Dean Barnett's Interview

Yellow – Professional Section

3:08

J: (3:08) David told me that you knew Tracy pretty well. I know you've worked with him…

Beginning of Army Ordinance Project

D: My professional interaction with Tracy was quite a history. I went to a seminar he gave. I had only come on the faculty in the Physics Department, and he, of course, was in Chemistry. Within about the first year I came here, I attended a seminar in the physics department where Tracy was talking about high-pressure work. After attending that seminar, I got to thinking, one of the things they needed to know was the crystal structure . . . how materials at high pressures. They didn't know anything about materials. I had done work previously in x-ray diffraction . . . determines the crystal structure, and I thought I knew a way, in his high-pressure tetrahedral press, we could send an x-ray beam in and determine the crystal structure and the materials that were there. (4:41) So I went over to Tracy's office and talked to him about it.

J: Do you remember what year this was?

D: I came to the University in September of 1958. So I expect it was in 1960. After I talked to Tracy, he said, "I think we can get a good grant, we can get the money to do that research and develop that technique. So if you want to write it up and see what you can do." (5:41) So I made up a few tests, and made a few drawings of how we could do it. I effectively wrote them on Tracy's name because everybody was trying to give Tracy money, because of the diamond he had made tons. (6:06) He had lots of contacts. He talked to the U.S. Army research branch. They encouraged us to write a proposal. So I did most of the leg work, and we submitted a proposal and were granted $105,000.

(6:45)

J: I've seen that document.

D: And it worked out quite well. We were the first people in the nation to do high-pressure x-ray diffraction studies. Tracy and I talked about a lot of

things, and he designed all the apparatuses. Well, I had the major idea, but all the details and designs of the pressure apparatus and the x-ray diffraction apparatus, which was a unique attachment to it. That was my contribution. But Tracy was tremendous at mechanical design. He was a chemist, but he had amazing ingenuity and creativity in mechanical design.
(8:04)

He made all the drawings, we talked about things, but he actually did the mechanical design of the press and the x-ray diffraction apparatus. And we started making measurements. (8:34) We discovered several new, interesting phenomena that took place at high pressure that were unique. We were on the front page of the magazine *Science* in ’63 or ’64 for a measurement we had made with the x-ray diffraction press. *Science* features small, interesting new developments.
(9:20)

After the x-ray press was built, I did most of the measurements. I had students who were working on it. We talked to Tracy a lot, but he was not really involved in the actual measurements. We did most of them. (9:57) Most of it was conceptual things that he talked about. For years, ten or fifteen years, we collaborated together, but he was just the advisor. I did most of the . . . Well, in fact the students did. I directed graduate students.

(10:29) Coming out of that x-ray work was an interesting little side issue. It turned out, back in those days, no one really knew what the pressure was inside of these apparatus that Tracy had designed and built. But there were other systems that were getting very high pressures. A group of the National Bureau of Standards that developed a high-pressure diamond cell (11:12) through x-ray diffraction. And they started publishing about the same time we did. Nobody knew what the pressures inside these devices were. They knew they were getting high pressures. At the lower pressures they could compare with other devices, what is called the piston-cylinder device. But when it got above 30 or 40 kilobars, nobody knew what the pressures were.
(11:54)

And I with the Doctor Daniel Decker in the Physics Department conceived the idea of using what we call a theoretical equation of state for sodium chloride, and using the x-rays you can measure the distance between atoms. From that you can calculate the volume, and so you can relate that to the pressure on a theoretical basis. (12:30) Then we made those measurements

and when we compared this with the theoretical equation of state of the sodium chloride, we told the high-pressure world that they were off on pressure by 30-40% (12:51) In fact, some of the devices, their pressures were only half of what they thought they were. Everybody was reporting very, very high pressures. We published an article that everything was way too high. People didn't like that. But this equation of state based on a theory by Daniel Decker in our department. Decker became kind of famous.

To show you what Tracy's personality was . . . I was back in a meeting in which they were discussing this discrepancy between what people had been reporting pressures, and what we were saying the pressures were. Of course, at first, everybody was saying we were wrong. Anyway, we were at this meeting, and Tracy happened to be there, and some young scientist [who] hadn't been in the field very long, didn't know very much, saw Tracy and said, "Oh, you're from BYU. Are you part of Decker's group?" Of course Tracy (14:41) started all of it. Tracy, who was known nationally, and when he came here, I got in involved, and then after I got involved, Decker got involved. Tracy said, "Well, I kind of work by myself."
(15:05)

D: Tracy was a very humble guy. (15:50) If you're interested in stories about him. . .

J: I would be.

