



ROBERT P. SHARP (II)
(1911-2004)

INTERVIEWED BY
SHELLEY ERWIN

May 28 and October 12, 1998

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Subject area

Geology

Abstract

This interview in two sessions in 1998 with Robert P. Sharp, Sharp Professor of Geology emeritus, begins with an account of his institution in 1984 of student field trips to Hawaii to study volcanism up close (Project Pahoehoe), thanks to the financial support of H. Dudley Wright. Recollections of alumni geology field trips that Sharp conducted over the previous two decades to Hawaii, Alaska, Yellowstone, Utah, Death Valley, Pennsylvania, New England, and Iceland, to bring alumni closer to Caltech. Discussion of the field course he has taught at Caltech since his retirement in 1979 (Geology of the Southwestern United States). Discussion of the evolution of the Division of Geological and Planetary Sciences at Caltech: early influence of J. C. Merriam on R. A. Millikan; evaluation of J. P. Buwalda's long chairmanship of the division; recollections of Beno Gutenberg; recollections of Chester Stock. Stock's work in vertebrate paleontology; the decision to phase out vertebrate paleontology after Stock's death in 1950; sale in 1957 of the fossil collections to the Los Angeles Natural History Museum. Recollections of the contributions of Stock's colleagues Eustace Furlong and William Otto. The interview concludes with a discussion of the new field of

geobiology and the interest in ancient DNA and possible role of the division in such investigations.

Administrative information

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Robert Sharp at Mesa Verde, Colorado, September 25, 1998. Caltech Archives.

CALIFORNIA INSTITUTE OF TECHNOLOGY

ORAL HISTORY PROJECT

INTERVIEW WITH ROBERT P. SHARP (II)

BY SHELLEY ERWIN

PASADENA, CALIFORNIA

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CALIFORNIA INSTITUTE OF TECHNOLOGY
ORAL HISTORY PROJECT

Interview with Robert P. Sharp (II)
Pasadena, California

By Shelley Erwin

Session 1	May 28, 1998
Session 2	October 12, 1998

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SHARP: This has to do with Project Pahoehoe [in the mid 1980s]—student field trips on the Big Island of Hawaii. I had been working in Hawaii with people at the Hawaiian Volcano Observatory and with two Caltech planetary scientists whose work in Hawaii required geological information. Both had me come to Hawaii several times.

ERWIN: Who were those people?

SHARP: One was Dan Dzurisin and the other was Mike Malin, who has recently been the principal investigator on the orbiter photographs of Mars; he and assistants made the camera that has taken the best pictures ever of parts of Mars. Both Dzurisin and Malin were trained as physicists and came into Caltech's geology division as planetary scientists. Malin knew quite a bit of geology; Dzurisin didn't know as much. I spent a lot of time on Hawaii with them. Dzurisin and I also began leading alumni trips in Hawaii. Every time I came back home I kept saying to myself, "We're not doing this right; we ought to get our students over to Hawaii." It's nice to do things for the alumni, but that's the past and we need to look to the future. On one occasion when I came back from Hawaii I sat down and wrote up a little proposal of what I would like to do in taking a group of students to Hawaii. I took it to Peter Wyllie, who was our division chairman at that time. Wyllie said, "OK, as long as it doesn't cost the division money." I said, "It's not going to cost the division anything. I will raise the funds for this, but I do need some secretarial help from the division." And Wyllie said, "Fine."

So I launched it. I couldn't handle more than, say, fifteen students very well, and a maximum of twenty; consequently I had to have a basis for making a selection. I decided that the people who were finishing up and leaving Caltech within the current academic year would be the most eligible. We would take the graduating seniors in the division who were leaving the institute in good standing. All the graduate students we considered were advanced PhD candidates, completing their theses that year. We aimed for a minimum of fourteen and a maximum of nineteen. We operated in modules of four, because our transportation on the island consisted of rented Aerostar vans with the backseats out to carry camping equipment and personal gear. Each van could thus seat four people, so we operated by units of four. Just one spare student was a headache to me.

ERWIN: Were these all geology majors?

SHARP: This was anybody in our geology division, even a double major or a radio astronomer. I got tripped up every now and then, because I would, for the senior students, ask the registrar's office to give me the list of senior geology majors in good standing. They sometimes listed somebody who was doing a double degree in chemistry and geology, and they'd list a student in chemistry every now and then. This was little—a minor thing.

That was the basis that I chose them on, and it worked out very well. In most years we'd come up with fifteen students. I often had trouble with a surplus of graduate students, because they thought they were going to get their theses done earlier than their advisors did. I always talked to the advisors, both the academic and the thesis advisors. Things got a little tight at times, but we managed to end up with fifteen to nineteen students each year.

I needed only about \$8,000 the first year; it's now double that. The first year, I went to Elba Smith, who was in the development office at that time. I explained what I wanted to do. She said, "Well, I think I know some people who might be interested in supporting that activity." In a very short time she called me back and said, "OK, I've got you two people." Howard Smits, a Caltech alumnus, benefactor, PhD—he had actually been my freshman drawing instructor—and a chap named John Navas.... I think Navas may have been an MIT man; I don't think he was a Caltech alumnus. He was interested in benefiting students in one way or another. He had

set up a little award for good teaching at Caltech, and Tom Gold got the first one of those awards.

Anyway, Navas and Smits put up the money we needed the first year [1984]. It was that easy. After that, it began to get harder. I had said I would try to do the trips for one generation of students—that is, for four years. In following years I had to find other benefactors, though Smits helped me a second year. Navas maybe had died by that time; I don't recall. After four years I was eager to continue the trips, they were so successful. By scraping hard, I was able to raise the money for two more years.

About that time, a chap named H. Dudley Wright—I don't know what the H stands for; anyway, he was always known as Dudley—who had established a Feynman fellowship here in physics, contacted me. Wright had been alienated by one of our early development directors, although he was basically favorable to Caltech. He turned Dudley off, didn't handle him right. Dudley was a rough, hard-nosed businessman, but with a heart of gold.

ERWIN: How did he hook up with Caltech in the first place?

SHARP: He had operated in the Pasadena area with a small medical instrument company—Endevco, I think it was called. It had some shops on South Pasadena Avenue—it was quite successful. He was bought out by Becton Dickinson, a big pharmaceutical and instrument company. Apparently, as part of the sales agreement, he agreed not to start another company that would compete with the one he had sold them. That would be only natural. So he went off to Switzerland and established another company in a high-tech field that measured partial gas pressures in commercial fluids. He took up residence in Switzerland, but he maintained close relationships in the US, not so much with Caltech but as a member of the board of directors for the Harvey Mudd engineering college.

I was in Hawaii, on a Pahoehoe trip, when he phoned my home in Santa Barbara. He had been having meetings of the board of directors of his Switzerland company in various parts of the world. He said, “Would you run some field trips for the members of my board if I held a meeting in Hawaii?” And I said, “Yes, I'd be glad to do that, if you will meet in Hilo.” And he said, “I'll meet anywhere you want.” So we agreed we'd meet in Hilo. The board wasn't big—six to eight members. Richard Feynman had been on the board at one time; Dudley Wright had

great admiration for Richard Feynman. Anyway, board members were to have their wives along, a typical board arrangement. They'd meet in the morning to attend to their business, and in the afternoon they'd relax. In the afternoon I was to take them on field trips.

I had a Hawaiian buddy in Hilo, and in the morning he and I would take the ladies to the orchid farms. After lunch, we'd all go on geological field trips. Dudley said, "I want to pay you an honorarium." I said, "Dudley, I don't want an honorarium, but I'd appreciate a contribution to my Project Pahoehoe fund. I'll tell you about it over there." So when we were done on the last day, he said, "All right, now tell me about Pahoehoe." So I told him. He immediately said two things: "First, you should bring younger faculty members with you who can run these trips after you can't do them anymore." I'm already at that stage, and Lee [Leon] Silver and Jason Saleeby are now running them. Then he said, "Secondly, you should have an endowment. You shouldn't have to be raising funds annually. I'll help you get an endowment." What he did was make a proposal to Henry Mudd, who heads the Mudd Family Foundation. Harvey and Seeley Mudd were both dead by that time. Dudley was on the Harvey Mudd College Board of Trustees. He said, "Henry, you know that I have been interested in getting biology into the Harvey Mudd curriculum," and he named an amount of money that he would give to biology at Harvey Mudd if the Mudd Foundation would make a corresponding donation to Bob Sharp's Pahoehoe.

I thought Henry Mudd couldn't turn this down, but he did. Later I was sitting in my cabin in Montana wondering what to do next when a letter came from Dudley Wright. The letter said, "I have just set up the H. Dudley Wright Foundation, and it will support Project Pahoehoe for as long as the geology division and the institute want to run it."

ERWIN: So he really came through for you.

SHARP: He really came through. But he didn't give me an endowment. He just said, "I will support it annually." So each year I would write to Dudley and say, "Dudley, this year I need \$12,000," or whatever it was. He would pen a check. Well, Dudley died. Now, I had two letters from him which stated that the H. Dudley Wright Foundation would support Project Pahoehoe for as long as we wanted to operate it. Fortunately, I knew the president of his company, Orbisphere Laboratories—a fellow named Ion Bals. He was a Yugoslavian. So I wrote to Ion sending copies of these letters. I said, "I don't know who heads the foundation board but I

assume you must be on it.” I got a letter back from him saying that the board would honor Dudley’s wishes. I simply wrote to him every year thereafter and asked for a check. The expenses had gotten up to about \$15,000; the major expenses are airline travel, rental of vans, and fees. There was very little equipment that we had to buy. It’s a bare-bones operation. We camp out. We cook our own meals. The kids get to swim just once. If you try to raise money to send students to Hawaii, people tend to be skeptical, thinking it’s a vacation trip. I always was very firm that this was an intellectual operation, in the finest place in the whole world to study hotspot volcanism. There’s no place better than Hawaii. Each student was to be our local resident authority on some topic; I’d give them a long list of topics and they’d elect one, and they’d make frequent oral presentations during the trip. It was not a vacation. The only time they got to swim was the next-to-the-last day of the trip, after we had taken off from Kilauea to touch base with the other volcanoes on the island. We spent one night on the Kona Coast at Hapuna Beach, a state park where we could camp. There is a good beach there, and they’d get to swim. We have to guard against the idea that Pahoehoe is a great vacation when it is actually a serious intellectual enterprise; Dudley understood that.

