Kirshenbaum: No, TMS was part of AIME. I was reporting on work that I was involved in in the production of ultra-pure metals, and specifically the paper was on ultra-pure molybdenum that was prepared by vapor phase—

10-00:08:10

Swent: How can something be ultra pure?

10-00:08:11

Kirshenbaum: Well, I guess one could safely say that there is nothing that is pure, because there's always a small amount of impurity or contamination in everything. But through chemical techniques, impurities can be removed to very low levels. We purified the molybdenum by working in the vapor phase, with a molybdenum chloride. If you have three nines purity (99.9 per cent), that's pretty pure. Ultra-pure, as I recall was considered five nines pure.

10-00:08:49

Swent: That would be ninety-nine point five nines?

10-00:08:50

Kirshenbaum: Ninety-nine with three more nines after it—99.999 per cent.

10-00:08:55

Swent: That's pretty pure, all right.

10-00:08:57

Kirshenbaum: Yes. Of course, today analytical techniques are so much more advanced— [tape interruption] Tremendous advances have been made in analytical techniques. Certainly one of the big changes in technology that I well remember is that you used to get an assay sheet that often would have, for many, many of the elements, columns that

would say “less than” a certain amount, because those were the limits of detection. You just could not detect, for many elements, quantities or concentrations less than, for example, a tenth of a percent or something like that. But today—

10-00:10:50

Swent: You’re going into parts per trillion now.

10-00:10:51

Kirshenbaum: Exactly. And not only are those detection limits possible to achieve, but the rapidity that one can obtain results has been speeded up so tremendously. It’s just like in medicine, where today you can get laboratory results—not from the assay lab but from the medical lab—while you’re still in the doctor’s office.

10-00:11:31

Swent: Or in surgery.

10-00:11:32

Kirshenbaum: Right.

10-00:11:38

Oh, we were talking about papers. Well, that was my first. And then I wrote a number on transportation of minerals, which we had discussed earlier. I became involved as the chairman of three international symposia on the transportation and handling of minerals. These were published as books of proceedings by *World Mining*. While working for Placer, I published a number of articles on coal, because of Placer’s Beluga coal property in Alaska. Some of these papers involved not only the mining and use and transport of coal but also manufacture of methanol from coal, as we were looking at that seriously, along with the production of liquid fuels.

10-00:12:48

Since I’ve retired from Placer, I’ve written some other papers that were really fun for me. I’ve given some papers, a couple of them, as I had mentioned, about mining scams. Also because of my collection of T. A. Rickard, including his personal scrapbooks, my interest in Rickard and his published works and presentations over many, many decades—I’ve given several papers on Rickard.

10-00:13:49

I put together a paper a few years ago, and that was published in the annual of the Mining History Association on gold dredging, the gold dredging history of California, which is really, to me, a very interesting industry.

10-00:14:13

A couple of my most recent papers. One I gave at the World Mining Congress in Greece was about the mines of Kosovo, which was the

territory in former Yugoslavia, and how those mines actually originated during the time of the Roman Empire a couple of thousand years ago and how they had lain dormant. When the Ottoman Empire came in after the Battle of Kosovo—I believe it was in the 1300s—and how Chester Beattie, who was a contemporary of Rickard, when he put together Selection Trust in London, sent people into Yugoslavia in the 1920s. And how, because of his interest and skill in mining history, he had sent people to look in the British Museum and the libraries in London and Yugoslavia, and how they were able to come up with essentially rediscovering these old mines.

10-00:15:41

Swent:

And what were they mining?

10-00:15:46

Kirshenbaum:

Lead, zinc, a good bit of silver, gold. And I found it really fascinating when, in about 1998, I came across some articles that really fit right into the news of the day. This involved the ethnic problems and fighting that was going on in Kosovo between the Serbs, who controlled the mines, of course—and actually, I believe, [Slobodan] Milosevic had a personal interest in those mines—and the Albanians, who were from Kosovo and were the workers.