D: I have another . . . When we were building this x-ray press, we designed it, and he arranged with a company back in Kansas City that [did] precision machining of apparatus. He arranged with them to build and sell copies of our high-pressure apparatus with the x-ray diffraction on it. And they sold that to some Russian company for $100,000 or so. (17:01) And just the royalties on that—Tracy had patents on the high-pressure apparatus, and Tracy and I hold a joint patent on the x-ray diffraction apparatus. And the total of it was about $100,000, so 10% of that is $10,000. So Tracy collected most of this, and I made about $1500. But anyway, we made up drawings and sent them to this company, and they did the machining. After they had it built, they hired Tracy and I as consultants to come back and get the apparatus working, check it all out, and then they shipped it. (18:00)

When we went back to check this out, we spent about 4 or 5 days, and the last day, this company put on a big dinner for some of the employees. There

were about 8 or 10 people—Tracy and I and the head of the company, and a few people who were working with us. A big fancy dinner—seven course dinner kind of thing—table in a fancy restaurant back room—just really a fancy dinner. I'd never been to that kind of thing. They started out with liquor. And then they'd have salads, and then they'd have more liquor. (19:13) When it came to Tracy to ask him what he wanted to drink, he said, "I don't want any of that stuff!" "Well, what can you drink?" He said, "I don't want coffee." He said, "Give me some orange juice." And the boss there said to the waitress, "Bring him some orange juice." He says, "We don't have any oranges." And the guy said, "Get it! Go to the grocery store." And he gave him this stern look and said, "Get the best oranges, I want the orange juice and squeeze the orange juice out of them."(20:13) They took one of the waitresses, sent her to the local grocery store. She came back, and they cut them and squeezed them. Fresh oranges. That was the best orange juice (20:25) They brought a big pitcher to us. That is the best orange juice that I ever had.

J: (20:46) So, was this during the period that you guys were doing the army stuff? What years did you work with Tracy?

D: Probably fifteen years, between 1960 and 1975, or so.

J: When would it have been when you went out to St. Louis and had that experience? (21:29)

D: That was in Kansas. This company had this machine shop.

J: Was this McCartney?

D: This was McCartney. McCartney was the guy who said, "Go out and get some oranges." McCartney came here to BYU and spent a few days, and I can't remember how they got into the discussion, but Tracy told him he was going out on the welfare farm to pick cherries the next morning and said, "How would you like to come with us?" This was a night we were eating supper at a restaurant. He said, "Yeah, I'd like to do that." So next morning we picked him up and took him out to the welfare farm with us, Tracy and I and our whole ward. Tracy lives here in our ward. We took McCartney out to the welfare farm, and he was dressed in his suit and had to climb ladders and pick cherries with us for a couple hours. (23:23) That was a good

missionary effort. I think he drank too much liquor to make a very good Mormon.

(23:51) The things that I got interested in high-pressure got to be more pure science, and less applied. And money was starting to get . . . We got funding from the army total probably about $350,000 over a period of ten to fifteen years. The first grant was for $105,000—and with inflation, that represented three or four times that in today's money, so it was for a fair amount of money—for a period of three years, and then we had that renewed at the rate of about $30,000 a year for another ten years or so. But research funding got a little harder. I don't know exactly what triggered us not getting additional funding. (24:59)

J: Now, that initial funding by the army—was that the high-pressure data center?

D: That was only x-ray diffraction studies. It was a special press (25:15) that you could get x-rays into it—a special press and then the x-ray apparatus that went with it. It was all a special design. But, Tracy was getting money from DuPont Corporation when he first came here. And they just gave him money to do high-pressure studies. But the thing he really spent most of his time on was chemistry, looking at chemical reactions that would go on at high pressure that would not at atmospheric pressure.
(26:01)

And the work I did was looking at the crystal structures of the materials while they were at high pressure, not before and after. That's an interesting difference is to make measurements while you are at pressure rather than put chemicals in and go up to high pressures then come back down and have a permanent transformation. The diamond, of course, was a permanent transformation. But most all the things I did studied were when you drop back down the pressure, there would be a reversal back to the original form. For example, sodium chloride salt, as well as many other materials, would go through transformations at high pressures is an interest theoretically, **(26:58)** but practically, isn't.

Tracy was much more practical than I was. Of course, that's why he kept getting money, and we didn't.

J: Let's talk about just being in the ward with him. I know you were the bishop after him.

D: I was the bishop just five years ago. Tracy was the oldest bishop they had in our ward for a long time when he was bishop. I think he 55 or 60. I was 64 when I was called, so I was older than him. (27:54) I was called to be bishop in 1995. And Tracy was in about 1980, or so. I think he was only about 55 to 57.

J: He served from 1976 to 1981.

(Looking at pictures of bishops.)

D: 29:47) This was Laurie Frieze. Tracy was the counselor to Laurie. Laurie just died about a year ago.

(30:39) There were nine bishops all in the ward, still alive at that time. Three of those have died since then.

