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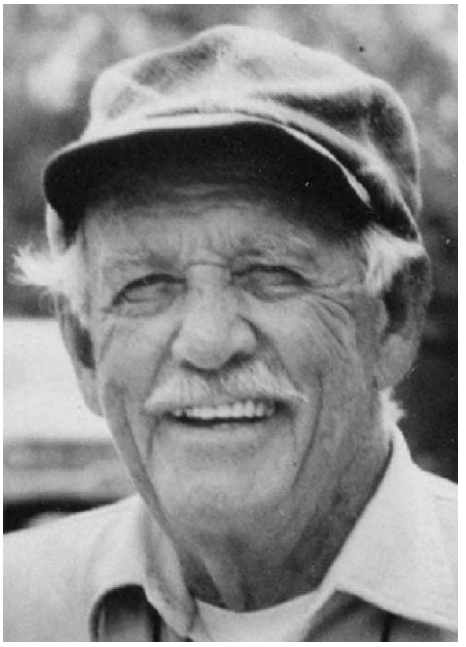
My geological career in Death Valley

Bennie W. Troxel



I owe many people a debt of gratitude for contributing to my career. I cannot acknowledge all of them in this brief account, partly from a faulty memory but mostly because there are too many to list herein. To those who I failed to identify, I ask your forgiveness.

Robert E. Stevenson created my interest in geology and started my education in the science. I am especially grateful to him. The faculty of the geology department at UCLA in the late 1940s provided me with a geological education. Lauren Wright was especially fundamental in making me become a scientist and improving my ability to write scientific articles.

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1. The beginning

Following service in the U.S. Army Air Corps during WWII, I returned to work at Northrop Aircraft in Hawthorne, California. I soon realized that I needed a college education so I enrolled as a student at Compton Junior College in 1947. While there I took college prep courses that I avoided in high school and went to UCLA during summers. For a college science course requirement, I took an introductory physical geology course. The instructor, Robert E. Stevenson, was such an interesting and skillful teacher that I became extremely curious about science. A course in mineralogy from him and a course in historical geology from Gordon Oakeshott convinced me that I wanted to become a geologist.

I then went to UCLA and was fortunate to get my Master's degree in geology from a superb faculty that included W.C. Putnam, J. Murdock, Don Carlisle, John Crowell, Clem Nelson, Cordell Durrell, U.S. Grant IV, Jim Gilluly, "Parky" Parkinson and others. I completed my course work in 1952 and at the recommendation of Don Carlisle, I went to the Los Angeles office of the California Division of Mines where I met and was interviewed by Lauren Wright for a position in the Division.

Olaf Jenkins, Chief of Division, said to hire me and after a few weeks working at the laboratory and at the information desk in the San Francisco headquarters office of the Division I was transferred to the Los Angeles office. While in San Francisco, I learned much about California geology from Gordon Oakeshott and Charles Chesterman.

In Los Angeles, I soon became involved in several projects which resulted in publications on mineral commodities (wollastonite, uranium, thorium, and abrasive minerals) and several geologic road guides for Bulletin 170. Lauren also encouraged me to publish a map of my thesis area (Shadow Mountains near Victorville, CA) in Bulletin 170. Paul Morton and I next undertook a 2-year investigation of the mineral resources of Kern County. Several other staff members of the Division contributed to the comprehensive report on Kern County. All of the material published from these studies was edited by Lauren and was improved by his input.

Soon after I started working in the Los Angeles office, Lauren invited me to accompany him on a trip to the Death Valley region. At that time Lauren was studying tale deposits for the Division and for a PhD degree at California Institute of Technology. On that trip he suggested that I consider making a geologic map of the north half of the Avawatz Pass 15-min quadrangle. I liked the idea and thus began a long and extremely satisfactory career of working with Lauren in Death Valley.

2. The early Death Valley events

Almost immediately after I started fieldwork on the Avawatz Pass quadrangle, Lauren and I began the preparation of a geologic guide through the Mojave Desert and Death Valley. I also met Levi Noble during this time, because of our interests in mapping in nearby areas Levi invited Lauren and I to map with him the complicated geology of the Virgin Spring area, the area of extreme importance to Levi. Subsequently we divided our long and frequent winter weekend trips between mapping our individual quadrangles and mapping with Levi. We usually visited Levi and his wife Dorothy at Valyermo on our way to Shoshone. Levi rode with us on many weekends, but occasionally he and Dorothy would drive to Shoshone in their walnut paneled 4-door Jaguar. It was a real treat to drive their Jaguar into Virgin Spring Canyon. In fact, it was a better field car than the 1954 Chevrolet Sedan that was our only field car at the time. The Division later acquired a Chevrolet panel truck that was converted to 4-wheel drive and we were able to traverse more terrain with it.

