BOEM DEEPWATER GULF OF MEXICO HISTORY PROJECT

OFFSHORE ENERGY CENTER HALL OF FAME

Interviewee: Philip D. Rabinowitz

Date: January 10, 2009

Place: Houston, Texas

Interviewer: Tyler Priest

Ethnographic preface: Dr. Phil Rabinowitz is a former professor of Oceanography and Geology & Geophysics in the College of Geosciences, at Texas A&M University. Throughout his career, Rabinowitz has taught and completed extensive research in the areas of marine geology and geophysics, plate tectonic reconstruction, and scientific ocean drilling. He was named a Regents Professor by the Texas A&M Board of Regents in 2004 and held the D. B. Harris Chair in Geophysics. Rabinowitz came to Texas A&M University in 1981 as a professor of Oceanography. Prior to that, he was a senior research associate at Lamont-Doherty Geological Observatory of Columbia University in Palisades, New York, where he earned his doctorate in marine geophysics. After joining the faculty at A&M, Rabinowitz served as director of the Ocean Drilling Program from 1983 to 1995, was named professor of Geophysics in 1988, served as interim head of the Department of Geophysics from 1993 to 1994, and was head of the Department of Geology & Geophysics from 1994 to 1998.

[note: preface adapted from http://icop.tamu.edu/news/110-rabinowitz-named-industry-pioneer-by-offshore-energy-center]

TP: This is an interview with Dr. Philip Rabinowitz, former professor in geology and geophysics at Texas A&M University, for the OEC Hall of Fame induction in 2009. The date is January 10, 2009, interviewer is Tyler Priest, and we're at the Westin Galleria in Houston. Let's start off with just some background. Where were you born and where did you grow up?

PR: I was born in Brooklyn, New York, and grew up in New York City. In fact, I don't think I ever left New York City until the age of about twenty-one. I went to

school at City College, CCNY, did undergraduate studies at CCNY, majored in physics, and it was a great university. At that time it was free, and they called it the Harvard or MIT of the poor. You had to commute. It was a commuting school. You had to be a New York City resident.

After I graduated, I really didn't have intentions of doing graduate studies. I took a job with Columbia University on one of their research ships, and I forget what the salary was. This was 1964, I think, and it was about $3,000 a year. It was crummy. I mean, I was offered a job with a government agency doing underwater sound research, and that was about 7,000 a year, to give you just an idea of the level of the differences. But this one took me on a ship, and I met the ship in New Zealand, and I'd never traveled outside New York City. I haven't stopped traveling since. I spent two years doing that.

We went around the world collecting data, and it was really pioneering work. Columbia University was the institution that probably did most of the ocean research at that time. The person who directed the lab was Maurice Ewing, the father of the entire field. He had a brother, John Ewing. And very little was know about the ocean floor. Every time you went across an ocean, you discovered new mountains and valleys and so on.

TP: So was it just a globe-spanning survey of—

PR: Yes, just a globe-spanning survey, that's all it was. The ship—every year Columbia ran two ships, and it went around the world constantly collecting data. You probably have seen a lot of these *National Geographic* maps of the world with the oceans, physiographic charts? They were all done at that laboratory by a man named Bruce Hazen. So Columbia had the archive of data, and Maurice Ewing sponsored me as a graduate student and backdoor'ed me into Columbia somehow. I did my Ph.D. studies there under his direction and a man named Manik Talwani, who's a fairly well-known scientist as well.

Spent seven and a half years. Spent two, two and a half years at sea, and then seven and a half years as a graduate student. It was a ten-year ordeal, but it was well worth it, because it was an apprenticeship. It was terrific.

TP: And you say you were often in very hostile weather conditions.

PR: Oh, yes. I mean, these ships—

TP: You were a landlubber before you did this.

PR: Right. I think I went deep-sea fishing off the New Jersey coast once and got seasick. These were days, too, when in the earlier days—the first year I spent at sea was before the air gun was developed for doing seismic work.

TP: So you were doing dynamite?