So things went along just fine on an annual basis. The ’98 trip, this year, [I thought] would have been the last one. But I saved money—a little bit each year, and some alumni have contributed money, so altogether we had enough, after the last check from the Dudley Wright Foundation, to run for one more year. Lee Silver, who is now in charge, says that we have been careful enough so we can run it one more year, so we’re going to run it again in 1999. We get some funds in from alumni. We’ll probably get some funds from the division, but we can’t count on them for major support. Ed Stolper says to me, “I’m not going to let it die. We’ll find some way or other.”

I am currently trying to raise a half-million dollars to endow Project Pahoehoe. I have just sent out five letters to what looked to me like my best candidates. I made a contribution myself. I have found that if you want people to do something, it helps if you do something yourself first. They are much more likely to say, “This guy is serious.”

ERWIN: There’s that old expression: “Put your money where your mouth is.”

SHARP: That's right. So I've already, by making a pledge, put my money where my mouth is. I'm looking for people to pledge \$50,000. I need ten all told, so I've sent out my letters. I was going to send them out back in January, but I came down with viral pneumonia, so I'm way out of phase in time. I've had only one reply to the five letters that have been sent out. It was from Nancy Glanville, who I knew was one of my best candidates. She was just taking off for three weeks in Russia when she got my letter. She wrote me the nicest little note saying, "I'm interested in helping you to continue Project Pahoehoe. I want to sleep on it." At the time, all I was asking for was pledges. I was highly skeptical about whether I could raise a half-million dollars. All I wanted was a pledge that can be paid off over a two- or three-year time interval.

ERWIN: Is she the wife of James Glanville?

SHARP: Jim Glanville was a major supporter of the raft trip, which I described [in the earlier interview, 1979-1980—Ed.]. We raised a million dollars by running raft trips through the Grand Canyon. Jim Glanville not only went but sent Nancy another year. He had four boys. He sent three of them on the trip. Rob, the fourth one, was too young. Have you ever met Nancy?

ERWIN: No.

SHARP: She's a delightful woman. Just delightful. Jim had a car accident driving in Houston. He died within two or three weeks after the accident. They had four boys: John, Charles, Thomas, and then Rob. John, the oldest, worked here at the institute for a while in the physical plant. He has subsequently been active in Caltech Associate affairs.

We are now very much at the crossroads on Project Pahoehoe. It's an eight-day trip, run during the spring break. We assemble the kids in Hawaii, normally on a Thursday, which is before the end of the exam period, but they're all able to come, being mature students. We don't travel weekends, because it's more expensive; we travel on a Thursday. The trip really gets under way Friday. They have to buy supplies; camping in Hawaii is not that easy. There are some county parks that have camping facilities, but often they are in miserable shape. The national park at Kilauea has a good campground with little cabin-type houses that you can rent. That's Namakani Paio. We stay there now about four nights. I won't tell you all of the places

we stay, but we use the county campgrounds extensively. The state also has parks where you can camp; an example is Hapuna Beach, which is on the Kona Coast about thirty miles up from Kailua. The shelters you can rent at Namakani Paio and Hapuna are welcome; it rains a lot in Hawaii. We end up on a Friday. Most of the students come home the same day, although some linger in the islands. And of course I'm always being asked, "Can I bring my wife?" "Can I bring my girlfriend, husband, boyfriend?" We encourage them to get together with members of their family before or after the Pahoehoe trip.

ERWIN: You stay on the one island, though, with your group?

SHARP: Yes, one island. Most of the time is at Kilauea on the Big Island, because that's where the current activity is. We've been lucky, in that after we started this trip, Pu'u O'o, which is a volcanic vent on the east rift of Kilauea—not in the central caldera—became active. It's now in its fifteenth year, the longest continuing activity historically recorded in Hawaii. So we've been able, three-quarters of the time, to get our students right up to the edge of red-hot lava, as close as you and I are together. And they can see the thing moving.

ERWIN: Coming right out of the ground?

SHARP: Right. It's an experience they will never forget. They really have stars in their eyes when they come back from having looked at that red lava. We've been lucky in that regard on about three-quarters of our trips. Frequently we take them at night and they can see flows coming down the pali, with its steep slopes. But getting close to it and seeing it from a distance are two different things.

Since the Dudley Wright trip, I have been taking each year at least one faculty member along who could run a field trip like this. Thus we have built up a core of people who can run the trip. I have taken others who would never do that—because frequently a student will drop out at the last minute and it's been easier to substitute a faculty member. Lots of times I've had as many as three faculty members. Those people contribute and it works very well.

The next-to-the-last day is a relaxed day. We've been at Hapuna, we've backtracked to see some big inclusions in the lava, and then come north to Waimea, right on the edge of Kohala, the northernmost volcano on the Big Island. That's where the big Keck building is.

ERWIN: That's the Keck headquarters?

SHARP: The Keck building houses the staff that services the big telescope on Mauna Kea. We do not usually go to the top of Mauna Kea, but I think next year Jim Westphal [professor of planetary science] is interested in helping us. Westphal owns a house on Hawaii. He retires on the twentieth of June. I just saw him the day before yesterday. He will take our people to the top of Mauna Kea. We go up there for geological reasons as well as astronomical. There we see features that have been glaciated, and moraines. My doctor won't let me go up there, so we haven't generally been going to the top, but Jim and Lee will take them up there, probably next year.

ERWIN: And that will be a first, as part of your trip?

SHARP: With the group, yes. We've never been to the top of Mauna Kea before. We see it a lot of the time. It frequently has snow on it in March when we're there. Mauna Loa is just 100 feet lower—almost as high, but you'd never think so looking at it. It's a great, big, curved shield. [Mauna Kea is] more advanced in its evolution.

Pahoehoe is a trip I wish somebody had [taken me on] when I was a young student—not that I would have become a volcanologist, but it would have sparked an interest. For example, in 1959 I would probably have tried to get over to see the Kilauea Iki eruptions, which were probably the most spectacular on record, because the lava was being shot out sideways in an arc out over the Kilauea Iki crater. Many people say to me, “Well, I saw the 1959 Kilauea Iki eruption, so I don't have to go to any other. I've seen the best.” Of course, we didn't have that privilege. We do go into that area and see the results. We do a lot of other different things. What we do depends a lot on the weather. We always have a top priority of getting to the active lava, if possible. We do that at any time.

We travel in four to five vans. When we have sixteen people, we have four vans; when we have twenty, we have five. We have a nice relationship with Budget. Most car rental companies won't take the backseat out of their vans, so it's a seven-passenger car and we don't have storage for the equipment. Thanks to Keilani Curnan, one of the managers of Budget in Hawaii, we get vans with the backseat out. Keilani would fracture all kinds of rules and regulations. We've been renting from her—first for alumni and then for these trips—for years. I would sometimes have trouble with the local field manager, who would say, “No, we won't take the seats out.” I'd say, “Look, here's a letter from Keilani Curnan that says that you will take them out. If you won't take them out, I'm going to get on the phone.” We had very nice relationships with the people after that. The Hawaiians are delightful people—very generous and bright. I stayed on the island for a day or two after the trips to store equipment and relax for a day. I loved the trips, but when they were over I always heaved a big sigh of relief, saying, “Well, nobody got hurt.” The students come back to Pasadena just bubbling. One can learn a tremendous amount by seeing something in action.

ERWIN: Have you actually made anyone into a volcanologist that you know of yet?

SHARP: It's hard for me to say, because people don't always get classified that distinctly. I'm sure that all of them now have an abiding interest in volcanology that they never had before. Volcanology was kind of a side issue in geology until the space exploration program got under way. Then you had the lunar surfaces and Mars in sight, and suddenly volcanology grew again in size and interest to a whole lot of people who had never given a thought to it before. That doesn't mean they became volcanologists, but they're sensitive to the field. Certainly Project Pahoehoe does that. It creates, I'd say, a life-long interest in volcanological happenings.

ERWIN: It sounds like a fabulous project.

SHARP: It's one of the best things I ever did. It will break my heart if it has to stop. And Ed Stolper says, “I'm not going to let it stop.”

ERWIN: Well, good for him.

SHARP: I'm trying to do my best, but I got slowed down. Don't ever have viral pneumonia. It just washes you out. Bacterial pneumonia can be cured with antibiotics, but with viral pneumonia you just have to wear it out. It affects you energy-wise, endurance-wise, strength-wise. I lost a lot of weight and endurance. It affects your mental processes. A nurse said, "You aren't getting enough oxygen in your brain." It's that simple.

Anyhow, that's Project Pahoehoe. The current situation is I'm trying to raise a half-million dollars. I know that I could get several alumni who would make a pool; if I get several pools going, I think we'll make our goal eventually. Most of my prospects are already committed in many ways to charitable giving, including right here at Caltech. Some that I would like to have tapped are simply not available; they have heavy commitments already. So it's tough going.

ERWIN: Well, maybe this leads us into the alumni trips. One question to ask about those would be, are these alumni who give to Caltech?

SHARP: Two of the five letters I first sent out were to alumni who had never made a major gift to Caltech, so we'll see. But the alumni trips have never been oriented toward fund-raising. They aim to make the people feel close to Caltech; indeed, they seem to work that way. Our geology division has received two unsolicited grants from participants on alumni trips.

ERWIN: Is your division the only division that runs trips?