10-00:16:40

Following the fighting that went on in Kosovo, after the fighting had quieted down, the operations had not yet fully resumed, but then the United Nations came in and shut them down completely because they claimed that the pollution from the smelter there was such that it was a danger to the population of the area. I remember making the comment in my talk that this was probably the first time in history that a mining or metallurgical operation had been shut down by troops (the United Nations armed forces there) for violating environmental standards.

10-00:17:41

Anyway, it was a paper that covered a number of personalities that I had interest in: Rickard, Chester Beattie, Herbert Hoover, and also a little bit about World War II, because of the importance of these mines to the German war machine, especially with the lead from these mines at Trebca that were vital for the batteries of the German submarines.

10-00:18:18

Last year, I gave another paper, which was fascinating to put together, on a particular phase of mining on the Comstock lode. I used newspaper archives from the University of California library in Berkeley to find contemporary reports in Virginia City papers such as the Territorial Enterprise. I gave this paper at a congress in Aberystwyth, Wales, on hydropower in mining. Specifically, it was the fact that two of the mines on the Comstock took advantage of the

Sutro tunnel having been completed and could drain the mines of the water that formerly had to be pumped out—with tremendous costs of energy and fuel. Instead, they took their water supply from on top of the Comstock and ran it actually down the shaft about 1,600 feet, and they put in—

10-00:19:51

Swent: Pelton—

10-00:19:53

Kirshenbaum: Pelton wheels, thank you. Put in Pelton wheels. In the first instance, they installed Pelton wheels which drove cables and transmitted power mechanically, the cables being driven at extremely high speed to the mill on the surface. It would have been successful except for the fact that the cables weren't able to stay spliced together.

10-00:20:24

Soon afterwards, the Pelton wheels, 1,650 feet underground, were used to generate electric power which was then transmitted successfully to the mills on the surface. This was just the time when electricity was being put to good commercial use on the East Coast and in San Francisco—very, very early days for electricity. But it just shows you how fast the technology was transferred to the Comstock lode.

10-00:21:13

Swent: Did Gray Brechin work with you on that?

10-00:21:17

Kirshenbaum: Right. I was delighted to invite Gray, and Gray was also delighted. I think he had never been in Wales, and he has some Welsh ancestry. I knew the Comstock was a favorite subject of his, so he enjoyed being able to present the historical, non-technical background of the Comstock; in other words, its connections to some of the banks and personalities of San Francisco, most notably, of course, for this paper, Adolph Sutro, himself. So each of us gave half the paper.

10-00:22:05

Let's see, you had asked me, I guess, for maybe some comments on corporate culture. I think I've voiced a few comments along the way, certainly when we were talking about Marcona. I guess I never took—in fact, I never did take a course in psychology, but maybe having—

10-00:22:53

Swent: You learned it along the way?

10-00:22:54

Kirshenbaum: Yes, I picked a little bit up along the way. It might have been useful being instructed in it, but—. I'm not sure if anything in my career would have changed, but I had heard a long time ago that for investment purposes, people should look at the management of

corporations, who is managing them, not just at what assets they have. Of course, in mining you tend to look at assets. But I suspect that there are many companies—and I'm not limiting myself, certainly, to mining—but many companies that have good assets. Without good management, they may not function well.

10-00:23:45

Swent: What do you call good management? How do you define that?

10-00:23:53

Kirshenbaum: Well, that's a tough question and probably one that I'm not very well versed in, but I think one can pick some of that up along the way.

10-00:24:10

Swent: Maybe think of some examples that you've seen. Have you worked with managers who you thought were particularly good? Or particularly bad?

10-00:24:22

Kirshenbaum: Yes. Certainly with managers. I reported to vice presidents and presidents on certain things. I would suggest that—it actually does come from the very top, because a company isn't going to be ruined by one manager, but I think a company could benefit or, contrarily, be harmed by a top management that didn't do things properly. Of course, in today's environment, and I'm talking about the last couple of years, where we've seen so many flagrant situations develop with top management using phony accounting practices and so forth and taking benefits out of the company that they were really egregious—those are not good examples of management.