PR: Yes, it was TNT, and every minute of the day you'd throw over a charge of TNT. It was before the eel [phonetic] was invented. Now there are streamers, but then there was just a series of hydrophones, and it was very noisy. So you had to be out in the fantail of the ship under all weather conditions. These are small ships, 200-foot narrow-beam ships, and slack hydrophones constantly. It was tough work, but it was fun. When you're twenty-one, twenty-two, twenty-three years old, it's an adventure. It really is. I really enjoyed it, and while I was on the ship, I was reading things about geology and geophysics. It was before plate tectonics. It was just an exciting time.

TP: Right. So this was in the mid-to-late sixties you're talking about?

PR: Yes, well, from '64 to '66, and then I started graduate work in January of '66.

TP: Okay, and you're about seven years there.

PR: Seven and a half years, yes. And one of the interesting things at this institution was I had the experience of being a technician for a couple of years. They called us scientists, but we were really technicians, and Maurice Ewing, if he liked you, he would send you out to sea as a chief scientist. After a year of graduate studies, I'd be leading expeditions, and I wasn't unique. I mean, he was a real motivator.

TP: Motivator, and wanted to get people's feet wet, literally, I guess?

PR: Yes. One of the problems he had was, he had two ships going around the world collecting data, and there were not enough scientists, so he had graduate students go out. There really just weren't. Plus there was more than two. We had ships of opportunity as well that he was able to get to collect data, but two of our own. And it was really a phenomenal experience, going out as a graduate student as chief scientist up in the Labrador Sea and the Norwegian Greenland [unclear] Sea around icebergs.

TP: Wow. I mean, you really got firsthand understanding of the ocean bottom.

PR: Yes, I really did, yes.

TP: So what was your thesis?

PR: My thesis was on the continental margin of eastern North America, a geophysical study. What I did is I looked at whatever data was available, and it wasn't really that much, as far as sophisticated seismic data, but mainly gravity data and [unclear], and compared it to some data I'd collected while I was a student, off West Africa. You rotated the continents together and looked at pre-drift reconstructions and tried to see where the boundary between ocean and continent was and so on. It was quite interesting.

TP: Yes. I guess the whole theory of plate tectonics was really just coming about.

PR: It was just coming about, yes. Yes, it was an exciting time, and opportunities that affected the industry were there. While I was a student—and again, this isn't bragging, because everyone there, all the other students were doing the same thing. It was just the way this institution ran. Before getting my degree, I published several papers in *Journal of Geophysical Research,* and others did it. All the students had to do that. They kept you there a long enough time that you could do it.

But I published a couple, one that had to do with salt diapirs off of Angola, and that was—it really wasn't known much about the offshore of Angola. One of my colleagues did some seismic work and looked and found these diapiric structures, and it looked like it could be salt diapirs, but it could have been igneous plugs. Another colleague from Woods Hole, he did some heat-flow surveys around it that indicated high conductivity, which would be typical of salt, and I did some gravity surveys which indicated it was probably typical of salt.

TP: Now Angola is one of the hottest offshore places in the world.

PR: It's one of the hottest offshore prospects now, I know. And I did that as a graduate student, and that's what really was amazing about this institution, is that students were able to really get involved in, like, frontier, really more than frontier, really hot things, I mean, hot topics at the time.

TP: And so what did you do after you got your degree?

PR: I stayed on at Columbia, worked my way up to senior scientist there, and then was it '81? I just decided I wanted to leave, and marine geophysics, which was my field, it's a small enough community in academia that people know—you tend to know each other, and just from out of nowhere, I got offers from a few institutions. Stanford is one, actually, and Hawaii Institute of Geophysics, and Texas A&M called me. I never applied and they called me and I went there and they offered me a full professorship, and at that time A&M was the most upbeat institution of any of them. They just were. No matter what you said to them, to the leaders there, any vision you may have they'd say, "Yes, you could do it. No problem. You could do it." It was exciting, so I accepted the job.

So I had mentioned something about I knew the Deep-Sea Drilling Project was coming to an end. I was involved in that before at Lamont, and I said, "Do you think we can bid on it?"

And they said, "Oh, yes, you can." I thought it was a little bit of B.S., you know, overstating, but it was also a place that one can afford to live in at the time. And it's been—it was a great career there.

TP: So you bid on it, and when did you get the Ocean Drilling Program?

PR: Well, the Deep-Sea Drilling Project ended in '83, and we thought originally that—

TP: Now, who were the original sponsors in deep sea—that was out of Woods Hole, right?

