Regional Oral History Office
The Bancroft Library

University of California
Berkeley, California

Western Mining in the Twentieth Century
Oral History Series

and

Earthquake Engineering and Seismic Safety
Oral History Project

Gordon B. Oakeshott

THE CALIFORNIA DIVISION OF MINES AND GEOLOGY, 1948-74

With an Introduction by
Richard M. Stewart

Interviews Conducted by
Eleanor H. Swent
and Stanley Scott
in 1986-87

Since 1954 the Regional Oral History Office has been interviewing leading participants in or well-placed witnesses to major events in the development of Northern California, the West, and the nation. Oral history is a modern research technique involving an interviewee and an informed interviewer in spontaneous conversation. The taped record is transcribed, lightly edited for continuity and clarity, and reviewed by the interviewee. The resulting manuscript is typed in final form, indexed, bound with photographs and illustrative materials, and placed in The Bancroft Library at the University of California, Berkeley and other research collections for scholarly use. Because it is primary material, oral history is not intended to present the final, verified, or complete narrative of events. It is a spoken account, offered by the interviewee in response to questioning, and as such it is reflective, partisan, deeply involved, and irreplaceable.

****

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

Gordon B. Oakeshott, "The California Division of Mines and Geology, 1948-74," an oral history conducted in 1986-1987 by Eleanor H. Swent and Stanley Scott, Regional Oral History Office, The Bancroft Library, University of California at Berkeley, 1988.

Copy No._____

SUBJECT: NECROLOGY ANNOUNCEMENT FOR GORDON BLAISDELL OAKESHOTT, 89

Dear Geology Colleagues:

With a feeling of loss and sadness we report the recent death of Dr. Gordon Blaisdell Oakeshott on December 27, 1993 in Walnut Creek, California. He was 89 years old and died after a brief illness associated with influenza. In 1929 Gordon married his first wife, Beatrice, and their family spanned five decades; Beatrice predeceased him. He is survived by his second wife, Mrs. Lucille Oakeshott; his brother; three children (Paul, Phyllis, and Glenn); and 7 grandchildren. As a widower, Gordon married Lucille in 1986, so they had been married seven years at the time of his death. His memorial service was held on Sunday, January 9, 1994 at the Montclair United Methodist Church in Oakland.

Born in Oakland, California on December 24, 1904, young Gordon was just 1½ years old when the 1906 M8 San Francisco earthquake struck the Bay Area; he was a proud survivor of "The Big One" and enjoyed humorous anecdotes of that earthshaking event. Oakeshott received both his B.S. (1928) and M.S. (1929) degrees in geology from the University of California at Berkeley under Professor Andrew C. Lawson. In 1936 he wrote the first Ph.D. dissertation awarded in geology by the University of Southern California on the geology of the San Fernando Quadrangle in the western San Gabriel Mountains.

Dr. Oakeshott had a 25-year distinguished career as Deputy Chief of the California Division of Mines and Geology from 1948 until his retirement from state service in December 1973. Gordon served under Division Chiefs Olaf Jenkins and Ian Campbell, and the modern state geological survey was built under his tenure. He was a member or Honorary Member of several dozen professional geological societies, and served as an officer, chairman, or organizer of many geological commissions, panels, boards, and conventions. As a prolific geological author, he wrote many books and articles on California Geology, seismic hazards, and engineering geology. His broad career spanned three completely different realms of geology: 25 years of government service, academic teaching for 18 years at Compton Junior College, and two decades of consulting engineering geology. Dr. Oakeshott was both a California Registered Geologist #14 and Certified Engineering Geologist #9, as well as an AIPG Certified Professional Geologist #45; the low serial numbers indicate an honorary professional leadership role. He continued professional geological work for 20 years after his formal state retirement. His autobiography entitled *My California* was recently published. His career summary was published in a cover story of the January 1974 issue of *California Geology.*

Formal obituaries are planned for several geological societies, and a *California Geology* article is in preparation by retired District Geologist Richard M. Stewart. This brief necrology announcement is intended for timely notification.

We ask that membership officers of each geological society take timely and appropriate action to close his membership file so that dues notices are *not* mailed to his elderly widow, Lucille Oakeshott, also in her 80's. My state telephone number is (916) 327-0807 if there are any follow-up questions. Thank you for your consideration.

Sincerely yours,

Robert H. Sydnor

Robert H. Sydnor
Senior Engineering Geologist
California Division of Mines & Geology

ACKNOWLEDGMENTS

Special thanks are given to the following friends of Gordon B. Oakeshott who contributed to the cost of producing this oral history.

Bruce A. Bolt
Catherine C. Campbell
Elisabeth L. Egenhoff
Mason L. and Marie J. Hill
Nancy H. Landwehr
Carl F. Love
Jane A. Rummel

TABLE OF CONTENTS -- Gordon Oakeshott

Interviews conducted by Stanley Scott, Earthquake Engineering and Seismic Safety Oral History Project

PREFACE

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Interviews were conducted by Malca Chall and Eleanor Swent.

Willa K. Baum, Division Head
Regional Oral History Office

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

May 1, 1988
Regional Oral History Office
486 The Bancroft Library
University of California at Berkeley

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

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

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

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

Lewis L. Huelsdonk, Manager of Gold and Chrome Mines, Spokesman for Gold Mining, 1935-1977, 1988.

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

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

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

Samuel S. Arentz, Jr., in process

Catherine C. Campbell, in process

Donald Dickey, in process

Evan Just, in process

Plato Malozemoff, in process

Langan W. Swent, in process

ADVISORY COMMITTEE, WESTERN MINING IN THE TWENTIETH CENTURY

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

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

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

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

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

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

Mr. John R. Kiely
Senior Executive Consultant, Bechtel, Inc.

Mr. Joseph P. Matoney
Vice President - Coal, Kaiser Engineers, Inc.

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

Professor Malcolm McPherson
Department of Materials Science and Mineral Engineering
University of California at Berkeley

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

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

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

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

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

* Deceased during the period of the project

DONORS
TO
THE WESTERN MINING IN THE TWENTIETH CENTURY
ORAL HISTORY SERIES
1986-1989

Organizations

American Institute of Mining, Metallurgical, and Petroleum Engineers, San Francisco and Southern California Sections
Woman's Auxiliary to the AIME, Southern California and Northern California Sections
California Mining Association
The Jackling Fund of the Mining and Metallurgical Society of America

Corporations

Bechtel Group, Incorporated
Freeport-McMoRan
Homestake Mining Company
Kennecott
Krebs Engineers
Newmont Mining Corporation
United States Borax & Chemical Corporation

Patrons

James Boyd
Donald Dickey
J. Ward Downey
Mrs. Paul C. Henshaw, in memory of her husband, Paul C. Henshaw
Plato Malozemoff Foundation
Dean A. McGee
Langan and Eleanor Swent

Individuals

Claude J. Artero
Clemence DeGraw Jandrey Boyd
Philip and Katherine Bradley
Catherine C. Campbell
Albert T. Chandler
Stanley Dempsey
Louis R. Goldsmith
Lewis L. Huelsdonk
Howard Janin
James H. Jensen
Jack M. Jones
James C. Kimble
Noel W. Kirshenbaum
Plato Malozemoff
Mrs. Frank W. McQuiston, Jr., in memory of Frank W. McQuiston, Jr.
L. Arthur Norman, Jr.
Gordon B. Oakeshott
Richard W. Rees
Richard M. Stewart
Simon D. Strauss
John R. Struthers
William I. Watson
William B. Whitton

INTRODUCTION by Richard M. Stewart

I cannot write an introduction to the complete career of Gordon Oakeshott, because I have known him for only 40 years of the roughly 59-year span of his activities relating to the geology and mineral industries of California.

Gordon and I joined the California Division of Mines (a designation later to be changed officially to the Division of Mines and Geology) in the same year--1948. Because he was in the headquarters office in San Francisco, and I started in the Los Angeles district office, our paths did not cross often. However, I certainly was aware of his work, characterized by him in part as relieving Olaf Jenkins (then Chief of the Division) of as many as possible of the state's increasing burdens of administrative detail. He shared these with Art Norman (L. A. Norman, Jr.); Gordon worked more on geologic administrative details and Art more on the mineral industry side of the division's activities.

I grew to know Gordon better after I was transferred to San Francisco in 1955 to assume responsibility for some of those administrative details. Essentially, they were those that had been handled by Art Norman, who by this time had left to return to private industry.

In the meantime, Gordon pursued his other initial charge (when joining the division), namely to become familiar with the geology of the state. That he did just that is clearly evidenced by his publications over the years in the field of geology and seismology, but more importantly by the esteem and recognition accorded to him by his colleagues and many professional societies.

His relationship to the staff of the division was characterized by loyalty, patience, dignity, and an understanding perceived by all parties involved that what the individual staff geologists were doing was important--important to their careers as well as to the goals and responsibilities of the division. His communications to staff were models of clarity, and if handwritten, were beautifully legible, much to the delight of those who had struggled to decipher notes from Olaf Jenkins and Ian Campbell.

I am sure that the oral history that follows includes Gordon's comments on division projects, and his participation in them, that brought national interest and acclaim--the state map series, earthquake and fault studies, etc.. Emphasis in the division's work had shifted, in the late 1960's and in the 1970's, away from mineral resources studies to those relating to geologic hazards, and various programs were started as a result of specific legislation. Gordon's earlier interest in seismology enabled him to take an important role in these changes and in the growth

of the seismology staff and their programs. In all these endeavors, Gordon's relationships with the scientific community, whether in the public sector, government agencies, or academic institutions engendered mutual respect and added to the success of the division's programs.

On a personal level, I admire and respect the man. I recall during the particularly difficult time for the division, when the headquarters office was required to move to Sacramento, that Gordon conducted himself admirably and as a gentleman in the face of unprovoked rudeness and hostility on the part of certain political appointees.

We are good friends and have shared much during our working careers and after retirement. His personality is warm and laced with good humor, kindness, and generosity. Yes, we are good friends, and I am honored that I was asked to write this introduction. Enjoy all that follows.

Richard Stewart,
Consulting Geologist,
Retired District Geologist
San Francisco District Office,
California Division of Mines and Geology

March, 1988

INTERVIEW HISTORY - Eleanor Swent

Gordon Blaisdell Oakeshott was selected as the first geologist to be interviewed in the series on Western Mining in the Twentieth Century. A 1928 graduate of the mining college at the University of California at Berkeley, he worked as a field geologist for an oil company, became a college geology teacher, and then, after instructing pilots for the Air Corps during World War II, he joined the California Division of Mines and Geology, eventually becoming chief geologist before retiring at age seventy.

Under his direction and that of Olaf Jenkins, the division prepared the first geological map of the state, a monumental task, involving collecting and coordinating existing maps from many sources, done to different scales, as well as completing the mapping of unmapped areas of the state. He also expanded the work of the division to include earthquake studies, and was instrumental in the first seismological field studies to look at faults as causes, rather than results, of earth movement. In the early 1970s he was advisor to Senator Alfred Alquist, the author of landmark legislation on seismic safety which followed publication of the 224-page report Meeting the Earthquake Challenge in January, 1974. These activities are discussed in Oakeshott's oral history.

Gordon Oakeshott was evidently born to be a geologist. His mother tutored John Muir's children, and passed on to her own the enthusiasms of the great naturalist. Growing up in Niles Canyon, Gordon observed very early the geologic and geographic features there. He wrote his first report at age eleven, in a letter to his father which described with remarkable clarity a visit to a dam and the ride through a valley. More than seventy years later, he is still working at his profession. In March, 1988, he prepared a history of mining in the Knoxville District, Napa, Yolo, and Lake Counties, California, for the San Francisco section of the Mining and Metallurgical Society of America, for their spring field trip. The document is in the appendix of this volume.

His interest in earthquakes also seemed inevitable. As a child he was aware of the damage that had been done near his home by the Hayward earthquake of 1868, and he had early memories of aftershocks of the great San Francisco earthquake of 1906. He happened to live in Compton at the time of the major quake there in 1933. He earned his Ph.D. (the first one given for geology at the University of Southern California) for work done in the San Gabriel Mountains, including the site of the San Fernando earthquake of 1971.

Gordon Oakeshott enjoyed both the study of geology and the dissemination of geological knowledge through his teaching, and through the activities and publications of the Division of Mines and Geology. His oral history is significant for his lively recollections of early days in Niles Canyon (a source of gravel for construction as well as the location of some of Charlie Chaplin's movies), and for his account of teaching both in college and in the army. Later, as he administered a state division, he observed changes in procedure under Governor Reagan which foretold some later policies of President Reagan.

Gordon Oakeshott and I first met at lunch in The Faculty Club in Berkeley in the spring of 1986. An accident had impaired his walking, but not his geniality nor his mental energies. A long and happy first marriage had ended in widowhood; at the time we met, he had recently remarried, and was joyful.

The letter inviting Gordon Oakeshott to participate in the oral history series was sent on April 15, 1986. Some planning was done by telephone, and a rough outline was prepared. Four interviews of about two hours each were held on afternoons between April 24 and May 14, 1986, followed by another on November 8, 1987.

It was natural from the start to call him Gordon; as his oral history shows, he is a man oblivious to differences of age or rank. The interviews took place in his study at his home, a one-story, seismologically sound structure in the Montclair hills of Oakland. The large, brilliantly colored geologic map of California covers one wall. The shelves and desk are orderly and uncluttered, and there is a serene garden view through glass doors. Gordon spoke fluently and concisely, from a few notes, with great consideration for the interviewer.

When the transcript was sent to him for review, he edited it meticulously and promptly, returning it with a few additions and minor corrections. Some sections were re-arranged for better chronological order. Having had much experience in the production of documents, he was generous and cooperative about all of the necessary arrangements.

Following in the same volume, there is another series of interviews conducted by Stanley Scott for the Earthquake Engineering and Seismic Safety Oral History Project; these provide a broader view of Gordon Oakeshott in the newly emergent field of engineering geology, and explore the relationship of geology, engineering, and seismology as they affect public policy in California. The two series were planned independently, but complement each other.

The tapes of both series of interviews are deposited at The Bancroft Library.

Eleanor Swent
Interviewer-Editor

May 1988
Regional Oral History Office
486 The Bancroft Library
University of California, Berkeley

INTERVIEW HISTORY--Stanley Scott

The following interviews with Gordon Oakeshott were conducted as part of the Earthquake Engineering and Seismic Safety Oral History Project. The project has two principal sets of goals. The first set of goals relate to the growth of the field of earthquake engineering, and the development of knowledge, design theories, codes and engineering practice adapted to and appropriate for use in seismically active areas. This has been a gradually accelerating process that began slowly in the long interim between the 1906 San Francisco earthquake and the 1925 Santa Barbara earthquake, was stimulated by subsequent damaging earthquakes, and still continues. The second set of goals relate to the formulation and implementation of seismic safety policy, particularly as exemplified in the experience of the California Seismic Safety Commission and related organizations, as observed by Commission chairs, executives, and other key associates.

San Francisco structural engineer Henry Degenkolb was responsible for my approach to Gordon Oakeshott with a request for an oral history interview. In the course of several such interviews with Henry, he had commented on the fact that structural engineers and geologists sometimes had difficulty communicating with each other, especially on matters of earthquake engineering and earthquake-resistant design. He did, however, note that Gordon Oakeshott was one geologist who seemed to understand the engineers' points of view better than most, and recommended that I consider interviewing Gordon.

This I was most happy to do, having already had dealings with Gordon over the years, and having found him always friendly and helpful. One early and very constructive encounter was in 1965 or thereabouts, when I went to the San Francisco Ferry Building office of the California Division of Mines and Geology, seeking help from Gordon, who was Deputy State Geologist, and from Ian Campbell, State Geologist. I asked their advice on ways for the Institute of Governmental Studies to become active in research and writing on the then much-neglected topic of earthquake safety and public policy. After encouraging me in my quest and having given the matter some thought, they recommended Perry Byerly, University of California Seismologist, Emeritus, as one of the best possible advisors whom I could consult.

Their recommendation proved crucial, as Byerly was later responsible for successful contacts with Karl Steinbrugge, who in due course wrote the 1968 Franklin K. Lane monograph, Earthquake Hazard in the San Francisco Bay Area: A Continuing Problem in Public Policy, published by IGS. Senator Alfred E. Alquist's prompt response to the Steinbrugge report was to launch an effort that resulted in creation of the Joint Committee on Seismic Safety in 1969. The work of the Alquist Committee--to which Oakeshott was an expert advisor--contributed greatly to improved public and legislative awareness of the importance of seismic safety. The committee's 1974 report charted a course that California is basically still following, on the necessarily long and difficult road toward reasonable earthquake safety.

The topics covered in my two interviews with Gordon include the differing approaches of engineers and geologists--as suggested by Henry Degenkolb--but also go far beyond that topic. Thus the interviews also treat successive major California earthquakes and the state's responses to them, as well as the growth of earthquake-related activities conducted by the California Division of Mines (later the Division of Mines and Geology). Gordon, who was usually Deputy Chief, but interim Chief and State Geologist from time to time, always played a central role in the division's earthquake work.

Many observers have commented on the 1952 Bakersfield earthquake as representing something of a watershed for earthquake studies. Certainly after that earthquake there was more state involvement than there had been before. Moreover the state made a signal contribution when it issued the 1955 report, Earthquakes in Kern County, California, During 1952, (November 1955). Gordon's several talents, not only as an "earthquake chaser" but also as writer, editor, and negotiator, were largely responsible for that valuable report being completed and published.

The interviews also treat another important development--the emergence and maturing of the field of engineering geology, linking the separate disciplines of engineering and geology and utilizing the expertise of both. Since man-made structures do not normally float in midair, but must be supported by the earth, it is essential to understand ground-structure interrelationships--especially in earthquake country.

The interviews also touch on the role played by a committee of the Association of Engineering Geologists--chaired by Gordon--in exploring concerns about the high, thin-arch dam that the Bureau of Reclamation proposed to build near Auburn. Preliminary work had begun in a site whose geology and potential seismicity caused some to question building a dam of that design in that location. The committee's deliberations were instrumental in getting agencies of the state government to look into the matter, and also helped prompt the bureau to conduct its own in-depth reexamination of the issue. The upshot was a consensus that such a dam should not be built on that site, and the project was deferred indefinitely.

Another interview section deals with geologic mapping, comprising Gordon's responses to questions I asked principally to satisfy my own curiosity. I have long marvelled at geologists' uncanny ability to tramp through rough terrain making field observations and collecting specimens, managing somehow to interpret underground formations from the assembled data, and piecing together a history of events that took millions of years to unfold. The questions about geologic mapping helped bring out still another side of our multi-faceted interviewee. We see him not only as an educator, author, editor, humanist and dedicated public servant, but also as a practitioner of the tough, tedious and demanding--but highly rewarding--discipline of field geology.

The interviews were conducted in Gordon's home, high in the Oakland hills. Little editing was required, as he characteristically organizes his thoughts carefully and expresses himself clearly. Since they focused principally on the topics noted above, my two interviews deliberately did not attempt to present a well-rounded or full-portrait oral history. Meanwhile, however, another oral history interviewer and project was covering other phases of Gordon's life and career. Consequently it seemed appropriate to combine them under a single cover. Together they provide a wealth of insights, recollections and observations by a first-rate geologist, respected administrator and delightful human being.

Stanley Scott, Interviewer/Editor
Institute of Governmental Studies
University of California

February 1988

OAKESHOTT, GORDON B.

Office: Consulting Geologist
(Home): 3040 Totterdell Street
Oakland, CA 94611
(415-530-5595)

Born: Dec. 24, 1904

1928	BS, Coll. of Mining, Univ. CA
1929	MS, Univ. CA
1936	PhD, Univ. So. CA

1973-date	Cons. Geol. on active faults and earthquakes; geothermal and mineral resources
1973-1974	Sr. Geol., part-time, CA Div. Mines and Geology
1972-1975	Instructor, CA State Univ. at Sacramento and San Francisco
1948-1972	Assoc. Geol. to Chief, CA Div. Mines and Geology
1930-1948	Instructor Compton Coll., Los Angeles County, in geology, earth sciences, meteorology, aeronautics; Civ. Educ. Adv., US Army; Cons. Geol.
1929-1930	Field Geol., Shell Oil Co., Santa Maria, CA
1928-1929	Teaching Fellow, Geol. Sci, Univ. CA

Member: Phi Beta Kappa; Sr. Mbr. of AIME; Sr. Fell. GSA; Hon. Mem, Am Assoc. Petrol Geol.; Hon. Mbr., Nat. Assoc. Petrol Geol; Hon. Mbr, Assoc. Eng. Geol,; Webb Award, Far West. Sect.; Nat. Assoc., Geol. Teachers; Fell. Explor. Club; Fell. CA Acad. Sci; Fell. Am. Assoc. Adv. Sci; Am. Inst. Prof. Geol.; Earthq. Eng. Res. Inst., past Board mbr.; GSA, past ch. Cord. Sect.; Nat. Assoc. Geol. Teachers, past Pres; le Conte Club, past Pres.; Penin. Geol, Socl., past Pres; Seism. Soc. Am., past Assoc. Ed.; Registered Geologist CA; Cert. Eng. Geologist, CA

Author: Approx. 100 technical papers and books

9/83

BIOGRAPHICAL INFORMATION

(Please print or write clearly)

Your full name GORDON (B) AISDELL OAKESHOTT

Date of birth 12/24/04 Place of birth OAKLAND, CA

Father's full name PHILIP SIDNEY OAKESHOTT

Birthplace LONDON, ENGLAND

Occupation ELECTRICIAN, SOUTHERN PACIFIC CO.

Mother's full name EDITH MAY (BLAISDELL) OAKESHOTT

Birthplace BISHOPS CREEK (BISHOP), CA

Occupation TEACHER + HOUSEWIFE

Where did you grow up ? OAKLAND, CA

Present community PIEDMONT PINES IN OAKLAND, CA

Education B.S. '28 ECONOMIC GEOLOGY, COLLEGE of MINING, UNIV. of CA, BERKELEY, CA. M.S. '29 GEOLOGY, UNIV. of CA; PH.D. IN GEOLOGY, UNIV. SOUTHERN CA, 1936.

Occupation(s) 1928-29 TEACHING FELLOW in MINERALOGY, UNIV. of CA; 1929-30 FIELD GEOLOGIST, SHELL OIL CO.; 1930-1948 INSTRUCTOR in EARTH SCIENCES, SURVEYING, MATH., + PILOT TRAINING, COMPTON COLLEGE, CA, 1948-1972; VARIOUS to CHIEF, CA DIV. MINES + GEOLOGY. GEOLOGIST 1927 —, RET. 1980.

Special interests or activities GEOLOGY of CA.

GORDON B. OAKESHOTT

Interviews Conducted by Eleanor H. Swent
for Western Mining in the Twentieth Century
Oral History Series

I GROWING UP, 1904-1924

[Interview 1: May 14, 1986]

Memories of Oakland and Niles, California, Including Earthquakes and Gravel Pits

Swent: Mr. Oakeshott, perhaps you would like to begin by sharing some of your early childhood memories.

Oakeshott: It's difficult to say how long one's memory can go back, but among my earliest recollections is the birth of my baby brother Elliot, September 27, 1908. My brother Paul, whom I want to talk about mostly, was born February 9, 1906. He and I had been sent to stay with my mother's younger sister, Aunt Lettie, and Uncle Patty Howard, on Rose Avenue in Piedmont while the baby was being born.

Aunt Lettie was mama's next younger sister. Uncle Patty was a plumbing salesman, and at one time, clerk of the City of Piedmont. We played in their old house, one door uphill from the new house that they were building at 922 Rose Avenue, a house which is still there, and very well maintained.

Other scattered memories of our life in Oakland before I was six years old come back to me, of Great Grandpa John Shuey when he was about ninety years old, coming by with his dog named Dewey. In the early 1900s, people were naming their dogs and their children after Admiral Dewey, because of the Spanish-American War. Dewey was a great hero.

Swent: Was Mr. Shuey your mother's grandfather?

Oakeshott: Yes.

Swent: This was the Shuey family of the dairies which became Berkeley Farms?

Oakeshott: Yes. The Shuey that owned the creamery was my mother's first cousin, There is a Shuey Street in Walnut Creek, named after the family.

Well, Great Grandpa Shuey would stop by and see us boys. And then, I claim that I remember the 1906 earthquake, but what I remember, no doubt, is the aftershocks. I recently looked up in the Townley and Allen catalog, the aftershocks of the 1906 earthquake lasted at least four years, so I was quite competent to remember some of the aftershocks later.

And then I remember my first automobile ride in my cousin Charlie's Buick, and playing in our back yard and across the street in a eucalyptus grove.

In about 1911, we moved to Niles, now a part of Fremont. Niles is located on an alluvial fan at the mouth of Niles Canyon, and it was then especially a very important railroad town. There was a Y there on the railroad that brought trains from Oakland up through Niles Canyon, to connect with the transcontinental railroad, and then also trains that turned south to San Jose to go down the coast, and then trains that came across the top of the Y from San Jose to connect with the transcontinental line. This was all Southern Pacific.

And all of these trains and tracks, at least six of them, passed directly in front of our Southern Pacific house. My father had his shop at one end of the house and we lived in the other end. We had no inside plumbing. We had had in East Oakland; there our home was connected to a sewer.

Swent: You moved down there because of your father's accident?

Oakeshott: Yes. You know, the unions came in and began to correct a lot of injustices a few years later. But big companies like Southern Pacific were often very kind to their employees. They took care of my father during his illness at no charge, paid him his salary; they gave him a special job in Niles in a battery shop, with his own home, rent free, and sure, he had to work ten hours a day, including Saturdays, and if there was extra work, he had to work on Sunday, there was no such thing as overtime--but they were good to him.

Swent: How did he have the accident?

Oakeshott: He was working at Oakland pier, and he put a ladder up against a train, which was not scheduled to go out for about two hours, and then he climbed up the ladder, got up on top of the train, and put another ladder up to reach the ceiling of the old station at the foot of Seventh Street. The train moved unexpectedly, he was knocked off, fell on top of the train, and

Oakeshott: then on to the ground. He had a hole in the top of his head for the rest of his life, about two inches across and an inch deep. In the hospital he claimed that he was one of the few people that had a look at his own brains. [laughs] But he lived, and got restored to reasonably good health, and lived to be eighty years old.

Well, all these tracks between us and downtown, between us and the school, meant that my folks decided we couldn't go to school until I was about eight years old. But my mother had been a teacher, so she taught me to read and write, and I taught my younger brothers to read and write, and finally we all went to school. I went to school in the third grade, and my brother Paul, a year younger, went to the second grade, and my little brother Elliot started school. There wasn't any kindergarten then.

I remember our folks taking us to church on Sunday, first to the church in Old Niles. Old Niles was founded on what we call the fall line of Alameda Creek. In many places in the world, including especially the East Coast, as streams or rivers came out of the hills, they would go over a falls and then on to the coast, and that was where they located the mechanical mills to grind the grain. So Vallejo's Mills was located first on the fall line of Alameda Creek, where it came out of Niles Canyon, over a series of little rapids.

The first activities in the Niles area were grinding of grain. The town was later founded on an alluvial cone of very rich soil, so the first things they grew were grain.

Shortly after the town had been flooded several times, they moved the whole town, lock, stock, and barrel, up to a higher elevation, but we used to have great times, on Sunday especially. Picnics--we made our own ice cream, with local fruit. Ice came in to us free in the trains from Truckee. Natural ice was cut on the lake up there and brought in to Oakland and San Francisco, ferried across the Bay.

One of the train men would put a big block of ice on his back and bring it in and stick it in our ice box, so we had a lot of service.

Paul, who was thirteen months younger than I, was always just behind me, so we were nearly always together at school, first at Niles, and then we went to Frick Grammar School in Oakland. I think in 1917 we moved back to Oakland. My father was moved back to work at Oakland Pier. Frick Grammar School was near 62nd Avenue and Foothill Boulevard.

Oakeshott: Foothill Boulevard was the main street along the front of the hills in those days. There were two main streets that went from Oakland out to the Hayward-Niles-Mission San Jose area. One was Foothill Boulevard, along the foot of the hills; the other was what we call East Fourteenth Street now. So they are old, old streets.

Swent: I understand East Fourteenth is built along the old Spanish Mission trail.

Oakeshott: It probably was. They date a way back.

At Frick, I worked assisting the janitor. I was always enthusiastic about any job I had. I loved to clean up around the school, and my folks were afraid I was headed to being a janitor all my life. [laughs] I liked every job I had.

Swent: Did you get paid?

Oakeshott: Oh, sure, sure.

Swent: No problems with child labor laws?

Oakeshott: Oh, no, no. I helped old Joe, who was a live-in janitor. Miss Poore was the principal, and she really kept everybody in line; she was an old-time principal. But I don't remember any disciplinary problems in those days at all. No problems were tolerated. The minute any kid stepped out of line, he went to the vice principal's office, or whoever was in charge, and got tanned, and that was it.

Swent: With what?

Oakeshott: A strap, or a good strong hand, or a ruler. In class, the teacher would smack your hand with a ruler if she caught you talking in class.

Swent: How many students were in a class? Were they big classes?