SHARP: No, but nobody else does it on a consistent basis, or runs trips of long duration. The alumni trips got under way when Lee Silver and Gene Shoemaker, who was at that time on our staff, were trapped on an airplane at the Dallas-Fort Worth airport. They had a minor mechanical problem, so the company didn't unload the plane, because they thought it could be fixed promptly. I don't know for sure, but they were probably on the ground for an hour and a half. The hostesses were serving free cocktails to keep everybody happy and relaxed. Gene and Lee—both of whom had worked in the Grand Canyon; Shoemaker, particularly, had rafted the canyon a lot—got to talking. At that time, our division had no endowed named professorship, so

they said, “We’ll get one for ourselves. We’ll run raft trips using big commercial rafts operated by a company.” Silver and Shoemaker came back and suggested the plan to Barclay Kamb, our division chairman at the time....He called me and said, “What do you think about the Silver-Shoemaker idea?” I said, “I think that’s great.” I went back to my office and wrote a proposal for “the trip of a lifetime.” Maybe we can’t take you to the moon, but we’ll do the next best thing; we’ll take you through the Grand Canyon with four geologists aboard.

Stan and Ernie Avery signed up immediately and then persuaded friends of theirs, some of whom were already Caltech benefactors, to go. We had some great trustees aboard. In the first year [1976], we made a half-million dollars; that was our most fruitful year. The next year we didn’t do so well. We ran the trip a third time and sort of finessed it. Stan Rawn had been giving money to the institute without designation, building up a good sum over a number of years. We knew this, so we asked him, “How would you like to sponsor the last trip, and bring your friends? You can bring anybody you want.” He bought the last trip and then brought friends and family. So, we got our million dollars.

We have tried to think of other geological trips that could be run that would have the appeal of the Grand Canyon. It isn’t easy. The astronomers could possibly offer a bang-up experience, but their heads are above the clouds. They could do something unusual with both the Palomar and Keck telescopes. They could possibly raise a lot of money for a new astronomy building; however, they don’t seem interested.

In our division, we have thought of things like taking people onto the Canadian Shield, to the oldest rock known anywhere in the world—about 3.95 billion years old. You have to fly in on a little float plane to this locality, but they could get out and hammer out a hunk of the oldest rock themselves and say, “Now this is the oldest preserved hunk of Earth.” It’s probably only close, because the Earth’s surface initially was so pummeled with all the incoming chunks that the initial surface has been totally destroyed. There’s no record of it. The library is burned.

What you need is somebody with fire in their eyes, who is almost fanatical about some particular thing interesting to a nonprofessional audience. The canyon is terrifically appealing. Day after day after day at the bottom of this magnificent gorge, a constantly changing scene—it’s great. We tried to do something similar in Hawaii on a reduced scale. Howard Keck was going to participate, but he withdrew and we never brought it off. It wasn’t on the scale of the Grand Canyon trip, nor as attractive. Credit that to Lee Silver and Gene Shoemaker.

The later alumni trips in geology [started in 1980, and] got under way because Lee Silver then was on the alumni board of directors. They talked about things they could do for the alumni. He said, “Why don’t we run them a field trip? Let’s run it to the Grand Canyon Park.” So they set up a date in late April. I saw an announcement and I said to myself, “Those two guys will never get their calendars together so that both of them will be able to go on that trip. They’re going to come around to me about three weeks before the trip starts and say, ‘Can you substitute for one of us on this trip?’”

Begin Tape 1, Side 2

ERWIN: You saw this coming.

SHARP: I saw it coming. I was happy to be involved. I had been in the canyon a lot and I loved it. The idea of going back to the Grand Canyon was great. I’d go any time you gave me the chance. So they came to me, and I said, “OK, I’ll help you. What’s the schedule?”

Phyllis Jelinek was the first executive director of the Alumni Association. She had been a secretary, hired by Jim Black, who had a genius for picking ladies who were very able, handing them a chore, then letting them alone. Phyllis Jelinek could do almost anything she wanted in cooperation with the alumni board in running the Alumni Association. She set up the logistics for the alumni Grand Canyon trip but unfortunately left the scheduling to Gene Shoemaker. Now, Gene Shoemaker was one of the most wonderful guys who ever lived, but he had no respect for timing or organization. He was going to put the alumni on a bus at the Athenaeum early in the morning and drive all the way to the south rim of the Grand Canyon for supper. I looked at that schedule and said, “Look, if you guys want me to participate in this, we’re going to change things. I will not follow that schedule—it’s inhuman! You just don’t do things that way. We’re going to stop and have supper in Williams. There’s a good place to eat there. And then we’ll go on after supper and get to bed by nine o’clock or so. We’re not going to go all the way to the rim before supper.” I got off to a real slow start with Phyllis Jelinek, as she had made the arrangements already.

ERWIN: How did it eventually work out?

SHARP: Phyllis had tremendous respect for full professors—I don't know why, but she did. She was late to the meeting we'd arranged to talk about my participating. She said, "Here were two full professors cowering on the floor, and there was this old guy standing word-whipping them." Carolyn Shoemaker was there, watching....The alumni trip plan was this: Drive to the Grand Canyon, stay overnight, walk down the trail to Phantom Ranch, stay in Phantom Ranch two or three nights—I forget how many—explore the region around there, back up the trail, final dinner, drive home. One day over, one day back, and the rest of the week in the canyon. We had a very nice bunch of people, and the trip went very well.

I have a place in Montana. I call it a cabin, but it's more than just a cabin—though it's not a house. I was spending most summers there by this time. Following the Grand Canyon alumni trip, I got an invitation from a couple who planned a summer party for the Grand Canyon alumni. I wasn't going to come down from Montana for a party, but I wrote a letter to Phyllis Jelinek saying that she could take the letter, if she wanted to, and read it to the people there. In it I said, "You know, we did it wrong. Almost anything is anticlimactic after the Grand Canyon. We should have saved that and run some other trips before we did the canyon, unless you want to go to Hawaii." When I came back—I had moved to Santa Barbara by that time, but I stopped here to eat lunch in the Athenaeum. Suddenly, here was Phyllis Jelinek at my shoulder. She didn't say hello or anything else, she just said, "We want to go to Hawaii!" And I said, "Well, I'm going over there in a couple of weeks to work with some fellows who need geological help and I will look around and see what kind of trip could be put together."

And I did that. We ended up running the Hawaiian trip five different years. We've run an Alaska trip five times, and Yellowstone-Big Horn five times. We have run many different trips, many more than once, usually one or two a year with a different group of people. We always have a trip every year—sometimes two. The alumni trips in the Grand Canyon [are] still going on. We have repeats—like we did in Zion Canyon, Cedar Breaks, and the southern Utah area. We did those on successive weekends in the fall, when the fall colors were great. We sometimes ran the same trip twice in a year. Other times we'd run two different trips in a single year. We've been to Iceland, because we had complaints from people on the East Coast that all our trips were western-oriented.

We ran a trip in Pennsylvania. It was a long weekend, Friday through Sunday, but it went very well. People gathered in Hershey and we got down to Gettysburg. A lot of those people then got interested in going on our other trips. They would cross the continent for that purpose.

ERWIN: Just briefly, what did you look at in Pennsylvania—the local geology?

SHARP: Pennsylvania is geologically a very rich state. In the Appalachians, and the Valley and Ridge Province. The valleys of Pennsylvania are just gorgeous. You've got the Amish and the Mennonites giving them flavor. Concerning the geology of the Gettysburg battlefield, the Union Army did have the advantage topographically, in occupying the high country. Lee didn't want to fight there. Actually, he was headed for the capital of Pennsylvania—Harrisburg, on the Susquehanna River. He figured to cut off the railroad going to Washington. He didn't want to fight in Gettysburg, but he got drawn into a battle there. He lost that battle partly because of the geology. Why is the high country on the Union side? What makes it? How did the Union get it? It's too long a story to relate here.

Elsewhere in Pennsylvania, you've got underground caverns—limestone caverns and wonderful structures of the rocks. The oldest mine in the whole US is the Cornwall mine that supplied iron for George Washington's cannons. That's now a state park, and it's a delightful one. Pennsylvania is a very rich state historically. The rural population of Pennsylvania is greater than the urban population; there aren't many states about which you can say that. I had flown back and forth and back and forth across that country many times and always ached to get down into those beautiful valleys. We ran a nice trip there.

Then we ran a New England trip twice. The geology is different and the fall colors terrific. New England geology is worth attention for the interesting story it tells.

ERWIN: That's where I grew up—in Maine.

SHARP: Maine is great. We were in Vermont and New Hampshire, so we didn't get into Maine. Those trips went very well. Janet Davis and I had explored a trip in North Carolina where you have the Great Smokies [Great Smoky Mountains]. That would have been a good trip, but

something happened in the administration of the Alumni Association. They had a committee that was concerned with trips—the program committee—but they never scheduled the North Carolina trip. Also at about that time our vice president of business administration very abruptly removed Janet Davis from the directorship and substituted Judy Amis. We never did do that North Carolina trip—too bad, it would have been a good trip.

We worked up a trip in the Upper Peninsula of Michigan, in the copper country—that big peninsula that projects far out into Lake Superior. There they have native copper. Copper normally comes as a chemical compound, but there it's native copper, which is most unusual. No refining required, you just melt it and it's there. That area has a great history. We were going to do a fall trip up there, when tree colors are nearly as good as those of New England.

The Midwesterners don't travel well, and the centers of population—Minneapolis, Chicago, Detroit—were peripheral to this Michigan copper area, about 300 to 400 miles from those places. We need close to forty people to make such a trip self-supporting.

ERWIN: They are self-supporting, and they don't aim to make any money? That's not the point?

SHARP: They aren't designed to make or lose money. Not enough people signed up, so we had to abort that trip. Too bad. We had it worked up for the right time of fall. The Upper Peninsula is not quite as good as New England in the fall—New England falls are just beyond comparison. I guess New Hampshire and Vermont are even a little better than Maine, but the mixture of conifers and oaks in Maine is terrific. You get very russet-colored red oak, and the green conifers make wonderful company.