10-00:25:30

But also I can compare two companies I worked for almost back to back, where there were different styles of management. One was Marcona, which I've described fairly well already. I may not have mentioned it—well, I think I did up to a point—where there was almost competition going on amongst the various departments. When you have situations like that, and I know it's not terribly rare, destructive competition is often something that results. Perhaps in some cases the competition enables a company to hasten getting something done or to take advantage of something, but I think the word “destructive” could be used in terms of the employees and maybe the employee morale.

10-00:26:41

Swent: I think you—as I recall it, it was between the marketing people and the development.

10-00:26:55

Kirshenbaum: That was specifically for the Marconaflo project, which was more than just a project. Chuck Robinson used to look up at the sky when he talked about Marconaflo. It was his vision. He had even the marine department as well as the development division, which was the mining and metallurgical side of engineering, and marketing also, all involved in Marconaflo.

10-00:27:25

Swent: It's my sense that in mining operations, there seems almost always to be intense competition between the mining and the processing people. The mill people and the mining people are always in some sort of tension.

10-00:27:44

Kirshenbaum: Yes. I will make a few comments on that, maybe by way of looking at metallurgy. But I guess just to finish the contrast I mentioned with Marcona, when I went to work for Placer, it was like a breath of fresh air. Probably that's one reason I stayed at Placer about twenty-four years. I didn't have the feeling there that I had to look over my shoulder all the time. It was a change to be at Placer where it was really the best of both worlds, as I'll explain.

10-00:28:35

The subsidiary I worked for had its headquarters in San Francisco. This was the U.S. unit of Placer. It had the advantages of a small company and yet we had the tie-in to the parent company in Vancouver, which wholly owned us. So we had all the resources available to us from a large company and yet we worked in the comfortable environment of a small operation.

10-00:29:04

Swent: You didn't feel you were at some disadvantage not being in the head office?

10-00:29:09

Kirshenbaum: Well, there was some of that, but for most of the time I spent at Placer, there was a lot of cooperation. We had a wonderful president in San Francisco for most of my time with Placer. His name was Alan Horton. He was just beloved by everyone. He was a Canadian geologist by background, and I think there's something to be said maybe for geologists. They tend to be optimistic people. They're often more enlightened than the average engineer.

10-00:29:52

Swent: [chuckles]

10-00:29:53

Kirshenbaum: They're also more curious than the average engineer. During this time, in Vancouver, another geologist, Tom McClellan, a UC Berkeley

graduate, was chairman of Placer. I didn't know Tom personally very well, but I had enough exposure to him to know that he was another grand fellow. After Tom, Placer's top management in Vancouver became headed by mining engineers or metallurgists. One of Placer's presidents, a metallurgist, was referred to as a bean counter; he certainly did not have the vision of some of his predecessors who were geologists. More and more, I believe, management has responded to a board of directors that had more knowledge and interest in finance than in mining.

10-00:31:06

Swent: That's been the trend, hasn't it?

10-00:31:10

Kirshenbaum: It certainly has. But I think geologists—and I had good exposure to geologists for much of my career. I think I've mentioned Hugh Matheson before—what a fine manager he was. He was a geologist, but he also knew a lot of metallurgy. He was something of a Renaissance person. I think among other things he said is that in order to be a geologist, one has to be an optimist because if you think of all the reasons why you might not find something, he said, you wouldn't even get up in the morning.

10-00:32:01

Swent: [chuckles] They have a long time frame, too.

10-00:32:10

Kirshenbaum: They sure do, yes. And they should have an appreciation of history because, again, as with so many mining projects—I think we've mentioned this previously, but the best place to find a mine is where an old one has been before. With new techniques of exploration or new ideas, very often one finds that. Actually, today we were talking with [William] "Bill" Humphrey, and he had mentioned something about that occurring, he thought, at the Braden Mine in Chile.

10-00:32:55

Swent: Yes, which is another reason why people get upset now that they have to destroy them and cover them up.

10-00:33:04

Kirshenbaum: Absolutely right. And that's another reason why the historic record is so valuable. These old geological records can be invaluable. Why drill something all over again, when you can get clues from the old records? But I'm afraid there are tendencies to jettison old files.

10-00:34:00

Swent: Clear them out.