Oakeshott: I don't remember that they were very big classes, but very often there was more than one grade in a class. My mother taught school in Byron, Brentwood, Martinez, in the nineties, and she had all eight grades in one classroom. Of course, she had to organize it so that the older kids helped teach the younger ones, and helped keep order.

I went to Melrose Heights Intermediate School. They didn't call it a junior high, but it was like a junior high, and then to Fremont High for four years. Fremont High was an old barn of a place that burnt down in 1930. They now have a pre-fire

Oakeshott: Fremonters Club that has luncheon meetings; I go to those once in a while. I graduated from Fremont in 1923, and Paul graduated a year later.

When I was twelve years old, I began selling papers at the Seminary Avenue station of the big red trains. They had big electric trains, run by Southern Pacific, that went down to the Oakland Seventh Street mole. Of course, the rival system was the Key Route system, that had yellow trains that ran out on the Berkeley pier, and then both of them went on the ferry boats over to San Francisco.

So we actually got over to San Francisco faster than you can now.

Swent: That's progress?

Oakeshott: Yes. [laughs] Well, we enjoyed the ferry boats. When I was twelve, I began selling morning papers down there at Seminary. Paul went to Fairfax station, which was a few miles further down, and sold papers also. Then when I was twelve, I discovered that I was very nearsighted, and I had never known it before. Well, glasses opened up a new world for me! Completely! I saw things I had never seen before. [laughs]

Swent: Had you been doing well in school?

Oakeshott: Yes, but I had been unconsciously crowding my way up to the front seat. The teachers didn't say anything, but in those days there were no school nurses, and teachers and principals didn't pay much attention to kids' health, unless they got obviously sick, and then they sent them home to mama. [laughs]

Paul and I mowed lawns, and we also went out to San Leandro and picked cherries, apricots, and red currants.

Swent: How did you get out to these places?

Oakeshott: Usually rode a bicycle. San Leandro then was a region of orchards and vegetable gardens, all feeding San Francisco. This was a function of the Niles area; it fed produce into San Francisco. Then Niles fed things like sand and gravel into San Francisco.

Our friends the Shinns, who had a great big ranch on Alameda Creek, out on the Niles cone, had a gravel pit, and this gravel pit would fill up with gravel brought in by the river in the winter. They would dig it out in the summer and sell the gravel to San Francisco for building after the earthquake. Then the following winter, it would fill up with gravel again, and they would scoop it out again and sell it. So it was one of these very unusual renewable mineral resources.

Swent: How did they scoop it up?

Oakeshott: With horse- or mule-drawn scoops or shovels. Excavations were done by mule teams that drew what they called shovels, but they were really big scoops. The City Hall excavation for Oakland was made the same way, about 1913. One type of brand name was Fresno scrapers.

One of the enormous improvements in mining operations that have taken place over the years, in my lifetime, has been the movement of earth. We move enormous quantities of earth nowadays, that we wouldn't have dreamt of in the days when I was a boy. [laughs]

Swent: Did you go out to Shinns and watch this going on?

Oakeshott: Oh, yes, once in a while. Of course, when they built dams across Alameda Creek and all of these streams, this meant that the gravels were not renewed downstream, so that ended it.

Swent: How was it shipped to the City?

Oakeshott: A lot of it went in gondolas or open railroad cars. The railroads were utilized far more in those days than they are now. There were railroads all over California, built for logging, for transporting gravel, built for special purposes. Gravel would be transported in trains of a hundred cars long, in to a big metropolitan area like San Francisco.

Swent: To get it across to San Francisco, did they go by boat, or did they go around the Bay?

Oakeshott: Both ways--on barges, across the bay, and they went around through San Jose. There were bridges quite early that were built around the Alviso area, like the Dumbarton Bridge. Boats and railroad cars were very much utilized.

We did all sorts of things; we mowed lawns, and if we got fifteen cents an hour, we thought we were doing pretty well.

Swent: You could probably get something with fifteen cents in those days, too.

Oakeshott: Yes, we could go to a moving picture show on Saturday afternoon, after they opened up the first one in Niles, for five cents.

Then when I was fifteen, I began to work at Arnold's Grocery, on Foothill Boulevard at 55th Avenue and Trask Street. I'd make up grocery orders and deliver them in a 1919 Ford. I drove without a license, because none was required. Then the state issued me a license for life, but they reneged on that.

Oakeshott: You know, the state has reneged on many things in a similar way. You remember, when they built the Bay Bridge, they said it would be toll-free when it was paid for? They forgot that in a hurry, and all they've done is raise the tolls. [laughs]

Swent: So after a few years, they told you your lifetime license had to be renewed?

Oakeshott: That's right; I had to turn in my lifetime license and get it renewed. But I had one lesson in driving in a Model T Ford and then the grocer's son who was instructing me said, "Okay, deliver the groceries," and I loaded up the car and delivered the groceries.

The first thing I did wrong was to make a U turn in front of the store on Foothill Boulevard. A car came along and hit me, bent the fender down against the tire. The Ford fenders were soft, you know, so a couple of us lifted up the fender back into place.

Swent: So it was easy enough to do your own body work in those days?

Oakeshott: Yes, it wasn't very serious. Imagine, we bought a new Ford for $500. [laughs] And they were efficient, they got us around in good shape. They were not what you'd call fast, but we got around. My folks never did learn to drive; they were the older generation.

Swent: Let's go back to Niles, and you can tell me about Charlie Chaplin.

Oakeshott: I told you we moved to Niles in 1911. Niles was about 500 people at that time. In 1869, the first transcontinental railroad had come through Niles Canyon. Although the golden spike was driven at Salt Lake, the railroad had not been finished through Niles Canyon, so it didn't come right into Oakland as soon as the golden spike was driven. There is a plaque out in Niles that tells about this. So the first transcontinental trains came through Niles Canyon, after the golden spike was driven at Promontory Point, Utah.

Alameda Creek is interesting to a geologist because it rises way back in the back country of Mount Hamilton, runs north towards the Livermore valley, and then cuts right across the Coast Range and empties into San Francisco Bay. This is what we call an antecedent stream. It was probably there before the hills rose. The hills were elevated, and the stream was able to cut down enough to keep up with it.

Oakeshott: Niles suffered some from the earthquake in 1906; so did Mission San Jose, of course, nearby. Then in 1868 there had been a great Hayward's earthquake. The place was called Hayward's then because it was named after Mr. Hayward. Later, the "s" was dropped and it was just called Hayward.

The Hayward's fault probably ran just about through our house at Niles, along the foothills. Of course it runs through the University of California stadium; you know that.

We knew a lot of people at Niles, particularly a Mrs. Overacker, who had been born in 1860, and she said a crack ran across her back yard. This was probably the original fault along which the Hayward movement took place. We don't know to this day how much movement occurred, but the best account of this earthquake is in the so-called Lawson report.

Swent: Where would I find that?

Oakeshott: It was published by the Carnegie Institution, written by a committee headed by Andrew C. Lawson, right after 1906. In the back of that is a report on the 1868 earthquake. In 1906, there were many people alive who had been through the 1868 earthquake. Up until 1906, this had been the Bay Area's big earthquake. But for some reason, no map has ever been found which shows the trace of the Hayward's fault in 1868.

"Broncho Billy" Anderson and Charles Chaplin; Early Western Movies in Niles

Oakeshott: Beginning about 1912, on our way to school, we passed big barnlike buildings that belonged to the Essanay Studio. That would be at what's now First and G Streets. The S was Spoor, an absentee partner of this moving picture company. The A was for Anderson, "Broncho Billy" Anderson, who directed and acted in the films that they made in Niles from about 1912 to 1916.

We weren't allowed to go outside the fence because of the trains, but we would sit on our fence and watch Broncho Billy and Ben Turpin. He was a "cockeyed" comedian. And Chester Conklin, and Edna Purviance, and for a short time Charlie Chaplin, race after railroad trains, jump on, tie the girls to the track, all this sort of stuff that was characteristic of the early Westerns. Broncho Billy would stay up the night before, write the play, and the next day they would run it off, with no retakes. They'd just run it off, and sell it. They made hundreds of them.

Oakeshott: Most of the actors were paid about $25 a week. Charlie Chaplin was hired by Broncho Billy because Charlie had just begun to be recognized as a great star, so he was paid $1,250 a week. Charlie Chaplin made five films in Niles. He was only there about three months, in 1915. His most famous film was "The Tramp."

The son of a cousin of mine, Bob McKay, ran it off for us one night. He collects old films. This film was made near the mouth of Niles Canyon. So I took young Bob McKay and some of his movie fan friends out there a few years ago, and showed him where Charlie Chaplin and his actors used to work out, and where "The Tramp" was made, and the Wesley Hotel that Charlie Chaplin stayed in with Edna Purviance, and where the old studio was. There's nothing there now of course, except the hotel on Main Street.

Swent: I suppose the trains were a big plus for the movies.

Oakeshott: That was a plus, and the climate was great. They had a lot of sunshine, the canyon was wonderful for taking pictures, and so they did very well. In those days, there was no Hollywood, and pictures were taken a lot of places, New York and other places.

Broncho Billy turned out hundreds of them. They were all clean, always had a moral, the girl was always rescued. They were pictures anybody could see, and they showed at the local theater for a nickel.

Chaplin was not well liked. He was feeling his oats; he was hoity-toity; he thought Niles was way beneath him.

There was a nice hotel, the building is still there, called the Hotel Belvoir. I remember my mother used to go to club meetings there. Ben Turpin, the "cockeyed" comedian, and Chester Conklin would perform for the ladies, just act the nut for the ladies' occasions, to entertain them, but Chaplin never would. Chaplin ate his fifty-cent dinners there and never paid a tip, but he was the one getting a magnificent salary. Twelve hundred and fifty a week in those days was a fortune. Twelve hundred a month would have been a fortune.

Family Background

Oakeshott: My middle name is Blaisdell; my mother's maiden name was Blaisdell. We found a Blaisdell street near the old Hotel Belvoir in a new development there. I think that was named

Oakeshott: after the former governor of Nevada. He was Blaisdell. It was a large family, and he was probably a remote cousin of some sort. He built a house there, I guess for retiring.

In 1976, my first wife Beatrice "Bee" and I attended the International Geological Congress in Sydney, Australia, and I looked in the phone book and found a J. M. Oakeshott. It was way out of town outside of Sydney. An old lady's voice answered. I said, "Could I speak to Mr. Oakeshott?"

She said, "I am J. M. Oakeshott. There isn't a Mr. Oakeshott; my sister and I live here alone."

I said, "I'm Gordon Oakeshott from Oakland; I think you must be a cousin of mine." She talked a little bit, but didn't say very much. The next morning I found a note in my mailbox, addressed to "Mr. Oakeshott of California," which said, "Call me."

So I called her, and she said she talked to her older sister, and "She reminded me that she and I and our mother and father visited you at Niles, California, in 1915." It turned out that her father was in charge of the Australian exhibit at the Panama-Pacific International Exposition, and he was a first cousin of my father, so my family had invited Cousin George and his wife and the two little girls to visit us at Niles. We had taken a walk up Niles Canyon and up in the hills back of Niles.

##

Oakeshott: The girls were about thirteen and fifteen, and you know girls that age don't pay much attention to younger boys. I was about ten years old, and I remembered the whole occasion, having a picnic, and a big dinner with ice cream, and walking up along Niles Canyon along the big wooden flume of the Spring Valley Water Company that brought water to San Francisco.

Swent: Isn't there also a chain of stores in England called Oakeshott?

Oakeshott: Yes, that was founded by my father's Uncle George. They had big families; my father's Uncle George had six or seven brothers. They all lived to be sixty or more. There's also an Oakeshott Street in London. My father was really born in Barnett, a suburb of London. His father was postmaster of one of the seven boroughs of London.

Swent: That must have been a responsible job.

Oakeshott: Yes, he took my father out of school and tried to put him in the post office, but my father didn't like that much. So he decided to pick up and come to California to make his fortune in the gold mines. A lot of them tried, but very few made it, and still fewer held onto it.

A few did, like Geoerge Hearst, who founded the Hearst fortune, but not many.

##

Oakeshott: My mother had been a teacher in California; my father had come from England when he was about eighteen to twenty years old. My mother's father also taught in California; he was the first teacher in Owens Valley. He went to Owens Valley in about 1870, and taught general school.

My mother coached the two Muir daughters through their late high school years at the old Martinez home, and she was very much taken with John Muir. She suggested to us boys, Paul and me especially, that since we liked the outdoors, and liked to walk around the hills, that we ought to go into something like physical geography, what she called it, after John Muir's great adventures. Because he would come home to Martinez, you know, after trips into Yosemite and the High Sierra, and he'd talk to my mother and other people like that about his adventures.

I didn't ever meet him. He died on my tenth birthday, in 1914, and I can remember my mother's tears when John Muir passed on.

This started my interest in geology. Then my mother had a great friend who was the mother of a professor at Cal [the University of California] in geology, Roy R. Morse. My mother advised me to go out and talk to him, which I did. I was still in high school, toward the end. He told me a little bit about the geology curriculum at Cal.

Working for Southern Pacific

Oakeshott: After graduation from high school, I met another lifelong friend, Charlie Rummel, who went into law, and he died about a year ago. Charlie and I went to work for Southern Pacific Company at 65 Market Street in San Francisco. It's now Number One Market Plaza. The building is still there; the Southern Pacific building was built in 1917, and it's one of San Francisco's staunchest buildings. It was very well constructed.

Oakeshott: Of course, down that low on Market Street, you're out over bay mud, so it had to have a good foundation, and it does, all right.

When I worked full time for the Southern Pacific Company, in 1923 and early 1924, my salary was $51.84 a month. I started as an office boy, but very soon they had me correcting freight waybills and shortly my salary doubled. I still have a copy of my application for employment. They asked me questions like: what was my religion? what was my race? what party did I belong to? Lots of things that you wouldn't dare ask now. [laughs]

Swent: You lived at home, so your expenses weren't great?

Oakeshott: Yes, that's right, I was very lucky. Like other kids, I suppose, I didn't fully appreciate that opportunity. [laughs]

Swent: Did your brother work for SP also?

Oakeshott: Yes, a year later, he followed me into the same job, and followed me into the College of Mining and did the same thing.

Swent: Were you given any preference in employment because your father had worked there?

Oakeshott: Yes, I first got the job because my father worked for Southern Pacific Company. He hadn't worked for that office; I worked for the auditor of freight accounts, but they interviewed me because my father had worked for a long time for the Southern Pacific Company. They were very nice to me. I was white, and I was Presbyterian, and I guess I belonged to the right political party, and wasn't subversive, so I guess I met their qualifications. [laughs loudly]

At Frick, we had met Gordon Oatridge, so in 1924, after working a year and a half, Gordon Oatridge and I entered the College of Mines at the University of California.

Letter written by
Gordon Oakeshott, age 11,
to his father

My first paper on engineering geology.
(Letter to my Father in Niles, while on a visit to my cousins in Livermore.

Livermore, Cal.,
July 3, 1916.

1930

Dear Papa ÷

How are all of you? I am well & am having a fine time. I will not be home to-morrow but will let you know when I will. If Theodore is home (he works at Martinez) we will go to Martinez to see him.

Yesterday we went on a picnic to the Calevaras Dam. It is not anywhere near completed. When it is completed it will cover a large valley as far as the eye can see. It will be

240 feet deep. The dam is to be made only of earth. There is only one side that has to be enclosed for it is nearly surrounded by high hills. It will be a large lake when it is done and very beautiful. It is quite high above the valley. I guess it is at least 500 feet. After lunch we went on to Milpitas. From Milpitas we went to San Jose and from there we went to Warm Springs, to the Mission & back again to Livermore. But I have forgotten that we went also to Alam

Rock Park & through the
beautiful Santa Clara Valley.
There was a fine road all
'round the foot hills & you
could look out & close beside
you were beautiful orchards.
Out further were the farm-
houses & little towns. Then beyond
this you could see San Fran-
cisco Bay. When we got back
we had traveled 75 miles.
On the way back we had a
puncture in the tube and had
to change the tire. Geo. Wagar went
with us. He is going to stay over
Tuesday. I & Dorothea have lots

of fun with him.

Yesterday we took quite a good many picture of the scenery. All the way to Milpitas the road is narrow and up & down grades & around curves. Sometimes you would look to your right & you would see straight above you rolling hills & to your left you would look almost straight down into a narrow canyon. I hope that some day you also may take that ride.

Lovingly,

Gordon Oakeshott.

II A STUDENT AT THE COLLEGE OF MINES, UNIVERSITY OF CALIFORNIA, 1924-29

Curriculum and Professors

Oakeshott: I registered in geology when I went to Cal in 1924, as one of the four options in the College of Mining. Then my brother just followed in my footsteps.

Swent: What were the other options?

Oakeshott: Petroleum engineering, mining, and metallurgy. In my class, one of my fellow students, Ralph Hultgren, was University medalist. He came through college with straight A's in engineering, which was unheard of. I knew Ralph very well; he was one of my best friends. I had good grades, but nothing like that, of course; that was fantastic. He was a whiz in mathematics.

Paul and I were both good students, and we got a special citation, or letter, from Professor Joel H. Hildebrand for doing well in beginning chemistry. He was the last of my old professors to die, but of course he lived to be 101. [laughs]

All of us started economic geology, and the first courses we had were under the great Andrew C. Lawson. He was an old curmudgeon, but we liked him because he was so enthusiastic. This was one characteristic that all my geology professors had, enthusiasm for their teaching. Some of them we would say today were bigoted and narrow-minded and authoritarian. Lawson wouldn't brook any disagreement with him, but I got along fine with him because he knew his stuff and he was an inspirational speaker.

You know, he was the old professor who became notorious for having a child at age eighty-seven.

##

Swent: Was Dean Probert there?

Oakeshott: He was the dean of the College of Mining, and he was a wonderful man. He had his shortcomings too, in the light of today. For instance, he didn't think girls belonged in mining or geology or engineering, so he made it tough for girls.

Swent: Were there many?

Oakeshott: No, they didn't stay long in his classes. He literally ran them out, because he didn't believe that women belonged in his class. Of course, all that is long gone. [laughs]

Swent: Did any of the Scopes trial business affect your geology studies?

Oakeshott: There was no trouble at Cal. Later, I taught at Compton College from 1930 to 1948, and among other courses, I taught historical geology, including evolution. There was only one student, of all the many hundreds I had, who came to me and said he had to withdraw because I was "destroying his faith." He believed in the literal interpretation of Genesis, so he couldn't quite stomach evolution. But there was no trouble at Cal.

We were taught some things that we know now were untrue. We didn't have the tools to work with that they have now. One notable change of course is in plate tectonics. We were told by Lawson himself that Wegner's ideas expressed in 1913, on drifting of the continents, were out of the question, because there was no mechanism to cause a continent to drift or move. It was mechanically impossible, so he dismissed that. That was the end of that; that's all there was to it. And now they start with that! That's fundamental.

I think it has a long ways to go. I don't fall, hook, line, and sinker for everything that some of the plate tectonists go for nowadays. But anyway, there's a great truth there that we have to handle, we have to deal with.

Of course there are many other things in detail, but that is probably the most spectacular thing. Nowadays, I think evolution is accepted.

I go up every once in a while to the foot of Mt. Hood, in Oregon, where my daughter lives. We built a home up there and visit there. When we are there, we go to a Lutheran church which has a young minister. A few months ago, he asked me to give an evening seminar on Genesis and modern ideas of Genesis.

So I told about how Genesis had been written by different people, and how it dated back to old ideas that had been expressed in Babylon hundreds of years before, and I mentioned

Oakeshott: evolutionary processes, and I overheard one of the people who attended afterwards say to the young minister, "Do you believe what Gordon said about evolution?"

And I heard the pastor say, "Yes, I believe everything Gordon said."

So evolution is accepted now. The progressive ministers recognize that they have to accept scientific facts, and the great age of the earth. This is a fact, not theory. The theory of evolution is a fact now. We don't know many of the details, but the general process is a fact.

In the days that I went to the College of Mining, we used to drive our old car into the Mining Circle, and park in front of the school, and walk into class. [laughs]

Swent: Life has not improved in every way since then, has it?

Oakeshott: [laughing] No, it sure hasn't.

Swent: Those really were the good old days. Did you have laboratory classes at all?

Oakeshott: Yes, there were even laboratory classes on Saturdays. We took at the College of Engineering the first two and a half years of engineering background, so we had two-and-a-half years of chemistry, physics, mathematics, and then we didn't have any English in college because we passed Subject A to begin with, when we first came in.

Swent: Did you take any history or liberal arts?

Oakeshott: No liberal arts stuff at all. Only, before I began to teach at Compton, I had to take a few units in history, so I came back during a summer session and took enough history, civics, and so-called education to get a temporary credential so I could teach junior college. I had taught for a year as a teaching fellow in mineralogy at Cal, in 1929-30, but that was not accepted by the state as teaching practice. University teaching was not adequate preparation for junior college or high school teaching. [laughs]

Summer Employment, Plumas County, 1927

Oakeshott: In the summer of 1927, Paul and I and a friend, Mark Hubbard, went to Engel Mine, a copper mine in Plumas County, where we worked for the summer to make some money. We were still in school. I was a year ahead of Paul, and had had enough geology so I was a staff geologist, but I was paid only $4.50 a day.

Oakeshott: Paul went underground and did some mucking, and shortly they made him a pipefitter. As a pipefitter, he made $5.00 a day.

Swent: What did they have in pipes?

Oakeshott: Air and water that went in to the face, where the drillers were working and moving the tunnel forward to get the air. The drills were run by compressed air. Poor Paul had a bad time because the [blasting] powder was mostly nitroglycerine. You get it on your skin, and it gives some people terrible, intense headaches. So Paul would come out of the mine every afternoon with a terrible headache.

Swent: Did you do your geology in the mine?

Oakeshott: No, outside. I went around with an old prospector. He showed me where to go around the country, and I was to recognize the copper ores and minerals, and to judge where they might have something to work on.

Swent: So you were doing exploration work.

Oakeshott: I was supposed to apply my geological knowledge, and he was the prospector.

These jobs were both gotten by our friend Charles Anderson who later became Chief Geologist of the USGS [United States Geological Survey]. At that time, he was a young instructor, and the bottom instructor at Cal in those days was sent up day by day to teach beginning geology at [the university at] Davis to the boys taking agriculture. He would just commute up there. He was a few years older than we were, but he was very kind to us, sort of took us under his wing.

When I graduated and got a master's my brother had just gotten his bachelor's. I was going to get married, so Andy, as we called him, got me a job with Shell Company of California as a petroleum geologist, and he got my brother a job as a geologist for Roan Antelope Copper Company, near the town of Ndola in Northern Rhodesia. I think it's Zambia now. Paul was very homesick, and after a year he was going to come home, but he developed spinal meningitis and died there.

Dean Probert wrote a beautiful letter to me and my family. He was really a fine man, apart from some of his antiquated ideas about girls in class and so on. But that was the time, you know.

Andy came to see us, and David Sharpstone, Paul's boss in Africa, came to see us, and told us about it. We have a picture

Oakeshott: of the little headstone in Ndola where he was buried. He would have been a good mining engineer, or geologist, whichever he had followed.

III FIELD GEOLOGIST, GRADUATE STUDENT, COLLEGE TEACHER, 1929-48

Shell Oil Company, 1929

Oakeshott: "Tucky" Taliaferro, one of my professors at Cal, assisted in getting the petroleum job for me. My big boss was Roy Morse, the professor whom my mother had known, who had left Cal to accept a more lucrative job with Shell Oil Company, a subsidiary of Royal Dutch Shell.

I started in field geology at Santa Maria, California. I got married a year later. My wife was a student at the California School of Fine Arts.

I went into the hills every day, five days a week, from dawn till dark, and then on Saturdays we had to work only until about 1:30 or so in the afternoon. We worked on our maps, at the home of the field trip leader. And then Sundays were clear; we were off.

Swent: Do you mind saying what you were paid?

Oakeshott: No, I started out at a premium salary, because I had a master's degree, $175 a month. I stayed at a hotel in Santa Maria and saved money on that. I started in May, 1929. Then at Christmas time, 1929, they gave me a raise to $200 a month, so I thought I was on my way. But in the meantime, in October, 1929, came the stock market crash. The oil companies immediately retrenched, by first of all firing their exploration geologists, and being one of the last to come on, I was one of the first to be fired. So by April of 1930, I was fired. [laughter]

Back to the University of California, 1930

Oakeshott: So I came back to Cal, and I thought I would go into teaching, because there weren't any jobs in petroleum geology, which was what I was trained for. I had to take a few formal courses in education, to qualify for a special junior college credential, because the state wouldn't accept my experience as a teaching fellow at Cal as adequate for teaching. This was not even considered.

I had to have some classroom experience in teaching. I couldn't find a job teaching high school geology, so they assigned me to teaching high school chemistry. I went two days, and then the university placement officer, a lady, got a telegram from Compton, in southern California, saying that they wanted a strong teacher in geology, geography, mechanical drawing, and meteorology. I responded with a telegram, and said that I was just the man they wanted. So I went down to Compton, and they hired me right away.

By that time, I'd been through a summer session at Cal. Professor Louderback gave me a teaching fellowship right away, and he offered me an instructorship at Cal, full time, at $1,600 a year, but even in those days, I couldn't see how I could support the family. My wife was already pregnant with our first child. I told Professor Louderback that I was sorry I couldn't accept the job.

Teaching at Compton Junior College, 1930-48

Oakeshott: I went to Compton, and I waited while the board of trustees decided what they were going to pay me. The superintendent of schools came out and said, "We can offer you $1,920 a year."

I said, "That's not quite enough; I don't think I can make that."

He said, "All right, I'll go back in to the board and see what I can do."

So he came out in another half hour, and said, "Well, we can offer you $2,040 a year, with summers off."

I said, "I'll take it." That was September, 1930.

This was a four-year junior college, the same sort of setup that Pasadena had. Educators at Compton and Pasadena high schools thought that the 11-12-13-14 organization encouraged

Oakeshott: post-high school work at low cost. Of course, it also qualified the district for state ADA money [money paid for average daily attendance]. Those were in the early days of the junior colleges. They were an outgrowth of graduate work in the high schools. I think about 1927 came the first of the formal junior colleges in California (usually thirteenth and fourteenth grades) and of course they spread like wildfire.

It was a wonderful deal, and I still think it is. The instruction is good; there's more individual instruction. At the university, you're liable to get teaching fellows who are totally without experience, and sometimes very poor teachers, while the professor goes off and does his research. Frankly speaking, that's what happens.

At the junior college, there's no nonsense like that. I taught as many as twenty hours a week, of geology, geography, surveying, meteorology. They're absolutely shameless in assigning teacher loads. I had as many as five preparations, three days a week, more or less formal lectures.

We had to meet college preparation standards. I had just come from Cal a year or two before, so I taught the way I'd been taught at Cal. The students were motivated; they were good young people. There was no such thing as disciplinary problems, none of these riots or protest marches, or anything like that.

It was the beginning of the Depression, junior college was a privilege, and practically free. All the expense that the kids had was the textbooks, and you could buy a good textbook for four or five dollars. Even considering the difference in the incomes of the times, that was less than they are now. I don't know how the kids get by now at all.

Getting the First Ph.D. in Geology at the University of Southern California, 1936

Oakeshott: I went down to southern California to teach at Compton Community College in 1930, and the only place I could work on a Ph.D., which I wanted to do, was at the University of Southern California, and they'd never given a Ph.D. in geology but they had a young professor, Thomas Clements, who had just gotten his Ph.D. at Cal Tech. I couldn't go to Cal Tech because I would have had to put in two years of residence there, but Tom Clements took me on as the first candidate for the doctor's degree in geology at USC. I did this without residence because I could go in late afternoons and evenings, and I could do my

Oakeshott: mapping in the hills on Saturdays and Sundays and summers, holidays and so on. I did that as an independent study, and so I got the Ph.D. in geology at USC in 1936.

Now there are a number of institutions that have excellent courses in geology at the graduate level, including UCLA and many others. In those days, beginning in 1930, there was no UCLA. The "southern branch," as they called it, was just getting started. They were not giving advanced degrees. Cal Tech was the only one besides Stanford and Cal who gave a doctor's degree, and they required residence.

Swent: You worked under just the one professor?

Oakeshott: They had another couple of teachers there, one in geography and another one in paleontology, and so I took a minor in geography by examination to fulfill the requirements, and then I did the geologic mapping in the San Gabriel mountains.

Swent: Is this when you joined Phi Beta Kappa?

Oakeshott: Yes, I got into Phi Beta Kappa sort of through the back door, because ordinarily it is given at the undergraduate level, but here was USC with no Phi Beta Kappa chapter in the early 1930s. They wanted to start a chapter, so they gave Phi Beta Kappa to a number of graduate students, including me, who had strong records in the upper division of the university, and strong graduate records. They gave me full credit for all the course work I'd taken at Cal, so that was very liberal.

The Long Beach Earthquake, March 10, 1933

Swent: Would you like to talk about the Compton earthquake now?