We did two Iceland trips, largely for the benefit of the eastern seaboard people. It's an expensive trip, and it's not much fun getting there, because all the flights that go into Iceland leave New York at about eight o'clock in the evening and arrive in Iceland the next morning around six o'clock. The first day is devoted mainly to recovery.

Our best trip of all is the Yellowstone/Big Horn/Beartooth area. It's a six-day trip. The variety of geology you get is just incomparable. You've got Yellowstone and all the hotspots. We never stayed in the park; we always stayed peripheral to it, for comfort and economy. That's a great trip; we ran it five times and we could probably run it again if we advertised it.

ERWIN: You were obviously closely involved in these trips. Who else participated? Lee Silver?

SHARP: Lee Silver has come in; now Lee is basically taking over. I ran most trips myself. I was the only one aboard. Occasionally I would have somebody else, not necessarily from our faculty. We ran three trips up in the St. Helens area. There I got a fellow named John Elliott Allen, from Portland State University, who knew the Columbia River Gorge like the back of his hand. Usually in Hawaii I had Dan Dzurisin, as mentioned. He was at the Hawaiian Volcano Observatory. One year I had Gordon Eaton, the provost at Texas A&M, aboard to help, because Dan couldn't. This man had once been the chief scientist at the Hawaiian Volcano Observatory.

ERWIN: I see. But he wasn't a Caltech alumnus?

SHARP: Yes he was. When I couldn't get Dzurisin, I started to think of others. There were two good possibilities. There was the director of the United States Geological Survey, a Caltech alumnus named Dallas Peck, and Gordon Eaton. I thought Eaton would do a better job than Peck, but both are top-notch. You don't easily pry them out for just a week. I wrote a long letter to Eaton, and my last sentence was "I look forward to your favorable response, and I expect it." His secretary got the letter, opened it, and before she ever passed it on to Eaton she showed it to the president and various other people in the A&M administration. They ganged up on Eaton and said, "You've got to go." So he came, and he was great.

ERWIN: But when you went by yourself with forty people?

SHARP: I nearly always had help. In Pennsylvania I had a professor from Penn State. So about half the time there was somebody to help me.

ERWIN: How did you manage the forty people?

SHARP: We'd travel by bus, and it would have a loudspeaker. We usually didn't do a lot of long hiking, but we did some, and I had a portable speaker. If we had people who weren't able to do a hike, I'd say, "Don't even try this. It would be better if you could amuse yourself looking for

flowers until we come back.” At the end of the day, if you were the only leader aboard, you’d had it, because you had been answering questions or talking the whole day long.

ERWIN: Well, that’s what I was thinking. Someone was going to be at you the whole time. And you have six days and more of that.

SHARP: Well, yes, you do need help. Lee Silver was on four of the Yellowstone-Beartooth trips and led one without me. He’s also been on all five of the Alaska trips and led one without me. Now he’s running his own trips to the plateau country in Colorado. He’s been running those by himself, without any help. You can do it, but you work hard. Anyhow, the trips have been very well received and successful. The problem on big trips is that they are expensive.

ERWIN: How expensive? Can you give an idea?

SHARP: Well, \$1,600 per person or something like that, for a four- or five-day trip. We did Glacier Park three times, once for the Caltech Associates and twice for the alumni. The Glacier trip was probably around \$1,500 or something like that. On the Icelandic trip, round-trip airfare alone from New York is around \$700. Actually we were servicing roughly the same group of about 200 people. The rapport between those 200 people was incredible. They loved the trips, partly because of the fact that they were yak, yak, yakking to each other and having such a good time. I don’t think there’s any question that the trips have created a lot of goodwill for the institute, and probably have benefited the solicitation program, but we don’t use them to raise funds. We try to bring the alumni into the Caltech family in a major way, and we did Hawaii five times, Yellowstone five, Yosemite twice, Death Valley twice, Zion twice, Iceland twice, Alaska five, Pennsylvania once, Vermont twice—I’ve never really counted up the total number of trips, but there are a lot of them. They started in 1980 and they are still going.

ERWIN: They’ve become an institution.

SHARP: Right. Bill Muehlberger ran a trip for us down in the Big Bend area of Texas. Lee has run trips in Colorado, New Mexico, and multiple times in Borrego Springs, California. Another

type of field trip that's been developed here is what I call the nonacademic staff field trips I ran for the division for a good many years....We started with just a one-day trip around the San Gabriel Mountains and another one-day trip up the Malibu coast. Finally we got to do a two-day trip, and all subsequent trips were for at least two days. I think the first one was in 1973 and we ran them through 1996—twenty-three years. Now we have stopped them, because we were not benefiting the people that I wanted most to benefit, the current institute nonacademic employees. We had a group of people coming on these trips who were largely no longer working for Caltech....

ERWIN: Did the people who went on those trips pay or did the institute?

SHARP: The bus fare was a major cost, and it was paid by Caltech. I nearly always had a small group that camped out and a group that stayed in a motel. For the campers it was a pretty cheap trip, except the meals. The people paid for their own meals and housing.

I've been retired for twenty years. When I retired I phased myself gradually out at Caltech....But I still taught a course after I retired, and I want to talk about that course for a moment. It was a course I set up back when I was on active status. In our department, a high percentage of the students who come here as graduate students have basic training in physics, chemistry, or astronomy. But now they're in the geology division, and we felt they ought to know a little geology. They didn't want to know any geology; they wanted to do their thing in the way they had been doing it. So I set up what I called a traveling field course, in which everybody who came had to be the authority on some subject that was assigned or chosen. We went on weekends—Friday, Saturday, Sunday—over a radius as far east as Nevada. I had nine or ten trips; they'd run in a three-a-year succession. Some students would take the course three times, so they'd get all nine trips. There were a lot of places to go: Death Valley, Owens Valley, Yosemite, the Mojave Desert, the Imperial Valley, the South Coast, the North Coast. I could handle only fifteen students. I tried taking everybody one time, but that was no good. Students had to give talks, and we couldn't get to all of them in three days. So I imposed a fifteen-student limitation. It was a pass-fail course.

ERWIN: Did this course have a name?

SHARP: Geology 136, The Geology of the Southwestern United States. It's still in the catalog. I declared a moratorium for this year—fortunately, because I wouldn't have been able to do it. I always ran this partly through the winter term and partly through the spring term, because there was so much competition for field equipment and transportation. A lot of the competing courses are required. This was not a required course, but even our radio astronomers took it. I did it especially for these people. I'd say, "Look, I know you don't want to take a course in mineralogy, but let me take you out in the field and show you some geology." Well, the word got around, so I had to limit the participants, and I had to have [a system of giving] priority. If one had never [taken such] a course, that was high priority. However, during the last two or three years of the 1990s, in competition with the required courses, I'd start with fifteen people and end up with only about five still registered in the course. I said, "We can't afford to run it this way," so I declared a moratorium for this year, which was just blind luck. It turned out that I couldn't have done it, because of my right leg.

Here I want to talk about the virtues of a small institution. When I retired, an emeritus professor could not teach his or her own course; you could teach, but only in somebody else's course. So I wrote a letter to the provost, Bob Christy. I said, "Bob, here's what I'm going to do." I explained about this special course, which I had built up over the years, and that it would still be in the catalog over the name of two other professors, who weren't going to teach it. I didn't make any bones about it. I continued, "It's a pass-fail course, so I'll take the grade card around to one or the other of these people, have them sign it, and send it in. But I'm going to teach it. If I don't hear from you, I assume that this is OK." So then he wouldn't have to write me a memo telling me to break the rules. I never heard from him, so I taught it for twenty years. To this day, Christy denies ever having gotten that memo.

ERWIN: Of course!

SHARP: Actually, I think, it could have been intercepted by Neal [Cornelius J.] Pings, who was the associate provost at that time. Neal could have decided that Bob doesn't need to see this.

But now the rules have been changed to conform with the laws of the country. Now an emeritus professor can continue to teach his own course.

ERWIN: So you've never stopped teaching?

SHARP: Yes, but I've taught only the one course.

ERWIN: Every year?

SHARP: Yes, until I voluntarily stopped at twenty years.

I was going to tell you what I've been doing since I've retired, besides teaching. I've been writing books that are mostly an attempt to describe geology to lay people. You see, scientists do not generally help people understand their science; they just say, "Give me x amount of dollars, because I'm going to do this, and it's too complicated to explain to you," or something like that.

ERWIN: You're a shining example of someone who has written many books for the public.

SHARP: Maybe. Anyhow, I've been writing books that are designed for lay people. I'm working on my latest book right now.

I also want to comment on Jim Westphal, Peter Goldreich [DuBridge Professor of Astrophysics and Planetary Physics] and guys like that—about the kind of current leadership in the division, which I think is superb. And about biogeology. I'm optimistic about the future of our division and about the future of the institute. We needed David Baltimore [Caltech's president 1997-present] very much. The chairman of the faculty [search] committee [Kip Thorne, Feynman Professor of Theoretical Physics], came and talked to me, and I thought he was going to solve this matter like you solve problems in physics: You get all the parameters, put them in a formula, turn the crank, and the answer comes out. So when he [was ready to leave] I said, "Let your intuition play a part in your decision. It's very important that you kind of relax all those parameters and let your intuition play its part." When the announcement came about Baltimore, I was really surprised. I didn't think the committee would be that daring. I wrote the chairman a postcard with one word on it—"Bravo!"

I'm optimistic. I think Baltimore is still operating at a gentle throttle, finding his way. He hasn't really opened up yet, but he will, I think, sooner or later. I haven't met him; I will eventually. When I do, I'm going to say, "David, Caltech, you know, had over forty years of superb leadership and direction and inspiration from Millikan and DuBridge. They were great. It's time we had another great president. I believe his name will be David Baltimore." [Tape ends]

ROBERT P. SHARP**SESSION 2****October 12, 1998****Begin Tape 2, Side 1**

SHARP: When Millikan turned to somebody for advice on setting up a geology division, you would have thought he would have turned to his former colleagues at Chicago. He didn't. He turned to John Campbell Merriam, who was a vertebrate paleontologist formerly from the University of California.