10-00:34:03

Kirshenbaum: I remember when we were trying to save the [California] Division of Mines [and Geology] library in the Ferry Building in San Francisco, which was really an invaluable resource to the mining companies that were around then—I know they were of value to Placer and, I know, to Homestake, and I think Utah as well—they moved that library out, and we finally were able to get the head of the state Division of Mines and Geology to come down, or actually the Department of Conservation to come down to try to argue our case to preserve this library and its associated mineral collection.

10-00:34:45

He took a look down the shelves rather quickly, and he said, “Boy, you’ve got copies of some of these books that are just like annuals. Copies from 1910 and ’11 and ’12, and ancient books of standards and so forth.” He said, “Why don’t you throw the old ones away, at least?” There’s just no appreciation. Some of the books I recall that he pointed to were ASTM standards. One of the functions of the CDMG is what happens in cases of earthquakes. Here you had the standards that old buildings had been built to, and if you’re just going to look at the current standards, you’re not going to know what went on before.

10-00:35:37

Swent: No.

10-00:35:42

Kirshenbaum: So I think there are lots of practical reasons, not just for keeping historical records, not just because someone might have an historical interest.

10-00:36:08

Swent: Did you want to say anything about mining education?

10-00:36:12

Kirshenbaum: Yes, I can do that now, I think. In my career time, so to speak—there used to be many mining schools, really in all parts of the country.

10-00:36:29

Swent: I think we have talked some about this last time, but—

10-00:36:36

Kirshenbaum: What has happened is that mining, per se, has become less attractive to American students. I remember Evan Just many years ago recognized that, and as I recall he commented upon that in his oral history. And consequently, many of the U.S. schools started—well, the demographics of these schools became largely foreign. This was true both in mining and even in metallurgy.

10-00:37:31

I think it's appropriate to say again that the metallurgy curriculum—which at one time comprised both physical metallurgy and extractive metallurgy—has started to phase out the extractive, and the metallurgy departments became, as I mentioned in the case of Stanford, became materials science. And there wasn't anything to do with mining in materials science. Certainly, these material scientists developed some wonderful materials, including substances which can withstand high temperatures, like rocket coatings and so forth, in the ceramics area and also in the electronics field.

10-00:38:25

So metallurgy went out that door, and mining became of less importance to the schools. They had so few students, and schools started closing; mining departments started closing. We don't have any, I would say, on the Pacific Coast any more. We still have two in the Far West, one in Reno and one in Moscow, Idaho, that I hope will be maintained in good stead for a long time. Of course, the Colorado School of Mines is still a famous school.

10-00:39:11

Mining engineering education, I recall, when I first went into metallurgy, that the mining curriculum required the mining engineer to take courses in things like ventilation and obviously a lot of geology, surveying, and accounting. A mining engineer was really a wonderful jack of all trades. He had to be practical. He was often sent to remote places, where he had to be self-sufficient, so he had to know a little bit of everything and be able to do everything, since it might be weeks before he could get help or a consultant or spare parts or something that was needed for the operation.

10-00:40:23

But in today's open-pit mining environment, it seems to me that very often the mining engineer is—well, one could almost substitute a civil engineer, because these are almost like construction projects, especially where we're not following veins, we're just digging out of a pit. If you have good mine geologists to tell you where to place your shovels and dig one place or another and under the proper controls, you don't require all that depth and breadth of background.

10-00:41:10

And in metallurgy, as I just mentioned, not only have the schools gone—or switched into materials science, but who is there to manage or oversee, to do work in processing and extraction? Well, this area of metallurgy has a lot of chemistry in it, and chemical engineers, to the best of my knowledge, are the ones who are getting jobs in this field.

10-00:41:48

I think there is one big problem here that I'd like to emphasize that is that chemical engineers—I can't imagine that very many, if any of them, ever has had a course in mineralogy. I think a result of this is that the person who might be involved in what used to be extractive metallurgy doesn't have an appreciation for the various species or even minerals that might be encountered. A proficient metallurgist cannot simply depend on an assay which reports the percentage of copper or ounces of gold per ton. In extraction, one really needs to know and to be astute in not only what the minerals are, or what the host rock or host mineral might be, or what might poison something in the circuit. So I think that this is something that the industry should have some real concern with.