Oakeshott: Officially it was called the Long Beach earthquake, but Compton suffered far more than Long Beach, considering the population difference. There were about three thousand people in Compton on March 10, 1933. We lived on the border of Compton and Long Beach. The magnitude of the earthquake on the Richter scale (developed later, of course) was about 6.3. It was only a moderate earthquake, but we know now that you can have very intense shaking in a moderate earthquake. My mother was visiting us, and my mother and little boy were both thrown to the floor. This earthquake occurred at five minutes to six in the evening. My wife and I saved ourselves by standing in a doorway. We had intense shaking for a few seconds. You have time to wonder just how long this is going to last.

Oakeshott: The first thing we did was to phone Oakland, where our folks lived, because I knew the phones would be haywire in a few minutes, and they were. The phone company shuts them off. And we drew a tub full of fresh water, because the water was cut off for a few hours. Of course electrical power was cut off, gas was cut off, for a couple of days.

The aftershocks were impressive, one right after the other. We spent the first night inside, because I said, very wisely [chuckle], that this was probably the main shock, and anything after that would be less. My wife was due on May 8, so she was about eight months pregnant, and she felt the aftershocks so much that she was shaking, aftershock or no, by morning. So the next few nights, along with the rest of the neighbors, we slept outside on the lawn. Everybody slept outside.

Downtown Compton was demolished. One thing that was done very wisely by the local city authorities was to move all businesses into a huge open building of the Fry Roofing Company, a great big open building that wasn't damaged by the earthquake, because it was like a cardboard carton. You couldn't break it up; there was nothing to break up. They set up the businesses in stalls analagous to the position they had in downtown Compton, so you could do all your shopping and marketing in a kind of free market area in the Fry Roofing Building. You could go to the drug store, or the doctor, or the grocery store, right there.

Swent: This commission that was established after the 1906 earthquake hadn't had any outcome as far as recommendations for earthquake standards or disaster procedures?

Oakeshott: Not like there was after 1933. After the Long Beach earthquake of 1933, it was only a few days until the state legislature passed the Field Act, which applied particularly to schools. What happened to schools in Compton and Long Beach was a scandal, you know, because it uncovered a lot of shoddy construction.

For instance, my classes were in the basement of an administration building that was three stories high, but the chimneys on top of the building came down through all three stories. The slaughter would have been terrible if it had been any time except after the kids had left school in the afternoon, and before night school. So it was absolutely the quietest time of the day, as far as students were concerned.

After the earthquake, we moved out of the school buildings, and held our classes in tents on the athletic field. They put up a series of open tents. As far as I was concerned, I thought that the results were just about as good, without the equipment

Oakeshott: and the formality, as they had been in the classroom. Because the students were motivated, they realized they had an emergency, and we did fine.

Swent: How long was this?

Oakeshott: Oh, we were there for months. I think it was over a year before we got into covered quarters, and they were kind of barracks. We were in those for a long time. Then we finally got back into more or less permanent classrooms.

But you see, Compton, part of it was located even below sea level, in an alluvial basin, water saturated. They'd had artesian water there, years before, and so it felt the shaking even more than Long Beach. Long Beach was closer to the epicenter than Compton.

People didn't know much about earthquakes in those days; this was an experience that was relatively new to them. It's more or less strange when you look back on it that there wasn't more fallout from the great 1906 earthquake. But the tendency was, after the great earthquake of 1906, to hush up the whole thing, and of course the fire did more damage than the direct earthquake. The fire started because the earthquake had broken the water pipes, so there was no water to fight fire. And also the gas lines were broken, so they started fires. The only way that the fire could be stopped was to break buildings down with explosives. And in general they stopped at Van Ness Avenue, which was a wide street, you know. So the fires raced across the waterfront and up Market Street as far as Van Ness and then it was too much of a jump to cross Van Ness.

There was quite a bit of trouble with insurance, because some of the insurance companies were located with their headquarters in Europe, and some of them said that this was an earthquake and they weren't going to pay for fire damage. Others said it was a fire and they weren't going to pay for earthquake damage.

Swent: Was this still true in 1933, that they had insurance troubles?

Oakeshott: I don't think so much so; I think the insurance companies were more honest in 1933. There were almost no fires in 1933, so this wasn't a problem.

Becoming Interested in Seismology

Swent: Was it at this point that you became interested in seismology?

Oakeshott: I got quite interested in it, and of course I talked with the teachers about earthquakes. They had no idea what caused earthquakes. We didn't yet have a Richter scale. Charles Richter didn't invent his scale until about 1935, so we didn't have that comparison. They had seismographs in California from 1887 on. In 1887 there were two seismographic stations in California, one at the university, in Berkeley, and one at the observatory on the top of Mt. Hamilton. And of course until roughly the same time, there was no uniform time in the United States, and time is very important to seismology. There were no time zones, in other words. Everybody kept his own time across the United States, essentially by the sun, until the 1880s. This was adequate for a farming population, you know.

Swent: It was the railroads that really forced uniform time, wasn't it?

Oakeshott: You're quite right. The transcontinental railroads, beginning in 1869, required time zones. You had to have time zones because you had to have schedules, and so from then on, seismologists had time. A lot of the seismographic work in those early days was done by people like astronomers, mathematicians, physicists. One of the early seismologists whom I knew very well was Perry Byerly. He died a few years ago. He was trained as a physicist at Cal, taught physics at the University of Nevada for a short time, and then came back to Cal and Lawson appointed him as seismologist for the University of California.

The university had had a seismologist before Byerly, a Father Macalwane, who was a Jesuit priest. The Jesuit priests have been in seismology ever since. You know, St. Louis University is a center for Jesuit priests who are strong in seismology. But they were under control of their church, so Father Macalwane was called back to duty of some other sort, and he recommended Byerly as a young physicist who was knowledgeable in mathematics and wave motion. Earthquakes are just wave motion, and so Byerly had the background. He took the job on, somewhere around 1927.

Compton, a Four-year Junior College ##

Swent: Well, Gordon, unfortunately, we had some tape problems earlier. I hate to ask you to repeat.

Oakeshott: Oh, that's all right.

Swent: There's a gap--you had been talking about the Compton-Long Beach earthquake, and we need to talk about your teaching and World War II, that period.

You mentioned that Compton was a four-year junior college, and I think you might explain that a little more. Now the junior colleges are all two-year colleges.

Oakeshott: The junior college was an outgrowth, a development from the post-graduate work being given in high schools in the late twenties. So Compton Junior College became a legal junior college in the late twenties and went more or less full scale as a four-year junior college, beginning about 1930. In other words, grades eleven and twelve from the high school, plus thirteen and fourteen, were classed as junior college grades. Now the equivalent college is a community college or a city college. When I started teaching in 1930 there were only two four-year junior colleges, Compton and Pasadena.

Swent: Were the students all youngsters going right on from high school?

Oakeshott: Yes, at Compton we were primarily a college preparatory or a transfer organization. The four-year junior college was quite successful because it did encourage eleventh- and twelfth-graders to go beyond high school a little ways into college. The courses I taught had to be transferable for full credit to the University of California.

Swent: Were there returning adult students in those days?

Oakeshott: Oh, yes, there were some returning adult students, but that really mushroomed after World War II. At first, most of my students would have been about eighteen or nineteen years old. With occasionally a mother or father in the class.

Swent: But that was unusual?

Oakeshott: That was unusual, yes. Then after World War II of course the boys came back from the service and they were all older and more and more adults got into the program.

Swent: And what were you teaching?

Oakeshott: I started out teaching geology for two semesters, physical geology and historical geology, geography, beginning course, and then a second semester of economic geography, and then surveying for a year, including field work. Then later of course I got into some other subjects.

Swent: What did you enjoy about teaching?

Oakeshott: [laughs] Well, I think that if I had any talent at all it was probably in teaching, because I started out when I was a small boy, teaching my brothers how to read. And I always enjoyed imparting a certain amount of knowledge to young people and getting a response.

For instance, I gave one little Japanese girl one time a D minus, she just barely passed the course. Then I got a card from Honolulu later saying that she had visited the Hawaiian Islands and enjoyed the volcanic eruptions. So sometimes a teacher makes an impression on somebody that you might consider more or less hopeless at the time. [laughs]

The kids all had a great time on field trips. I was really fortunate that we didn't have any accidents or bad times because I took students out into the hills a number of times, once in a while by bus when the school district would allow it, and the rest of the time by automobile.

Swent: Did you have interesting geology around there?

Oakeshott: Oh, fantastic geology! Mostly in the Santa Monica Mountains and the San Gabriel Mountains. Of course the Santa Ana Mountains were nearby too. In other words, we were located at Compton in the Los Angeles basin, and so this was really rimmed by mountains on at least three sides, and open to the ocean through the Long Beach area. So yes, there was plenty of geology. And you know, almost everywhere you go--I've been to a lot of places--there are a lot of geologic features that are very interesting.

Lucile and I took a trip last summer to New Orleans, and there the flat delta country, Mississippi River Delta, has its geological problems and interests, entirely different from anything you get in California. But California has a tremendous variety of geologic features, so it's really a fascinating place to be.

In the summer of '59 I did some writing at the University of Minnesota at Duluth, and there around Lake Superior was again entirely different geology, but many geologic features of

Oakeshott: interest. Anywhere you go, there's geology, because you're on the surface of the earth. [laughs]

Some places it's well exposed, and some places, like the Gulf Coast, most of the information comes from drilling for oil. And all the companies now keep logs so they know the strata that they pass through.

Swent: What was your wife doing at this time? She was an artist, wasn't she?

Oakeshott: Oh, yes, she was an artist. She went to the California School of Fine Arts in San Francisco. I met her on a date in Berkeley because she boarded in Berkeley with a couple of friends.

In those days--we got married in 1929--the young wife was expected to stay home and take care of the children and housework and so on. The husband was expected to provide the living. [laughs] Nowadays it's a little bit different.

Swent: Did she continue with her art?

Oakeshott: Yes, she continued, and once in a while she would sell a painting. She got a big thrill out of that. I've given away a lot of them to my children and grandchildren. So they've been pretty widely distributed now.

Swent: Did you entertain the students very much?

Oakeshott: No, we didn't do much of that. Some.

Swent: So in that respect, it was more like a high school.

Oakeshott: Yes. They did have at Compton illegal fraternities, and at the junior college level the college administrators thought it necessary to recognize these because by recognizing them, we could offer them some supervision. So we as teachers were often assigned as an extra-curricular activity the sponsorship of a fraternity or a sorority.

Swent: They weren't residential, were they?

Oakeshott: Oh, no, just local kids. And really they could have called them clubs more than fraternities.

Swent: And they were illegal?

Oakeshott: Yes, because high schools and junior colleges are secondary schools in California, and the law says that there shall be no fraternities or sororities in secondary schools. But this is universally disobeyed.

Swent: To this day?

Oakeshott: Oh, sure. There are some things that just don't work out according to law.

For instance, after World War II, the fellows came back from the service, and 75 percent of them smoked. Well, by law there's no smoking on a secondary school campus. The superintendent tried to enforce this at Compton, but after a week of trying to enforce it, the next thing we saw were ashtray stands set up all around the buildings and grounds. So practically, we said there was no smoking in class, but out of class they could smoke. In other words, the administration gave up. They couldn't handle it.

Well, these young people that came back from the war were very much adults, you know.

Training Pilots for World War II

Swent: What about the war? Did you have premonitions of it before it began?

Oakeshott: The first connection I had actually in anything to do with the war was in the fall of 1939. The government set up a pilot training program in colleges throughout the country.

Swent: You mean airplane pilots?

Oakeshott: Yes. So at Compton we set up a program called CPT, Civilian Pilot Training program. The superintendent came to me and said, "You're elected to teach navigation, meteorology, and civil air regulations to these students who are taking pilot training at our Compton airport."

So I said, of course, that I had never taught these things, but the superintendent said, "Well, you've taught engineering subjects, so you're it."

So I just kept one step ahead of the students. Our flight contractor gave me some complimentary flight lessons in a Piper Cub so that I could get a better feel for the ground courses I was teaching.

Swent: This was the fall of '39?

Oakeshott: Yes, two years before the war broke out. As a matter of fact, I soloed on December 7, 1941--Pearl Harbor Day. Then the government changed this to War Training Service, WTS. Shortly

Oakeshott: we had an order to move our flight program inland 150 miles or more because at that time there were scares about Japanese bombarding the coast of California, Oregon and Washington.

So we moved our program, lock, stock, and barrel, to Owens Valley. Independence, the county seat, used the high school for ground school. Then we had a small landing field there where we gave the boys flight training under contract.

I went to Independence for about a year and a half and was what they called coordinator of the pilot training program. Of course I contracted out flight and room and board. We were sent groups of thirty army enrollees, young men who didn't want to go into the walking army, but were interested in flying, so we taught elementary pilot training.

Swent: These people in the original pilot training program, were they students from the college?

Oakeshott: Yes, they were.

Swent: But these others were already in the army?

Oakeshott: Yes, they were already inducted into the army. We gave also what they called the secondary pilot training program, in which they went into higher horsepower planes.

In one program, I had young men from the movie industry. They were enrolled in a special program because they wanted to work off their war service, but they were interested in learning to be flight instructors.

I taught ground school--civil air regulations, meteorology, and air navigation, and then I hired teachers from Compton Junior College to teach things like military science, aircraft engines, and aerodynamics. This worked out very well for the college because young men from the college were going into the service. We had a surplus of teachers.

Our pilot training program picked up several of the top-notch teachers. I had my choice of the best teachers. And we all went to Independence and lived there.

Swent: Were you employed by the army?

Oakeshott: Well, it was kind of an odd setup. I found out later, I was given credit for full-time junior college teaching, so the eighteen years at Compton, 1930-1948, I was given full credit for teaching, but the army paid me on two occasions. On the pilot training program, they paid me through the junior college and then when I came back to Compton in 1943 I was the advisor,

Oakeshott: liaison, between the Army Specialized Training Program--ASTP--and the junior college administration. There I was paid civil service through the army. But even then, the state gave me full credit for teaching at Compton. So this was a good setup.

You see, I was a little bit too old for World War II and a little bit too young for World War I. So I did the same thing I would have done if I had been inducted as an officer, but they didn't give me a commission, they just paid me at the rate of a lieutenant colonel. In those days, this wasn't magnificent.

Swent: Was this a civil service rating then?

Oakeshott: Yes, it was a civilian program paid through the army. I was only six months on that because the army took over their own training in mid-1943.

Swent: You said that they were trying to do flight training, but didn't have any airplanes.

Oakeshott: Our contractor had to buy his own airplanes, and of course airplanes were scarce so we had planes in 1942 and '43 as old as 1931. Things like a Waco, about 225 horsepower single-engine airplane, seating in tandem, and we had an old Fleet. So we had to buy our own planes.

Incidentally, before the program ended, our head flight instructor was killed. He was ferrying one of these old planes from Compton up to Independence in Inyo County and he ran into a mountain. He was an old World War I pilot.

Swent: That was a very interesting period, wasn't it?

Oakeshott: Yes, very interesting. While I was in Owens Valley, there was plenty of time during the daytime because we had in the summer very hot weather and difficult wind system up there, very difficult, because of the mountains and the valley and the high temperatures in summer. We had plenty of time during the daytime, and some of the students wanted credit for something, so I taught them geology and they got full college credit for geology.

Swent: So this time wasn't professionally wasted for you.

Oakeshott Not entirely. We took a few field trips. The beautiful Inyo Mountains on the east, you know, and the Sierra Nevada on the west, so it was fantastic country for geology. They could see it, all they had to do was look out the windows.

Swent: And your talents for liaison work were being used, too. You've always been involved in that.

Oakeshott: Oh, yes. I guess I told you that my junior college credential meant that I could only teach the thirteenth and fourteenth year students. But at Independence, the high school asked me to teach in the high school, eleventh and twelfth years. The Inyo County superintendent of schools was right there in Independence, so I went to her office and asked about this, and she said, "Well, I make a ruling here and now that your credential is valid." She just took that responsibility herself.

Swent: Were your children in school there then?

Oakeshott: Yes, the two oldest children went to the high school right there. We had a reasonably good time.

In 1943, after a year and a half at Independence, we moved back to Compton, and took over this army specialized training program. That only lasted six months, and on that I was liaison between the army and the junior college administration. Though again the boys in the service had not yet come back in any large numbers, so I had my choice of the best teachers. I had my pick of a dozen teachers who taught primarily refresher courses in almost anything and everything.

We included English, all foreign languages, chemistry, physics, mathematics, and so on. I taught some make-up algebra. Saturday morning classes, a year of algebra to sixty students, all in one class. They were good students.

Of course there was a very wide range in math. I had never taught math before but in the class there were a few students who got every problem right, everything you could throw at them, and there were a few students who got nothing right. A very wide range, but all of them were eager, adult, well-adjusted young people.

The superintendent gave a talk to the teachers before the boys returned in large numbers, warning us about psychological problems and so on and so forth, but I didn't encounter any. They all seemed to be eager to go on and get back into civilian life.

Swent: And of course the community was solidly behind them.

Oakeshott: Oh, yes, solidly behind them. On our flight program, and our specialized training program later at Compton, the college did very well financially because the government subsidized the whole program.

I remember I sat in with the superintendent and an officer from the army, just before the college accepted the program. The superintendent was very uneasy because he thought the school

Oakeshott: couldn't afford this program. And then before we broke up this meeting, which lasted two or three hours, the colonel who had come to represent the army said, "Oh, by the way, Mr. Superintendent, the college gets a 20 percent adjustment to take care of any additional costs you might have."

So the superintendent was very happy from then on. [laughs] Well, you know these government programs--they're all fully financed. We had very good backing all the way around.

The main problem was that the students were all inducted into the army before they came to us, so they would march into class, take their seats, the instructor would give them the instruction they were supposed to have, and at the end of the period, one of the students who was in charge would say, "Attention!" and everybody would stand up and march out.

Well, this gave no opportunity for the students to contact the instructor and to talk to him about problems. Then a little bit later we did have a library setup where in the evening students would come into the library and study, and there was an instructor there to help them with their problems.

This was the one thing that I had against the army, that they operated like a military unit, and there was very little chance for any kind of work with individual students. And your average high school or college student expects to be able to talk to the teacher. But the army was adamant in this arrangement.

IV THE CALIFORNIA DIVISION OF MINES AND GEOLOGY, 1948-74

[Interview 2: May 1, 1986]

History of the Division##

Oakeshott: In 1851, Dr. John B. Trask was informally appointed the first state geologist. Medical doctors and preachers and teachers were the only educated people, practically speaking, and they were the ones who knew about everything, including science. He was an active member of the old Academy of Sciences in San Francisco. They weren't in Golden Gate Park before the earthquake; they were somewhere on Market Street. Essentially all the records and specimens and books were destroyed in the earthquake and fire of 1906.

Trask was appointed state geologist and given a budget of about $2,000 to make a report on the geology of California. He did write about four reports. I thought that whether this was official or unofficial was unimportant, but some fellow at the Academy of Science a few years ago indignantly took me to task on this because he said that Dr. Trask was never officially appointed. So, although he was given an appropriation, apparently the legislature never did act on the governor's unofficial appointment of Dr. Trask. This was important to this man at the Academy. It wasn't very important to me, but this is an example of the sort of thing that is important to some people.

Of course, the legislature was interested primarily in gold, and the development of gold in California, after the gold rush. So Trask made a good impression on the legislature, and after him came Dr. Josiah Whitney. He was appointed by the state legislature as the first official state geologist, in 1860. He was a noted geologist for his day, and he got an immediate appropriation of $20,000 to make a study of the geology of the state.

Oakeshott: Unfortunately, I've said it before and I say it again, although Whitney was a great scientist for his time, he published, not a report on the situation of gold, but he published a report on paleontology. [laughs] And this made a distincly poor impression on the legislators and the governor of course. And then to clinch the action of the governor on any reappointment, Governor Downey had asked Whitney to help with his selection of gold stocks, and Whitney had indignantly refused to do this. And the governor was miffed at this.

Swent: Was there a connection with Mt. Whitney?

Oakeshott: Yes, I think Mt. Whitney was named after him. Whitney made some major mistakes as a geologist too in the light of today's ideas. Of course, we should consider these people in the light of their times. For instance, he said that Yosemite Valley had been formed by a great rift in the Sierra Nevada as the mountain range rose. Well, of course Muir, who was not a geologist, later came along and emphasized the effects of ice and glaciation. Muir went even too far in his reports of glaciation in the formation of Yosemite Valley. You have to think of the times, and the knowledge of those times.

There's always an argument among geologists about those things anyway. And then Whitney went before the legislature and made a personal plea for a new authorization for continuation of his survey, and he could see that he was going to be turned down, so he told the legislature to their faces that he and his geologists had gone through the perils of field and stream exploration, and now they found themselves in the "jaws of the legislature." [laughs] Well, this went over with a dull thud, of course. And then in 1874, the survey was abolished. But in 1879 and '80, Whitney used his own money to publish two volumes that the legislature really had wanted, on gold in California, and these are classic volumes.

Swent: Now you're using "survey" and "bureau" interchangeably.

Oakeshott: They called it the Whitney geological survey. And then in 1880, the State Mining Bureau was put into law.

Whitney was a well-known geologist all over the country. He'd been trained in New York under the famous geologist James Hall, so his reputation was nationwide.

Swent: How far did he get on the survey?

Oakeshott: Well, he published the works on paleontology, and then with his own money, the works on gold. And of course he had a good staff. For instance, he hired Clarence King, who became the

Oakeshott: first director of the U.S. Geological Survey, when the survey started in 1879.

Swent: The USGS and the California Mining Bureau were started about the same time, weren't they?

Oakeshott: Yes, the California State Mining Bureau was started in 1880, and it has operated continuously ever since that time. So it's the oldest state survey that has really operated with continuous funding to the present day. Others operated for a while, and then for various reasons have been cut off, not funded. Money would give out, or very often the legislators or the governor would consider that the survey had been completed, and would go on to something else. So surveys would drop out of the picture for a while and then be picked up again.

Swent: So the primary focus of the bureau was the geologic survey, mainly mapping?

Oakeshott: The Mining Bureau as it started out was headed by an old miner, and for a long time operated largely on statistical reviews of mining operations and production figures, this sort of thing. And comparatively little in the way of geologic work. They published a few geological papers from time to time.

Relations with Other Agencies and Organizations

Swent: You said that Clarence King worked for the California Bureau and then went to the USGS. Has there always been a close relationship between the two?

Oakeshott: Yes. The U.S. Geologic Survey works all over the country and all over the world, as far as that goes. There's always been a close relationship, but there has been a certain amount of political jealousy between state surveys and federal surveys. For instance, the federal survey can come into a small state with many times as much in the way of funds and personnel as the state can afford, so it takes over. And this is resented by state geologists.

I remember that the state geologist of Maryland in 1950 told us that he was so disturbed by the USGS moving into his state that he sent his men out one night to change the decals on all federal cars to state insignias. [laughs]

Swent: How do they differentiate then? How do they decide who does what?

Oakeshott: It just has to be done by negotiation and agreement. When I first went to work for the State of California in 1948, the federal government had just moved two or three people from the USGS into the old mint building at Fifth and Mission, and they were starting to consider a little work in California. So the Division of Mines of course was immediately interested, and conferred with these people. The first office work connected with the division through the USGS was through Ward Smith, who has long since retired from the survey. He was with the USGS in the old mint building in 1948. But State Mineralogist Olaf Jenkins was not completely free from that feeling of jealousy either.

Of course the state geologists had quite a strong organization. They had annual meetings when they did call in officials of the USGS and talk to them. I went to these annual meetings usually, because whatever my title was, I was always working with the chief in administrative matters, so I went to these meetings and I saw what went on.

But a few years ago, a written agreement was drawn up between the Association of American State Geologists and the United State Geological Survey, outlining the areas of investigation and duties.

The State Map

Oakeshott: For instance, in California, the job of making the state geologic map by agreement with the USGS has been a state matter. Of course, we had a very good staff for doing that, so we made maps like this [indicates map on the wall, reproduced on p. 77] and then the 1:250,000 scale maps that were completed several years ago for the state as a whole. This was strictly a state Division of Mines and Geology job, using USGS mapping, all that was available, and all mapping that might be available from companies like oil companies, mining companies, and the work of students, student theses, and so on. Everything that we could possibly get our hands on went into these state maps. Our staff evaluated the data of course, reduced it to the proper scale, and incorporated it in the state map sheets.

This was a tremendous job. The maps submitted to our staff were on all sorts of scales, everything you can imagine.

Swent: How are they printed?

Oakeshott: Most of our maps are printed by Williams and Heintz, in Maryland. The reason we've had the work done by them for so many years is that it's a highly specialized type of work.

Oakeshott: The lithography is quite difficult. It requires a special knowledge of pattern and color and a little knowledge of what the geologist is trying to show. Because the geologist is trying to show age of formation and the formation unit, the type of rock, and its distribution on the map, so he has to deal with color and pattern. The lithography is very critical.

The state says by law that you have to put this sort of thing out to three bidders. Well, you put it out to three bidders, and some of the bids that come back, the work looks like the funny papers, with overlapping color, crude colors and patterns, totally unsatisfactory. So there are only maybe one or two lithographers in the U.S. besides the USGS or the USCGS [United States Coast and Geodetic Survey]. We had only one lithographer we could really rely on, Williams and Heintz. The only way we could get around the state requirement of three bids was to set the specifications in such detail that only they could meet the specs. So they would bid, and we'd take their bid, and that would be it.

##

Swent: Williams and Heintz aren't a California company, are they? Does this cause problems?

Oakeshott: They're in the East, but they have had a lot of experience in making maps, and since they worked for us, they've made many state geologic maps, and they've done a lot of work for the USGS also, so they have a good reputation, but we had to educate the state.

The maps are constantly being revised. Several of these 250,000 scale sheets have been revised more than once, as we learn more and get more information. You see, the amount of information available in terms of geologic maps has just about doubled every ten years.

Swent: Why is this?

Oakeshott: Knowledge of all science has increased very rapidly. New developments, and many, many more people working. For instance, now the American Association of Petroleum Geologists, just petroleum geologists, has over 40,000 members. When I started out as a petroleum geologist in 1929, I don't think there were more than two thousand geologists in the whole country; probably not that many. So geological workers and geological knowledge have vastly increased.

Swent: What's the difference between the USGS and the US Coast and Geodetic Survey? They don't infringe at all on the geologic work?

Oakeshott: There was some overlap in terms of seismological surveys because the strong motion work, as far as earthquakes were concerned, used to be done by the Coast and Geodetic Survey. For instance, in 1952, when our Division of Mines cooperated on working up the big Arvin-Tehachapi earthquake data, published a bulletin on that, we worked with the Coast and Geodetic Survey. The USGS did some geologic work on earthquakes, but the Coast and Geodetic Survey worked on the earthquake wave motion and this sort of thing themselves. And then only in the last several years has the seismological work of the C&GS been turned over to the USGS. So it's now in the USGS. The seismological work was taken from the USC&GS and put into the USGS.

Swent: So prior to that, you were working with both of them. Did you have meetings with them like the one with USGS?

Oakeshott: Oh, yes. Now here's a bulletin we put out on earthquakes in Kern County in 1952, and we had a whole bunch of cooperators, cooperating agencies, there were about maybe twenty of them all together here.

Earthquake Studies

Swent: This is Bulletin 171, Earthquakes in Kern County, California, During 1952. This is one of your more than 100 publications?

Oakeshott: Yes, this is one that I edited and wrote parts of. We cooperated with the Coast and Geodetic Survey on this. One of the contributing authors was William K. Cloud. Bill Cloud was head of the US Coast and Geodetic Survey in San Francisco at the time, and his particular responsibility was earthquake studies. They did things like study the intensities of earthquakes. They would show maps that would show lines of equal intensity.

Swent: What was your province then in this?

Oakeshott: That particular earthquake, we call it the Arvin-Tehachapi earthquake, was in July 21, 1952. It was a major earthquake, about 7.5 on the Richter scale. As soon as the earthquake occurred, the chief of the division, Olaf Jenkins, and I and Dr. Hanna of the Academy of Sciences, went down to the Arvin-Tehachapi area to investigate the surface faulting. We met William Cloud of the USCGS and the seismological professors at Cal Tech. We then called a meeting held at Cal Tech, just a short time after the earthquake, in which the Cal Tech professors of seismology and Jenkins and I of the Division of Mines, and Cloud of the Coast and Geodetic Survey, participated. It was mutually decided that the investigations would be carried

Oakeshott: on by all these people but that the Division of Mines, under state auspices, would publish the accounts, and that we would get contributions from these different agencies, wherever we could.

Well, I made what turned out to be the serious mistake of calling the University of California geology department and the seismologists and suggesting that they get down there and investigate this earthquake because it was a big one, with a lot of surface faulting. Well, it turned out that Perry Byerly, who was seismologist at the University of California, and Dr. Beno Gutenberg, who was the professor of seismology at Cal Tech, had set up an agreement a few years before, that Cal Tech would write and work on all earthquakes south of the northern border of Kern County, and the University of California would work on earthquakes north of Kern County. So, as Byerly said, "Cal people stay away, because this is Gutenberg's earthquake."

Well, this seems very unscientific, but I talked to Byerly about this, and it was a fact. These two were really great seismologists, great scientists, but it seems to me it was a very unscientific sort of agreement. Because earthquake wave motion was received by Cal's instruments, particularly at Mt. Hamilton and at Berkeley.