ERWIN: How do you think he knew Merriam?

SHARP: During World War I, John Campbell Merriam had somehow gotten himself to Washington with a group of physicists including Millikan, who were dealing with the problem of the German submarines sinking Allied shipping. Now, what Merriam could bring to that outfit I don't know, except political acumen, I think. He, apparently voluntarily—now, I don't know this—went to Washington trying to find where he could be useful in the war effort. Somehow he got together with these people. I don't think he really knew Washington that well, but he was a man who could have made his way in Washington very easily, and that may have been what they wanted him for.

ERWIN: Was he a Californian or a Westerner?

SHARP: I don't know what John Campbell Merriam's antecedents were. He was at Berkeley for a long time and was very well known, famous, and a very dominant character, who did not get along with Andy Lawson [Andrew C. Lawson], who headed up the geology group. To this day there is a little wariness between paleontology and geology; they're something of two separate operations, I think, even now. But during the time when Merriam and Lawson were in charge they just didn't get along. Both were powerful men.

Millikan knew John Campbell Merriam from their wartime association. Instead of turning to the people at Chicago, he turned to Merriam for advice. I can only guess as to why

Millikan wanted to have a geology department. One reason he probably didn't go to Chicago was that he didn't have anything to do with the geologists at Chicago and didn't want to have anything to do with them now. He was more comfortable with John Campbell Merriam.

Now, Merriam was very glad to advise him and proposed that he hire two of his protégés at Berkeley, [John P.] Buwalda and [Chester] Stock. Stock was a vertebrate paleontologist. Buwalda was primarily a field geologist and a structural geologist. He was somebody who could go between John Campbell Merriam and Andy Lawson; as a matter of fact, I always felt, in my relationship with Buwalda, that he was more of a Lawson man than a Merriam man.

So John Campbell Merriam suggested the two of them to Millikan, and he hired both of them, but with the understanding, apparently, and probably on Merriam's recommendation, that Buwalda be the head of the department. That was the right decision. Stock would not have been a very good department chairman at that stage. So Buwalda arrived in Pasadena with a blueprint of the Berkeley department in mind. He got his PhD there and came back as a young professor on their staff not very long after his graduation. He set things up here very much in the image of Berkeley, with even greater emphasis on seismology, which of course was the right thing to do in Southern California. He brought the idea from Berkeley. Berkeley had seismology, and he thought we ought to have seismology, too, because we've got just as many, perhaps even more, earthquakes.

ERWIN: Of course, Pasadena had a seismology station at that time.

SHARP: That was created by the Carnegie Institution. Harry O. Wood of their staff had already made a start. To begin with, the Carnegie was into seismology more than Caltech was. Eventually—I don't quite know how he managed to do it—Buwalda gently and slowly phased out the Carnegie Institution. One way he did it was to bring [Beno] Gutenberg from Germany, an outstanding world seismologist whose reputation was way above that of people here.

ERWIN: You must have been here when Gutenberg came [1930].

SHARP: It was just about the same time.

ERWIN: But you would have been an undergrad.

SHARP: I took sophomore geology, and my remembrance is that Gutenberg lectured once to us in sophomore geology. I'm not positive. By the time I was a senior, I knew Gutenberg modestly.

ERWIN: What was Gutenberg like as a teacher and a lecturer? I don't think we have many people who have been able to tell us that.

SHARP: As a scientist Gutenberg was superb. Of the people in our geology department at that time, Gutenberg was the most outstanding, nationally and internationally. He was a small man, very polite. It was always a joke that you couldn't get through a door after Gutenberg; you had to go first. He was extremely polite.

ERWIN: This is a European trait?

SHARP: No, a European professor usually doesn't defer to students. Just the reverse.

ERWIN: But Gutenberg did?

SHARP: Oh, yes! It didn't matter who you were. you went through that door before Gutenberg. His wife was a very gracious lady. She was also small.

Gutenberg taught a course but—like all of the seismologists, in particular [Hugo] Benioff—he didn't take his teaching too seriously. I would meet him in the hallway during an exam period and he'd say, "I've got all my exams corrected." "How could you possibly do that? You only gave the examination this morning, and here it is noon and you've got them all corrected." Gutenberg gave true-or-false exams, which is not a very good way to teach in an advanced course like his. The lecture he gave in the sophomore physical geology course was really mostly over the tops of the heads of all of us. As I got older and learned more, then I began to understand what he had been talking about. It was important, but at the time and in the way he presented the subject, it was difficult to understand. So the seismology staff—and

especially Benioff, who just refused to do any teaching—contributed little to the educational program. Benioff regarded himself as solely a research professor, a species we didn't have. The Gutenbergs were socially part of the department and entertained at their house very nicely.

If you were doing something with Gutenberg, he would cut it short when he felt that you understood. Somehow he'd make it clear that he had something else to do, and he would go do it. He'd say, "Well, I guess we don't have anything more to talk about." There's no question, as I've already said, that the reputation of the Caltech geology department rested nationally, and to some degree internationally, on the Seismology Laboratory. Buwalda didn't publish. Stock did; I'll come back to Stock. But it wasn't a distinguished staff, and it wasn't a distinguished department.

ERWIN: When you say that it was built along the lines of the department at Berkeley, did that make it any different from any other university, particularly in this country, at that time?

SHARP: No, I'd say that the Berkeley department was pretty representative of the whole bunch, although the emphasis on seismology probably gave it some distinction, and they had their own publication series. That was not unique at that time, though it wasn't general.

ERWIN: Buwalda wanted to establish that here too, didn't he?

SHARP: Buwalda certainly wanted his own publication media, although Buwalda himself never published very much. He also set up a museum. What is now our division office was once a big room that was a museum. That was one of the first things I changed. I said, "We're not in the museum business."

ERWIN: Now, was that in the Arms building [Charles Arms Laboratory of the Geological Sciences]?

SHARP: Yes. You'd come in the north door and walk straight ahead through big iron doors, where it was all museum.

ERWIN: What was the museum designed for? Was it designed to lure the public in?

SHARP: [Laughter] I don't know that anybody ever asked the question. If you were going to be a real geology department, you had to have a museum, because that's where you'd exhibit specimens, and it would be good for the students. It was, like so many things, a custom, so to speak. You did it because it was customary to do it, without asking, "Do we really want to do this?" I don't know whether Buwalda ever asked himself questions like that. What he ended up with was very much like the Berkeley department in terms of seismology, field geology, a publication series, and a museum....

It's changed a lot now. Geology gets a lot more respect among physicists than it did back in those days. Physics was riding high and handsome, and they were arrogant. Now it's biology that's the top science. Anyhow, our own geophysicists really introduced physics into our department. I sat down one day with our faculty of about thirty members and made a hasty survey identifying at least ten whose initial and primary science training was in physics. Not all physicists fit well into a geology department, but when you get a physicist who fits, that's gold in the bank. Physicists bring so much to the field of geology; a lot of our faculty are geophysicists.

Andy Lawson at Berkeley was a very strong department chairman and tended, I think, to override contrary opinions without making a fuss about it. He made independent decisions without a lot of consultation. I think Buwalda modeled himself somewhat on Lawson. We lost a very good man early in the game—Wendell Woodring, a paleontologist who went on to a notable career. He was on the faculty before I got here. He was a good friend of Chester Stock's. I asked Chester one day about Wendell Woodring. I said, "I thought he was one of the best invertebrate paleontologists in the whole country. How come he didn't stay?" Stock said, "He came to me and said, 'I can't stand Old Iron Face any more. I'm leaving.'" He didn't feel that he was consulted on matters in his field. We lost a good man there. My remembrance as a student is that Buwalda was the dominant person in the department, in terms of operations. I don't know how much he consulted with anybody, because as a student you don't know these kinds of things.

ERWIN: Was he out in the field?

SHARP: Only on student trips and consulting jobs. He was good in the field. We always had a field trip during the spring vacation. Everybody in the department—all the students—were expected to go. You didn't get any credit for it, but they were great. As a matter of fact, Buwalda led many good trips. One of the things I got the most out of as an undergraduate here were the spring field trips and the other trips that Buwalda led. He was good at it.

ERWIN: He was chairman of the division for a long time.

SHARP: He was chairman for over twenty years. He taught the elementary physical geology course and courses in structural geology and engineering geology. I regarded him as a good teacher. He tried to make you think about things, as well as just listen to what he thought about them. When I got away from Caltech and found out how the rest of the country viewed it, I realized that I had an exaggerated opinion of how good Buwalda really was. He was not known in the rest of the country.

ERWIN: That was largely, I suppose, because he didn't publish.

SHARP: Yes. Or give presentations at national meetings.

ERWIN: He didn't attend meetings?

SHARP: He gave short papers at local meetings but not at the big annual gatherings. Early on, he worked for the United States Geological Survey for at least a year in Washington, and I think he had an appointment as an instructor at Yale for a year or two. I'm hazy on that. He'd been there, but not for very long. He went to the University of Washington as an undergraduate [Buwalda matriculated at the University of Washington but spent his three last undergraduate years and got his degree at the University of California, Berkeley.—Ed.] He was a big, husky man, and rowed on the [University of] Washington crew, which was one of the outstanding national crews at the time. He was totally western in his orientation. He was a deliberate sort of person. When he talked, it was deliberate. He was careful with what he said. I think I rated

him, when I was here, much more highly than he deserved, but I didn't know any better. One of the best things that I ever did was to go from Caltech to Harvard. Take a map of the United States—it's hard to get two institutions that are geographically farther apart than Harvard and Caltech. Buwalda had four children. He had a tall wife, who was ambitious and politically oriented [Imra Wann Buwalda]. She was active in California and national politics.