In the 1950s we were provided with a vehicle and $16.50 per diem for expenses. The motel room in Shoshone for two was $6.50 per day. We cooked breakfast in the motel, packed a lunch, than ate dinner at the café in Shoshone. We plotted the geology with 7 to 9 H pencils then using crow-quill pens “inked in” our maps after dinner. Evening events were terminated at 10 p.m. when the electric generator for Shoshone was turned off. We mapped independently in the Virgin Spring area and discussed what we saw as we returned to Shoshone. Levi listened carefully and early next morning he would make notes about our observations. I commonly made wild interpretations of our work and Lauren was kind enough not to laugh at them. Our detailed mapping proceeded very slowly. We each rarely mapped more than 1/10 of a square mile in a day.

During this time a group of Levi’s peers would make an annual fieldtrip to review our progress. The group included Henry Ferguson, Jim Gilluly, Chester Longwell, Bill Pecora, Charles Anderson, Charles Denny, Charles Hunt, and others. If the group was too large, Levi would make an itinerary for Lauren and I; Levi would stay home. Before Levi died he had agreed with us that his Amargosa Chaos was formed by extensional activity rather than compression. Unfortunately, we never published a joint paper with him to document this fact.

Levi also had an interest in the Funeral Mountains and Lauren and I decided to make a geologic map of that area. Over a period of many years we completed the 1/48,000 scale map of the Chloride Cliff and Big Dune quadrangles. We are grateful to Mike Carr for getting it published. It was in the Funeral Mountains that we noted that west-dipping normal faults flattened at depth and joined on a common plane. We then realized that a similar fault pattern existed in the Virgin spring area.

During this time Lauren and I continued to map 7 1/2-min quadrangles independently. His work

included parts of the Shoshone and Tecopa quadrangles and mine included parts of the Avawatz Pass and Leach Lake quadrangles. Later we jointly started mapping the Greenwater Range.

3. Later events and people

As interest in Death Valley geology began to grow many other people began studying various problems there. I can list only a few of them herein. The early group included Charles Hunt and Don Mabay, Don Curry, Harold Drewes, Charles Denny, Chet Wrucke, Jack Stewart, Mitchell Reynolds and Jim McAllister.

Lauren encouraged students and faculty from Pennsylvania State University to study various problems. Eugene Williams and Charles Thornton supervised student activities in Death Valley, as did Lauren. Somewhat later I began to attract students from the University of California at Davis. The Institute of Technology initiated studies in the Paramint Mountains. Faculty and students from the Massachusetts Institute of Technology and Harvard University also began working on problems in Death Valley. Laura Serpa and Terry Pavlis encouraged many students from the University of New Orleans to study a wide variety of problems in the region and deserve special mention for initiating, with Susan Sorrell, the SHEAR facility in Shoshone. Many other University faculty and students commended students in the region and I apologize for not listing them here.

Lauren has identified many students that we have worked with but I wish to identify a few others for whom I greatly appreciated having worked with. They are Roland Brady, Paul Butler, Pam Burnley, Marty Giaramita, Julie Miller, Dan Graff, Rick Kramer, Sue Hall and Mitch Casteel. There were others whose names escape me.

4. Supplemental information

I was fortunate to work in surrounding areas, usually with others and thus gain regional knowledge that was useful in understanding Death Valley geology. These areas include the Spring Mountains where I co-taught summer field geology for 2 years at the University of Nevada at Las Vegas; reconnaissance geology for the 1:250,000 Trona sheet of the California State geologic map (Cliff Gray and I mapped a large portion of this sheet); in the Fort Irwin area, we upgraded G.I. Smith's map with Roland Brady, Matt McMackin, Terry Paulis and Laura Serpa; reconnaissance mapping in the Arawatz Mountains with Dick Jahns and Lauren; field review with others of Don Kupfer's seminal work in the Silverian Hills; field trips near Las Vegas with Chester Longwell; reconnaissance geology of the Last Chance Range with J.H. Stewart; and mapping the State Range with G.I. Smith, Cliff Gray and Roland Von Huene.