Swent: They didn't share any of their information?

Oakeshott: They didn't have the right to publish on it; it was "Cal Tech's earthquake."

Swent: Did Cal Tech use any of the information from University of California instruments in their publication?

Oakeshott: Not that I could see. [laughs] So in that bulletin that we published, you'll see that Cal Tech is the university that cooperated, but not the University of California.

##

Swent: Did the same thing happen in later earthquakes?

Oakeshott: Later, it was changed. Byerly passed on, and so did Gutenberg, and Bruce Bolt, who is a good friend of mine--he and I have kept in close touch--who is now the head of the seismology section of geology and geophysics at Cal, as you probably know, has a very different idea. He uses all information from all over the world, all that he can get. He's very good at cooperating. He has looked up some of the old data on the Arvin-Tehachapi earthquake and has published some things on this, I think.

Swent: What about the San Fernando earthquake? You did the big publication on that.

Oakeshott: Yes, my work was strictly geologic mapping, as it always has been. I started way back while I was teaching at Compton. I taught there from 1930 to 1948 so I mapped in the western San Gabriel Mountains and finally wound up completing a fifteen-minute quadrangle. That's fifteen minutes in each direction, about 250 square miles. And that covered the area in which the earthquake of February 9, 1971 occurred, and so there was a lot of use made of my publication. I didn't get this published until 1958; I was busy with a lot of things. I got it done well before the earthquake, thirteen years before the 1971 earthquake, so I was very pleased to see that the geology held up to the very detailed scrutiny that it was given after the earthquake. It held up very well. Of course, they found some new information. But these faults that I had mapped, I had considered inactive; it turned out that they became active.

This has happened more than once in California's earthquake history. Faults that we had considered inactive--the White Wolf fault that caused the Kern County series of earthquakes in 1952 was one one of them--it was considered long inactive, and all of a sudden, it came to life. So this is one of the difficulties in earthquake prediction, of course. We just don't know when one of these so-called inactive faults is going to become active again.

Swent: How do you feel about these little earthquakes all the time? Do you think that they release energy and delay a big one or are they precursors of a big one?

Oakeshott: Well, there are two opposing ideas. One is that small earthquakes tend to release energy and therefore the big one is not so likely to occur. The opposite idea is that small earthquakes are an indication of activity and that the big earthquake is going to follow. I think that the evidence we have had from California's earthquake history, short as it is, is in favor of the latter idea, namely that a buildup of small earthquakes, for example along the San Andreas Fault, the Hayward Fault, and the Calaveras fault, all of which are probably becoming more active, indicate that we're going to have a major break sometime in the near future.

Swent: Near, geologically speaking?

Oakeshott: Well, whether it will come in my lifetime is questionable, but it may come in your lifetime.

Swent: Maybe in a mere thousand years?

Oakeshott: I would guess that it would come in your lifetime, say, by the year 2000. I think that we'll have a major earthquake in California before the year 2000, just based on the frequency of the small earthquakes that seems to be increasing. I know that Bolt strongly favors this idea. You've heard him over the TV, haven't you?

Swent: Yes, I have.

Politics

Swent: One part of your work of course with the mining division was this seismological work. Did you do anything to try to establish policy in the state in this regard? Did you have dealings with the legislature to try to get them to beef up building standards?

Oakeshott: Yes, I had quite a hassle with various people over the division of work among state agencies. For instance, a major one came with the Department of Water Resources. They built up a large geological staff in connection with building the West Side Canal. So I suggested many years ago that the state should have one agency doing geological work, namely the Division of Mines or the Division of Mines and Geology--the name was changed from time to time--and that other state agencies should contract with the State Division of Mines for that work. Well, this brought me up against the administration of the Department of Water Resources.

Swent: Who were you talking to about this?

Oakeshott: Well, I tangled most with William Warne, who was under [Governor Edmund] Brown. Just about the time--well, Reagan came in as governor at the first of 1967, and "Pat" Brown had been governor before that.

Swent: Did you have dealings with Governor Brown?

Oakeshott: Oh, yes, I had lunch with him a couple of times. He was a nice democratic sort of governor.

Swent: Democratic with a small d as well as a big D?

Oakeshott: Yes, that's right. He was a politician, but he was a nice, considerate politician.

Swent: He was also quite interested in mining, I understand.

Oakeshott: Oh yes, he was quite interested in mining, so at this lunch he talked to us mostly about his mining interests, you know. But anyway, William Warne had been appointed head of the Department of Water Resources, and he had a chief geologist who was analagous to my job as deputy chief of the Division of Mines. So I'd been a friend of this fellow, Laurence B. James--I remember his initials because they were the same as LBJ, the president. Anyway, Larry and I had talked about this.

I had two bosses. Ian Campbell was my chief, and I was his deputy. DeWitt Nelson, "Swede" we called him, was director of the Department of Conservation, and Ian Campbell's superior. So Warne should have talked to Nelson or Campbell, but instead he picked out me and worked me over. He invited me to lunch one time and spent the whole lunch period telling me how wrong I was to try to take over his geologic work.

Swent: What were you doing that made him think this?

Oakeshott: Writing and talking to others, like his chief geologist Larry James, and to my own bosses. And Hugo Fisher then came in as still another level between us and the governor. He was one of the five administrators who were set up by Pat Brown late in his administration. Hugo Fisher was the first Secretary of Resources. He was directly under the governor; he saw the governor almost every day. Nelson was under him, and Campbell was under him.

Swent: Not too long before, the director of the bureau had reported directly to the governor.

Oakeshott: Yes, so these new levels were stuck in there. Hugo Fisher was convinced by my talking about this.

Swent: These people were in Sacramento, but you were based in San Francisco.

Oakeshott: Oh, I was always going up to Sacramento. And Fisher had been a senator, but he was very unorthodox in the way he worked, and he cut right across channels. For instance, he would see me and talk to me about something, when really he should have talked to the director of Conservation who was two steps above me. But Fisher said, "Gordon, I agree with you. I think we should have one agency that does the geological work."

So just a few days before Governor Reagan came in, I saw a note that Fisher had sent to Governor Pat Brown: "Dear Pat, I would like to go ahead with the transfer of all geological work in the state into the Division of Mines and Geology." And on

Oakeshott: this note, Pat Brown had written, "Okay, Hugo, go ahead." And the note had come to my attention, and to the attention of Chief Geologist Larry James, of the Department of Water Resources.

So Larry called me and he said, "Gordon, what'll we do? Here we have this, and Pat Brown's going to be out in a few days."

I said, "Larry, we do nothing, because Reagan is going to be in, in a few days, and he's going to have his own ideas of government organization, so anything we do now would just be wasted motion. Just forget it, just go ahead the way we have, and let Reagan do what he wants to." So nothing ever came of that. But of course the Department of Water Resources, as soon as the work on the West Side Canal was completed, fired most of their geologists. Nearly all their geologists were fired. They still do some geologic work, but it's small. And the Division of Mines and Geology has never had to make any staff reductions. Occasionally there was someone who left for various reasons, but there were no forced staff reductions.

Of course, Warne was out, and there were tremendous changes in state government when Reagan came in.

Swent: Were there changes in your division?

Oakeshott: Yes, there were a lot of changes. During the next few years, I point out in this report, we had a whole series of chiefs, and quite a hassle. Just a couple of years before I retired, there was a real political upset in state government as far as we were concerned.

Swent: Would you like to talk about that?

Oakeshott: Well, it was quite involved. In the latter half of 1966, the Brown administration was fading out in anticipation of Reagan coming in. People at the higher levels fail to show up for work, you can't contact them and so on, and new people are not yet in power. So Secretary Hugo Fisher and Conservation Director Swede Nelson both resigned. My chief Ian Campbell was appointed interim director of the Department of Conservation, knowing full well that he would not be permanent, because Reagan would be coming in a matter of days. As soon as he got around to it, he would be making an appointment of his own people. And Reagan was never the man to let anybody come into any kind of position without his personal okay. He had to be a good Republican. And so I served as chief of the division because Ian Campbell went to Sacramento.

Officially, August through December of 1966, it was. Then when Governor Reagan appeared in January of 1967, he appointed Norman Livermore as secretary of the Resources Agency.

Swent: What experience did he have?

Oakeshott: The Livermore family had been a very well-known pioneering family, in California. We call him Ike; Ike's mother was the excuse for naming the Mt. Ida peak on Angel Island. That sort of thing. He and his family were very well known in California. He was a forester and a conservationist. Reagan also appointed James Stearns as director of Conservation. Jim Stearns was 100 percent a Reagan man. I sat in a mining board meeting with Jim Stearns and my chief, Ian Campbell, and others, and the chairman of the mining board said, "Mr. Stearns, what do you consider your greatest problem in the next year or two?" And Stearns said, "The reelection of the governor." I had a hard time to prevent myself from jumping to my feet and hollering, "That's the least important thing I can think of." Because all I cared about was the technical and public operation of the DMG. I didn't care who was governor; it didn't make any difference to me.

I mention it because it was evidence of the increasing political influence, beginning with the Reagan administration. Before that, we had been pretty well left alone. Sacramento didn't bother us. Now, one of the first things Reagan did was to force me to come to Sacramento, for instance. Again, he overlooked my boss, the chief, because Ian was about to retire, so Jim Stearns nailed me and said, "The governor says you've got to come to Sacramento."

I said, "No way, I'm not going to Sacramento; the Division of Mines has always been in San Francisco, and that's where we do our work." Finally, Stearns called me in to his office, and he said, "Gordon, you're moving to Sacramento." I said, "All right, okay Jim, if you say so." So I moved into a temporary office, and commuted a while, and then we moved up there for four-and-a-half years until Reagan finished his term. [laughs]

Reagan's idea was that all administrations, right down to the divisions and bureaus, should be coordinated in Sacramento. Of course I couldn't quarrel with that; it's a sound enough idea, if you want to do it that way. Some governors would say they should be dispersed out through the state where they're in closer touch with the people. Reagan said, "We want them in Sacramento where they're in closer touch with the governor." So that's the way that went.

I thought then, and I know now, that Reagan had his eyes on the presidency right then. So he was already looking ahead. Reagan was fundamentally opposed, in his heart, to civil service, and I was under civil service because I was deputy chief. And I took examinations for chief. But even the chief was under civil service.

Oakeshott: Just as one personal indication of where Governor Reagan stood on civil service, Director of Conservation Jim Stearns said to me early in the Reagan administration, "Gordon, your position is now appointive." I said, "I'm sorry to correct you, Jim, because you're my boss, but nevertheless, as long as I'm the incumbent in office, I'm under civil service. I'm strictly under civil service regulations." His assistant of personnel confirmed this, so Jim had to back down.

Reagan was very much afraid of civil service because of their organization. He does not like employee organizations. Of course, he's shown this in the federal government.

Stearns was 100 percent Reagan, and whatever the boss thought, and Reagan was the boss, so thought Jim Stearns.

Swent: What did it matter to him that you were under civil service?

Oakeshott: Reagan would have liked to reorganize by appointing lower down than he was able to do. He could only appoint as low down as directors of departments like Conservation. But he could not throw out Brown's civil service appointees. But chiefs of divisions and all below directors were civil service, so he had no control over who was division chief or deputy, or who worked below those people.

Swent: Did you ever feel pressure?

Oakeshott: Yes. Yes. About that time, I began to feel pressure.

Swent: In what way?

Oakeshott: It was very tangible. On November 1, 1969, I was on a field trip in Hawaii, and the director of Conservation divested the deputy chief of all administrative and supervisory duties, and also notified three district geologists under me that they were all divested of their duties. So the division and its districts were left without supervisors. The director's office took charge.

Swent: So he couldn't fire you, but he--

Oakeshott: All he could do was take my duties away. And actually, they had a man in mind for chief of the Division of Mines, a good Republican who had been head of the Republican party in Kern County. He was a geologist, so they had in mind that they wanted to make an appointment of him. So they divested me of my duties as deputy chief, and all the supervisors. We were really in limbo.

Oakeshott: The director's office took charge, but contrary to a statement in "California Geology," February 27, 1971, page 26, none of the director's staff members was qualified to act as state geologist, or chief of the Division of Mines, or deputy chief, because there were civil service requirements. So Jim Stearns himself, or his deputy, could not qualify as chief or deputy of the Division of Mines, because they couldn't meet civil service regulations. So we were actually in limbo from November 1 to December 17 of that year. [laughs]

Well, Ian Campbell retired, and this new guy, Wesley Bruer, was appointed chief of the Division of Mines. He was a Bakersfield geologist, and he was appointed on December 17, 1969.

##

Oakeshott: The director on December 17, 1969, officially appointed Wesley D. Bruer as state geologist, and that made him chief of the Division of Mines. Ian Campbell had retired, so this appointment could be made, since Bruer was a geologist. Well, I knew Wes Bruer, and as a matter of fact, I had given a talk in Bakersfield a couple of years before that, and Wes Bruer had been chairman of a committee which gave me a prize because they considered it the best talk of the year. So Wes was already a friend of mine, and he was kind of in an embarrassing position. He was sort of forced into this position, you know. He was very kind, and kept me on as his deputy. So he and I got along fine until I retired.

Then I came in conflict with Governor Reagan again when I retired, because Reagan put through a law just when I was past sixty-seven, mandating state retirement at age sixty-seven. Since I was already past sixty-seven, I was allowed to work full time until I was sixty-eight, and then Wes Bruer, being a nice guy, kept me on quarter time as a consultant through the next two years until I was seventy, and then I was fired again at age seventy. [laughs]

And of course I had gone to Sacramento with the understanding that I would be retiring at seventy. Reagan's idea at setting the maximum age at sixty-seven--one idea was to cut the state budget, because he'd get the high-salaried people at the top off the payroll, and bring in lower-priced people at the bottom. And then he, of course, took the biggest job in the country at age seventy! [laughs]

Swent: Of course, that happens to all of us. The older you get, the younger people seem at that age, don't they?

Oakeshott: That's right. Well, I didn't quit working of course when I retired from the state officially.

Swent: You did consulting.

Oakeshott: I never pressed it. I only did consulting by request. Oh, I consider myself retired now, but the other day I still did some work for a company.

The Mining Board

Swent: You mentioned the Mining Board. What sort of relations did you have with them?

Oakeshott: There was a five-man State Mining Board for all twenty-five years that I was with the division, from 1948 to 1972. I always knew them very well, and I always met with them. The chief and I always met with them, no matter what my official status was.

Swent: They were appointed by the governor, weren't they?

Oakeshott: Yes.

Nowadays there's a Mining and Geology Board that publishes an annual report. The present day Mining Board is what the state likes to regard as a public board. Seven members, made up of people who largely are not mining engineers or even geologists.

Swent: Willard Fuller is a mining man, and James Anderson is a geologist, on the current board.

Oakeshott: Now, I've just got a notice of their next meeting, June 3, and I only know one of them, Dorothy Steller. She's a geology teacher and a very good one, at one of the junior colleges down south.

When I first started out with the division in 1948, the Mining Board was composed entirely of mining engineers. Then for some twenty-five years, Phil Bradley was chairman of it, so it didn't change much. They were very strong, they had various mining interests represented, but they were very strong in gold mining. The gold miner on the Mining Board for several years was Lewis Huelsdonk.

Swent: Yes, I'm going to interview him.

Oakeshott: Oh, you are? Well, you give him my best regards. I haven't seen Lew Huelsdonk for years. He's strictly a gold man; he can talk about gold from the year one. Not from the same standpoint

Oakeshott: as Bill Clark, but from a monetary and economic standpoint. He ran one of our best gold mines, near Downieville.

Then the Mining Board had a petroleum man on it, and usually a non-metallic man. Now, as you can see from the agenda of this next meeting, there's a great deal of emphasis on geologic hazards.

Swent: "Geohazards" is a new word to me. What were they interested in when you dealt with them? It seems that the emphasis when you began with the division, and even before, was on mapping and cataloging resources, and now hazards have come to the fore. When did this come about?

Oakeshott: The Mining Board has a different relationship to the Division of Mines than they used to have. The board has always had a certain amount of policy responsibility, but now they have particular responsibility for SMARA, the Surface Mining and Reclamation Act.

Swent: Reclamation is a new thing, too.

Oakeshott: Yes, it deals with cleaning up mine properties. Then they spend a great deal of time also in trying to study and use their influence to set aside areas of important mineral resources which are being overwhelmed, we'll say, by urban or agricultural activities. For instance, we need in our great cities enormous quantities of limestone, cement, sand, and gravel, just the ordinary minerals. Yet what do we do? We build over them, and we do everything we can to destroy them, so mining operations have to move out further and further.

Every time you have to transport gravel another fifty miles from where you use it, the price about doubles. So instead of sand and gravel coming from Niles to make aggregate to build San Francisco's buildings, they have to get it from Livermore, or even further.

This is one thing that they try to do, so the Mining Board of today is entirely different from the Mining Board when Phil Bradley was chairman. But he can tell you all about that.

Swent: I was thinking of the relationship of the board and the division.

Oakeshott: Somehow I was always involved in reporting to the Mining Board. Whatever my particular job title was at the moment, chief or deputy, I was always reporting to the Mining Board. We reported about our work, told them about our technical job, and then we'd go out to lunch, and once in a while we'd visit a mining operation. They were all mining men, and always in my time the

Oakeshott: Mining Board meetings were attended by the director of the Department of Conservation, and sometimes by the deputy director, and by the chief of the Division of Mines, and his deputy, which was usually me.

Swent: So it wasn't an adversary relationship?

Oakeshott: No, we were pretty close. There were minor differences, but we always had a pretty good relationship. Of course, Phil and I were always old friends, and people like Huelsdonk, I always got a kick out of him. Mining Board meetings would go on for hours.

Swent: Was it because of your interest in seismology that the division became more involved in earthquakes?

Oakeshott: Oh yes, they approved my activities on earthquakes. And they approved my going to Alaska after the big earthquake, and asked me about that. I chased a lot of earthquakes, went there at state expense. Alaska, Utah, Baja California, Nevada, Washington, Hawaii.

Swent: To help California to be ready?

Oakeshott: Yes. I always reported, one way or another, with an article in a publication. They approved those things, and were receptive.

Work with Other Agencies

Swent: What other agencies consulted you?

Oakeshott: I used to attend a lot of meetings of the Directors Council. The Department of Conservation director and deputy director would meet with the chiefs and sometimes the deputy chiefs of the various divisions. I went to those meetings, so I had some input in forestry, soil conservation, parks and recreation.

For instance, before Hearst Castle was first opened up, it was offered to the state as a park by Hearst heirs who didn't want to pay the taxes. The chief of the Division of Beaches and Parks asked us to take a trip with him and have a preview of Hearst Castle. That was probably early in the 1950s. They didn't mention Marion Davies at that time, because it was scandalous. She was nonexistent. [laughs]

Swent: Were you consulted on building codes?

Oakeshott: Yes, we cooperated with the state architect. I got them to cooperate by writing about the characteristics and nature of

Oakeshott: damages to various types of buildings, particularly school buildings, in connection with our earthquake bulletins. We always had something from the other departments and divisions. We tried to cooperate with every department.

I had a chance to put in my oar even on things like forestry. For instance, budgetary matters. We discussed the budget in a broad way. Forestry was talking about their budget, so I said, why on earth don't you develop a budget that will take care of these forest fires that occur around the state almost every year?

And the director said, "The state legislature won't let us increase our budget to take care of fires, but after a fire occurs, we can have unlimited money to take care of it."

If there's a big fire, they don't neglect it for lack of money, they take care of it from some mysterious fund of money ("the governor's budget") which was not budgeted beforehand at all. You gradually learn how those things are handled.

As far as budget is concerned, I was always spending all of our budget, and a little more too, because if you didn't spend all your budget, next year you got cut back to what you did spend. But if you exceeded your budget, they did a lot of crabbing, but then the department would help us out by transferring some funds from somewhere to help us meet the deficiency, and then they'd say, next year you're going to have to have an increase in that area. [laughs]

Swent: That's a fact of bureaucracies, isn't it?

Oakeshott: They told me yesterday that the budget of the Division of Mines and Geology is now seven million dollars, and when I first worked there, it was half of one million. A junior geologist now gets about as much as I did when I was chief. I started with the division in 1948 at a premium salary as associate geologist, $456 a month.

Swent: Liaison has always been your strong point, hasn't it?

Oakeshott: Yes, and that's what Wes Bruer had me doing after he was appointed chief of the Division of Mines, mostly liaison with these various government agencies, USGS, USC&GS, and others.

Swent: It's interesting, because really that's what you were doing in Compton also; this has been a thread all through your life.

Oakeshott: Oh, yes, that's right.

Swent: You told me the other day you didn't think you were a politician, but you must be pretty good at some aspects of politics.

Oakeshott: Well, [laughs] I don't like it to the extent of swapping principles for something to be gained in the other direction, you know. I don't like to say, I'll vote for your bill if you'll vote for my bill. I like to support something, like the need for strong-motion seismological work in California. I want to support that, but I don't want to have to be put in a position where I'll say to so-and-so, I'll vote for your bill if you'll vote for my bill on seismology. So I'm out when it comes to that sort of politics.

Swent: Was that kind of pressure ever put on you, to support something else in return for something? Were these kinds of arrangements being made?

Oakeshott: Well, I was strong for civil service protection. For instance, a senator would occasionally call me up and say, "My boy has just graduated in geology and I'd like to have him work for the Division of Mines."

I'd say, "Well, Senator So-and-So, we'd very much like to have your boy; the next civil service examination will be such-and-such a date." "Oh, thank you, thank you."

Well, that's all I could do, under civil service regulations; I couldn't appoint his boy. I'd say, "Now if your boy passes within the top three, I certainly will look at his record."

Swent: You had that much leeway.

Oakeshott: Oh, sure.

Swent: Did you pay attention to how people voted?

Oakeshott: Not in the least. Not in the slightest. Well, one thing that bothered me in the Reagan administration, too, was that the deputy of conservation actually nailed a couple of our supervisors who worked under me, to do a certain amount of legwork in support of the governor. Well, this is strictly against civil service regulations.

Swent: That's against the Hatch Act, isn't it?

Oakeshott: Oh, sure, but they did that. They did a certain amount of this, yes.

Swent: To get back to the Mining Board. They were appointed by the governor; how competent were they?

Oakeshott: Well, they had no real power to direct the Division of Mines. They had a pretty strong influence on indicating policy that the division should follow. We always presented reports of progress to them; we'd tell them about our work.

Swent: This gave the governor a good deal of influence, didn't it?

Oakeshott: Oh, sure. When Governor Brown and Governor Knight--he met with us also at lunch--when those governors met with us at lunch sessions, the chairman of the Mining Board and one or two of the members would go along. Most of the time Phil Bradley was chairman. This went on for years and years.

Now, one thing, when this hassle with the governor and Wes Bruer went on, the deputy director of conservation was very, very much a Reagan man, and he sent a letter down bawling us out for informing the Mining Board of the details of the last stages of budget preparation for the following year. We were not supposed to do this.

Well, we dug up a directive from the director of the Department of Conservation, who was this man's boss, of a few months back, that said that was precisely what we should have done. They didn't coordinate. This deputy director did not know the order, and bawled us out for not obeying his directions. Well, his directions were contrary to his own director's. So he was a problem because he did this sort of thing. This is tough going, you know. [laughs]

And then he didn't like Phil Bradley, so one time during this transition period, I picked up Phil Bradley in Berkeley and took him up to a meeting at Sacramento, and the deputy director bawled me out for associating with Bradley. And I said, "Well, listen, John, I'm scheduled to go over to the Assembly Ways and Means committee. The chairman happens to be an old friend of mine; I knew him down at Compton. If you care to pursue this matter, I'll take it right over to Assemblyman So-and-So and I'll blow this sky high before the committee. Do you want to go ahead with it?"

He said, "No, no, no, forget it. I'm out of line; forget it." Now, imagine that. Bawling me out for consorting with the chairman of the State Mining Board.

Swent: Whom you had known for how many years? You were at Cal together, weren't you?

Oakeshott: We were at Cal together. So I'd known him since 1924.

Swent: It wasn't as if you were cultivating a new friendship. That would be forty years that you'd known him.

Oakeshott: This was some of the political business that went on, you know, and that's the sort of politics I don't like. But most of the time, everything was very pleasant. People were nice to work with. And Jim Stearns himself, the director of Conservation, was a nice man to work with, as long as I could keep things on a technical basis, tell him about our work and what we did and so on, and why we did it. He was a very nice man to work with and so on, but he was 100 percent Reagan, and he would brook no ideas that didn't conform with what he thought Mr. Reagan wanted.

Swent: Did you serve under Jerry Brown at all?

Oakeshott: Yes, a short time. I started out briefly under Warren, and then there was Knight, and then Pat Brown, and then Reagan, and Jerry Brown. Well, Governor Reagan was really remote from the division; he did all his work through subordinates. Pat Brown and his high staff were quite close to us.

There was a time, when I first went to work for the division, when as I say, we would once in a while go out for lunch with the governor. If we wanted to talk about financial matters, we would see the director of the Department of Finance. When Mr. Reagan came in, we only dealt with the lower echelon; we didn't deal with the top people. [laughs]

More About Earthquakes and Maps##

Swent: Last time, just before I left, Gordon, you told me that your house is seismologically sound; it's one story, wood frame, on bedrock—right?

Oakeshott: Yes, that's a good situation as far as safety of the inhabitants is concerned, because although such houses sometimes suffer quite a bit of damage, and the contents suffer quite a bit of damage, the people historically have pulled through; people haven't been hurt. In Long Beach, in 1933, for instance, the one-story wood-frame houses fared very well. We were in that earthquake, and we had a one-story, wood frame, stucco-surfaced house, and we didn't have any damage at all. There was very severe shaking. I may have mentioned before that we know now that you can have very severe shaking in even a moderate earthquake. It doesn't last as long as in a great earthquake.

Oakeshott: This question of geologic maps of course is very important to a geologist, because the map is the way the geologist expresses what he finds in the field. The kinds of rocks, the ages of the rocks, the structural arrangement of the rocks, the rock formations, the mineral deposits, and all these things are located in space, and by using proper diagrams and colors, also in time, on the geologic maps. So one of the first things in early days that geologists tried to do, was make geologic maps.

Probably the first really decent state map, anywhere nearly decent state map of California, was made in 1891 by the California State Mining Bureau. We don't know just what the sources of information were, but the state mineralogist, they called him at that time, really state geologist, had a geologic map made of the entire state which used color and pattern. I think if I remember rightly there were only about eight formations shown.

Swent: Had people actually walked the entire state by then?

Oakeshott: No, they'd walked parts of it, and certain routes of course had been pretty well traveled, and other routes had not been traveled at all. So a lot of imagination was used.

Then in 1916, Stanford University was the main activity behind a very good state geologic map that was put out by the State Division of Mines. In fact, Olaf Jenkins worked on it; he became the first real geologist in charge of geology for the state, later. He was a student at Stanford, and he worked under J. P. Smith, a professor at Stanford. They put together a very nice geologic map of the state.

Swent: What sort of tools did they use in mapping?

Oakeshott: In the field, they used compasses, and chains for measuring distances where they were measuring accurate distances at all. They used levels of course, and they used barometers for measuring elevations. For instance, some of the early-day geologists climbed mountains like Mt. Diablo out here, with a mercurial barometer on their backs. Imagine climbing a high mountain with a mercurial barometer on your back!

Swent: Are they very heavy?

Oakeshott: Well, it's not that so much, as that you can't spill the mercury. They're hard to handle, so it was kind of clumsy. They measured approximate elevations, but they didn't get them exactly right. They were much refined later by the Coast and Geodetic Survey and the Geologic Surveys.

Swent: What kinds of things do they use now?

Oakeshott: Well, they use triangulation, very accurate triangulation, and they use laser beams for very, very accurate measurements of distances and elevations too, and of course, aerial photographs.

Swent: So the greater accuracy was possible because of electronic and other technological developments?

Oakeshott: Oh, yes. Of course one of the most important things in making a good geologic map is to have a good base map. My first work as a full-time geologist was in 1929 for Shell Oil Company. I worked at Santa Maria, California, and we didn't have any decent base map. Usually a contour map is used. Nowadays they have beautiful 1:24,000 scale contour maps that show a lot of detail, very accurate distances and very accurate elevations. Maps are made by photogrammetric means.

In those days we didn't have any decent base map at all, but the first vertical aerial photographs were coming in. So we did our geologic mapping on aerial photographs, but they were distorted at the outer edges. The photograph was taken vertically above an area of ground, and as you look at the outer edges of the photograph, you get distortion, so we used overlapping aerial photographs for our maps. And then to report to the oil company, we transferred the data that we got onto the big, rather crude, smaller scale topographic maps.

Since then, map bases have greatly improved. The first really comprehensive state geologic map put out by the Division of Mines was in 1938. Olaf Jenkins was then chief geologist of the Geologic Division of the State Division of Mines, and he was in charge of compiling a state geologic map.

You have mentioned proprietary information. He and his assistants did a remarkable job of getting information from oil companies which had a lot of proprietary information which they ordinarily wouldn't have released, but they released it to the state. They also got information from students who had been mapping for thesis work; especially doctoral theses were very good for compiling a geologic map. They also used the work of professors especially at Stanford and Cal and then many other institutions. About roughly every ten years, geologic information for compiling maps has doubled in California, so we're constantly revising these maps, even now.