PR: No, out of Scripps. My involvement, like I was out on the ship, but at Lamont we subcontracted to do—and I was in charge of this—the geophysical work, the geophysical site surveys before drilling. So we did a lot of that. But Scripps was running the program.

At first we thought NSF would ask for proposals, put out an RFP to submit proposals. But then at the last moment, they changed. There's a group called JOI, Joint Oceanographic Institutions, and at that time there were the ten major U.S. oceanographic institutions. It was Lamont and Woods Hole and Scripps and Washington, Hawaii, A&M and UT. They were going to let the drug [phonetic] board select a science operator. This is something I don't think we could do at A&M now, because the bureaucracy is just so much greater. But then we were able to give the president of the university a call on a Friday afternoon and say, "Hey, we're interested in doing this. Can we write a letter under your signature of what you can commit for the program?"

He said, "Sure." And he did it, and we sent it to the drug board, and they selected us. I mean, now you'd have to go through many layers of vice presidents. It's so [unclear].

TP: Oh, I know, yes. I'm at a university, and I know the process.

PR: We had a man with vision, Vandebar [phonetic]. He's from Rice originally, but he was a great guy as president. He committed to building things, and we got the program. That was hard to believe. Part of it—I don't want to say why.

TP: Talk about your involvement with the industry. Then we'll sort of follow up with the drilling program.

PR: Sure. Well, for example, work off Angola, discovery of salt arms. After that, myself and some colleagues, we did work where we looked at how the South Atlantic fit together, and in continental drift from plate tectonics, that's the classical fit of continents is the way South America fits—

TP: South America and Africa.

PR: Yes, fit very nicely. But we did a very rigorous, detailed look, not just an arbitrary, "Let's take the two continents and rotate them together," but we used geophysical parameters to try and figure it out. One of the things that pops out is if you map where the Angola salt diapir field is and look at the other side, beneath

it is, when you rotate back, is the Sao Paolo plateau of Brazil, and that gave indications of—

TP: The Campos Basin—

PR: Yes, right.

TP: And then the other areas that they were developing there.

PR: Right, that there may be oil there. I had a graduate student at Lamont who was Brazilian, and he took some of the ideas that we had, you know, you find some structures off Angola, and then you go and look off Brazil to see how it continues down.

TP: Who was the student?

PR: He's still there. Luiz Gamboa [phonetic] is his name.

TP: I'm sort of interested in Petrobras' deepwater development. So did he do a paper on this, or research?

PR: No, I did it, but he used some of it. I did it with another colleague. The work he did with his dissertation with me had to do with some other fracture zones that came into the continent there and a little bit on the Sao Paolo plateau, but he used some of the research.

TP: So that's when Petrobras in Brazil started to get some idea.

PR: Yes, right. Another thing we did was, I had the last funded cruise of a ship called the *Vema* that was run by Lamont, and the *Vema* was the first ship in oceanographic history to sail a million miles collecting data. And Lamont's other ship, the *Conrad* is the second ship. There's only two ships that have ever done this. It's remarkable how constantly collecting data—and this last cruise was off East Africa on a kind of a margin, and we did some seismic work off of Kenya and Tanzania, and we saw how Madagascar fit into pre-drift reconstructions, and we were able to date the timing and all.

But in the process of Madagascar moving south, southeast relative to Africa, there are some structures that go into the coastline. We mapped that, and I know—I haven't really followed this recently, but I saw in *Offshore* magazine that research is being done, exploration now is being done by northern Tanzania and southern Kenya in that region based on a lot of this stuff, because it was all that was ever published. So industry tends to pick up on—they have an industrial associates group at Lamont that look over your shoulder.

TP: What happens with all the data that those two ships collected, over a million miles apiece? I mean, where does that data get stored?

PR: Well, Lamont really was one of the pioneering institutions in computerizing data storage and so on. Then there's a national data agency, NGSDC, I think it's called, in Boulder or Denver or around that area, and all of that data is archived there, along with all of the other institution data in the U.S. and perhaps other places. I think all of this was funded out of U.S. government funds, so National Science Foundation or—

TP: Right, so it's public.

PR: It becomes public, though people tend to hoard it for a while. You know, scientists like—they have to live, too.