10-00:43:17

And extending that same concern into the mining field, I think today's mining engineers probably could benefit from a little more mineralogy, too. Most schools probably require some mineralogy, but there have been many cases where I've seen samples, and even geologists sending samples to a lab, and the main thing that they were interested in was what percentage, without enough attention being paid to what the specific mineralization was.

10-00:44:13

This mineralogy can have a great effect on what the ultimate processing can be, both in terms of cost and success in extraction. One very simple example, a common one in recent years, not too far away from us, are the extremely refractory gold ore bodies over in Nevada, the carbonaceous gold ores. Extraction of gold from some of these difficult-to-treat ores was a problem in the old days in Colorado. Certainly the telluride ores, gold tellurides, gave real problems in recovery. That was recognized a long time ago.

10-00:45:05

But the carbonaceous ores of Nevada have required roasters to be built or autoclaves to be installed. Actually autoclaves, if course, were used up at Homestake's McLaughlin Mine. Actually, I believe Homestake probably had the first autoclave in the gold—

10-00:45:28

Swent:

I think it was the first one in gold.

10-00:45:34

Kirshenbaum:

Yes. There were a number that came in about that same time.

10-00:45:37

Swent:

And it was a continuous process rather than a batch process, which was different.

10-00:45:42

Kirshenbaum: Right.

10-00:45:45

Swent: Yes. It's been copied.

10-00:45:46

Kirshenbaum: Right.

10-00:45:47

Swent: Widely, I think, yes. But I believe it was the first application with gold.

10-00:45:49

Kirshenbaum: You can just picture the great difference in both capital and operating costs between heap leaching and running an ore through an autoclave. In both cases, you're treating an unconcentrated material, even though you might like to have it concentrated, if the mineralogy enabled that. Heap leaching is as inexpensive as you can get, permitting very low grade ores to be treated, but in autoclaving, you're literally cooking the whole mountain. I mean, bringing all the ore up to high temperature and high pressure. And that's something you need to know early on, because—well, Getchell is perhaps a good example.

10-00:46:44

The Getchell Mine did put in autoclaves, but they had some real problems after they were installed. The high grade of Getchell ore was certainly an attraction for many decades, but it was only the autoclave treatment that ultimately was able to process that material.

10-00:47:07

And then Placer, after they acquired Getchell in the late 1990s—their exploration proved many millions of ounces more, and at high grade. But the treatment costs, underground mining costs, were just too high. But I think lately there's hope that perhaps increasing prices and maybe certain advances in the technology will enable that to ultimately come into its own.

10-00:47:52

Swent: It's gone deeper, then?

10-00:47:53

Kirshenbaum: Well, deeper and wider, too. Placer had a tremendous drilling program. They were drilling—I forgot the length of time up there, but they were drilling around the clock, I think at one time with about thirty drills. They spent a tremendous amount of money, on top of the billion-dollar-plus it cost for the acquisition, itself.

10-00:48:21

Swent: That's an old mine, too, an example of a mine that took redoing.

10-00:48:33

Kirshenbaum: Right. And I remember talking to Frank McQuiston about that, because Newmont had Getchell for a while, and Earl Herkenhoff was up there, working on that. This is one of those times when talking to someone like yourself about these things not only jogs my memory but makes things come together, as we were saying earlier. The carbonaceous ore had been one of the problems as well as the extremely high arsenic.

10-00:49:08

Swent: I was going to say, I remember Frank telling about arsenic flakes like snow.

10-00:49:15

Kirshenbaum: Yes, and the people who lived there couldn't have pets. One wonders today, you probably wouldn't be allowed to live there.

10-00:49:20

Swent: They couldn't do it at all.

10-00:49:22

Kirshenbaum: They had one of the first Fluosolid roasters to get rid of the arsenic and I guess probably to take care of the carbon, too, one of the Dorr Fluosolid reactors. You know, you wonder how much arsenic came out of the stack.