Then very much later, we started the program of making a geologic map of the state on one-degree by two-degree sheets, on the scale of 1:250,000. In other words, about roughly one inch equals four miles, covering the entire state. We did that work, sheet by sheet. We had a geologic map section for most of the time, for about twenty-five years. It was done by Charles Jennings and his staff. They did an excellent job of getting

Oakeshott: information and reducing it to the scale of 250,000. All the scales had to be changed, because a doctor's thesis might be done on 1:24,000 or 1:20,000.

Swent: There was no standard scale?

Oakeshott: There was no standard scale used.

Swent: Is there now?

Oakeshott: Well, state geologic maps, largely through our initiative in California, have more or less adopted this 1:250,000 scale. Then, about the time that we began doing this, the Army Map Service began to compile excellent base maps, so the base maps that are now used on the 250,000 scale are really very fine maps. That's the scale we use now.

Swent: Who started it, you or the AMS?

Oakeshott: I don't think we did it before the Army Map Service, but the Army Map Service first of all came out with 250,000 scale sheets, but compiled using any odds and ends of maps which had far different reliabilities and different accuracies. Later they realized how important these base maps were that they were giving out, so they went to the best mapping sources.

Swent: What date are we talking about?

Oakeshott: This 250,000 scale mapping was initiated by the division with the publication of preliminary maps in 1955.

California was the leader in the making of state geologic maps. Then of course the US Geologic Survey very early agreed with the California Division of Mines and Geology that this was a state function, so they didn't interfere; rather, they helped us a lot with some of their work.

Swent: And they in turn used your maps?

Oakeshott: Oh, yes. We used USGS work and they used some of our work.

Swent: How did you reach this agreement?

Oakeshott: Well, just by mutual discussion, word of mouth; meetings with geologists from the USGS, probably from Menlo Park. I think I mentioned before that the Association of American State Geologists is pretty strong, and has always had annual meetings to which the USGS officials have been invited, so there were always discussions with them.

Swent: Was this sort of thing easier when your office was in San Francisco?

Oakeshott: Oh, much! Yes, sure. You see, San Francisco was always the mining and financial center of the state, and it's only in the last few years that those things have more or less decentralized.

##

Oakeshott: The Division of Mines moved around in San Francisco in various locations from its organization in 1880, until January, 1899, when they moved into the new Ferry Building. It was new then.

I don't suppose you remember, but there were four streetcar tracks that came down Market Street, and all cars turned around in front of the Ferry Building in San Francisco. All transcontinental trains and transportation came across the continent into Oakland and Berkeley, and ferry boats transported everything, including passengers, across the Bay, through the Ferry Building, and then very often up Market Street, where they spread out to their various destinations. The Ferry Building was the important and characteristic building of San Francisco.

Swent: And the Division of Mines was the key agency?

Oakeshott: Yes, yes. We had a huge relief map in the Ferry Building in those days that was visited by thousands of people. As a small boy I remember going through the Ferry Building, and on the streetcars out to Golden Gate Park and so forth.

Swent: Where is that map now?

Oakeshott: Oh, I don't know where the map is now. It was purchased by some private individual and taken up to Redding, and that's the last I heard of it. It requires too much space, so that nobody can figure out what to do with it.

Swent: Was this map done by the division?

Oakeshott: It had been done by the division, as far as I can remember, probably assisted by Works Progress Administration people during the depression years of the 1930s. And incidentally, on the 1938 state geologic map that Jenkins and his staff put together, a lot of the work was done by WPA people who were paid a small sum, as I understand it, by the federal government. So we had--I say we, but I wasn't with the division yet--the division had some people who later became well-known geologists, like Tom Dibblee and Harold Hoots. Tom Dibblee is now retired and at UC

Oakeshott: Santa Barbara part of the time; Harold Hoots passed on. Others later became well-known geologists and mining engineers. During the bottom of the depression, everybody was looking for jobs, including geologists and mining engineers.

Another example of cooperative work that was a great triumph for the state as far as getting proprietary information was concerned is this huge volume I'm holding in my hand now: Geologic Formation and Economic Development of the Oil and Gas Fields of California, Bulletin 118, published by the State Division of Mines in 1943. That is really a petroleum geology of California, oil field by oil field. The amount of proprietary information, like maps of individual oil fields, is amazing. The oil companies were very, very generous in their cooperation with the young state Division of Mines in this type of work. They put out this volume which became a sort of bible for the petroleum industry.

Swent: They must have had a lot of confidence in your basic integrity to do that.

Oakeshott: Oh, yes. It's still amazing. For years and years that was used. Of course, it's out of date now. After all, that was over forty years ago.

My own contribution started when I was named as a contributor to the 1938 state geologic map. I was teaching at Compton, and had done some mapping in the San Gabriel Mountains, so my little bit of mapping was used.

Swent: And as it turned out, the place that you mapped in the San Gabriels was also the place that had the earthquake?

Oakeshott: Yes, in 1971. That was right in the southern part of my area. I had worked at Santa Maria for Shell Company, and fortunately I had a field leader who was meticulous and a very hard worker. So I was used to walking every foot of the ground. He was Leslie M. Clark, long gone, but one of the great exploration geologists. This was my background, so I carried this sort of activity on in my own mapping in the San Gabriel Mountains.

Swent: When you went with Shell and when you left Shell, was there any concern about your divulging what you knew?

Oakeshott: Oh, yes. Shell Company, like a number of other oil companies, was very, very tight about their information, and our field geologists were instructed in the field that if they met another company field geologist, to cover up their maps and not discuss the matter. [laughs] Which is pretty hard to do if you meet a friend in the field.

Swent: So there were competitors?

Oakeshott: Oh, sure, there are always competitors.

Swent: You were working on land that Shell did not own?

Oakeshott: No, Shell didn't own the land we worked over, and very often we worked over new territory without permission of the landowner. We didn't have time to get permission, and so we just went on the land. We'd be across it one day and get the information we wanted, and then we'd be on some other property.

Risks and Hazards to Geologists

Swent: Were you ever worried, was there ever a risk?

Oakeshott: Oh yes, sometimes there were hostile landowners, but I was never attacked physically. I came close to it sometimes, but I always talked my way out of it.

Swent: Do you want to tell about that?

Oakeshott: Well, one time I went through a man's property with an old car, and evidently he didn't like it because he came after me with a shotgun, so I just drove the car into a gully and lay low for an hour or two until he disappeared. He got tired of hunting for me, and then I went on about my business. [laughs]

Swent: This land wasn't planted or anything?

Oakeshott: Oh, no, no. I didn't do any harm; it was entirely rough rangeland, and of course we had to be a little bit careful about cattle. Sometimes there would be a bull that would be hostile.

Swent: You were driving off roads of course. What kinds of vehicles did you use?

Oakeshott: With the Shell Company, most of the time I had an old Dodge touring car. I'd drive it over hills, anywhere I could, where the hills were bare. One time I turned it over. I drove it down the hill and hit one of these deep gopher holes, and the car flipped over. These cars had great big heavy steering wheels. The top was a cloth top. The top was demolished, but it came to rest on the steering wheel, and my partner and I were lower than that down in the seat, so we weren't hurt. We got out. I thought I'd be fired for sure, but none of my bosses said anything about it. All they said was, well, take the car and get it fixed.

Oakeshott: We got hold of a bunch of Mexicans who were working nearby and asked them to help us, and we went over and picked up the car and turned it over, and drove it off. [laughs] So we got by that time.

Swent: So you worked in pairs then?

Oakeshott: We went out alone, but this time we happened to be working two of us together. We went out alone most of the time.

Swent: You always used vehicles, not horses?

Oakeshott: No, we didn't use horses, although many of the early-day geologists did use horses and mules. Real early-day geologists in the last century of course covered a lot of ground.

Swent: You had to be an auto mechanic as well.

Oakeshott: Well, you had to take care of certain things, you know. Minor things that you'd expect to happen. In those days, something was always happening to your automobile, you know.

Swent: When you ran into other geologists, you just stayed mum?

Oakeshott: Yes, we just stayed mum, and they did too. And whenever a new well was drilled by an oil company, other oil company scouts would try to find out where they struck oil, what formations they went through, in their drilling and so on.

Swent: When was this in relation to the Kern County discoveries?

Oakeshott: There were some of the Kern County discoveries in very early days, because there were, as in several parts of California, oil seeps. The first wells were drilled on these oil seeps and were very shallow, just a few hundred feet deep. Rancho La Brea is the most famous of the oil seeps, and there were many like that; there were some in the Santa Maria district, where oil actually seeped out to the surface. There were some in the western San Gabriel Mountains where I worked. Later on, drilling got deeper and deeper.

Swent: What sort of authority did you have as a geologist to recommend drilling?

Oakeshott: When I worked for Shell Company, I was just a beginner, so I was pretty low on the totem pole. I would discuss the matter with my field leader, Les Clark, and he would review it, and then he would take it up with our boss in Los Angeles, who was then Roy Morse. Morse had been a professor at Cal who helped me get a job

Oakeshott: in the first place, and was our chief geologist for Shell Company. His boss was Vice President E. F. Davis of Shell Company who was really in charge of all exploration.

This Bulletin 118 that the division put out was noted as the bible by many geologists for years and years because they found so much to which they could refer through the years. Many times I've been told how unusual it was for the oil companies to divulge information, like specific information and data on some of these oil fields and underground structures of certain oil fields.

Some countries have a much more liberal policy than the state of California on exchanging information. For instance, in Canada, oil companies have to exchange information. But in California, you can drill duplicate exploratory wells, by different oil companies, and so quite a bit of wasted effort goes on.

Swent: You have to stake a claim, as you do for mining, don't you?

Oakeshott: Yes, each oil company has its land office that is responsible for buying or leasing land, or making some arrangement, maybe with a royalty payment to the land owner, this sort of thing, before they can enter the property and drill.

Swent: To get back to mapping, what sort of scale were you using for Shell?

Oakeshott: We mapped in the field, on these early aerial photographs, and I think the scale was around 1:18,000 or 20,000.

Swent: Who made these photos?

Oakeshott: Fairchild Aerial Survey, a private organization, made a lot of photographs of California, and other major companies like that, on contract to the Army Map Service, and probably to the USC&GS and the USGS; they were all interested in aerial photography, so now there are quite a number of agencies that contract for aerial photography. You know, they use this in agriculture too, to map photographically different types of crops and the aerial distribution of crops throughout the state. They can even locate marijuana.

Swent: Now, that's a new hazard for the geologist too.

Oakeshott: Definitely! Definitely! Professor Bruce Bolt and I did a job two or three years ago for PG&E [Pacific Gas and Electric], who were interested in the earthquake safety of their Scott Dam on Lake Pillsbury, which is right in the heart of the Northern Coast Ranges, a very remote area in Mendocino County. Bolt and

Oakeshott: I were driving along a county road, a county road!--we knew it was a county road, and through areas that we knew were partly privately owned, and partly Forest Service land. We stopped to look at an outcrop along the road, and we were accosted by somebody who said, "What are you doing on this road?"

I said, "What are we doing on it? It's a county road, isn't it? Can't we go where we want to?"

"Well, hardly."

Then we stopped and talked to the sheriff of Mendocino County, and he said, "You'd better stay on the road, because you're taking your life in your hands if you go off the road. There's a lot of marijuana grown here, and you could be shot. They'd just as soon shoot at you as not."

So it's highly hazardous for a geologist who's climbing around through the brush. Mendocino County's major industry is the growing of marijuana. The sheriff told us that he had a one-man office with a deputy, and he said, "What can I do?" Of course, maybe he was taking a cut; I don't know. Anyway, it's true; what could he do? It's too big a problem for one sheriff. Anyway, the thing for the geologist is that it becomes highly hazardous to explore that type of country, so we visited the dam site and we went along the roads, but we didn't attempt to go out cross-country in the brush. [laughs]

There were of course always, in the past, private landowners who were very, very possessive of their property, and some crackpots who were armed and who would challenge anybody who came on their land.

Swent: Were you ever warned of this when you studied geology at the university, or was this something you learned later?

Oakeshott: Oh, they didn't pay much attention to it. [laughs] The professor talked to you about it when you went into the field, and they took their own precautions. For the summer field courses, for instance, the professor would make arrangements with the landowner ahead of time, because we would camp out, so that was all in the clear. But the sort of work I did in the San Gabriel Mountains, I didn't stop and ask for permission.

The place where I had the most trouble was with the Los Angeles Department of Water and Power, around the San Fernando dam. They had made excavations which exposed a lot of rock formations around the dam; a very critical area. I wanted to get in there and see those. So I crawled under a fence. You know these fences are never man-proof; places where a little stream has eroded under a fence, you can crawl under. So I got

Oakeshott: in and I was challenged and told I couldn't do this, so I got out and then I asked for permission from the Department of Water and Power, and they sent me a letter saying that I was permitted to enter from four o'clock in the afternoon until five o'clock on a certain day. Well, that was utterly ridiculous, so I just went in whenever I pleased, and got away with it. [laughs]

Swent: This is the dam that was in the news?

Oakeshott: Yes, it almost failed, but it didn't quite fail. If it had, it would have been a major disaster. The water came up to within about two feet of the crest of the dam, but they got it released and lowered in time to prevent failure. That was a close thing.

Some of the rules, you know--well, any rules have to have exceptions, because there are some things that become unworkable. I remember one time, driving into Death Valley with my friend the chief, Olaf Jenkins. He always had me drive, and he and I drove in an old state Ford, years ago, into Death Valley, when it was quite hot. We shouldn't have gone in there, with nobody else around. But we drove across Death Valley, and the engine froze, and we were stuck.

Finally we were able to let it cool off enough to make it into Shoshone, and there the car made a horrible racket, and they couldn't repair it in Shoshone. It was using enormous amounts of oil and water. Jenkins took off on a bus for home, and told me to take care of the car. So I drove the car to Baker. I took a five-gallon can of oil and kept putting oil into it every few miles, and several cans of water, and kept putting water into it, and with a terrible clatter and bang, I finally got into Baker, and then to Barstow.

At Barstow, I took it to a Ford agency, and said, "Put a new engine in this car." Now, my limit under state regulation was $100. I couldn't expend more than $100 without getting approval of the director of the Department of Finance, which would involve a lot of red tape and so on. But I just did anyway, because the engine had to be replaced. The mechanic went into it and he pulled out handfuls of pistons and the thing was just a complete wreck.

There was a standard price for Ford motor engines, and a standard price for labor, so I could get it done in Barstow just as cheaply as I could in Los Angeles. I did this, and it cost about $200; in those days it was pretty cheap. So I did it and went on my way, after losing only a day, and I called up the financial officer of the Department of Conservation and said, "Ernie, I want permission to buy a new engine for this car," and I told him the circumstances.

Oakeshott: He said, "You know, Gordon, you can't do that, it runs over $100, and you're going to spend $200 on this."

I said, "Ernie, I've already done it. What are you going to do about it?"

He said, "Well, you can't do it!"

I said, "I've done it! What do we do now?" I said, "The alternative was to be towed to Los Angeles, which would have cost a mint of money, to use two or three days of extra time, which would have cost the state another mint of money, and to do it at the standard price that the Ford motor company offers, which would be exactly the same as I paid in Barstow. And so I used my head and had it done here."

He said, "Okay, forget it." [laughs] So occasionally, you have to break a rule.

Swent: How did you cover the mechanics of such an arrangement? Did you carry that kind of cash with you?

Oakeshott: They just took my order. One time I was in Nevada, investigating some faults in central Nevada, in a California state car. You can go into an adjoining state without special permission, if necessary. And I didn't have any money or any credit card, and I ran out of gas. I charged gas at the gas station, and they took my word for it. They billed the State of California for it.

Swent: You have to use your head sometimes.

Oakeshott: Yes, you have to use your head, and some rules are made to be broken.

One time I got stuck, though. I took some geologists up to Oregon for a geological convention, at Portland. This was logical and reasonable. We drove two or three cars up there. We went up the Columbia gorge on the Oregon side.

Well, unknown to me, the other car that was with us, a state car from California, the driver was a Washington boy, and he thought it would be nice to come back the Washington side. On the Washington side, unfortunately, he broke an axle and had to have it replaced. This was turned in to the state, and I caught personal hell from Sacramento for being in the state of Washington without permission, because this was not an adjoining state. So I had to explain what had happened. [laughs] That time they had me dead-to-rights, of course, because I didn't belong in Washington.

Oakeshott: We had very fine people to work with, for the most part, and they were very helpful. The Department of Conservation was very helpful from time to time.

Changes of governor were usually pretty remote from us. The Department of Natural Resources was put in as early as 1930, and later changed to Department of Conservation. Then later, the agencies put another layer between us and the Governor.

Swent: Would you care to talk about the appointment of Ian Campbell as chief when you were acting chief? Was this sort of a blow to you?

Oakeshott: Oh, yes, but I'd known him for a long time. I'd known him since 1931, when he first went to Cal Tech, because I was at Compton and used to go out to Cal Tech to read in their library and to listen to some of their lectures. Ian Campbell was a young professor who had just come to Cal Tech then, so I went out to hear him give a talk, and from then on, I knew him.

He and I took the examination for chief of the Division of Mines and state geologist when Olaf Jenkins retired. I was state geologist for about a year, practically speaking, and Campbell and I both took the examination, among a lot of other people. He and I both passed it at the top, and so the Mining Board decided it would be better to bring in Campbell as chief and keep me as deputy. So I went down to Cal Tech to see Ian Campbell when I had notice of this.

Swent: Who advised you?

Oakeshott: The department was very nice to me. The director of the department sent his deputy on a special trip down here to my house to tell me about this, and explain what their views of the matter were, so they were very nice about it, and also the chairman of the Mining Board, Phil Bradley, was an old friend of mine, so he told me about it too. They figured that we would work well together.

I went down to Cal Tech and told Ian Campbell that I would resign, regardless of civil service regulations, and take another position, if he wanted to pick his own deputy. But he was very nice too, he said, "Oh, no, you're exactly the man I want," and so on. So that was very nicely handled.

The salary of the chief at that time was only 5 percent above his deputy anyway, so the difference in pay was insignificant. [laughs] They were very nice people to work with.

Working with Olaf Jenkins, Division Chief##

Swent: Gordon, if you don't mind, let's backtrack now. I'd like to know what made you decide to leave Compton.

Oakeshott: Well, I had taught at Compton for eighteen years, from 1930 to 1948. In the last two or three years my father had been living in an apartment near us in Compton. He died in early 1948 at barely eighty years old.

I felt that I had been getting away from my profession of geology. I had had only a year as a petroleum geologist in the field in 1929, before I was terminated at the beginning of the Depression. I felt I had been losing something in my profession. I had gotten a Ph.D. in 1936.

I had known Olaf Jenkins, the state geologist with headquarters in the Ferry Building in San Francisco since the early 1930s.

Swent: How did you happen to meet him?

Oakeshott: First of all, when I was still in petroleum geology, I attended a petroleum geologists' meeting in San Francisco in the fall of '29, so I met him there. He was getting his Ph.D. at Stanford. Then he came to the Division of Mines about 1930. In the early 1930s, I was doing field work in the western San Gabriel Mountains, north of Los Angeles, for the Ph.D. and Olaf Jenkins came down to look at my work. We went out in the field together.

So after that I had kept up an acquaintance with him. Then in the summer of 1948, after my father had died, Jenkins called me from San Francisco and asked me to take an exam for associate geologist. I said, "Well, I thought this was Parker Trask's job." He was a noted geologist and had been with the division. He said, "Oh, I fired Parker." (They couldn't get along together.) "So I want you to come and take this job."

So I said, "Well, I doubt that I would take it." He said, "Take the examination anyway."

So in early August he called me back and said, "You're number one on the civil service list and I want you to come up and go to work." I said, "Well, I'll think about it." Then on September first he called again and said, "You've been on the payroll for the past week and I want you up here." [laughs] So he had put me on the payroll August twenty-fifth.

Oakeshott: I brought my family up to Oakland January thirty-first, 1949. This came at the right time. Father had passed on, I felt that I had lost sight of my profession, and I knew that working for the State, I'd be able to do geologic work over the entire state, and that I would be fully in the profession, because he wanted me to do liaison work with the organizations. So I would join things like the Geologic Society of America, American Association of Petroleum Geologists, and others. I probably joined too many all together [laughs] but I joined them all. And we were cooperating of course with units like the U.S. Geological Survey on making a geologic map of California.

Swent: What was your official title?

Oakeshott: My official title first of all was associate mining geologist.

Swent: Were you the only one?

Oakeshott: There were three of us with this title. But Olaf Jenkins started to give me administrative duties right away. He didn't like administration. And so he assigned me to represent him at Sacramento and to represent him with the geological organizations, this sort of thing. And then I had to do various things like--well, frankly, he had neglected administrative duties because he wasn't interested.

He was interested in geology. I had to do things like coordinate the use of automobiles, approve field plans, and get some accountability from the geologists as to the use of their time. This sort of thing. So I got involved in assisting in administration.

Swent: Were you doing editing also at that time?

Oakeshott: Some. We had two very fine girls who were doing editorial work: Elisabeth (Betty) Egenhoff and Mary Hill. They did much to make our geological publications a success. Young geologists are not always good writers.

I was promoted pretty fast to supervising geologist. Jenkins divided the division into mining engineering, under a supervising mining engineer, and geology, under a supervising geologist. So I was supervising geologist.

Then the supervising mining engineer died and Arthur Norman, from the Los Angeles office, was promoted to supervising mining engineer. He came to San Francisco and then he left in a few years for private practice. And at that time Olaf Jenkins just promoted me to the new position of deputy chief, and I was to assist him in administration, directly under him and over the staff. So I took over both mining engineering and geology.

Swent: Were you continuing to do geology as well as administration?

Oakeshott: Oh, I made a lot of field trips. Jenkins and I went on a lot of field trips together. Geologists are self-motivated, you know, so we didn't have any trouble leaving them to work on their own.

I remember the first time I went out in the field with Jenkins after I started work, he was newly-appointed chief of the division, and he felt the burden pretty strongly. So during the middle of the morning, he said, "I've got to call the office and see what's going on." I said, "Olaf, if you can't trust your people, you don't have any staff." He said, "I'm going to call."

He came back red in the face, angry. "What's the matter, Olaf?" He said, "The so-and-sos have all left the office. They took advantage of you and me being absent and they just haven't come to work."

I said, "Does Columbus Day have anything to do with it?"

He said, "Oh, yes, certainly, the state always takes all holidays. They're off legally."

I felt the burden of my administrative duties too, so one time after such a field trip, I came back to the office and I said to one of the young geologists, "How did you get along while we were gone?" He said, "Oh, were you gone?" That cut me down to size. [laughs] So you're not as important sometimes as you think you are.

I owed Olaf Jenkins a great deal. For instance, he furnished copies of my thesis in 1936 to University of Southern California, who had demanded 100 copies or a 100-dollar deposit. Of course, I had neither one. Jenkins published my thesis as a Division of Mines paper and gave me a hundred copies to give to the USC library, so I was all set.

Swent: And that was before you were working with him.

Oakeshott: Oh, yes, many years before I worked with him. And this was really why he got in touch with me when he had this vacancy later.

Swent: Because of your expertise in that area.

Oakeshott: Yes, I had minor administrative experience at Compton, of course, with these various programs, and this sort of thing. I carried a terrific load at Compton. I had as many as twenty-two full college credit courses per week. Twenty-two hours.

Oakeshott: Soon after I went to work for the division I came into the office one morning and Olaf Jenkins was laughing. He had a copy of a Compton paper that the superintendent had sent him, knowing where I was going to work, of course. He was laughing because the paper said that three instructors had been hired to replace me--one to teach aeronautics, one to teach surveying, and one to teach geography and geology. Of course this was part of their load. But it sounded as if I had been very busy.

Swent: Well, you were very busy.

Oakeshott: It was possible because there were that many hours in the day, and after being there many years, the preparation was no problem. The main problem was that I had to grade all my own papers.

Swent: That's an awful lot of papers to grade.

Oakeshott: I had as many as three hundred. Three hundred every week. So I tried to give objective exams and make it easier to grade.

Publications

Oakeshott: I had a chance in the Division of Mines--not only a chance, but really a duty--to publish. So I published lots of things. First of all, rising out of the western San Gabriel Mountain problems.

Swent: Yes, I think you have a list of over a hundred publications.

Oakeshott: Well, yes, but it's been a long time, Lee. [laughs] I did publish a lot, though. Some of which I'd like to re-write in the light of today's knowledge! McGraw-Hill asked me to write a geology of California, to start a series on geologies of the various states. I wrote it mostly in the early mornings before going to the office--called it California's Changing Landscapes. I also wrote a little book designed for a quarter course on Volcanoes and Earthquakes--Geologic Violence. The latter was translated into Japanese.

I'm still writing. Right now I just finished an obituary for Don Tocher, the former seismologist at Cal. He died in his mid-fifties of cancer. He was a very fine seismologist. I knew him from his student days on.

I've written a number of obits lately, because you know, people around my age are dying off. And so it's always for some old friend, usually whose entire career I was familiar with. So

Oakeshott: that's the way it goes. Then I'm about three-quarters of the way through an autobiography. I don't know whether anybody will ever read it. [laughs]

Swent: What about seismology? Were you doing any seismological work?

Oakeshott: No, I was never a seismologist, but I was very much interested as a geologist in faulting and the causes of earthquakes. So beginning with 1932 and the Arvin-Tehachapi earthquake, when the Division of Mines put together that Bulletin 171, I got more and more interested in what the seismologists were doing.

I became eventually a good friend of Perry Byerly, the head seismologist at Cal, and his successors. So I've more or less kept up with them. And there were several of the younger seismologists who got out into the field. I went out with several of them from time to time.

It was unusual for a seismologist in those days to be interested in the field. Byerly never went into the field. They studied the earthquake records. So when some of these young seismologists like Don Tocher, 1952, wanted to go look at the fault, he went out with me in the field and we looked at faults. Both in California and Nevada.

Central Nevada had a series of earthquakes in 1954, so two or three of us from California went out into the field to examine the surface faulting with University of Nevada professors.

Swent: And this was a little unusual?

Oakeshott: Yes, it was unusual because up to that time, seismologists had been largely trained through physics and mathematics, so they were interested in interpreting the earthquake wave motion, and not so much in the field. And as late as 1950 there were many scientists who were not thoroughly convinced that there was any real relationship between faults and earthquakes.

It seems strange to us now, because everybody knows about the San Andreas fault, the Hayward fault, and so on, in this area. But it was a while before seismologists and geologists fully recognized that fault breaks caused earthquakes, and not the other way around. There were many who thought that these faults that appeared in the field in some strong earthquakes were the result of the earthquake, and not the cause. So people like Don Tocher--and that was his full name, Don--who got his Ph.D. in seismology under Byerly at Cal--people like Don who became interested in the field evidence of earthquakes were scarce.

Swent: It seems to me you were at the Division of Mines at a very interesting time.

Oakeshott: Yes, I was at the Division of Mines at a very, very good time because one of our major projects was to make a geologic map of Calfornia, like that one [indicating large map on wall]. Then we had mineral resources to keep track of. Gold was the most popular one, of course.

Swent: What about War Production Board order L-208? Were you aware of that at the time it was issued?

Oakeshott: Oh, sure. But California is the state of the union with the greatest total value of mineral resources, year by year. Everything from the non-metallics, which are very important--they include things like rock, sand, gravel, and limestone--those things add up to very large figures in terms of value.

Swent: Were you catching up at the division with a backlog of work from the war?

Oakeshott: Oh, I suppose that's one way to look at it. We had a staff during the war. But of course I didn't go to work for the division until 1948.

It's interesting that during the war, Olaf Jenkins had some geologists working for the division who were on these war training service programs--WTS, War Training Service. You remember that the young people, especially young men, were able to get paid, even at the bottom of the Depression, for these government programs. Things like the Civil Air Patrol, where the government paid costs of keeping young men occupied.

Swent: What about oceanography and meteorology at the division?

Oakeshott: We didn't do any meteorology as such at the division. I taught meteorology at Compton as an outgrowth of the pilot training program, but at the Division of Mines we did have a marine geologist. One fellow is still classified as a marine geologist and he's working right now out of the University of California at San Diego. We did to a small extent, because we only had one professional person working on that.

Swent: And did that extension come while you were there?

Oakeshott: Yes, it started while I was there.

Swent: Seismology was a new thing there, too.

Oakeshott: Seismology was a new development, and it came out of--really our first serious work was in 1952 at that Arvin-Tehachapi earthquake.

Swent: I saw something the other day about the Kern County earthquake; is it sometimes called that?

Oakeshott: Yes, that's right.

We thought at the time, that is, some engineers were interested, and the U.S. Coast and Geodetic Survey had a strong motion section, and we thought at the time that the State should get into strong motion earthquake work because it was so important in building design for earthquake resistance. And so I advocated through the Division of Mines the hiring of a seismologist or two. Then later we got involved with the State on strong motion work.

Legislation for Seismic Safety

Swent: Who else in the state would be doing this?