TP: So talk a little bit about the Ocean Drilling Program, I guess. Once it arrived, how did you set it up?

PR: Oh, that was interesting, because I never ran a program like that before, and we started with zero. I mean, we didn't have a building, we didn't have a ship, we didn't have any money coming in yet. But I quickly hired a few key people, and we put out an RFP for a drill ship, and we had help from the international scientific community in what we wanted in a drill ship, and what we wanted in laboratories on the ship and things of that nature. We chartered a ship—the RFP, the most responsive group was Sedco at the time. That was Governor Clements' company. That was before he was governor. We worked with them, and they were really good. I mean, they were a real can-do, real Texan type of can-do group.

TP: I saw your anecdote about negotiating for the BP-471 with Dillard Hammett. I know Dillard, because he was with Shell.

PR: Was he with Shell?

TP: Yes, he was Shell before that.

PR: Okay. Dillard, he's an interesting guy. He's a wonderful man. He's a really bright guy, and he's a motivator. He has all the great attributes. He's also a bit of a comedian. But we negotiated with them. But they were just so fantastic in that we had a deadline to build a six- or seven-storey laboratory stack on the ship and put all this equipment on and just change the ship around a lot, and their people were just amazing. Every time I think back at the things that Sedco was able to do, it's awesome.

TP: So this was a long-term lease on this?

PR: Very long term. Yes, we wanted a minimum ten-year contract, plus another five years at our sole option, plus another five years somehow or other. Years fifteen or twenty, I don't remember exactly. Maybe things would be renegotiated. But we wanted it for twenty years, and neither us nor them I don't think, well, certainly not me—I don't think Sedco or any other company had a long-term contract like that. In those days, people would hire out an offshore rig for a couple of jobs.

TP: Yes, a day rate or something.

PR: Yes, and the thing with the day rate that's interesting is that how do you project a day rate for ten years? We put in some day-rate escalator, which was very negotiable, and that was a tough one, you know, because a percent or two of a lot of money is a lot of money if it changes when you compound it.

TP: Yes. So what was the first task you set the Sedco ship to do?

PR: Well, we had a shakedown cruise first in the Gulf of Mexico, and it took about two weeks before we were able to take our first core, because we pushed that ship off the dock. I mean, we just wanted to get it out before it was even ready. There were reasons for that at the time, but because of pressures from international partners, we had to get out by the end of January, and the last day of January 1985 we got out.

TP: Who were your partners?

PR: Well, there's nineteen countries. It was supposed to be fifty-fifty, U.S. paying half and the remainder paying half. It usually ended up being sixty-forty, as it usually is the case. But who were the partners? France, Germany, the UK, Canada, and then there was a European science foundation, a grouping of fifteen or whatever the number of countries that made up one member.

TP: So the mission was to just take coring samples?

PR: On a global scale, yes.

TP: How did you prioritize?

PR: Well, we operated the science part of the ship in a science part of the ship, and the international community as a whole went and determined what the scientific priorities were, and we would filter that to some degree, of course. I mean, there were things you can't do, and their appetite for wanting to collect data was much greater than the amount of funds we had to do it with. That's always the case. But they would prioritize types of problems and where they can be solved, and

we'd make sure that there was enough geophysical data to support what they did and there were no safety problems.

One of the things with us was we didn't drill with a riser or a blowout preventer, so if we had a blowout, oh, it would be a catastrophe. I mean, it would really be horrible.

TP: So you were taking basically fairly shallow cores?

PR: Well, up to—we did 2,000 meters of sediment.

TP: Oh, really, okay. Well, there's a chance then.

PR: Yes, there's a chance. But what we would do that industry did not do is our money was the core, the samples. That's what we wanted, not the oil, right? And we try to drill where there's no oil, and we'd have safety panels—it was a panel of an international group, who would look at all the data and they would say, "There's no chance of oil." And then we had our own group just as a secondary. But oftentimes they're wrong. Just as we were wrong in finding oil, they're wrong in not finding oil.

TP: You could get unlucky and find oil.

PR: You can get unlucky and find oil, right. [laughs] But what we would do is we would take continuous cores, and we would sample the bottom of each core for hydrocarbons. And if you look at the ratios of different hydrocarbons, you could tell. We had chemistry labs on the ship, and if we would sense that there probably would be any possibility, we would abort the hole and then go on somewhere else. And it happens. One of the first places we drilled during the shakedown cruise was in the Bahamas in an area like that. But we had to be squeaky clean. I mean, we really, truly did. And we were.