10-00:49:46

But the jog to my memory was the fact that Earl and Frank McQuiston were involved right after World War II—and I don't think we picked up on this before, but I mentioned it in that same article about Cortez. Earl was with American Cyanamid at the time. Their idea came together to use activated carbon, and they thought, well, if you introduced some reactive carbon that maybe the carbon would pull the gold out of the solution.

10-00:50:36

Swent: Wow.

10-00:50:38

Kirshenbaum: And this ultimately resulted in displacing the Merrill-Crowe process, using zinc. Earl and Frank told me that their first carbon that they tried was—this was in about 1946 or so—they had used some carbon that they obtained from a war-surplus store selling old gas masks made for World War II. And it worked. And, of course—well, it was a while later because the gold industry was not in its heyday at that time. In fact—

10-00:51:23

Swent: The mines were all closed.

- 10-00:51:24
Kirshenbaum: The gold industry came back, but everyone thought that inflation and the fixed price of gold would stop gold mining. Except for Homestake—the only gold mine running in this country for many years. I guess at that time, Homestake was still using amalgamation. But then—
- 10-00:51:51
Swent: They picked up on the carbon.
- 10-00:51:53
Kirshenbaum: Picked up on the carbon. When was that? That was probably in the late seventies, I would think.
- 10-00:52:02
Swent: There was talk of it earlier.
- 10-00:52:06
Kirshenbaum: Yes, the Bureau of Mines. They did a lot of fine work on carbon recovery of gold, especially their Reno research station. I certainly lament the Bureau's demise. That was going to be another comment I was going to make about how the industry has changed. Well, the Bureau wasn't exactly the industry, but its loss is really a shame. I guess we're fortunate that the powers that be haven't seen fit to cut back too greatly, at least, the USGS [U.S. Geological Survey].
- 10-00:52:51
Swent: The USGS almost went.
- 10-00:52:53
Kirshenbaum: Yes, there was some real concern about that, and certainly very big concern that they were going to shut down the Menlo Park, western office here. Fortunately, the Survey has been able to pick up on the data collection, which is invaluable to the industry. But as far as the research stations, there were stations in—some were in the field of mining and others were metallurgy. Spokane was a mining research center. Albany, Oregon, metallurgy; Reno, metallurgy; Rolla, Missouri, metallurgy. Boulder City, at one time—that had closed earlier—that was metallurgy. And then—
- 10-00:53:46
Swent: There was one on the campus here.
- 10-00:53:49
Kirshenbaum: Yes.
- 10-00:53:50
Swent: In earlier days, in mining.

- 10-00:53:54
Kirshenbaum: Right. Yes, and I think we maybe mentioned that briefly, because of the thermodynamics work that was going on in the School of Metallurgy in the Hearst Mining Building. I mentioned Ralph Hultgren and K. K. Kelley.
- 10-00:54:08
Swent: That's right, yes. That's long gone.
- 10-00:54:11
Kirshenbaum: Yes.
- 10-00:54:14
Swent: Reno still has—that was the last one, I guess, wasn't it?
- 10-00:54:22
Kirshenbaum: When the Bureau of Mines was eliminated—this was about 1997—
- 10-00:54:29
Swent: Not too long ago.
- 10-00:54:32
Kirshenbaum: About '97, all of the research centers were shut down. Some of the functions, as I mentioned, were picked up by the Geological Survey, but that is mostly in terms of literature and data collection and reports.
- 10-00:54:53
Swent: Of course, seismology has kind of saved them here, in this area—the earthquakes.
- 10-00:54:56
Kirshenbaum: I think so, right.
- 10-00:54:59
Swent: It's definitely relevant.
- 10-00:55:02
Kirshenbaum: Right.
- 10-00:55:05
Swent: It's a shame.
- 10-00:55:07
You'd said something earlier about how you liked to have a companion on a business trip. What was that?
- 10-00:55:15
Kirshenbaum: In the same way that some of your questions have triggered my brain remembering something—I guess I'm not too fond of large meetings, but a meeting with three people or so, I think can be very productive because you're pulling things out, and you give a person time to think about the next question while someone else may be writing down.

Because when I've been on a business trip and trying to make notes, ask questions, listen, think of the next question and so forth, it's a bit of a chore. It's tiring.