Oakeshott: At the state level, Senator Alfred E. Alquist put through a series of bills for us. In 1974 and beginning two or three years earlier, he was joint legislative committee chairman on seismic safety. Well, the Division of Mines along with some engineers and seismologists cooperated in preparing legislation for Senator Alquist to put through on earthquake safety. The final result of all that was the bulletin called Meeting the Earthquake Challenge, signed in January 1974 by Alquist. My job was chairman of the advisory group on engineering considerations and earthquake sciences. Awful title, but that was it. We had an advisory group on disaster preparedness, an advisory group on post-earthquake recovery, and an advisory group on land-use planning, and an advisory group on governmental organization. Together we wrote legislation that was designed to help take care of earthquake problems in California at the state level.

Swent: Has this really been implemented?

Oakeshott: It has been implemented. In the early 1970s, I was pushing this at the legislature, with the help of engineers and seismologists, and so Alquist got a bill passed in the Senate setting aside a fund for state-level consideration of earthquake safety problems. He had passed a bill, amazingly, without the funding stipulated, that is, just how the funds were to be set up.

So his office called me and said this bill has gone through the legislature without any statement as to how we're going to raise the money. So we want you to give us an estimate of how much money is needed.

Oakeshott: So I called around to every place I could think of to find out what the total value of building permits was in California. I got enough answers so that I was able to call back to Senator Alquist's office and say that seven-hundredths of one cent on the dollar of building plans would finance us. Well, as it turned out, we got more money than we needed, and this was set aside as a separate fund in the state, not through the State Department of Finance. It was a special fund and instead of raising about $100,000, which I thought it would raise, over the years as prices and costs went up, it raised many times that sum.

So the State Division of Mines and Geology now has about forty seismologists and the state is instrumented so that any earthquake in the state would leave a strong motion record. In the early days, the sensitive seismometers would go off the record if they were too close to a major earthquake. But now we have the whole state instrumented; there are several hundred seismograph stations where the instrument is set up in a box connected to the ground so they get the strong motion.

Swent: How do you coordinate with universities on this?

Oakeshott: Informally, through Cal, Cal Tech, and others.

Swent: They have their own seismograph at the university, but not all around the state?

Oakeshott: Oh, yes, the university set up the first seismographs in the country.

Swent: Are you duplicating at all?

Oakeshott: No, we're not duplicating at all. They don't have this big series of strong motion stations. They have certain seismograph stations. The first two were installed at Berkeley and the top of Mt. Hamilton, in 1887. Recently we had a hundred year celebration of that event, at UC Berkeley in 1987, organized by Bruce Bolt. We had a series of technical meetings out at Cal and then wound up with a dinner at the Faculty Club.

##

Swent: You were talking about seismology.

Oakeshott: It so happens now that the acting state geologist is a seismologist. The state has advertised for a permanent state geologist, but this guy Brian Tucker has a doctor's degree in seismology. He is trying to not cut into mineral resources. He wants the division to continue to study the mineral resources of the state, which of course is a prime reason for the existence of the division.

Swent: But seismology has become one of the major activities?

Oakeshott: That's right. Certainly it's a major activity.

Swent: What about the politics of this? Who would be the opponents of Alquist's bill?

Oakeshott: There were very few opponents. That's why it went through without stipulation of funding. It's like motherhood, you know; everybody's in favor of earthquake safety.

Swent: What about these building permits over here? [referring to some nearby houses being built in locations which appear very risky, both for earthquakes and landslides]

Oakeshott: I suppose that the county is even in violation of the law, because the law requires the counties to take some responsibility for earthquake safety. Every county has to have an earthquake safety section which is supposed to operate, to serve in an earthquake emergency.

Swent: I suppose in a sense nearly every building site in California might be vulnerable to an earthquake.

Oakeshott: That's right. The builder, for instance, and the government agency, city or county, are responsible for informing the owner or prospective builder of any facts which might be important to him concerning his lot. So the City of Oakland, I think it could be said by law, would be obliged when they issue a building permit to say this is a former landslide area, and it's excessively steep. Go ahead if you want to, but this is it. Now whether the city did anything like that, I very much doubt, because Oakland avoids that problem. So does Berkeley.

Swent: I imagine there are lots of building developments all over the state which have ignored that.

Oakeshott: Oh yes, I should say. Some engineers have pointed out that if before 1906 we had had such interest and earthquake safety organizations, the city of San Francisco would never have been approved; it's too close to the quake faults. So the attitude of the engineers, and it's a practical viewpoint, is that we build in earthquake areas, but we build for safety. We design for earthquake motion.

You know about the Field Act and other things that have expanded on that to require safety in building design.

Swent: I guess it has been one of the biggest changes in the division and in geology in this period, hasn't it?

Oakeshott: It's been a tremendous development. The University of California is primarily a research and teaching organization, so the seismologists at Cal have always emphasized research and teaching, and not the practical application, but even the university now is getting closer to the practical applications of seismology.

Swent: When did you retire?

Oakeshott: I officially retired at the end of 1972, so I was there from 1948 to 1972. Then in 1973 and 1974, the division hired me as a quarter-time consultant, until I was seventy.

I retired at the end of 1972 because Reagan, when he was governor, had sponsored and signed into law a bill requiring state retirement at age sixty-seven. I was already sixty-seven and a half when this bill went through, so the state personnel board and my State Geologist Wes Bruer said, well, you can work until you're sixty-eight.

Then the new state geologist [Bruer] was a friend of mine, a very nice fellow, so he said, why don't you work quarter time on a consulting basis for the next year or two. Then they ran out of funds when I reached seventy, and that was it, for this purpose. Anyway, I always thought it was odd that Reagan would put through such a law and then almost immediately take off for the biggest job in the country at age seventy. It didn't seem consistent. [laughs]

Swent: So you had eighteen years at Compton, and twenty-five with the division.

Oakeshott: Incidentally, this quarter-time consulting work--when I retired, I had 24.6 years with the Division of Mines and Geology. They give a twenty-five-year pin. So after I had worked two additional quarters, I asked the personnel board if I could have a twenty-five-year pin. They said, no, we don't count work after official retirement. So actually I had 25.1 years of service, but they didn't credit the last part.

Swent: But no pin.

Oakeshott: But no pin. [laughs] That wasn't important.

Swent: We'll have a picture of that beautiful map for your oral history. They sent us some from the California Geology.

Oakeshott: Oh, did they? That's good.

Swent: Gordon, this has been very nice of you to catch up these details. It's been a pleasure to interview you.

Oakeshott: Thanks, Lee. I enjoy talking about it, obviously.

Transcriber: Eleanor Swent
Final Typist: Elizabeth Eshleman

GORDON B. OAKESHOTT

Interviews Conducted by Stanley Scott
for the Earthquake Engineering and Seismic Safety
Oral History Series

I MAJOR CALIFORNIA EARTHQUAKES

[Interview 1: November 17, 1986]

Oakeshott: Suppose I start with a few remarks in chronological order in terms of occurrences of earthquakes, then I'll come to the emphasis on the beginning of the state's interest in strong-motion research, because that's what interests the engineer.

California, of course, has had three really great earthquakes--1872, in Owens Valley; 1906, in San Francisco, and way back in 1857 there was probably the third greatest earthquake in California, due to movement on the San Andreas Fault down in the Tehachapi Mountains area. The Arvin-Tehachapi (Bakersfield) earthquake in 1952 was pretty close to being one of the great earthquakes.

(Added later: The first recorded earthquake in California, in 1769, was reported by the Franciscan fathers. Its epicenter was probably in the Whittier Narrows area, similar to 1987.)

Owens Valley, 1872

Oakeshott: As far as the 1872 earthquake and Owens Valley is concerned, my grandmother was living there. She left a diary, or notes on her life. The great state geologist, Whitney, went to Owens Valley after the 1872 earthquake, but he didn't note in which direction the horizontal component moved...whether the mountains moved south relative to the valley or north. So I looked through Grandma's diary, just hoping that she somehow had noted this, but when she got to about February, 1872, she said, "father decided to go to Oakland to Crow Canyon to visit the relatives, so we hitched up the wagon and took off." Then after she got back home, she said there'd been a great earthquake in our valley, and lots of people were killed. That's all she said. Of course, just a few years ago, the Geological Survey looked through some old records, and they found that indeed there had been right-lateral movement. In other words, the Sierra Nevada Mountain block moved relatively north, and also up, so it was an oblique-slip type of movement. Well, so much for 1872.

Scott: In terms of learning more about earthquakes or seismic safety, I guess nothing much happened after the 1872 earthquake? It was just a big earthquake.

Oakeshott: One of the most interesting things to me regarding observations on that earthquake is that John Muir was in Yosemite Valley, where he reported there were great disturbances. Some of these loose granitic blocks on the sides of the valley fell down, and they moved so rapidly across the valley that they hit other rocks and started fires through friction. He was highly excited and delighted by the earthquake, of course, and after that he theorized that all of these talus slopes at the foot of the cliffs in Owens Valley and other places had probably been caused by earthquakes. Not exclusively, but some of them.... (Note: In March 1987, for example, rock slides closed the exit road to Yosemite Valley; no connection to an earthquake.) But Muir was an enthusiastic observer of the 1872 earthquake. Yosemite was probably about 100 miles away, and the fault was very prominent in the Independence and Lone Pine area of Owens Valley, almost as far north as Bishop.

San Francisco, 1906

Oakeshott: In 1906 I was living in Oakland. I was about a year and a half old, so I don't really remember the main earthquake, but I do remember aftershocks, which lasted at least four years.

I dimly remember playing with downed bricks from chimneys, and this sort of thing. And I remember seeing the gas jets in our old home swaying back and forth, from my bed.

Scott: You think that was from the aftershocks?

Oakeshott: I know there was an aftershock as late as 1910, according to the records. By that time I was big enough to have some memory of this sort of thing. I've read later through the best sources that about 150,000 people came over from San Francisco to Oakland to be safe from the fires that followed in San Francisco, and from the terrible aftershock shaking that went on. That was the first big gain in Oakland's population. San Francisco had been the big city before that, but then after the earthquake the East Bay began to grow. They came to Oakland and Berkeley. Many of them didn't ever go back.

As far as insurance was concerned, some of the insurance companies paid up, and some didn't. Some of them said it was a fire, some said it was an earthquake, and they weren't responsible for earthquakes. There was payment by some insurance companies, but not all. As far as the engineering is concerned, much later I worked in the Ferry Building for many years, and in 1906 the tower had been badly damaged. Dean Derleth from the University of California, along with another committee, examined the Ferry Building Tower. He said, reinforce it, shore it up, and don't tear it down. So the Ferry Building Tower stands to this day, as you well know. But the damage to the Division of Mines, which was in the Ferry Building, was not recorded except in a few notes in the trustees' minutes. The Board of Trustees recorded about $1500 worth of damage done to mineral display cases and that sort of thing. These were old walnut and glass cases, and they had to be repaired.

Long Beach, 1933

Oakeshott: The next earthquake with which I was involved was the one of March 10, 1933 when I was in Compton--the family and I were in Compton. I was teaching at Compton College--it was a four-year junior college, and we were just a few miles from the epicenter, which was offshore from Long Beach. The magnitude was only 6.4, but we have found through later experience that the intensity of local shaking in a moderately strong earthquake can be very high. So that close to the epicenter the 6.4 magnitude earthquake was very damaging. Especially, the damage to the schools was very bad.

At any rate the 1933 earthquake was the impetus for the Field Act. As you know very well, the Field Act has been highly successful. It has cut down on the damage to public schools very drastically, so in later earthquakes--all the earthquakes that have followed--the damage to schools has not been so catastrophic.

Anyway, our little town of Compton suffered more than Long Beach. Long Beach was closer to the epicenter, but Compton was in a low area--part of it was even below sea level--and water-saturated. They had artesian water there years ago. This water-saturated alluvium just shook to beat the dickens, so poor construction came down flat. The little town suffered very badly. I think about 115 people were killed in the Long Beach earthquake--the same number of people who were killed in Alaska in 1964, but Alaska's earthquake was vastly greater in magnitude.

Arvin-Tehachapi, 1952

Oakeshott: Then more appropriate to what we're talking about--relationships to engineering--was the 1952 earthquake. The 1952 earthquake occurred due to movement on the White Wolf Fault, which was a northeast-trending fault across the south end of the San Joaquin Valley, about 20 miles south of Bakersfield. The White Wolf Fault had been marked by geologists as a fault, but an extinct one. We've been caught that way several times in history. We mark faults as being dead or extinct, and they come to life again. We're a little more careful nowadays than we were then.

Site Visit

Oakeshott: Anyway, on July 21, 1952, around 5 o'clock in the morning, there was an earthquake that amounted to about 7.5 in magnitude, maybe up to 7.7 in magnitude, which was a major earthquake. It wasn't as great as 1906, which has been calculated at 8.3, but this 1952 Arvin-Tehachapi earthquake was disastrous. I went over to the office in the Ferry Building at 8 o'clock that morning. Olaf Jenkins was chief of the division then, and I was deputy. We got together with G

Oakeshott: Dallas Hanna of the Academy of Science in San Francisco and drove down to Bakersfield right away. We first went to the wrong fault--we went to the Garlock Fault south of there, and spent most of the day tracing it out. But it turned out that the earthquake had been on the White Wolf Fault, which was on the southern end of the San Joaquin Valley--right on the margin of the valley, and mostly cut through old granitic rock. It was a thrust type of fault, with a little left-lateral displacement. In other words, the hills--the southern end of the Tehachapi Mountains--actually moved up, over the valley. So the next day after the earthquake, we traced out the surface expression of the fault for several hours.

Strong Motion Concerns

Oakeshott: In Arvin, where there was a lot of damage, I met Bill Cloud. He's long gone, unfortunately, but Bill Cloud was the US Coast and Geodetic Survey man, with headquarters in San Francisco, in charge of strong motion records of earthquakes in the west, and very much interested in strong motion. That was his field, and he was supported by the US Coast and Geodetic Survey. In the same earthquake zone, I shortly also met Karl Steinbrugge, who was a structural engineer. Bill Cloud, Karl Steinbrugge and I all agreed that engineers needed records of strong motions in earthquakes. Believe it or not, Stan, at that time we had no real, solid records of the characteristics of ground motion in earthquakes. That's not so long ago--1952. The state of California had no program. There was only this US Coast and Geodetic program of informally recording the intensities of earthquakes. For instance, Bill Cloud had a woman on the staff who became quite expert in assigning numbers on the Mercalli intensity scale to earthquakes.

Scott: That is based on observations of actual damage to structures and physical things, rather than on motion as such.

Oakeshott: Exactly. But she did it for many years, so there was quite a bit of consistency in the records.

Scott: This would have been before the 1952 earthquake?

Oakeshott: Yes, long before.

Scott: And at Cloud's instigation?

Oakeshott: Yes. So Bill Cloud, Karl Steinbrugge and I figured that the state ought to do something about the matter. It turned out that there are two main seismograph stations in California with real expertise. One was at Cal Tech, and one was at University of California, Berkeley. Cal had established theirs in 1887. They had set up a seismographic station on the Berkeley campus, in back of the Greek Theatre, and another on the top of Mt. Hamilton. Cal Tech had set up one in the hills right near Cal Tech. Perry Byerly--did you ever meet him?

Dividing the Territory

Scott: I can't remember ever meeting him, but I sure can remember talking to him on the phone, because that's when he introduced me to Karl Steinbrugge. He told me to go talk to Karl Steinbrugge.

Oakeshott: Incidentally, Perry was the one who got me in the Earthquake Engineering Research Institute about 1949, when it was just a group of interested fellows who met. He told them they ought to have a geologist, and said, "Gordon's the man to sit in with you." So Perry got me into that. Anyway, Perry Byerly and Beno Gutenberg of Cal Tech had made an agreement that they would give any earthquakes north of the north boundary of Kern County to Byerly, and south of it they would be Gutenberg's. It was kind of unscientific because as you well know, earthquake ground motion extends everywhere, and they ought to have some data obtained from other places.

Anyway, I made two mistakes on that Arvin-Tehachapi earthquake. In the first place I went to the wrong fault. Then when I got back I called up Cal and said to the guy who headed the geology department at the time, "you ought to get somebody down there to look at the ground surface developments in this earthquake. It's very fascinating, fantastic." So the chairman sent somebody down there. Well, very shortly we both got a communication from Perry Byerly, "Get the hell out of there." "That's Cal Tech's earthquake. That's south of the northern boundary of Kern county, so it's Gutenberg's earthquake. We from the University of California are not going to have anything to do with it. Let Gutenberg have it." If you can imagine that....

Writing Up the Earthquake

Oakeshott: The upshot of the discussion between Steinbrugge, Cloud, Jenkins and me was that Olaf Jenkins and I went down to Cal Tech a few days later. We met with the seismological and geological faculty at Cal Tech. They were all for studying the earthquake, and writing it up from both Cal and Cal Tech. Of course the Division of Mines had responsibility for the whole state. We didn't care whose earthquake it was. It was our earthquake. This committee at Cal Tech, including Jenkins, Cloud and so on, said the Division of Mines should be the one to write it up because they had the budget to do it.

So Jenkins assigned that job to me. John P. Buwalda of Cal Tech was supposed to be Cal Tech's man. He was a noted geologist who was then chairman of the Cal Tech geology department. But Buwalda was a procrastinator, to put it frankly, and he never did anything. I figured out an outline for a bulletin, and showed it to Buwalda. He said, "Sure, that's fine." So I went ahead, contacted the authors, and produced the book that you see here--Earthquakes in Kern County--authored by numbers of engineers, seismologists and geologists. They're all listed there.

Scott: It's bulletin 171, of the Division of Mines, dated November 1955. The title is Earthquakes in Kern County, California, During 1952.

A First for the State

Oakeshott: I mention this because it was the first really extensive cooperative job for the state on earthquakes, done under state financing and auspices--a cooperative job involving engineers, geologists and seismologists.

Scott: This was the first time there had been this kind of interdisciplinary study?

Oakeshott: Yes, that's the way to put it. We involved engineers, like Steinbrugge. Also Henry Degenkolb and John Blume were interested in getting out into the field and seeing earthquakes. Don Tocher was at Cal at that time, and it was kind of touchy for him to get out to see it, but he came anyway.

Scott: Touchy for him because of the dividing-up of territory?

Oakeshott: Yes. At that time he was a UC graduate student, so he didn't have Byerly's approval to get involved in it. Tocher didn't write for us, but he did go down and look--unofficially.

Scott: Fascinating. They wouldn't think of doing that sort of thing now, would they? Dividing up territories?

Oakeshott: No. On a major earthquake you get reports from all over the world, and they are studied from all angles. That's an extra volume if you want to take it with you. You've probably seen it before.

Scott: I've seen it. I don't know that I've seen a hardcover version.

Oakeshott: Do you have a library of these things?

Scott: Me, personally? I don't have a comprehensive collection, though I have a fair amount of earthquake-related stuff.

Oakeshott: Let's see, I've got another copy, so I'll donate that.

Scott: All right. I'll take good care of it.

[telephone call]

Oakeshott: Some people refer to the Arvin-Tehachapi earthquake as the Bakersfield earthquake. It was on July 21, 1952. Then about a month later there was another quite strong earthquake--maybe a 6 magnitude, I've forgotten--originating on a fault that was not exposed, and was much closer to Bakersfield. It did further damage in the City of Bakersfield.

Scott: The second one was more focused on Bakersfield?

Oakeshott: Yes. It was a very damaging earthquake. There've been three historic earthquakes over 8 in magnitude: 1857, 1872, and 1906. Then if I recall correctly, there have been about ten in the 7 magnitude range, which would be classed as great earthquakes. Then many more in the 6 magnitude range, like Long Beach.

Also Interdisciplinary Cooperation

Oakeshott: I feel this 1952 effort was kind of important because it launched direct work by the state--work on earthquakes, officially sponsored by the state. After that the state felt they could budget funds for earthquake work. The other point is that the 1952 effort introduced the formal cooperation of engineers, geologists, and seismologists. We began to work together instead of each going off in his own field.

II CALIFORNIA'S RESPONSES TO EARTHQUAKES

Scott: Say a word or two about why that happened, the cooperation. Was the time just ripe?

Oakeshott: I think that had a lot to do with it. The time had become ripe for all sorts of things happening.

1906: The Time Was Not Right

Oakeshott: In 1906, for instance, the time was not ripe for people to take cognizance of earthquakes. The great Lawson report came out, sponsored by the State of California. This is a copy of it right here.

Scott: It's a landmark report....

Oakeshott: Oh, a wonderful thing, but it was published, and that was the end of it. The seismological society had been organized, but they did not begin their bulletin series until 1911. After the Lawson report had been brought out and digested, the reaction in San Francisco and the Bay Area and California was that we should keep the matter quiet. "We don't want California to get the reputation of being dangerous because of earthquakes." They said the so-called earthquake of 1906 was mainly a fire. But of course the fire was due entirely to the earthquake. Water supply was cut off, gas mains were broken, so you had the ideal set-up for a fire. But times were not right for learning earthquake lessons.

The 1868 earthquake on the Hayward (then "Hayward's") Fault was probably a moderately strong earthquake. There were very few people around in those days, and we can't find any reports on it, except a short account in the Lawson volume. It's the best account of the 1868 earthquake, and there's nothing in there about how much movement took place, how much surface displacement there was. We know there was some surface displacement. For instance, when I was a small boy we lived in Niles, out near Foothill--what's now Fremont--for a few years.

##

Oakeshott: A friend of ours, Mrs. Overacker, told the family that there had been a break across her family's backyard in 1868. Mrs. Overacker lived to be about 96 years old, and one of my regrets is that I never went back to see her and quiz her, but you know how young people are--they don't think of those things.

But in 1906 and thereafter for several years, the times were just not ripe to really investigate earthquakes. The tendency was to try to kick them under the rug, to deny that California was an earthquake-prone state. Of course the San Andreas Fault had been recognized as far back as the late 1880s, but people were just afraid to talk about earthquakes. So it wasn't until much later--I'm sure 1911 was about the date the first bulletin of the seismological society was published--and after that we began to openly investigate earthquakes.

Richter and Byerly

Oakeshott: Then of course, in about 1935 Charles Richter came out with his earthquake-magnitude scale, which gave us a way to measure the actual strength of earthquakes from any place on the surface of the earth. And also around the same time, Perry Byerly came out with his computations of the strike and dip of a fault plane, working from seismographic records. He studied the direction of the first motion, as indicated on a seismograph, and was able to relate that to the initial direction of movement on the fault that caused the earthquake. Those were two things that gave an impetus to earthquake studies.

Working on Strong Motion

Oakeshott: Then the Coast and Geodetic Survey was given the responsibility of recording strong motions. I'm not sure what year that started. I think it started in the 1940s, because the Earthquake Engineering Research Institute started originally in the mid-to-late-40s as a committee appointed by the Coast and Geodetic Survey to advise them on earthquake studies. Perry Byerly was one of the first members of that committee.

Scott: Would that have been advising principally on the strong motion type studies?

Oakeshott: Yes. They were getting interested in relating this to engineering, beginning to see the importance of this to engineering.

Significance of Strong Motion

Scott: At this point I might ask you to say a little more about the distinction between the strong motion--what they're referring to when they talk about strong motion,

Scott: as compared to the kind of motion or energy that is recorded by these very, very sensitive seismographs, and that results in the Richter magnitude readings.

Oakeshott: Well, earthquake wave motion is very, very complex. It consists of a number of waves that proceed as any wave motion does--there are longitudinal waves that arrive first at a given station. Transverse waves are transmitted across the direction of motion--they arrive next. Then come the surface waves, which are usually a complex mixture of wave motion that cause most of the damage. Well it's this last kind of wave, the ones that are actually felt, that we classify as strong motion. These are the waves the structural engineer is interested in.

The Engineer's Concern

Oakeshott: The structural engineer is building something on the surface of the earth, on rock or soil, and the motion of this rock or soil will affect his structure. So he is interested in the nature of the motion, the strength of the motion, and the duration of the motion. It makes a lot of difference how long the shaking lasts. If I jog this table like this, nothing much happens, but if I keep up an equal strength of the motion for 20-25 minutes, pretty soon the thing begins to weaken and topple over. We've seen that in many earthquakes.

For instance in 1964 in Anchorage, Alaska, the Penney Building was observed by people who were there at the time--I wasn't lucky enough to be there--but people who were there saw the Penney Building gradually break up. The earthquake's strong ground motion lasted for about 40 seconds or more, and the building gradually broke up. The first motion didn't affect it very much, but it kept swaying more, and more, and more, then it began to crumble, and break up.

So at the time that Bill Cloud and his staff began to investigate it around the early 40s, strong ground motion was recorded with such devices as charcoal pens or pencils attached to some kind of pendulum device. The earth would shake under it, you see, and it would make a tracing. Those were crude seismographs that only recorded the strongest motion. The very distant earthquakes, and also of course very minor earthquakes, don't yield motion strong enough to actually affect structures.

Scott: I guess you're saying that the really strong motion tends to be felt closer to the earthquake epicenter and fault.

Oakeshott: Yes, the closer you are to an earthquake, in general, other things being equal--that is ground and rock conditions being equal--the closer you are to the earthquake epicenter, the stronger the motion. Of course the rock type and soil type also have a lot to do with the motion.

Earthquake Measurements

Oakeshott: The old Rossi-Mercalli scale, later revised and called the Mercalli scale, was a measure of the local intensity of the ground shaking. That would differ, depending on how far you were from the earthquake, the type of soil you were on, how high up in the building you were, and so forth. But the Richter magnitude scale measures the strength of an earthquake, and theoretically anyway, in Alberquerque, New Mexico, Santiago, Chile, and New York, they should get the same Richter magnitude for an earthquake originating in San Francisco. In actual fact, they don't, because there are certain differences in instruments, and so forth, but theoretically the readings should come out the same. They measure Richter magnitude by taking the seismogram, which has been recorded at that station, and reducing it mathematically to what would have been recorded by a certain make-up and style of seismograph--the Wood-Anderson--at a distance of 100 kilometers, I think it is....

Scott: A standardized distance.

Oakeshott: Yes. At any rate, the magnitude of an earthquake should be the same, recorded everywhere. There is no theoretical upper limit to the magnitude, it's an open-ended scale. The strongest earthquake in the world's history has probably not been over 9 in Richter magnitude, if it reached that high. So San Francisco, 1906, and Owens Valley, 1872, and Fort Tejon, 1857, were all somewhere around 8.3. They were very strong, near the practical upper limit. But it's an open-ended scale. The press often gets this mixed up. They refer to the Richter magnitude scale of ten--well, it's not a scale of ten, it's an open-ended scale. Also they can record Richter magnitudes of less than zero--way down--with instrumentation, sensitive seismographs.

On the other hand, the intensity scale now used to measure damage--the Mercalli intensity scale, Modified Mercalli, it's called--runs from I to XII, so it does have a maximum. That scale is worked out in terms of damage, so a Modified Mercalli earthquake intensity of XII would mean total destruction, which you rarely ever get. Even in the huge Mexico City earthquake a year or so ago, only 1% of the major buildings were destroyed, so it was far from total damage. But locally it reached a Modified Mercali scale of VIII, or maybe even IX.

Since 1952: More State Involvement

Oakeshott: Since 1952, the state has become involved more and more. I think I have some figures in those reports I lent you, on what the state is doing now. The state now has a strong motion section with about 30 employees--technical, seismologists--and has a strong motion system throughout the state. They've instrumented dams, various types of soil, and various types of structures, so we now can get an enormous amount of data, which the engineers are translating into design criteria for structures. People like John Blume, Henry Degenkolb, Karl Steinbrugge and others are getting in on it.

Earthquakes: A Governmental Responsibility

Oakeshott: Of course later, especially after the conferences on the Arvin-Tehachapi and Alaskan earthquakes, we had still more and more conferences. And in 1969 Senator Alquist pushed the legislation, which we all worked on--you and I, Karl, and all the rest of them. Many, many people worked on the Alquist Committee advisory groups. By that time it was recognized that the state had an important responsibility for earthquake safety, and that governmental responsibility was a serious matter.

Psychological Aspects

Oakeshott: Also, there are other things associated with earthquakes, in addition to geology, the faulting, the engineering. There were the social and policy aspects. And psychological. For instance, I remember--though at the time I didn't think of them as being social aspects--down at Compton after March 10, 1933, our administration building at the college was destroyed. For about six months I taught college in tents out on the athletic field. People were very much disturbed by that earthquake--even mentally disturbed. There was a physics professor at our school, for instance, who took his family back to Kansas. He left California because he recognized that California could have more earthquakes, and he was scared to death. I told him he was moving right back into the tornado belt. But tornadoes didn't scare him as much as earthquakes did.

Scott: I think I'll take the earthquakes, having come from the Texas panhandle.

Oakeshott: Another family I knew that had three boys--big boys--one was 16 by the time they gave up babysitters--who were scared every time there was an aftershock. After the first main shock on March 10, about 5:50 in the evening, people came out of their houses and slept out on the front lawns for several nights. My wife was pregnant with our little girl--now 52 years old--who was born two months later. I said, "Bea, we're sleeping in, I'm sure that was the main shock, and the aftershocks will all be less, so we don't have anything to worry about." Well, we had a succession of aftershocks throughout the night, and before morning she was shaking and shivering whether there were any earthquake shocks or not. She had a physical and mental reaction to the thing.