ERWIN: The Archives has some of her papers as well. She seems to have made her mark in some way.

SHARP: Do you have a copy of her book [a history of Caltech]? It never got published. It basically wasn't publishable.

ERWIN: I understand she was a policewoman?

SHARP: Yes, she was very interested in the penal system, particularly the women's penal set-up. She was a recognized, influential person in California politics. She talked about "Pretty Boy Reagan." [Laughter] The Buwaldas lived in a rather nice stucco house on the eastern part of San Pasqual Street. Imra Buwalda was never around the department much until John Buwalda died and she got to working on her book. The children we didn't see very much of, either. I never remember being in the Buwalda house as a student. He didn't hold seminars there; all his seminars were on the campus. The family didn't mix in much.

ERWIN: You never had a sense that he was unhappy here or anything like that?

SHARP: No, I don't think John Buwalda was unhappy here at all. He was riding the crest of a wave. He was the head man. There was no question but that he was top dog in some off-campus endeavors, such as Yosemite Park and the Colorado River Aqueduct.

ERWIN: And getting our division going.

SHARP: Yes, right. And by that time, he was deeply into consulting activities that addressed problems in Southern California.

ERWIN: Millikan supported that?

SHARP: I don't know whether Millikan supported Buwalda specifically or not. There definitely was a time when engineering was dominant at Caltech. I think I got here in a transition period.

ERWIN: Yes, I would have thought so. Only engineering dominated in the twenties—not much longer than that.

SHARP: Anyway, the engineers regarded consulting as their god-given right.

ERWIN: That's true.

SHARP: The story is—and it's a story that probably has no real substance—that Buwalda got into consulting because his big family needed more money and Mrs. Buwalda said, "Go out and earn more money," and he did what she told him to do. I don't know whether that's right or not. That's the kind of thing that somebody can make up. Buwalda was on the advisory board for Yosemite Valley. He was very proud of that relationship and kept telling us about experiences he had with regard to building roads in Yosemite or doing this or doing that. He regarded that as a plum, obviously. I think his motivation was sincere. He wanted to preserve it in as near its pristine condition as possible and still make it available to the public. If they built a road, they consulted with him to make it as inconspicuous as possible and still a sound highway. He got very heavily into what we now call engineering geology. He taught a course in engineering geology. The field was not as well developed as it is now. There weren't many engineering geologists at that time, and Buwalda was basically an engineering geologist in many ways.

ERWIN: What do they do?

SHARP: They deal with the impact that geological relationships have on engineering activities.

ERWIN: Buildings?

SHARP: Dams, aqueducts, and that sort of thing. He worked, along with [Frederic L.] Ransome on the metropolitan water aqueduct: “You’re crossing a major fault here; you’ve got to worry about that.” They did a lot of work on such problems. The Owens Valley aqueduct was already in, but the metropolitan wasn’t. Buwalda and Ransome both worked on that.

ERWIN: Those would have been big public works projects?

SHARP: Big public works projects indeed! Buwalda did a lot of work for the Pasadena water department on the geology of Pasadena, which was never published. But I have, or had, a copy of Buwalda’s report, which he gave me at one time. It’s a really good analysis of the groundwater basins in the Pasadena area and how they were controlled by faults. It’s a useful document.

ERWIN: So there’s no question that he was really competent?

SHARP: No. His time and effort, aside from his teaching and administration, was all in applying geological knowledge to practical problems. There’s no question about that. And he also paid attention to administration. As a young man, he had written a couple of reasonably good papers. A lot of his engineering geology work, of course, was, I would expect, confidential to the sponsor. But water supply, dams, aqueducts, highways, bridge foundations, and almost anything like that would come under public domain.

ERWIN: So you’ve been gone from Caltech for only about ten or twelve years.

SHARP: I think I was gone twelve years, all told. I stayed one year as a graduate student [1934-1935]. I didn’t really want to do that, but Caltech was not well known, and we had a grading system based on numbers—2, 3, 4—that nobody could understand, although it was the same

thing, practically, as an A, B, C, D. As I said, the staff wasn't distinguished. I applied to several colleges, mostly in the East—Princeton, Harvard, Yale.

Here is a little story. I went to our dean of students, [Frederic W.] Hinrichs, who was a West Point alumnus and a very straightforward man, and asked him for a letter of recommendation. He knew me fairly well. He called his secretary in and dictated that letter right in front of me. The last sentence was "And this boy was captain of our football team." People told me subsequently at Harvard that, to them, "this boy" had to be a great big, dumb oaf and they didn't want him. And that, I think, helped sink me the first year I applied for graduate studies elsewhere.

ERWIN: The reference to the football team?

SHARP: Yes. One person told me—at Harvard at least—that the comment sank me the first year. It didn't sink me the second year, because they didn't have that letter before them; I got other letters the second year. So I spent one year as a graduate student at Caltech; I really didn't intend to or want to do that, but this was the one place that provided significant support. We didn't get any money, but we were housed in the Athenaeum and fed there, and we didn't have to pay any tuition. When I went out on my field projects from Caltech, I'd go to the Athenaeum kitchen and ask for a half-pound of bacon, a half-dozen eggs and some bread and fruit. So although we didn't get to see any money, we were cared for in style. The other students were a great bunch of guys: Willy Fowler, [Simon] Ramo, [Dean] Wooldridge. As [graduate] students living in the Athenaeum, we'd eat together, but also with interesting visitors. It was a very good environment.

But then, the next year, I got a splendid offer from Northwestern University. I didn't want to go to Northwestern University. Harvard gave me only a tuition scholarship, which I guess was about the lowest of all, but I decided to go to Harvard anyway, and I'm glad I did. But then I had to make my way there. The nicest thing at Harvard was an Austin graduate teaching fellowship. My first-year roommate, from Washington University in St. Louis, had an Austin teaching fellowship, which was a nice deal. I kept wondering, how did he get an Austin teaching fellowship, when all I could get was a tuition scholarship? I figured I was better trained and just as smart as he was. I ultimately learned that old school ties did it. There was a

professor at Washington University who was highly admired at Harvard, and nobody out here at Caltech was highly regarded by Harvard except possibly Ian Campbell. But after two years at Harvard, I had a top fellowship.

ERWIN: You've talked about this elsewhere. I guess you had to be in the army for a while. And then you went to the Midwest.

SHARP: Well, the first job I could get after graduating was at the University of Illinois...and I was there for five years. Then I took a leave of absence to go into the Army Air Forces, as it was called at that time....My outfit was stationed for three months at the University of Minnesota....I got acquainted with the people at the University of Minnesota in geology at that time. Their geomorphologist—someone interested in surface processes—died of meningitis, and they offered me the job while I was still in the army. Well, I preferred being at Minnesota more than at Illinois, so I resigned my leave of absence at Illinois and went to Minnesota when the war was over.....Suddenly, both Stanford and Caltech out of the blue offered me a job....[Lee A.] DuBridge had just come to Caltech [as president] the year before [1946] and was doing great things here. He moved in very rapidly and took the faculty from a nine-month to a twelve-month salary scale, for example.

ERWIN: How did you know about this? You had enough contacts that you knew what was going on at Caltech?

SHARP: How I knew some particular thing I don't remember, but I was impressed. He wiped out meteorology, which he had to do because Irving Krick was operating a business in meteorology out of the Caltech campus, and Caltech couldn't permit that and still have a tax exemption status. He didn't throw out all the meteorologists, but he told them to start looking for other jobs; when they found one, they would leave. So he wiped out meteorology. But he later on would have liked to re-establish it. At one time he asked me, "Would you people like to get back into meteorology?" I demurred and said that I thought we had other things to do that were more important. We got into planetary science, because both DuBridge and Bob Bacher, who by that time was provost, sent up a smoke signal saying, "Our astronomers are interested in the far-out

things, like galaxies and black holes, and meanwhile they're ignoring the solar system. Would you people be interested in something within the solar system, let's say planetary science?" He didn't say, "Do it." He said, "Maybe we can help you." He didn't promise me anything. But it was a signal. And so on the basis of that, we got started in planetary science, which is now one of our strongest arms.

ERWIN: Well, backing up a little bit to when you came back to Caltech as a faculty member. That was 1947. Was Stock chairman of the geology division?

SHARP: Stock was chairman, but only within the year.

ERWIN: You had of course known Stock before.

SHARP: Yes. I knew Chester as an undergraduate, because he gave us a lecture in elementary geology. Then in my senior year here I had a course in historical geology for which he was responsible, but he didn't do much of the teaching. It wasn't a very good course. I knew him a little bit at that time. Then when I came back I knew him better [laughter] than I had before, for a curious reason. One summer my wife and I were traveling back to Illinois across Wyoming. We ran into Chester Stock and his [second] wife in a Wyoming town. at that time. We'll come back and talk about his wife later. He had run out of funds and wanted to know if he could borrow \$20.

ERWIN: Do you mean literally? He didn't even have anything in his pocket? You just met him on the road?

SHARP: [Laughter] It was in a town—in a service station or a motel or restaurant, and we recognized each other. Then with embarrassment he asked me if I had enough money to loan him \$20. Of course, I did.

And before I came here as a professor, there was considerable correspondence back and forth between us. When I was at Minnesota I remember him saying in a letter, "If you can get your ear muffs off, I want to talk to you about the possibility of coming out here."

As a young professor and scientist, Stock was very intent on his professional work, almost to the exclusion of everything else. He wanted to make a national reputation. He didn't lecture well nor did he teach well. When I first came to Caltech, a major tragedy in his life occurred: His first wife died—they had two children, I believe. That was a terrible shock to him. He later told me, "I used to wander the streets of Pasadena wondering what will happen to me," while he should have been wondering what was going to happen to his kids. But no, it was "What's going to happen to me?" Not too long after she died, within a year or two, he married a much younger girl, who worked in the athletic department, in an office that was in the basement of Throop Hall. She raised the children. I'm pretty hazy about this. She and Chester eventually started a child of their own, but one of the other Stock children had a childhood disease and the second Mrs. Stock got it and aborted the fetus. That made things complicated for Chester.