I've got an interesting story. When Tracy was bishop, they had a little garden slot out in back that's only ten feet by twenty, or so. Tracy went and bought a roto-tiller. Not a $300 roto-tiller. This was really a high-quality, professional roto-tiller. Must have been $1,000, or so. Not do his own little garden spot, but, when he was bishop, he would go around to all of the widows in the ward, house to house, during the spring, and roto-till a dozen or twenty houses. (32:05) I'm sure he bought that roto-tiller thinking he'd do that.

J: Did he do that for a couple of years?

D: He did it for several years while he was bishop. (32:22) He used to hire our teenage boys to go out and work on his farm in Payson. My son worked a few weeks a year, and Ida Rose did all his directing. (32:57) That's one of the neat romantic story of how Tracy deferred to her so much. And you'd think (33:25) he'd run the show. But, in their home he just worshipped her, and she took charge of things.

J: What was he like as a bishop? He couldn't defer to Ida Rose for everything as bishop. (34:05)

D: He was a good bishop. He was very willing for other people to have input. He was not an authoritarian bishop at all. He was anti-authoritarian. He could listen to other people. During the time that Tracy was bishop, I was a bishop on campus. I was bishop on campus from fall of 1979 till about 1983. the three years I was over there, I was bishop on campus 1978 to 1981, and that was the last three years of his tenure. (35:48) So I was really not intimately involved in any way.(36:06)

(Trying to remember facts)

(36:52) All the time that he was bishop, I was on the high council in a BYU stake for two years, and then three years as a bishop. And that was the time that Tracy was bishop.

(38:57) Anyway, so the five years Tracy was bishop, I was actually not in the ward. So I don't have an awful lot of memories . . .

J: (39:24) If there is something this book should say about Tracy, what would you think it would be? What kind of a person was he?

D: I was always impressed with Tracy's humility and honesty. He was just faithful. But being a scientist, there were things, I would say conflicts, that were not understandable in science. (40:40) But he was very open about saying, "Well, I don't understand. There are certain things I don't understand, but it's all right. I still have a testimony of the gospel." That was a feature that I admired in Tracy. I have the same feelings. There are a few things that I just don't understand, but I understand enough to live the gospel. (41:19) That's all I need, understanding. Things like evolution don't bother me, but at some time you have to reconcile or cope with the scientific approaches to things, and it doesn't bother you. (41:57) I was impressed that he was always forthright about those kinds of things. He had a testimony that the gospel was true, that Christ was the Christ. And I don't have to have all the little things argued. (42:30)

(42:43) The other thing I was always impressed with Tracy is his willingness to serve. He was not pretentious. Tracy had an interesting self-confidence. He had confidence that he could do things.
(43:09)

He would tackle new subjects. When we started doing this x-ray diffraction crystal structure analysis, x-ray work was not in his background. That's more the physics area of science, whereas his training was chemistry. (43:42) But he went and got some books, and he studied it, and he gave two or three seminars at the university. But also he actually gave the faculty lecture. The university has a faculty lecture once a year to honor some professor who has done unique work. Tracy gave the faculty lecture, and he lectured on crystal structure, which he had no understanding of two years before. It was a masterful lecture. This was a lecture given to the faculty as a whole. Therefore, it was general college level discussion. He wasn't a specialist. (44:58) I was impressed with him . . . I knew everything he was talking about because that was my field.

But he went out after I told him about it and got involved in this area at my instigation. He went and studied and understood it out of books. Several instances I know he did this. He would go study on his own and learn it. That was a great characteristic of Tracy's that permeated a lot of his scientific life. (45:54)

In designing high-pressure apparatus, you have to know something about the strength of materials—how strong certain steels are… (46:10) What kind of strength steels have, so you can put everything to it's limit at high pressures. But he designed the belt apparatus (46:28), which was unique in getting pressures high enough to make diamonds. Then he designed the tetrahedral press, and it was capable of making diamonds. (46:39) He kept using more pressure to pushing materials to it's limit.

And yet these great, great contributions to the field of science came out of material that he studied on his own. (47:07) That's an interesting feature that needs to be said some place. It applied to religion as well as it did to science in some ways. He studied the gospel the same way. (47:28)

(Repeat of previous information)

(49:04) Tracy still liked to do his own independent things—he directed graduate students in chemistry himself. You know that was the reason he left General Electric and came to BYU was because he wanted to do more fundamental research. And he wanted to make diamonds faster and faster—more and more.
(49:47)

(51:00) About a year or so ago—I'm one of the counselors in the high priest group leadership, and I asked Tracy to say an opening prayer in priesthood meeting. And by this time his mind was pretty well gone. But he got up and said a beautiful prayer—couldn't find his chair—didn't know where to go back to his seat. (51:39)