Six months later in October we had a strong aftershock. We were playing bridge with another couple. The woman turned pale and almost fainted--she was scared to death by the shake, but no damage had been done.

Scott: She had been affected by the earlier earthquake, and her psychological reaction....

Oakeshott: Had been conditioned. So earthquakes have all sorts of ramifications. Of course, this is not my field, so I'll not say anything more about it.

Scott: Let me pursue the strong motion topic a little more. You mentioned the San

Scott: Francisco conference in '64--it followed, and reported on, and was stimulated by, the Alaskan earthquake earlier that year.

Oakeshott: That's correct. It was on March 27, on a Good Friday, and that's as early as Good Friday ever comes.

III EMERGENCE OF ENGINEERING GEOLOGY

Scott: Do I understand that back then some geologists, at least, were taking a purist point of view--"we shouldn't build near a fault"? And engineers--some of them--were saying "we could engineer to build right across one if we really had to"?

Oakeshott: They were saying, "we can build to withstand any shock," but of course this is not a practical thing to do.

Scott: Are you saying that the views or interpretations gradually got closer together? This is something that seemed to really bother Henry Degenkolb. He felt that the interpretation of some geologists was that to prevent collapse, engineers ought to be designing for much stronger lateral forces than most of the structural engineers felt they needed to. In other words, the engineers thought they could design for lower forces and still build a building that wouldn't actually collapse.

Oakeshott: Like many engineering geologists, I've grown to recognize that there are also economic factors. There's an economic limit to what is practical. An engineer can probably design for any earthquake--any structure in an earthquake, even on an active fault. Theoretically he could suspend it across the fault, but that would be beyond the reach of reasonable economics. So engineering geologists have grown up as a profession, really since the '60s. This is a major development in geology--the whole emphasis on engineering geology.

Scott: That's an interesting point--could you say a little more about it?

A Self-Made Field

Oakeshott: Beginning in the 1960s, the first engineering geologists started out in the Division of Mines by doing what we call urban geologic mapping. We mapped in geologic detail in cities like San Diego, with due attention to faults and fault dangers, and so on. Later this urban geology became engineering geology. There were no courses for it in the university, so I was one who didn't join the Association of Engineering Geologists, because I thought I wasn't an engineering geologist. After a while I recognized that what it amounted to was the practical application of

Oakeshott: geologic knowledge to engineering problems. This field or discipline has grown until the Association of Engineering Geologists is now an international organization with several thousand members. I did join in 1969 because I recognized that, like other engineering geologists, I was self-made. In other words we had to recognize the applications of geology to engineering problems. This is what the engineering geologist does.

Scott: Are you saying that the initial engineering geologists were self-made? You butted up against these problems out in the field and had to learn how to deal with them?

Oakeshott: Did you ever know a fellow named Parker Trask, at Cal? Around 1948 he went to Cal as a professor in mineral technology. Parker Trask did some of the first engineering geology, as a professor at Cal. In fact, I took over his job with the State, because he left the Division of Mines. For instance, he studied the bay muds, and the later sediments around the marsh of the bay, in relation to their possibile use as sites for building structures, and this sort of thing. He recognized the importance of the types of soil and rock materials as foundations for engineering structures.

What the Engineering Geologist Does

Oakeshott: This is what the engineering geologist does--he's really responsible for consulting with the engineer, advising the engineer on the properties of and characteristics of soils and rocks, including the possibility and characteristics of failure in relation to the structure the engineer wants to build. This is the burgeoning field of geology nowadays. A good example of a high-level engineer with some geological and soils emphasis is Harry Seed at Cal.

Of course, petroleum geology has now hit a low because the price of petroleum has dropped and the oil companies have let a lot of their exploration geologists go. But engineering geology is on the upgrade, because more and more engineering geologists are needed,...anywhere that structures are involved. That would even include a canal that goes across-country. As an example of that, the state Department of Water Resources hired over a hundred geologists to help build the Westside canal, to advise on the soils and rocks, and the tunnelling they had to do for that canal.

Scott: They built that in the late '60s I guess. I think it was done around the time that Highway 5 was being built, (or maybe a little before), which would have been the late '60s.

##

Oakeshott: In the '60s when I was in the state service, I had strongly plugged with top-level state government to have all the geological work assigned to the Division of Mines and Geology--(they'd changed the division's name by that time). I believed that all of the state's responsibility for geology should be assigned to the Division of Mines, or Division of Mines and Geology, on the grounds that there should be only

Oakeshott: one state agency responsible for geological work. A department like Water Resources, which required more or less temporary geologic advice, could contract for it with our division or department. This raised quite a political hassle, of course, and I got the okay of the Secretary of the Resources Agency and Governor Pat Brown; but when Governor Reagan came in the whole matter was dropped.

Scott: The other departments probably resisted.

Oakeshott: That's right, sure. You know how departments are. They all want to maintain their identity, and if there's any buildup of staff, they want to be the ones to build up their own staff.

Scott: That is universal bureaucratic behavior.

Oakeshott: Anyway, by now engineering geology is a highly accepted branch of the profession, and engineering geologists--all the good ones anyway--have learned to cooperate with the engineers. They know quite a bit about the engineers' problems. There are even some who have engineering certification, as well as geological certification.

Auburn Dam

Oakeshott: Well, several years ago, the Association of Engineering Geologists--the national association--appointed me chairman of their seismic safety committee. A project that I recognized as needing attention was the proposed Auburn Dam, up above Sacramento. It was my opinion, and my committee concurred with me, that unfortunately for the geologists who were working on it, this was a dangerous situation. It was a dangerous type of dam to build there. Well, one of the guys on my committee, Don Rose, was a certificated civil engineer, and also a certificated engineering geologist. He helped me out--he concurred--and we were instrumental in getting reconsideration of the building of the Auburn Dam. This was a tough thing to do for me, because I didn't like to put geologists out of work. But I'll be darned if I was going to see geologists working on a project that was not the sort of thing that should be done.

Scott: This was the Association of Engineering Geologists, and it was their seismic safety committee you were chairing?

Oakeshott: That's right. The question of the safety of the Auburn Dam was something we undertook because it seemed to me that it was a practical project that we should be interested in. I knew something about the geology of the area--I went up and visited it several times, talked to engineers about it, and we had an engineer on our committee. We decided we should recommend against the dam, which we did. And this went to high-level government officials in the Bureau of Reclamation.

Scott: Did the Oroville earthquake in 1965 have something to do with it?

The Site Investigation

Oakeshott: It had something to do with it in this respect. We geologists had considered that the faults through the Mother Lode foothills of the Sierra Nevada were dead faults, extinct faults. They had been great faults in the past, but we thought they had not been subject to modern movement. Well, the Oroville earthquake woke us up to the fact that renewed movement could take place. This of course was one factor in deciding against the Auburn Dam. The government hired a firm of engineering geologists to make a very thorough investigation of the site of the Auburn Dam, and they abundantly reinforced what my committee had said. So this was another major factor in their deciding against the dam. Then, of course, in the meantime with all these delays costs ran up, so the thing became almost impossible in terms of cost--even for the government. But the state of course had long previously set up a dam safety division, where they have a geological staff that carries on periodic studies of the safety of dams throughout the state. State dams, and they also have something to say about federal dams too. A number of government agencies--you know better than I do about this--are involved, or are interested in earthquake hazards nowdays.

[Interview 2: March 17, 1987]

Deferred Indefinitely

Scott: We can start out again on the relationship between and differing viewpoints of engineers and geologists.

Oakeshott: Yes. That was one of the critical points, say in the late '50s and the early 1960s, when we began to get more conscious of what could be done by way of engineering responses to earthquake ground motion, landsliding and other similar geologic activities.

The engineer is understandably very often interested in construction. For example, the Army Corps of Engineers and the Bureau of Reclamation are engaged in building things. A good example was the proposed Auburn Dam. I mentioned this before, but Auburn Dam had been planned for years and years and years. I went out there with the geologists who first began to examine the whole area from the standpoint of the dam's location. Then when the dam was designed as a high, thin-arch structure across the canyon I was very doubtful about it. If the dam were to fail, then a wall of water would go down and over the old Folsom Dam and across the City of Sacramento, many feet deep. So it was a rather hazardous thing.

Moreover I wasn't at all certain of the fault activity in the region. It happened that I was appointed chairman of the National Association of Engineering Geologists' committee on seismic safety in 1976. Our committee went into this matter pretty thoroughly, and decided the dam would be unsafe. We took this up with the Bureau of Reclamation, and of course they wanted to build the dam. We made ourselves a little bit unpopular with geologists in the Sacramento area who were working on the geology of the dam, because our activity might affect their jobs. At any rate we questioned the dam and objected to it. I

Oakeshott: organized a symposium in San Francisco before the Association of Professional Geologists on the matter of the Auburn Dam, with talks and presentations by the federal government, and by our own local geologists who were concerned with the area. This brought a little publicity to the matter. So the Bureau of Reclamation hired an engineering-geological firm to make a thorough review of the matter. Of course along about that time there was an earthquake up near the Oroville Dam, and that reinforced our ideas of the danger of the other structure. So Auburn Dam was deferred, and I think it's deferred indefinitely now.

IV DIFFERING APPROACHES: ENGINEERS AND GEOLOGISTS

Oakeshott: There is a difference between the engineering approach and the geologist's approach. The geologist was looking at the rock formations, the faulting, the jointing in the rocks, and the possibility of earthquake damage. The engineer was looking at the matter as a project under construction--he wanted to build the dam. There was no question in his mind that the dam should be built. So the engineers designed the dam, and were proceeding to build a dam. There's that difference in ideas. One of our cooperating engineers was Bill Moore of Dames and Moore, from the 1950s and on. Bill Moore is a very sensible sort of guy, and he said, "Look, the City of San Francisco wouldn't have been located where it is if they had taken into account the fact that the San Andreas Fault is nearby. Yet the City of San Francisco is there, and is a great city, and so on." So the geologists had to temper their recommendations a little, with consideration of the economic factors involved, and other factors too, of course.

I've heard engineers say that they could build a structure to take care of any situation, even a bridge across a landslide area, or a bridge across a fault zone, with engineering features that would allow the structure to cross a major fault or landslide, or whatever. But of course this isn't always economical--there's an economic limit to things. The City of San Francisco has had a parapet ordinance for years, and yet they have never really enforced it because it would be a big economic drain on some of the owners of old buildings. Anyway there are these different approaches and viewpoints.

A Lot Closer Together

Oakeshott: But I think geologists and engineers have gotten a lot closer together over the last 20 years or so.

Scott: Along that line, the structural engineers basically recognize that they can't economically design high enough lateral force resistance into structures to equal the greatest earthquake forces that might hit a building if a major earthquake occured nearby. In other words, during the strong motion of earthquake shaking, there are going to be lateral forces that are at least momentarily of higher acceleration than the resistance they're economically able to design into the buildings. I think this is one point that Henry Degenkolb was making--at least

Scott: this is the way I'm interpreting it. Some of the geologists felt that engineers should design for the full force that we think is going to hit a structure in an earthquake. Henry is saying that the engineers realize that you just can't do that with a building. It will have to take some deformation, and maybe some damage. Geologists and seismologists point to high ground accelerations, but engineers know that no building is perfectly elastic, but must absorb energy. There is always stretching, at least minor breaking, and cracking. Also, for practical reasons, there must always be compromises in design.

Economic/Political Considerations

Oakeshott: Nowadays the engineering geologists are beginning to recognize that. The best ones recognize this as a matter that has to be considered. Take the City of Oakland, for instance. It wants to allow building in the hill area. From a geological stand point--I think most geologists would advise against building on some of these very steep hills, especially where there has been some landsliding. There has been a lot of landsliding in the Berkeley hills connected with earthquakes, and many landslides connected with natural, over-steepened slopes, loose rock, and the addition of water. After a heavy, wet winter the hills are particularly susceptible to landsliding. Well, the City of Oakland says they do not want to outlaw any lots, and want to allow buildings on them. They want the tax money, and the people. So they build on places in the Berkeley hills, or places where you don't think a house should be located at all. The City of Oakland doesn't even have a geologist who can say, "no" to building in certain areas. They don't want to get a "no" answer. The city also tends to ignore potential traffic and parking problems.

I don't know about Berkeley right now, but previously Berkeley, Emeryville and El Cerrito did have some geological work done. Oakland had a kind of engineering geologist a few years ago, but he died and I don't think he's been replaced.

To sum up, geologists would advise against building in certain areas. On the other hand, engineers tend to accept the geologic conditions as a challenge. They would build if they can do it economically. So there's that difference in approach. But engineering geologists are now recognizing the economic aspects of things a whole lot more than they used to.

Views on Strong Motion

Scott: Maybe it would be good at this point to focus in on a special point Henry Degenkolb made regarding the difference in view of the geologists and of the structural engineers in interpreting strong motion. We're getting such-and-such kinds of strong motion recordings--what does that mean with respect to how we ought to design buildings, or what the codes should say? You might talk a little about your view of that difference of opinion.

The Need to Compromise Our Ideas

Oakeshott: I remember, particularly after the Arvin-Tehachapi earthquake, when we first began to have more meetings of geologists, seismologists, and engineers. Eventually, in 1964 we set up the earthquake and geologic hazards conference, that you attended.

Scott: Yes, December 7-8, 1964. That's the conference that got me interested in seismic safety.

Oakeshott: At what used to be called the Jack Tar Hotel.

But at first when we talked with people of various disciplines, geologists were inclined to simply say, "Don't build a structure on or near an active fault." Then, I remember my friend Bill Moore saying, "Well Gordon, we never would have located the City of San Francisco where it is if we had followed any criteria like that, because San Francisco is near an active fault." So we have had to compromise our ideas a bit.

And the engineer in turn said, "Well, we can engineer for any kind of ground motion," which wasn't quite true. They found that many, many buildings were older buildings that had not been designed to resist ground motion, so they failed. So the engineers were not able to design for any kind of ground motion, when we consider the economics of construction, and the geologists had to back down a little bit on their idea that you should never build a structure near a fault.

V ENGINEERING GEOLOGY: HOW THE FIELD DEVELOPED

Scott: Do the engineering geologists provide something of an intellectual meeting ground between the structural engineers on the one side and the pure geologists on the other?

Oakeshott: I think so. I think that's a good way to put it. Some of our people, like one man on my seismic safety committee several years ago--Don Rose--had a certification as a civil engineer and also as an engineering geologist. He was a good member of that committee because he had the engineering design aspects of the dam pretty well in mind, as well as the geology. Some engineering-geologists are really geological engineers, with more emphasis on the engineering.

Notable Contributors

Harry Seed

Oakeshott: Harry Seed at Cal is a top-flight man when it comes to soil movements, and design and construction for taking care of soil movements, and that sort of thing. Although a civil engineer, he has the geological idea to a certain extent, as well as the engineering.

Scott: He started out as an engineer?

Oakeshott: Yes. He's really primarily an engineer. Of course nowdays the engineering geology work at Cal is done in the engineering colleges. Harry Seed is an example of a top-flight engineer who has a particular interest in what engineers call the soils, the surface materials, and the relationship of structural engineering to the surface ground materials.

Scott: That brings up another closely related field--soils engineering.

Bill Moore

Oakeshott: Yes. People like Bill Moore of Dames and Moore--he's retired now--he and his firm were quite often concerned with things like the proper pilings for a pier on the bay. They're concerned with the soils, the bay muds--in other words concerned with building structures that can hold up and perform in spite of their location. Harry Seed and Bill Moore are two examples of top-flight engineers who really have an understanding of the importance of the surface formations and the soils. They're very practical engineers, and also they have a full understanding of the materials they're building on, and how those materials behave--for instance in an earthquake or a landslide.

Scott: How would you classify a person like Lloyd Cluff. I'd always thought of him as basically a geologist, but the other day Lloyd referred to himself as an engineering geologist. Could you say a little about his background.

Lloyd Cluff

Oakeshott: I've known him ever since he started work, and of course he's still only a middle-aged fellow. When he started work as a geologist he came and talked to me. I was working for the Division of Mines--that must be about 25 years ago. I've kept in touch with him more or less ever since, a little bit less in later years. He's now moved to PG&E [Pacific Gas and Electric Co.] as chief geologist, which is an excellent position. My latest contact with him was a couple of years ago. Bruce Bolt, a seismologist at Cal, and I did a joint job for PG&E on the safety of a dam up in the northern coast ranges. I made a presentation before Lloyd and his engineers at PG&E. Both disciplines were there--the engineers, and Lloyd Cluff as the geologist. Well Lloyd is a very hard worker, a very knowledgeable geologist. Over the years he's become more and more understanding of engineering work. So I was quite interested to hear you say he called himself an engineering geologist, because I think that's what he is now. PG&E has certainly needed one for a long time.

Scott: I guess they simply never had the geology emphasis before. The firm is full of engineers.

Oakeshott: That's right. They preferred to hire consultants to do their geological work, where it was needed. Bruce and I also did a job for PG&E on geothermal resources, looking primarily at earthquake possibilities, at what could reasonably be expected. They were vitally concerned with that.

Years ago I went into the Sierra Nevada with Barry Cooke, a top-flight engineer for PG&E, and looked at some of their dam projects up there. Cooke said, "Well, we didn't need a geologist up here. Our tunnels went through solid granite--that's all there was to it, no problem." I said, "If you'd been in the Coast Ranges where you'd have gone through a lot of serpentine and shale and fractured sandstone and faults, it might have been different."

Oakeshott: Lloyd Cluff is one of the top engineering geologists, as far as I'm concerned. For one thing, he's a very hard worker--he works all the time. He keeps up with his geology, and with the seismological side too, because he's vitally interested in earthquakes.

Courses Weren't Available

Scott: Could you say a little more about the development of the field of engineering geology? You said earlier that basically you considered yourself an engineering geologist....

Oakeshott: I do. I'm certified engineering geologist #9.

Scott: You said you were kind of self-made.

Oakeshott: Like all of my generation, I had to be self-made. I couldn't take any courses in engineering geology because they weren't available, so I had to learn as best I could otherwise. Before I joined the Association of Engineering Geologists, I was doubtful about doing it because I didn't think I was an engineering geologist. By 1969, however, I began to see that neither were the rest of the old timers. They were all self-made. Engineering geology is simply the application of geology to engineering problems. I took my geology through the College of Mining at Cal--we had all the engineering courses that went along with it. I finally joined the association in 1969, and later they gave me a citation for the Auburn Dam work. Then in 1979 they made me an honorary member. There are only about a dozen honorary members. This honorary membership class is rather fragile, because the association waits until you're well-along in years before they give it to you. So if you live long enough, you get to be an honorary member.

Urban Geologic Mapping

Ian Campbell

Oakeshott: I got associated with engineers in the '60s. For one thing, in the early 1960s my immediate boss was Ian Campbell. He was always very much interested in applications of geology, so he fell right into engineering geology. In fact, I consider him one of the first engineering geologists, because he started the state's work on what he referred to at that time as urban geologic mapping. I think I mentioned this in the previous interview. Ian was with Mines and Geology from 1959 to 1969. Then he retired on account of reaching age 70. That was it at that time. The urban geologic mapping that we started in San Diego County was Ian's idea first of all. But it was nothing more or less than engineering geology, and he enthusiastically developed that through the years.

Oakeshott: For one thing, he and I got very much involved in the registration of geologists in California. He was a very diplomatic man. He understood how to deal with people, and he was, I think, a major factor in putting across the idea with the state government of the necessity of registering geologists. Engineers were registered, and because they were not registered, geologists were kind of second-class citizens. The Board of Registration, which was set up when the law went into effect in the mid-sixties, passed on people and grandfathered in the oldtimers. So I was grandfathered in and made certified engineering geologist #9. A couple of my friends suggested that I got among the first ten because I knew all the board members--they were all friends of mine. Of course I claimed that this was all entirely coincidental. Whether it was or not, I don't know.

Background: First In Illinois

Scott: Can you say a bit more about the urban geologic mapping program? Why was it started? What was its background?

Oakeshott: There was gradually developing interest. You know how fashions sweep through the sciences. It was the beginning of the recognition of the potential for greater application of geology to people's problems. Geology had always been applied to mining, but with urban geologic mapping we had an application of geology to all the problems of construction. One of the very first formal engineering geology programs was set up by the State Geologist of Illinois in 1927, way back then. Morris Leighton was his name. He has a son down at Whittier who has an engineering geology firm. I knew Morris Leighton because he was a state geologist, and as far back as 1927 he had set up a division in the Illinois State Geological Survey devoted to engineering geology.

But this didn't carry over much into the geological surveys of the other states until the mid-'50s and early '60s, when people like Ian Campbell in California picked it up. So now every state, including Alaska, Puerto Rico, and Hawaii, have state geologists. They're all involved in engineering geology to some extent. So it has really caught hold.

More On Contributors

Richard Jahns

Oakeshott: As far as developments of the field are concerned, Richard H. Jahns was one of those who developed engineering geology very thoughtfully and very well. Dick Jahns came to Stanford from Pennsylvania. He had gotten his education at Cal Tech in the first place. Then he went to Pennsylvania, and became dean there. Then he came to Stanford as dean of the School of Earth Sciences. Dick was a self-made engineering geologist. In my opinion he was one of the very top geologists in the country. Very knowledgeable, very intelligent, and very concerned with the application of geology to engineering problems. He started

Oakeshott: giving courses at Stanford, as well as serving as dean of the School of Earth Sciences. So Stanford developed a strong program in engineering geology.

Dick came to Stanford about 1964, and I was closely associated with him.... Later, for example, in the early '70s, he was on the State Mining Board. He and I had a lot of conversations and discussions. Then he was on the Alquist committee advisory groups. He was in my group on earthquake engineering considerations. He was a top-notch man in his development of interest in engineering geology.

George Kirsch

Oakeshott: As long as we're talking about these old timers...another one was George Kirsch. In the 1950s he went to the Southern Pacific Company as an engineering geologist. You know, in the early days the railroads were given every other section along the right-of-way, so SP has large land holdings. They decided, for economic reasons--a matter of moving freight and so forth--that they should have a geologic study made of all their lands. George Kirsch was put in direct charge of a staff that they built up to map all of their sections throughout the state. Well, the Division of Mines, where I was located at the time, cooperated with them. We got information from George Kirsch's people, and gave them information from our mapping. Southern Pacific did that job with the staff that they hired, finished the survey and dropped it. It is the same sort of thing that many of the state surveys did. The politicians or business sources who were providing the funds for such things had an idea that the geology of a region could be done, completed, and that was the end of the need for survey work.

##

Oakeshott: I went to the state legislature, and one of the senators once said, "When are you going to complete this geologic mapping program of the state?" I said, "Never, Senator. It goes on. Geologists' ideas change. It becomes more important to put the work onto a larger scale. Different problems arise. We get more information, so we're constantly revising these geologic maps. The program is ongoing--we have to continue it."

Scott: You're saying that many organizations tend to view geologic survey work as if you were doing a conventional map, say of an urban area. You do the map and until the town changes you've got a good map.

Oakeshott: That's it.

Scott: But things do change, and also you constantly learn more.

Oakeshott: A good example is the whole new business of plate tectonics that developed in the '60s. This was a realization that the earth's crust is not perfectly stable, but that various huge plates are moving around. This is an entirely new concept. At least practically, it's a new concept. Of course way back as early as 1913, Wegner proposed such things. But his ideas were rejected. Then much later, after new

Oakeshott: evidence was discovered, all of a sudden it became the fashion to accept plate tectonics.

Scott: That forced a whole different set of interpretations of what had been observed, and of the underlying geology,...interpretations as to how things got to where they are, geologically.

Richard J. Proctor

Oakeshott: Yes. On this business of historic developments...,I might mention one or two other fellows. Richard J. Proctor is an interesting character. He was with the Metropolitan Water District in southern California for about 20 years. He was their chief geologist, and has been president of the national Association of Engineering Geologists. He's also a self-made geologist. He's another example of a man who dealt with geological problems in connection with all kinds of waterways--canals, pipelines, and similar construction projects, bringing water from the Colorado River into southern California.

Many Contributing Agencies

Oakeshott: Then I think we should also be cognizant of the fact that seismologists nowdays contribute a lot to engineering geologic studies in the broader sense, through their study of earthquake wave motion, and its application to the response of ground and structures. Of course now a lot of this work is done--both geologic and seismologic--through the U.S. Geological Survey. There are now a lot of contributing agencies. I think for the Alquist Committee report I counted up something like a dozen different state agencies in California that are concerned with engineering geologic problems, and have something to say about them.

Scott: Have we pretty well covered the names of people you wanted to mention?

Jasper Holland

Oakeshott: I think so. Well, there is Jasper Holland, the guy who was president of the national Association of Engineering Geologists at the time the Auburn Dam was being reviewed, who is an example of a good practical engineering geologist. He's in Portland, Oregon. He's retired now, but he was active then. He's another self-made engineering geologist who belongs to my generation. He was like most of the rest of these fellows I have named, all self-made. They simply recognized the necessity of applying geology to engineering problems. There's no end to the list. There are a lot of other people who could be mentioned. It's a profession that now employs...I suppose over the whole country certified engineering geologists number about 3,000--a small fraction in numbers, compared to engineers,

but nevertheless substantial, and they're growing. On the other hand there are about 40,000 petroleum geologists, or there were before the recent cutbacks.

Sources of Employment

Scott: Where do most of the engineering geologists practice? Are they mostly in private practice, or on state geological survey staff, or are many of them in academic institutions?

Oakeshott: The precise information on this you could get from the American Geological Institute. Just off the cuff, I would say there are several major areas of employment. The USGS employs several thousand--something on the order of five or six thousand--and they do work all over the world.

Scott: This is five or six thousand geologists?

Oakeshott: Yes, strictly speaking, geologists. State surveys employ a fraction of that, but they still employ a substantial number, probably a few thousand altogether. Then there is the teaching profession--universities, colleges. California has about 65 community colleges, and they practically all give some courses in geology. So the teaching profession employs a lot of geologists. But the largest employer is the oil companies. The American Association of Petroleum Geologists has a membership of 43,000--at least that was their maximum membership--so that represents the largest number of geologists. Then engineering geologists number a few thousand over the country.

Consulting geologists--it's a little bit hard to say how many consultants there are. After they retire as geologists, many fellows put themselves down as consulting. I put myself down as consulting, since I passed 80. Might as well. But I'm completely retired. At any rate a lot of the consulting geologists are not fully employed by any means. They take part-time jobs.

There are quite a number of geologists employed by firms like Woodward-Clyde, and Dames & Moore. I see that Woodward-Clyde is moving their offices over to Oakland in a few months. I think they have several hundred geologists and seismologists--I'm using that in a broad sense. But the oil companies are the largest employer of seismologists. Most oil companies have seismological crews that go out and create artificial earthquakes and study the wave motions to determine the subsurface stratification and structure.

Scott: They've been doing that for a long time, haven't they?

Oakeshott: The main start of this was about 1930. I remember that, because in 1929 I started out as a petroleum geologist with Shell Company, with a master's degree. Following the big stock market crash in October 1929, geological staffs were just dismissed by the oil companies. Many of them went into the new branch of the profession, namely seismic exploration. They started working in places like the

Oakeshott: flat floor of San Joaquin Valley, where you couldn't see outcrops. And the gulf coast of Texas, and so on.

Scott: Incidentally, I remember as a kid in the Texas panhandle when those seismic survey crews would come through, testing for formations that might indicate oil. But in our part of the panhandle they never found any oil.

Oakeshott: Well, they did good work, and a good many geologists, if they had a mathematical bent, switched over into seismic exploration. I started out for Shell Company with a three-man crew. When we were all dismissed, I went into teaching. I got a teaching certificate, came back to Cal for a summer session, and qualified for junior college teaching. The second partner in my crew went into seismic exploration and stayed with it the rest of his life, until he died a year or two ago. The third partner went back to Stanford for school for a year or two, and then he got back into geology with an oil company. So that's what happened to those people.

I remember particularly vividly that around 1930 seismic exploration began to come into its own. The maximum in the petroleum industry a couple of years ago was probably 150 crews over the United States. Now it's down to something like 30 or 40 crews.

VI ACTIVITIES OF CALIFORNIA DIVISION OF MINES AND GEOLOGY

Scott: Next maybe you could expand a little on the activities of the Division of Mines and Geology, especially the seismic and earthquake-related activities. You've talked about that a little already, and of course your article of a couple of years ago dealt with the work of CDMG. The other thing you might take up is your own earthquake-chasing activities. In the interview with Lee Swent you mentioned Alaska, Utah, Baja California, Nevada, Montana, Washington and Hawaii as earthquake sites you either visited or felt were significant for postearthquake studies.

Before 1952

Oakeshott: I don't want to repeat too much of what was said before, but in 1952, the big Arvin-Tehachapi earthquake brought together engineers, geologists, and seismologists to produce the whole story of the earthquake, from its geologic origins along the White Wolf Fault, through the earthquake motion, the seismological side of it, even to the reactions of people--the social reactions of people--to the earthquake. I consider that the beginning of the involvement of the state in earthquake studies. Back in 1906 the state had published the big two-volume Lawson report. But that didn't really develop into safety regulations or legislation. Those things had to await later developments.