10-00:56:07

Swent: But it's stimulating, too.

10-00:56:08

Kirshenbaum: Oh, absolutely. But one can, I think, be more productive, even in terms of man-hours, by having more than one person, man or woman, at a meeting and be to ask and field questions.

10-00:56:41

Swent: Speaking of man or woman, have there been many changes in your field as a result of women's lib? Have more women come into your particular arena?

10-00:56:52

Kirshenbaum: Well, there are a few. One does see more women at mining operations. I think in geology they are there and there are a few in metallurgy, but that discipline is pretty small, overall.

10-00:57:29

Something that has happened—and I think this is worth commenting upon and this is a wonderful thing—is that universities are becoming much more interdisciplinary. I may have covered it very briefly before, but I think this is really important in technology. In fact, I was thinking about this just the other day, actually—that metallurgy may be considered one of the first interdisciplinary fields because, even though I said that mining engineers have very broad training, metallurgy really is a mix of various sciences. It's chemistry, it's geology, certainly mineralogy. And there's also the engineering studies. This mix is sometimes maybe forgotten or even ignored, as I may have alluded.

10-00:58:40

I will admit to never having had a course in organic chemistry, which probably would have been advantageous in later years, but I figured, when I was still in school, that the flotation reagents, one of the very few areas that involved organic chemistry and, heck, I can just buy something off the shelf or get someone who knows that to provide the know-how.

10-00:59:21

As an example of where things are going, I had mentioned, I think in our last conversation, the research I was involved with in my last years at Placer. It went into an area involving geology and metallurgy and not just organic chemistry or biochemistry but even microbiology. The professor we worked with at the University of Washington is in the

Department of Genetics. I feel Stanford was way ahead of this interdisciplinary trend long ago, but the University of Washington is now right up there.

10-00:59:57

Swent: Right.

10-00:59:59

Kirshenbaum: So these things are really coming together, and I have no doubt that there are going to be tremendous advantages in the future here. We see, just in the last few days, people are talking about computers that will be made essentially with DNA molecules and so forth.

10-01:00:22

Swent: It's really mind-boggling, isn't it?

10-01:00:23

Kirshenbaum: Yes.

10-01:00:25

Swent: It truly is.

10-01:00:24

Kirshenbaum: A lot of these things frankly are not going to require much in the way of metals, at least not so much in the way of metal tonnage. Perhaps a greater variety of metals because of the different things that technology is coming up with, but in terms of tonnage, I suspect the per capita tonnage, the tonnage of almost every metal, if not all of them, is decreasing. Look at copper: the telecommunications that have advanced so tremendously in the last few years, the huge dot.com bubble that got a lot of these companies in trouble, involved investments in fiber optics, which has great advantages over copper lines.

10-01:01:35

But again—this has come up a number of times recently in our conversation, the non-metallics, the so-called industrial minerals certainly are increasingly important. Some of the less sophisticated are used mainly for construction materials, and we can certainly expect that they're going to be in demand. But because of environmental reasons, many of them are going to have to come from sources further removed from their places of use. In other words, people who live in cities don't want to have the cities ringed by quarries.

10-01:02:17

Swent: No. But sooner or later, all these things come out of the earth.

10-01:02:23

Kirshenbaum: Exactly.

10-01:02:24

Swent: Whether it's fiber optics, no matter what.

10-01:02:27

Kirshenbaum: Yes. We talked the other day about plastics, and many such materials use multi-component substances. Some have metallic elements in them, but the components are not metals. Take limestone, for example; it contains the metallic element calcium, but you never see the calcium metal.

10-01:02:57

Swent: I don't think of calcium as a metal, even, but it is technically, isn't it?

10-01:03:04

Kirshenbaum: It is, yes. Maybe another background comment about the industry. Historically and certainly before my time, the exploited mineral deposits were usually high grade and therefore small. Often one person or a family could run the operation or business. Sometimes these grew into larger companies, and corporate capital became very important because of the scale of the investment required. The United States, and the United Kingdom, with its colonies in the British Empire, took advantage of the capitalistic system and brought mining operations into existence worldwide.