As he got older, he became recognized as an outstanding vertebrate paleontologist. Nowadays there aren't very many, so the competition isn't very great. But he was good—no question about it. He got elected to the National Academy of Sciences, and I think he was once president of the Geological Society of America. The bigwigs took him aboard, so to speak. As a result, Chester changed quite a lot. He had a good sense of humor, and it came out as his confidence grew. When I [joined the Caltech faculty], our relationship was very cordial. Soon, however, Chester died [1950], after a cerebral hemorrhage or some cerebral stroke. Once, when I had been here only a couple of years, he came into my office and said, "What are you working on?" I told him. He said, "Work hard on it and finish it up. You don't have too much time." I didn't know what he meant. He knew he was going to die and I was most likely to succeed him as division chairman.

ERWIN: You're quite certain of this?

SHARP: I think he must have been [thinking] that I was the most likely successor and it was going to cut into my time. He never explained; he just said, "You don't have a lot of time. Work hard and get your work out."

ERWIN: The implication is that he must have had some warning.

SHARP: Yes, I think maybe the doctors told him that this was incurable and that it was going to get him sooner or later. He died in his sleep, as I recall.

ERWIN: How old was he?

SHARP: I'd say he was in his sixties, but he wasn't way up there [Chester Stock was fifty-eight at the time of his death—Ed.]. He was a very pleasant person, jovial and relaxed in his later years. Before that he was too intense. He was so focused on his work. Chester did two really monumental studies. One was on the Rancho La Brea fossils—an incredibly rich thing to work with, and he did that very well. A second was the Sespe Formation. Caltech used to own that collection. The Sespe is a formation about 7,000 feet thick of land-laid deposits in the midst of some 60,000 feet of marine sedimentary beds that occupy the Los Angeles and Ventura basins. It's an anomaly. But it had vertebrate fossils in it. Chester tended to focus on big fossils, not rodents, chipmunks, or anything. Big—horses, ground sloths. The Sespe had a lot of big fossils—like hippopotamuses and similar animals. He made himself *the* expert on the Sespe Formation, and he did a good job.

Those were the two big things he worked on. He worked on other faunas too, but he focused on those particularly, and the work was monumental. He published his papers, unlike Buwalda. Actually, the Carnegie Institution published a lot of them. He almost had, in a sense, a private organ for publication that many other people didn't have, because John Campbell Merriam, who controlled the purse strings at the Carnegie Institution in Washington, had supported him.

I don't know if I can tell you any more about Chester Stock. I was very fond of Chester [when I was] a faculty member. As a student, I felt that he was not much interested in education. It was the wrong time of life for him; his personal life had just gone to pot.

There's no question that as he got recognition, he felt he had it made. Outstanding figures in geology began almost patronizing him, you might say.

ERWIN: Caltech has some portion of his papers, but not by any means all of them. I think a lot of them are at the Page Museum. [Tape ends]

Begin Tape 2, Side 2

ERWIN: Did you ever go to the Rancho La Brea or the Sespe site and look at what was going on there? Did you see the digging?

SHARP: Stock took us once, when I was an undergraduate or graduate. As a graduate student, I took a course in vertebrate paleontology that Chester Stock was supposed to teach, but his teaching assistant taught almost a hundred percent of it. Stock would come in once in a while. He did take us to Rancho La Brea and described and pointed out some special things. I know I was over there with Stock; whether it was as a graduate student or as an undergraduate I don't remember.

ERWIN: Did you actually get down in the ground and dig things out?

SHARP: No. We looked at some of the fossil pits, but we didn't do any digging.

ERWIN: Well, I've seen somewhere—perhaps this was at the Hancock Foundation down at USC—pictures of the Rancho La Brea dig. I know there was a lot of volunteer work done there. In fact, one gets the impression that people were just pulling bones out of the ground any old way and sort of dropping them in heaps. Perhaps I'm under a misconception, but in any case, how was the digging done? Would it have been very different from the way people dig up bones today? I mean, you have to worry about whether you're dislocating something.

SHARP: Well, I think today they are much more careful, partly because of the archaeologists, who save everything. The San Bernardino Museum excavations [at Calico, California,] are striking. I don't know whether you've ever been to any of them or not. If somebody is working there as a volunteer, they have a square yard of ground, and they're responsible for everything that comes out of that square yard. Every bone or trace of bone or artifact is separated and classified. They are very careful. They've got this deep shaft that they've dug down about thirty or forty feet. In profile it looks like a miniature skyscraper, because different people are working

at different [levels]. I think that was never done at Rancho La Brea; I think you're probably right that a considerable amount of bones was wasted, but I had no knowledge of that.

ERWIN: In some sense, it wouldn't matter so much?

SHARP: It wouldn't matter so much because there was so much fossil material. But at Calico, in the desert, everything mattered. The archaeologists are now coming around slowly to the idea that most geologists have always felt anyway—that man has been in North America considerably longer than most archaeologists think. They are terribly conservative. But that's a separate subject. Chester was not into archaeology; that's a different business.

ERWIN: Was he out in the field a lot himself?

SHARP: When he was young, certainly. He did his PhD work in the John Day fossil beds in Oregon. From there comes one interesting story. This is a dry, desert kind of country, and Chester was wandering back and forth, looking for fossil remains. He had a little chant he chanted repeatedly: “Dear Lord, please grant your servant just one little bone, just one little chip, just one little fragment. I'd be ever so grateful if you would....”

As I say, I think Chester always had a sense of humor. It didn't really come out full force until he relaxed and he could say, “I've got it made and now I can afford to enjoy things.” Chester's devotion to his first wife, whom I never knew—she died before I got to know Chester—I think must have been very deep and very sincere. His relationship with his second wife was probably much more tenuous. I'm not surprised, because I don't think his second wife had much in common with Chester.

ERWIN: We left Chester praying for a bone up at the John Day fossil beds. But as a young man, you were saying, he was very much in the field?

SHARP: Oh yes. He collected in the field. This was before he got to be a professor at Caltech.

ERWIN: We have, in his collection here, field notebooks. And you know there has been discussion about the field notebooks and whether they belong with the bones or not. The fact is the field notebooks we have are all from his early period. They go up to 1920 only. What I'm asking is, did he keep field notebooks, do you think, after he came to Caltech?

SHARP: On that I haven't the faintest idea. I don't think he spent a lot of time later in the field. You see, now he could afford professional collectors. He had—I wouldn't say a crew—but he had experienced people who collected for him.

ERWIN: So that's how it worked? He sent people out into the field?

SHARP: Yes. He directed the work of collecting and probably didn't do much himself. When he was a graduate student at Berkeley, he was doing all his own fieldwork and all of his own collecting, even his own preparations. But once he got financial support and could hire people to do that type of thing, he directed, identified, and published the results.

ERWIN: And he was comfortable doing that?

SHARP: Of course, it was normal in that profession.

ERWIN: Who was Eustace Furlong? He was connected with Stock.

SHARP: That's right. In his later years, Eustace Furlong was Chester Stock's righthand man. He was the principal field collector. The other person who was very important was Bill [William J. P.] Otto. You've seen the *Smilodon*—the saber-toothed tiger over in [the geology division]? Sitting alongside that gigantic skeleton is this wooden *Smilodon* that was sculptured by Bill Otto, who was basically a frustrated sculptor. He's still alive, and served for years as Stock's principal preparator. He's about ninety-four now and lives over in New Mexico. Normally I would have been able to give you an address for Bill, except about three weeks ago someone stole a valise out of the car I was driving which had my address book in it, among a lot of other things. It's like suddenly not having a knife or a spoon to eat with. I'm slowly building it up again. The

only virtue is that you get rid of a lot of phone numbers you didn't need. I've lost Bill Otto's, but I can recover that. I have a source, I think.

ERWIN: Well, that's amazing. He's been around for a long time. Did he do the preparation of the fossils?

SHARP: He did the preparation. He did sculptures too, so he knew how they ought to go together. He was very careful. Then when Chester died, we took Bill onto our division staff as a handyman to do any kind of work. He was Teutonic in his outlook, but he had spent time in South America. He was always drinking maté.

ERWIN: Oh, I don't even know what that is.

SHARP: Well, it's like tea—hot water and dried leaves. I have contact with Bill once in a while, not very often, though.

ERWIN: The things that were collected by Furlong and prepared by Bill Otto—these were not a part of the museum?

SHARP: No, they mostly weren't museum items; they were science collections. That was what the Los Angeles Natural History Museum bought.

ERWIN: Were they collected using the special funds that Chester Stock had?

SHARP: Otto may have had some support from the Carnegie Institution. I don't know that. I wouldn't be surprised but that he did have.

ERWIN: So these collections started from the time that Otto came?

SHARP: I doubt that early. Preparators not known to me may have had an earlier hand in them.

ERWIN: And when they were sold, the item number was about 55,000 specimens.

SHARP: I don't know that. We got only about \$100,000 for it. I remember that's how we started the construction of geochemical facilities: a curious switch—we went from vertebrate paleontology to geochemistry. We had to drill holes in concrete floors; we had to convert a building that had never had a chemistry laboratory or anything in it into a building that has a number of chemistry laboratories, and that involved drilling holes in concrete floors and walls and everything else for years. And a lot of the money went to that purpose.

ERWIN: Whose idea was it finally to sell Chester Stock's vertebrate fossils?

SHARP: I think it was the Los Angeles County Museum that wanted to buy them. I was division chairman at that time. We had spent about seven years looking for somebody to succeed Stock. That had not been my choice, but I had to placate Heinz Lowenstam, who had come from Chicago. Harrison Brown, whose name you must know, had written two unauthorized letters to Heinz Lowenstam promising him the moon, practically, to get him to come here.

ERWIN: To be your paleontologist? Is that essentially what it was?