There was a definite public effort to down-play earthquakes in the San Francisco 1906 earthquake. San Francisco didn't want to be known as a city of earthquakes--it was referred to as "a fire." So nothing much happened. Not until 1911 was the first volume of the Bulletin of the Seismological Society of America published, although the society had been formed before that. Because of public pressure, public reaction, the number of people who lost their lives in the 1906 earthquake is usually given as 700, but there were whole areas like Chinatown that were unreported. Chinatown was very bad--it had lots of very poor structures so they must have lost a lot of people who were unreported. In those days, strangely enough, a Chinaman wasn't considered worth as much as a Caucasian.

In 1933 we had the Long Beach earthquake. I was in that one because I was teaching at Compton then. That earthquake resulted in the Field Act, which really brought about a tremendous increase in the safety of public schools, and it

Oakeshott: got the state directly involved. Jack Meehan is another name we might mention. Jack is soon retiring as head of the school safety section in Sacramento. Anyway, that program developed out of the Long Beach earthquake in 1933--the legislature passed the Field Act only a few days after the earthquake.

1952 and After: More State Involvement

Oakeshott: Beyond the Field Act, however, we still didn't do very much about earthquake safety through any formal state involvement until the 1952 work of the Division of Mines. Then we began to get involved. I had been appointed to work with the engineers and Cal Tech's staff on preparing a bulletin on that earthquake. From then on I chased the major earthquakes in the United States.

Nevada, 1954

Oakeshott: In 1954 we went to central Nevada. I went on several trips there with people like Don Tocher, a seismologist, Karl Steinbrugge, a structural engineer, and staff members of the Nevada School of Mines, and examined the faulting. There was beautiful surface faulting in central Nevada in Fallon and vicinity. We studied the geologic formations, the faulting, the type of faulting, direction of fault movement, the amount of displacement, and the differences in faulting through different types of rock--it was very different.

Daly City, 1957

Oakeshott: Then there was the earthquake in San Francisco in 1957, the Daly City earthquake. It was not a large earthquake--only 5.3 on the Richter scale, but quite damaging and interesting because it was on the San Andreas Fault. It was the first earthquake of any consequence since 1906. It occurred at about 12 noon, and we felt it in the Ferry Building. I had told the staff, including the stenos, not to be proud, but to dive under the desk if they felt an earthquake coming on. We had a long corridor on the third floor of the Ferry Building. Right after the main shock I walked along the aisle and saw the behinds of the stenos sticking out from under the desks. I thought that was great. You know, if you get under a structure like a desk, even something like this one, and a roof beam falls down you wouldn't get killed. In church, get under a pew. They're massive things, some of those pews.

Montana, 1959

Oakeshott: Then there were other earthquakes that I was very fortunate in getting in on. I was at the University of Minnesota at Duluth in 1959, working on a high-school-level book for geology students, for the American Geological Institute. At the end of August, 1959, there was a big earthquake at West Yellowstone, Montana, the so-called Hebgen Lake earthquake. It was along the front of the Madison Range, and the motion was largely vertical.

The Lake Tilted

Oakeshott: One of the startling things was that the lake behind the Hebgen Dam was tilted--not the lake, but the ground. The ground was tilted so that one side of the lake drowned the land surface, and the other side was elevated to expose land that had been below the water level of the lake. That provided a very visible record of what had happened. Here is the fault, and the ground had been tilted down against the fault. The Madison Range had been elevated.

Vertical Displacement

Oakeshott: I was with my wife and little boy. We followed the Hebgen Lake fault zone through different types of rock. You were asking me what observations we made on these things. Well, one startling observation was, when the faults passed through solid rock, there was relatively little displacement--maybe three or four feet. But they passed through unconsolidated alluvial materials in one place where there was a 20-foot scarp. Unbelievable! Vertical displacement of 20 feet. I took a picture of my wife down at the bottom, and it was about four times her height to the top of the scarp. It showed how important the geologic rock formations are in influencing the passage of earthquake wave motion and the displacement that results.

A Huge Slide

Oakeshott: The other great feature of the Hebgen Lake earthquake was a huge slide. About 43 million cubic yards of rock came down in a massive slide across the Madison River, forming a natural dam. Right away of course they called the resulting lake "Earthquake Lake." But this dam was a startling thing. We got there a couple of days after the earthquake. They had army officers and sheriffs out there keeping people away. We wanted to go up to the foot of the dam to see what it looked like and what happened. So we walked along the road that had been buried by all this debris. We came to an officer who said, "You can't go in there." We said,

Oakeshott: "okay," and walked back a half mile, then went under a fence. These guys never move--they just sit at a spot on the road.

Scott: In other words, what you did--going under a fence to get access--is part of the strategy of an experienced field geologist?

Alaska, 1964

Oakeshott: That's right. It was the same thing in Anchorage. You'd go down the street to the main landslide area, and there would be a young soldier there to keep people out.

At the time of the Alaskan earthquake of '64, I happened to be in Tacoma giving a couple of lectures at the University of Puget Sound, and I got word from the boss in Sacramento to go on up to Alaska. They sent a guy from the Department of Water Resources to go along with me. It was David Hill, a groundwater geologist. He was very good at logistics, so he got all the tickets set up. I met him up in Anchorage. The Alaska state survey people showed us around. And of course USGS had people up there. We went through the Alaskan cities--Anchorage, Fairbanks, Cordova, Valdez, Kodiak Island, Seward--and examined the earthquake effects, and the effect of the tsunami. There was quite a tsunami that affected the lowlands.

We examined all the surface effects that we could. The principal and most damaging effect was landsliding. In Anchorage landsliding was very bad. Whole streets dropped down ten or fifteen feet, or went up. We were primarily looking for ground effects, but of course we did note the structural effects too. Buildings, motels...at that time there were only two highrise buildings in Anchorage, and both were damaged so severely they had to be taken down. Dave Hill and I stayed in the Anchorage Westward Hotel. The name has changed a little bit now, but it's still there. But there was a landslide under that hotel. The upper stories were badly damaged, from about the sixth floor up. We had to stay down on the lower levels.

Scott: You mean the land slipped?

Oakeshott: Yes. An actual landslide went down several feet, right under the building. Of course the building was pretty well tied together. We went down through the back way and saw them working on repairing that hotel building. It would shock you, because concrete and structural steel had been used as the basic framework. But the people who were repairing it were cutting off the steel that stuck out through the concrete, gunniting it over, and that was it. If they get another earthquake there, buildings like that, which were not properly reinforced, will be severely damaged again.

Scott: Those buildings are just sitting there waiting for something else to happen?

Oakeshott: That's right. Well, it was a major earthquake, one of the world's great earthquakes--probably about 8.3 magnitude. I remember that 115 people were

Oakeshott: killed in the Compton-Long Beach area in 1933, and 115 were killed in the Anchorage-Alaskan region. Of course comparatively speaking, there were relatively few people up there. But the Alaskan disaster was caused by a major earthquake, and seismologists finally developed from their records that it was one of these motions of the Pacific plate under the Alaskan mountain chain. You've got the chain of the Aleutian Islands there--they're largely volcanic, and are the result of subduction along that coast. In 1964 the idea of subduction was just in an early stage of development, so this was revolutionary.

##

Significance of CDMG's Site Visits

Scott: Let me ask you to say something about the significance of the state division beginning to do earthquake site visits. It really started in '52, and then later they'd send you out of the state.

Oakeshott: I did sneak into Mexico (Baja California) a couple of times.

Scott: I guess the state felt that there was a significant amount to be learned from visiting earthquake sites?

Oakeshott: Yes, they began to get educated on the importance of having some kind of policy with respect to safety in connection with earthquakes. The state has an agency especially set up for reviewing disasters--a disaster agency within the state--so the state had begun to recognize the importance of doing something about earthquakes. For instance, toward the end of Reagan's administration as governor, the Division of Mines published a bulletin on projections as to what would probably happen in loss of life, loss of property, and damage, up to the year 2000, especially if no earthquake safety measures were undertaken. You know about the Alquist Committee--Senator Alquist worked in setting up these various study groups. That was a major step forward in the development of earthquake safety measures in the state. The activities you and I were involved in resulted in a lot of legislation that certainly will affect earthquake safety for generations to come. So that was a major development.

The times have changed. Now people are earthquake conscious. They're conscious of volcanic dangers and earth hazards--these have become subjects of investigation. The federal government has a number of agencies involved in earth hazards and earth-hazards prevention.

VII GEOLOGIC MAPPING: HOW IT IS DONE

Scott: Geologic mapping intrigues me. Could you describe how geologic mapping is done--the process you go through in preparing a map? Dick Jahns used to talk about it--he loved to do geologic mapping. It always kind of fascinated me.

My Doctor's Thesis

Oakeshott: As an example I can use what I did for my doctor's thesis. I was teaching at Compton, and could only devote weekends and some night courses at the University of Southern California to the project. I went into a new area--relatively unmapped--in the western San Gabriel Mountains. I had to work by myself because I couldn't afford to hire a field assistant. To take a student along would only increase the work time and allow me to accomplish less. So in my case, the mapping was a one-person activity. Nowadays a lot of work is done by field parties--two or more people go out. Another change is that now girls are involved, as well as young men, but at the time I started this in 1930, it was almost exclusively a man's job.

Field Work: Mapping the Contacts

Oakeshott: I went into the San Gabriel Mountains, first by using all of the roads, either in the forest reserve or outside--anywhere I could find a road and road cuts. The first objective was to obtain the best available base maps.

Scott: Let me ask you about the roads--you looked for roads, for access, to get into the area. But also you were looking for road cuts to give you some sense of what was underlying the surface?

Oakeshott: Yes. Fresh road cuts are especially good because they expose rocks that may be covered by soil where the surface is undisturbed. A wonderful example is down there by the San Fernando Reservoir. The 1971 earthquake there made it important for geologists to review all previous work. I had started mapping there

Oakeshott: in 1930, so my work was gone over with a fine-tooth comb; a swarm of hundreds of geologists and just interested people used and criticized my mapping.

But to get back to how we do these things, first you get the best base maps available. When I started in the San Gabriel Mountains, there was only a mile-to-inch topographical map, which had been made by old methods, not by the photgraphic methods they use nowdays. It was rather crude, not very precise. Finally, I used the best available 1:24,000-scale mapping to compile a new 1:62,500 base map for publication as the Division's Bulletin 172 in 1958.

Scott: Were those USGS maps?

Oakeshott: Yes. I would go out in the field, and take the access road to get in there. When I got to my area, I would examine all the rock formations, and note on the map the contacts between major types of rock formations. A formation is defined as something you can map--that's one definition of it.

For instance, along the front of the San Gabriel Mountains I'd find a belt of volcanic rocks. I'd find a belt of brown sandstone. I'd find a belt of red conglomerate or granite. In the San Gabriel Mountains I had everything from old Precambian feldspar rocks on up to Recent (Holocene) alluvium, and everything in between. I mapped the contacts between all rock formations. I used aerial photographs taken vertically from above. These were the best, because near the center of the photograph where there wasn't much distortion you could get a very accurate scale picture of the ground. I then transferred the geologic information to the topographic base maps.

Scott: Where did you get these aerial photographs?

Oakeshott: I got them mostly from Fairchild Aerial Survey, but USGS makes them, and various other agencies--private and public. The army map service made a lot of maps, which later became very good. Things like faults would show up on an aerial photograph. I had faults that separated...white feldspar rock from, we'll say, dark granite, and that will show up like a light on an aerial photograph. On the photograph, comparing it with what you could see in the field, you could draw in the faults and you could draw in the kinds of rock formations. Where there were fossils you could take them in to a paleontologist and get a judgment on their age. So it was a case of going over the ground foot by foot, through the brush and trees and everything, mapping the different kinds of rock and the contacts between them.

Scott: When you say the contacts between them, do you mean where one formation overlies another?

Oakeshott: Yes.

Working Out the Geologic History

Scott: How do you map the contacts, where one is on top of the other?

Oakeshott: If one is on top of the other, so that it's concealed, you can't map them on a plane geologic map, but they would show up in cross sections. But you map them because they're folded. So if it had been turned up on edge, you've got a contact that would show on a map. I would go out on Saturdays, Sundays, and holidays, and take my base aerial photographs, and map the contacts on those, and work out the kinds of rocks. You collect rock specimens in the field, and take them into the laboratory to determine specifically what they are.

Scott: From your previous knowledge you could look at the rock and know in general terms what it is?

Oakeshott: Yes. You look in the field and say, well, this is a granite. But is it a quartz monzonite, or is it a quartz-rich granite itself, or what kind of "granite" is it? There are many different variations and distinctions you can make. The objective of the geologic map is to finally make an interpretation of what happened--to work out the geologic history.

My conclusions on the San Fernando area were in the realm of the geologic history--figuring out what happened in the Precambrian and every other epoch on up to Recent time. What happened? What about the fault? Was the San Gabriel Fault still active, or wasn't it? What sort of movement had it had, when did it start, and so forth.

Scott: Did you work out your conclusions, your interpretations on all these points?

Bulletin 172

Oakeshott: Yes. The result was finally a bulletin (Division Bull. 172). This was really the result of that study.

Scott: You are showing me Division of Mines and Geology, Bulletin 172, Geology and Mineral Deposits of San Fernando Quadrangle: Los Angeles County, California, February 1958.

Oakeshott: The geologic map is the main thing. It is in the pocket in the back. You will notice different kinds of rock, which are shown in different colors and patterns, faults, which are generally black lines on this type of map, and a breakdown of the ages over here in the key.

Scott: These are the things you could see at the surface?

Oakeshott: That's right. I would actually follow the faults out. See here, one has displaced the rock formations. Nowadays there are all sorts of ramifications of geologic studies. There can be geophysical studies that cover the whole area. Magnetic studies can cover an area like this. So all kinds of ramifications of this sort of thing are carried on today.

Scott: In connection with this bulletin and the mapping, is this a one-person product?

Oakeshott: This was a one-person setup.

Scott: Did a team come along later and round out what you'd done?

Oakeshott: Oh yes. Like this area in here (Tick Canyon); it's quite complex. Southern California students have used that. They've taken my map and gone out there and made their own maps; their own interpretations. UCLA and USC especially have gone over and over and over...year after year they've used that area for student projects. Dick Jahns also worked in that area.

Data Sources: Cuts and Oil Well Cores

Scott: In the earlier days, what did you do when there was substantial territory where there weren't any cuts, but only the natural surface?

Oakeshott: It's more difficult. In writing my book on the geology of California, I had to talk about the whole central valley as a geologic province. For that, I had to take the work of oil companies--their seismic work--and cores from oil wells, etc., to work out what lay beneath. But when working as an individual with no special tools except a compass, a pick, and a bag to carry samples--that's about all I'd have in the field--when I'd come to a flat area, I'd just have to interpret what I thought would probably lie under there, based on what is seen at the surface. In some places you get wonderful outcrops, and in other places you get nothing, just soil.

Around that San Fernando Reservoir, especially, the surface materials were largely gravels and sands, but in digging the original reservoir, they had done quite a bit of cutting around the margin. I got the permission of the L.A. Department of Water and Power to go in there, and I was able to do some pretty accurate mapping, because they had artificially exposed a lot of rock outcrops around the margin of the reservoir. They had gone down through the thick soil cover, and I had a rare chance to get some really good data.

Scott: Were the oil well cores fairly readily available?

Oakeshott: No, there was a lot of difficulty about that. There always has been in California, because each oil company maintains proprietary information. You can have two or three or four different oil companies coming in and drilling exploratory wells in the same area, but you don't always get the data. Every oil company has scouts who go out and spy on other oil companies. When I was working for Shell Company in 1929-30 we had instructions not to show our geologic map to rival companies in the field. If I'd see a friend of mine from Standard Oil mapping the same area I had, I wasn't supposed to confer with him. I'd say, "Hello Jack, how's the weather." I wasn't supposed to tell him what I was mapping.

In California this is still going on, but there is a little more openness about it now, and many of the oil companies exchange information for a consideration. It's a service that they can perform.

Scott: But I take it you were able to get some of these cores?

Oakeshott: Oh yes. You can get to see some of them. Well, suppose a company has decided there's no further economic interest--then it's "Oh sure, look at my cores." So in some places I got a lot of information, but not in others. In some other countries, like Canada for instance, the government keeps a much greater control over such data, and they require the exchange of information.

Scott: In fact in Canada the companies are prohibited from making such information a proprietary kind of thing.

Oakeshott: Yes. It's in the state's interest, and the information is in the public domain. The laws in that respect vary greatly between countries, and even between states in our own country. Generally in the United States an oil company or a mining company conducting exploration has a right to keep the information proprietary--within reason. This is something we in the Division of Mines were always interested in--we recommended to the state that information be opened up--in the public interest.

Scott: But that has never been fully done?

Oakeshott: Never been completely done. But now for example, they do have a core depository at the community college in Bakersfield--where they store cores. You can go in as an interested geologist or company, and examine those cores. So you can get a certain amount of information, more than you could when I started work in California.

Conclusion

Scott: When did you start that mapping; was it in 1930?

Oakeshott: Yes. I started in 1930, and then it went on for years because I didn't have much time.

Scott: Was that mapping done in connection with a thesis or a dissertation?

Oakeshott: It was done primarily for a doctor's degree at USC, which I got in 1936. It took me six years just to get the degree, but the degree work only covered a part of the area I finally published on. I expanded it for publication.

Scott: You're talking about this publication, Bulletin 172, February, 1958?

Oakeshott: Yes.

Scott: Is this principally yours, or...?

Oakeshott: It was published by the Division of Mines and Geology, but I did the field work, the write-up, and the laboratory work. So it took me a long time.

Oakeshott: These figures in the book represent thin rock sections that I looked at through a microscope and drew. Here's a black and white map of part of the area. I took

various photographs of the rocks, different rock types. It was a lot of work. (Shows some maps and figures in text.)

Scott: Do you view this as one of your major projects?

Oakeshott: Oh, sure.

Scott: I'm always in awe of you geologists' ability to go look around in the field and somehow figure out the age of those rocks, determine what they are, what eras they come from, and interpret what went on geologically....

Oakeshott: You learn this in school, with some good professors. A lot of my work was at Cal. Then the work I did at USC was part-time. I took some courses in the evenings and on Saturdays, but the work for the Ph.D. is primarily what's in this book. Mine was the first Ph.D. in geology that they gave at USC. In those days you didn't have much choice of universities. It was Cal Tech in the south, or Cal and Stanford up north. That was about it. UCLA wasn't giving Ph.D.s in the early '30s; and the other branches of UC had not been set up, so things have changed.

##

Transcriber: Maria Wolf
Final Typist: Maria Wolf

TAPE GUIDE -- Eleanor Swent (pp. 1-77)

TAPE GUIDE --Stanley Scott (pp. 78-117)

NOTE: In transcribing, editing and preparing final copy, some interview material was shifted to improve clarity and flow. Consequently in places the sequence in the text departs from that heard on the tapes.

GORDON B. OAKESHOTT, GEOLOGIST

3040 TOTTERDELL STREET
OAKLAND, CALIFORNIA 94611
PHONE (415) 530-5595

Mar. 11, 1988

Eleanor Smart
Oral History Office
Bancroft Library

Dear Lee -

This was prepared for NASA field trip.

Use as you like.

Yours,
G. Oakeshott

History of Mining in the Knoxville District, Napa, Yolo, and Lake Counties, California

Production in the District in 1988

Today the famous old Knoxville mining district of Napa, Yolo, and Lake Counties produces sand and gravel, stone, salt, and silver, with gold far in the lead as the major mineral product as the mining of that metal comes to the forefront as the McLaughlin gold mine comes into full production (Burnett 1987).

Mercury (Quicksilver)

Historically, none of the non-metallic mineral products has been notable. For more than a century and a quarter, mining for mercury has dominated mineral production in the Knoxville area.

In 1858-60 there was great excitement in Napa because of the discovery of "silver" of untold, unknown richness. The influx of prospectors, the organization of mining companies, and the sale of stock in the mines was reminiscent of the gold rush in the Mother Lode district. One man, roaming in the vicinity of Mt. St. Helens discovered a ledge of solid silver! Claim jumping was common and miners stood guard over their claims with shotguns. In San Francisco there were large numbers of "assay" offices, where for $15 a sample an analysis would be made in which anything submitted would show silver values from $20 to $500 per ton (Egenhoff 1953).

There were big strikes and astounding developments. In 1860 a company of 12 was formed in Napa City to prospect for minerals.

Neither the company nor the prospectors knew anything about mineralogy. The samples brought in ranged from pyrite to bituminous shale, supposedly containing silver. The purplish-red of cinnabar (the sulfide of mercury) was not unlike that of some silver ores, so that some of the more knowledgeable prospectors were understandably confused in their sight determinations. Finally, in 1860, the true nature of the liver-colored, heavy mineral, cinnabar, was recognized. This led to the opening of the rich Redington quicksilver mine, at that time considered second in importance only to the famous New Almaden mercury mine.

Production and Utilization of Mercury

Mercury is the only metal which is liquid at room temperature. An unique property is its affinity for gold and silver. It amalgamates (is a solvent) for these and some other metals. Hence it was of great value for the extraction of gold from its ores. This was its principal use for the first century of mercury mining. It is most fortunate that the discovery and production of mercury coincided with the discovery and production of gold in California.

Nowadays most mercury is consumed in industry where its high density, liquid state, electrical conductivity, heat conductivity and amalgamating properties give it special value. It is widely used in dentistry, agricultural pesticides, munitions, and medicines.

Something like 80 per cent of the mercury produced in the United States has come from the California Coast Ranges.

Production of mercury in California has been recorded from 1850 to date (Davis and later publications of the State Division of Mines and Geology). In 1877, the maximum year of production,

79,396 76-lb. flasks of quicksilver were produced. Close to 3,000,000 flasks have been produced in total to 1988.

McLaughlin Gold Mine

"Working with a newly developed model in 1978, Homestake geologists began searching for gold in northern California. The second application of this model resulted in the discovery of the largest gold deposit found in California in this century." (Mining Engineering).

Gold is one of the most widely distributed of all metals in the outer part of the earth's crust. The presence of gold in the Knoxville District was not unknown prior to 1978. However, it was not economic at such low concentrations until modern technology in mining and recovery, a large open-pit operation, the high price of gold, and large capitalization (Homestake has invested over $280,000,000)changed the picture. No small operator could deal with a gold deposit averaging a fraction of an ounce per ton of rock.

The McLaughlin mine, named after the late CEO and chairman of the Board of Directors, Dr. Donald H. McLaughlin, has estimated reserves of 93 million tons of ore, grading 0.152 ounces of gold per ton. The new mine covers the old Manhattan mercury mine. Mine life has been estimated at 20 years. The open pit, 70 miles north of San Francisco, spans parts of Napa, Yolo, and Lake counties. Homestake calculates 90 per cent recovery of gold from the ore (Mining Engineering).

An article by George Argall includes a flow sheet and details on the recovery methods.

As we "go to press" the news tells us that corporate raider

T. Boone Pickens is looking at Homestake.

Geology

The deposit is about 5,000 feet long. It lies along a major thrust-fault zone, part of the great Coast Range thrust. The rock formations include the late Jurassic Franciscan mudstone, siltstone, graywacke (sandstone) and altered serpentine, cut by diabase sills and with interbedded basalt flows; all overlain by the Stony Creek Formation (part of the Cretaceous Great Valley Sequence).

Gold and silver mineralization was formed by geologically-late hydrothermal alteration, just as was the mercury. Most of the gold is in the rocks of the slightly metamorphosed Franciscan Assemblage which is crossed by numerous silicious (quartz) veins which form a stockworks. General strike is about 40 degrees northwest and dip 45 degrees northeast. Upper plate of the thrust fault is typically Great Valley rocks thrust over intensely sheared fault and faulted melange (mixed rocks). Surface geysers and hot springs depositing calcedonic sinter testify to the continuation of hydrothermal action.

Most of the mercury was in the shallow part of these rocks; gold goes a little deeper.

An article by George Argall includes a flow sheet and details on the recovery methods being used.

Franciscan Assemblage

The dominant geologic formation in the Knoxville District, and in the McLaughlin Mine area in particular, is the Franciscan

Assemblage of diverse rock types of Mid-Jurassic to Late Cretaceous age (160,000,000 to 70,000,000 years old). This Assemblage constitutes most of the surface rocks of the area. It is a heterogeneous and intensely disrupted and pervasively sheared unit of sedimentary, volcanic, and metamorphic rocks consisting predominantly of massively-bedded graywacke (dark sandstone) with interbedded dark shale, low-grade, metamorphosed sedimentary and volcanic rocks, minor vari-colored hard cherts, rare gray-to-red limestone, altered volcanic rocks usually called "greenstone," widely-distributed small proportions of green chlorite-actinolite schists and blue glaucophane schists, and dark green serpentine and its hydrothermally altered yellow-brown equivalent, silica-carbonate rock.

So disorganized and mixed are some units of the Franciscan that they are referred to as "melange" (mixture). The Franciscan lacks consistent stratigraphy, contains very few fossils, is extensively sheared internally, and shows complex, internal thrusting. The tougher, harder, more coherent rocks in this assemblage often appear as "knockers" or rounded masses of very resistant rock in a sea of sheared rock and black shale.

We have noted that at the McLaughlin Mine these rocks are hydrothermally altered.

Modern geologic thought recognizes that the Franciscan Assemblage was formed during a process of subduction. That is, the Pacific Ocean plate, several miles thick, has been thrust under the North American plate, beginning in Late Jurassic time. The major thrust-fault zone is the Coast Range thrust. Overlying the thrust is the unmetamorphosed and unaltered Great Valley Sequence (See attached diagram from Dickinson).

Selected References

Argall, George O., Jr., consulting editor (mbr MMSA), Oct. 1986, Perseverance & winning ways at McLaughlin gold: Eng. & Min. Jour., p. 26-32. (Good geologic account; emphasizes metallurgy; includes a flow sheet showing details of recovery.)

Averitt, Paul, 1945, Quicksilver deposits of the Knoxville district, Napa, Yolo, & Lake counties, California: California Div. Mines, Rpt. 41, p. 65-89. (History, geology, mines & prospects, production, & est. of reserves.)

Burnett, John L., Oct. 1987, California Mining Review: California Div. Mines & Geology, California Geology. (Latest statistics & comments on mineral production, including Napa county & McLaughlin mine.)

Davis, Fenelon F., 1957, Mercury, in Div. Mines Bull. 157, p. 341-356. (Full account of mercury in California, incl. mineralogy, geologic occurrence, localities, a section across the Knoxville district, marketing, year-by-year production from 1850, uses, & an extensive bibliography.)

Dickinson, W. R., Ingersoll, R. V., Cowan, D. S., Hermold, K. P. & Suczek, C. A., 1982, Provenance of Franciscan graywackes in coastal California: Geol. Soc. Am., Bull. 93, no. 2, Feb. (Modern concept of the origin of the Franciscan Assemblage by subduction, & diagram of subduction zone.)

Egenhoff, Elisabeth L., 1953, De Argento Vivo, Historic documents on quicksilver & its recovery in California prior to 1860. (Contains extracts on quicksilver that date from 300 B.C., & pictures & extracts from writings on the discovery & mining of quicksilver in California): Supp. to California Jour, Mines & Geology, California Div. Mines, Oct. (See particularly p. 142-144, "On discovery in the North.")

Koenig, James B. (compiler), 1963, Geologic map of California, Santa Rosa sheet, scale !:250,000. (Shows basic geology of Napa, Lake, & Yolo counties.)

Mining Engineering, Jan. 1986, Homestakes McLaughlin mine: One of the largest US gold mines comes onstream in 1985: p. 24-25. (Occurrence, geology, mining, metallurgy.)

Yates, Robert G., & Hilpert, Lowell S., 1946, Quicksilver deposits of eastern Mayacamas district, Lake & Napa counties, California: California Div. Mines Report 42, p. 231-286, scale 1:62,500. (Detailed account of regional geology of the McLaughlin mine area. Dominated by Franciscan Assemblage [Jur.-Cret.] incl. Knoxville Fm. & Stony Creek & overlain by Plio-Pleist. Sonoma Volcanics.)

Gordon Oakeshott
March 1988

INDEX—Gordon B. Oakeshott

Eleanor Herz Swent

Born in Lead, South Dakota, where her father became chief metallurgist for the Homestake Mining Company. Her mother was a high school geology teacher before marriage.

Attended schools in Lead, South Dakota. Dana Hall School, and Wellesley College, Wellesley, Massachusetts. Phi Beta Kappa. M.A. in English, University of Denver. Assistant to the President, Elmira College, New York. Married to Langan Waterman Swent, mining engineer.

Since marriage has lived in Toyoltita, 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.

Stanley Scott

Stanley Scott has been associated with the Institute of Governmental Studies, University of California, Berkeley, for most of his professional career. Until recently he directed the Institute's publications program. He has also written on numerous topics, including metropolitan area problems, state and local government, coastal conservation, and seismic safety policy.

He has been a member of the Seismic Safety Commission since it was established in 1975, and was chairman in 1981-1984. During the past two years most of his time has been devoted to seismic safety and earthquake engineering. His recent activities have included preparation of articles and working papers, oral history interviewing, and extensive public service with the Commission and its committees.