5. Important events and speculations

Almost simultaneously Lauren and I recognized what we then called a basin facies of the Noonday Dolomite. My work in the Saddle Peak Hills revealed a clastic unit atop lower Noonday and beneath upper Noonday Dolomite. Lauren's work in the Ibex Hills revealed eroded lower Noonday Dolomite incorporated as basal clasts in a clastic unit overlain by upper Noonday. We later identified this as the Ibex Formation.

Our joint work in the Funeral Mountains/Virgin Spring area and individual work in nearby areas eventually led to the recognition of extension tectonics in Death Valley. Fundamental to this recognition was the documentation of the relationship of listric normal faults and an underlying planer surface now known as a detachment fault. The flattening of normal faults at depth and convergence of them were plotted by me in the Saddle Peak Hills in the late 1950s but their significance was not recognized until many years later. The map of the Saddle Peak Hills is yet to be published (2003).

An anomalous northwest-trending tertiary dike swarm in the Saddle Peak Hills and smaller ranges on each side was an enigma for many years. Our work in the Kingston Range and especially the work of Jim Calzia led to the recognition that extension in that area was to the southwest before 12.4 mya and was not overprinted by the effects of later extension to the northwest so commonly documented in most of the Death Valley region. I am now convinced that the dike swarm in the Saddle Peak Hills was emplaced during pre-12 mya extension to the southwest. Northwest-

trending listric normal faults in the southern Napah Range are further documentation of extension to the southwest. A Tertiary basin on the southwest edge of the Montgomery Mountains at the north end of Pahrump Valley may record the site of a pull-away basin due to southwest extension. Likewise a similar basin may have developed on the northeast side of a northwest-trending small ridge in the northeast corner of the 15-min Avawatz Pass quadrangle. I have informally called this ridge "Fatzinger Ridge" for many years.

While mapping with Lauren in the Greenwater Range, I became intrigued with the relations of the Shoshone Volcanics and the underlying plutonic rocks of nearly the same age. Very recently I convinced Rick Haefner that we should study the area in more detail. Unfortunately, Rick died soon thereafter. Basically, the problem is one in which volcanic and lesser sedimentary rocks were deposited over a small pluton that continued to rise as it crystallized and it subsequently deformed rocks of nearly the same age and younger volcanic flows. The problem is unresolved, important, and warrants detailed study. The area is at the southern end of the Greenwater Range and is informally called "Chocolate Sunday Mountain".

Early in my career I became intrigued with the Kingston Peak Formation, named and first described by another of my heroes, Foster Hewett. Many have speculated upon its origin and most have become convinced that it is a glacial deposit. Their evidence is the presence of occasional (rare) striated stones (usually in non-layered strata) and even less common faceted stores. I do not doubt that these features are derived from a distant glacial terrain but the layers in which they are contained were deposited in submarine fans—so-called drop stones may well be carried into the area of deposition by icebergs but may have been dropped many miles from the point of origin of the icebergs.

These problems and others will continue to be a matter of debate and speculation. In addition the amount of northwest extension will also be debated. The fact that wide deficiencies of opinion exist about many facets of geology in the Death Valley region guarantees that the area will continue to be intensively studied.

I feel extremely fortunate to have become involved in the geology of such a critical area. The abundance of evidence available in such well-exposed outcrops is overwhelming. As I have said before "In Death Valley one is apt to be confused by the huge abundance of data."

In conclusion I want to list those who have been so fundamental to my accomplishments in Death Valley. They are Lauren Wright, Levi Noble, Chester Longwell, Foster Hewett, Jim Calzia, Matt McMackin, Fred Johnson, Henry Ferguson, Mitchell Reynolds, Laura Serpa, Terry Pavlis, Olaf Jenkins, Dick Jahns, Gene Williams, John Crowell, Don Carlisle, Jim Gilluly, Robert Stevenson, Brian Wernicke, Martin Miller, Roland Brown, Paul Butler, and many others. I am also grateful to the many people who have been on field trips that I have led. Their useful questions have helped improve later trips.

Lastly, I am forever grateful to my beloved wife Betty and our two children who has been extremely tolerant of my many absences from home while working in Death Valley.