SHARP: Paleoecologist.

ERWIN: I know he did have that special title—ecologist. But in a sense, he would replace Chester Stock. Is that what you're saying?

SHARP: No, Lowenstam did not replace Stock. We gave up vertebrate paleontology. Stock was not replaced. We had had invertebrate paleontologists here, going back to Wendell Woodring, who would have been great, but Buwalda turned him off after hiring him. We'd had two other younger people—Frank Stehli and David M. Raup, both of whom left of their own volition. They were invertebrate paleontologists, and we had wanted to replace the invertebrate paleontologists. Instead, we got Heinz Lowenstam, which was great. He was in paleoecology and that suited us well. It's a different way of getting at paleontology.

Stock was always by himself. When Stock died, we made an honest effort to find somebody else in vertebrate paleontology. I think it's just as well we didn't succeed, because we then got into geochemistry instead, which has been a very successful endeavor for us.

The Los Angeles County Museum realized that we weren't going to find a vertebrate paleontologist. Vertebrate paleontologists throughout the country used to come and stand in front of me and curse me from top to bottom. There were so few centers for vertebrate paleontology, and I was wiping out one of them. Oh, boy! Some of those people had been my good friends, up to that point. But I thought it was the thing to do. I was not solely responsible, but I was a lightning rod for them to strike at.

ERWIN: You must have had some support from your division to do this.

SHARP: Yes, of course. Seldom does any division chairman do something single-handed.

We made an honest effort for seven years to try to find a vertebrate paleontologist. Heinz Lowenstam was the principal one who kept beating on me that I was not doing things the way he wanted. I finally said, "We've spent seven years futilely. We're never going to find the right person. We can take the money that the museum is now offering us." It is clear that Caltech is not a good place for the field; even biologists don't give a hoot for vertebrate paleontology. I used to say to George Beadle, who was chairman of the biology division, "George, I'm going to get myself a jackrabbit. I'm going to grab him by the ears and I'm going to go around in your department and shove him into the faces of all your professors and say, 'Now what is this?' and they won't know." He said, "I don't want them to know. I want them to know modern molecular biology."

ERWIN: Oh, how funny!

SHARP: Well, they were doing what they should be doing. They were moving into molecular biology, which is where they belonged. It's where they should be. Caltech was not really a good place for Chester Stock to have come to. The Southern California location was fine, but in terms of colleagues and people to interface with, no.

ERWIN: He certainly had strong ties with the Natural History Museum.

SHARP: Yes, indeed. They had vertebrate paleontologists over there.

ERWIN: My impression was that he spent a good portion of his time there, and with their fossil collections.

SHARP: Yes, that's where he had people he could talk to who understood. That's exactly right. That is not really Caltech's area, you see. He was a loner. He was respected on campus, and liked by a few people that knew him well enough to understand what kind of a guy he was. He was certainly treated richly by Millikan. But if you stood back and said, "What is Caltech doing in vertebrate paleontology? Why do they have a vertebrate paleontologist?"—it was totally foreign to the things we are doing, except perhaps for the fact that we have several field geologists. Stock did attract a few students, and several have become outstanding vertebrate paleontologists, but he didn't have many. One of them was Paul Henshaw. In the early days we had a requirement: You had to have a major and a minor in your PhD work. Paul Henshaw, who majored in vertebrate paleontology and minored in economic geology—mining geology—couldn't get a job in vertebrate paleontology. But he was hired by Homestake Mining Company and later became their president. Other students fascinated by vertebrate paleontology were less fortunate. Jobs were scarce.

ERWIN: So the collection was sold [1957], and then you were able to take this money and build labs. I have looked at the inventory, which isn't much of an inventory, exactly. It doesn't list things bone by bone. But there is a note in the trustee minutes from 1957 saying that there were 55,000 specimens...

SHARP: I haven't the faintest idea.

ERWIN: ...of which 50,000 were unidentified. So only 5,000 were identified. You know, this was the basis of the problem that we subsequently had with the museum. They felt that the records that would have identified those 50,000 specimens were somehow still at Caltech.

SHARP: To the best of my knowledge, there is no clear evidence that the bits and pieces were ever identified. A lot of that material is little slivers of bone that were maybe thought to be the shin bone of a horse or something like that, but they don't really know. So they are unidentified. I don't put much stock in that 50,000 figure. I don't know where it came from.

ERWIN: It certainly could be erroneous, but it is listed that way in the trustee minutes. You know, later the museum came back to Caltech and asked to have documentation for the collection.

SHARP: They wanted field notebooks.

ERWIN: Field notebooks—of which we were never able to find any.

SHARP: That's true, because they probably never existed.

ERWIN: I think that was the theory that eventually evolved.

SHARP: Chester operated independently. As a matter of fact, after he left Berkeley, I bet that Chester never made any real serious field notes.

ERWIN: Do you think someone like Eustace Furlong might have had all sorts of field notes and they have just stayed with him?

SHARP: I doubt that. We're talking about field notes and not about some laboratory data. You know, I was division chairman during the time the sale was consummated. I don't remember any details about the affair except that we couldn't find a trace of books of any kind.

ERWIN: OK. Well, you know, today with the push into—I guess we'll call it geobiology for the moment, although I'm not entirely sure what that means—the current chairman of the geology division [Edward M. Stolper] has referred to the Natural History Museum as a sister institution,

and there's this feeling that there's going to be a big rapprochement between Caltech and the museum now. Is this something really new, or are we just sort of, in a sense, going back?

SHARP: "Geobiology" is a general term for any mixture of geological and biological endeavors. The museum has been, up to now, more geobiologically oriented than Caltech. What the future holds, I don't know. I hope our latest hire, Dianne Newman, is our new thrust into geobiology. Joe Kirschvink is about the only one in our division that could be classified as a geobiologist. His geobiology has been to tell you whether whales have magnetite in their brains and so on.

ERWIN: He was a student of Lowenstam, right?

SHARP: As an undergraduate, yes. He was a protégé of Lowenstam's, more than a student. But he was a great admirer of Heinz. Lowenstam got into the biological origin of minerals, like magnetite. Joe is in that same area. He and his wife are trying to solve [those kinds of problems]. How can honeybees go out and do what they do and come back to the right place? And whales and so forth. Magnetite in the brain may have a lot to do with that. Of course, we've got magnetite in *our* brains, too.

We just hired another microbiologist—that's Dianne Newman. Microbiology is getting to be very important. There's a big hassle between companies that want to use the hot springs in Yellowstone Park. There are all kinds of microorganisms in those hot-spring environments, some of which are very important to these companies. The environment in which they are living is a geological environment, but it consists of more than hot water; there's a lot of geochemistry involved. Can you artificially create the environment that exists in natural hot springs like Agua Caliente and others in Yellowstone and build these things so that you don't have to go to the park?

ERWIN: To harvest [these organisms]?

SHARP: Yes. It's tricky in a national park, when people want to exploit it commercially. If somebody could say, "Look, I know what you need to make a hot spring all of your own

somewhere”—that’s a geological-chemical problem. You can plant your microbes in it and that’s a microbiology spring!

One of the things the biologists and others are very interested in is ancient DNA. When I first started talking about this, biologists said the oldest known [DNA] was about 35,000 years: “Anything beyond that has been destroyed by heat; it doesn’t exist.” The date since then has been pushed back and back; we finally got it back to about 35 million years at a Utah locality. And I said, “Gee, you guys said thirty-five thousand years and now we’re back to thirty-five million!” I have even heard of a possible 50 million years. It’s becoming basically a geological problem.

Where would I look for really ancient DNA? Well, I have a seemingly absurd candidate. I haven’t the faintest idea or hope that it would ever yield anything, but it’s a geological approach: It’s in the eastern Grand Canyon, where we have protozoic sedimentary rocks that are at least 700 million years old. If they have chert in them—chert nodules, and I don’t know that they have—maybe the precursor DNA would be in that chert, which is like amber, very tight. Besides the tightness of the system, we want something that’s never been too hot, because heat will ruin DNA. I’ve seen truly old sedimentary shale beds in the eastern Grand Canyon that are soft and unconsolidated and apparently have never been deeply enough buried to get hot enough to be metamorphosed. I’d get out there and start scouting around, looking for unfractured chert nodules. If there is any unaltered primordial DNA, that’s where it might be. Thanks to the stable isotope work that Sam Epstein does on organic materials, we have a capability in our geology department to work with stable isotopes—a capability that doesn’t exist anywhere else on the Caltech campus. We’ve got about nine or ten mass spectrometers, the equipment needed to work with very old samples. We can do a lot with the biologists, if they are interested.

ERWIN: So this is an outgrowth of geochemistry in a sense?

SHARP: Yes. It uses geochemical know-how and equipment. We were lucky we had our geochemistry going when planetary science started and they began returning samples from the moon. That’s where our geochemists came in. We got heavily into planetary science partly through geochemistry. I think we can get heavily into biogeology, involving geology and biology, through our geochemistry stable-isotope gang. I think we ought to do it.

You know, it's very interesting. It's much easier to start something new than it is to stop doing something old. I've met Baltimore only very briefly, and I haven't really talked with him. He wants Caltech to diversify. You don't necessarily have to get bigger to diversify; just stop doing something so you can do something new. But it's very hard to stop doing something.

ERWIN: But Caltech has had the reputation of being able to do that. That's the formula.

SHARP: Well, OK. I hope we can do it. I think it's the way to go. We stopped doing vertebrate paleontology to do geochemistry, in a sense. That proved to be the right thing, there's no question about that. Even my most severe critics would say, "Yeah, that was the right thing to do, although we abused you for doing it."

ERWIN: It took some years for them to stop abusing you?

SHARP: They'd come to me and, sneering, they'd say, "How is the department of geochemistry at Caltech?" And I'd say, "Well, give us fifteen to twenty years." In twenty years, they were trying to hire our geochemistry graduate students. [Tape ends]