10-01:04:32

And then, of course, over the years, companies got larger and diversified. They grew larger by mergers and acquisitions, and you came up with companies like Newmont that was really very widely diversified, with operations in gold mining, geographically diversified, copper. They bought Foote Mineral. They were in lithium. And, on the other side of the ocean, Rio Tinto, which was an old, large company, got even larger when they bought U.S. Borax and got into more of these non-metallics. They were very big in talc.

10-01:05:27

Then we saw, around the 1980s and maybe a little before, the takeover of the mining companies in the United States by the oil industry, as we discussed. What happened afterwards really left the mining industry very, very changed. Metal prices generally were going down, especially in terms of real currency, in terms of real prices, because of the tremendous inflation in the early 1980s. The industry was left with many fewer companies than there had been. Copper is a very good example of that in the United States. We've mentioned just the other day that Phelps Dodge is the only U.S.-domiciled survivor.

10-01:06:49

And then we've seen the recent trend of the big companies getting larger. One, of course, is Rio Tinto, which has always been London-based. They had a major merger with their subsidiary, CRA, in

Australia, a few years ago. And Anglo-American, which had been headquartered in Johannesburg, has moved to London—and that, I think, depending upon your definition of how things are measured, is the largest or certainly among the top two mining companies.

10-01:07:54

And third would be BHP Billiton, which has been the largest company in Australia and was the largest Australian company operating in the United States when they [BHP] bought Utah. And then they merged with Billiton, and I heard that maybe that company would move to London. There's something interesting here: one might think that London, which was a source of so much mining capital and education at the Royal School of Mines, which itself has essentially ceased to exist as a significant source of education in the mining industry—

10-01:08:52

Swent: But it's still the center.

10-01:08:53

Kirshenbaum: London, yes. Isn't that interesting?

10-01:08:56

Swent: It truly is. They sent the capital for the gold rush, all the gold rushes here, in Colorado—

10-01:09:06

Kirshenbaum: And Australia.

10-01:09:08

Swent: And Australia.

10-01:09:09

Kirshenbaum: And then all the British developments in Africa.

10-01:09:13

Swent: Yes, it's still the center.

10-01:09:19

Kirshenbaum: Yes. We were talking about how things move, starting in the United States with Boston, then New York, and Denver. I don't think we mentioned London at that time, but—

10-01:09:26

Swent: No.

10-01:09:30

Kirshenbaum: There aren't very many there, but there aren't many mining companies, and the fact that the two or three largest—

10-01:09:39

Swent: Are still London—

10-01:09:41

Kirshenbaum: —are London-oriented, is quite interesting.

10-01:09:46

Swent: It truly is.

10-01:09:47

Kirshenbaum: Well, I've enjoyed having a broad career. Metallurgy, itself, is broad because of all the sciences that come together in it. Not only, as I say, is it interdisciplinary, but I've had the pleasure of working in the fields of non-ferrous and ferrous metallurgy, in precious metals, byproduct metals, fuel minerals such as coal and even a bit in oil, and in the very large and expanding field of industrial minerals and non-metallics.

10-01:10:50

Swent: You've really done it all, haven't you?

10-01:10:56

Kirshenbaum: Well, if I haven't done it all, I've seen a lot of it.

10-01:11:00

Swent: You've been touched by it all, anyhow. Yes, that's pretty amazing. Very widespread career.

10-01:11:09

Well, that may be a good place to wind it up. That's about it, isn't it? I think it's deep enough, as they say.

10-01:11:22

Kirshenbaum: Right.

10-01:11:24

Swent: The disk is just about ready to end, so—

10-01:11:28

Kirshenbaum: Oh, great.

10-01:11:32

Swent: We timed it pretty well. This has been wonderful, Noel. Thank you.

10-01:11:34

Kirshenbaum: Well, thank you very much. It's been great to have known you for quite a while, and I just think that the work that you have done on this entire oral history project has been tremendous.

10-01:11:54

Swent: It was a pleasure. I'm going to turn this off now.

[End of interview]

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 Letters degree by South Dakota School of Mines and Technology.