TP: How did the data that you collected on this program help the offshore industry? I mean, I guess you're putting together probably big regional pictures of the ocean bottom.

PR: Yes. Well, it helped the offshore industry, not just oil. One example would be an area we drilled under Juan de Fuca ridge off of Canada. We sampled sulfide ore deposits for the first time in three dimensions. We were able to tell. On smaller research vessels and even with our ship drilling, we've sampled some sulfide deposits here and there, but we were really able to map it. The Canadians, it was right near Canadian waters, and they said if it was onshore it certainly would be economically viable, but still not yet. But we don't know what's going to happen.

TP: They're still talking about manganese nodules.

PR: Yes, right, and that's just one example. You know, the mid-ocean ridges extend on a global scale. That just happened to be close to land, so it's not just oil. With respect to oil, it's frontier-area research. I mean, all the data we collect is published in volumes, and the companies all have collected our volumes, and they look at the data.

TP: Yes. One thing I'm interested in is sort of determining continental margins for claims under the Law of the Sea convention. Were you involved in any of that at all?

PR: Well, yes, in indirect ways. For example, we drilled off Sri Lanka. There's something in the Law of the Sea that there's so many miles for—

TP: Exclusive economic zone, yes.

PR: —exclusive economic zones and other things, but it's not just miles. It has to do with the slope of the shelf and the amount of sediment there, and we were having problems. But we were the only ones who really knew how much sediment there was. I mean, the people in Colombo didn't know. So I had my assistant director act like he was an ambassador from Texas, and that satisfied them. They knew he wasn't, but we agreed to certain things and were able to do it.

TP: Did you ever run into a guy named Hollis Hedberg?

PR: Yes, Princeton. He was at Princeton and with—

TP: Gulf for a long time.

PR: Yes. They have the *Hedberg* as a ship. It was ages and ages ago.

TP: Yes, right. Well, because he was involved in—I guess they used sediment thickness to determine the outer boundary of national jurisdiction. He was always claiming that was sort of artificial, that you'd find the base of the slope.

PR: Yes. I don't quite understand all of the details, but there's a lot of problems with that. So it's not just amount of miles. It could be much greater than the amount of miles. And we had some problems in other places. Once, we were going to do some work off Mauritius, the island of Mauritius, and nobody's ever had problems getting—when I was at Lamont, Lamont did work there, and no one ever had problems getting permission to do work. And again with this program—with Lamont, we always violated—I shouldn't say it, but we just did what we did and no one ever complained, but probably not very legal, I don't know. But with this program, because it was international, we really had to be clean. We really couldn't be violating.

No one ever had problems, and then suddenly at the last moment, I mean, literally at the last moment, they gave us permission and then they pulled the plug, and we didn't know why. It ended up, I think the French and the British and someone else all were converging to do research around that area at the same time, and I guess the Mauritius government thought there was something going on, so they denied everyone permission.

TP: Something funny there.

PR: Something funny is going on, and it was just fortuitous, because all of those other countries were involved in that program as well. So we were able to do the work, collect the same data off the Maldives, basically on the other side of a ridge access, and I had to fly to the Maldives just like on a moment's notice, because the ship was going to start its work. I spoke—and I can't think of his name, it was the president of the country for the Maldives. I was prepared at the time to make an offer. I know they were concerned about tides. You know, I think three meters may be the highest elevation anywhere in any of the islands, and I was going as an expert on tides, but I'm not an expert on tides. But I was prepared to offer, you know, if they had any graduate students who wanted to do work in the U.S., or come to the U.S. and learn about tides, we would do it for them. We would fund that. As it worked out, they didn't have students. They didn't even have an embassy, a U.S. embassy there. But it worked out.

TP: What about your own research agenda? What kind of things were you interested in personally?

PR: Well, I was interested mainly in kind of the margins and fitting the continents together. I did work in the North Atlantic, central Atlantic with [unclear].

TP: Stemming from your dissertation.

PR: Dissertation. I spent a lot of time off the coast, actually circumnavigating Africa and then looking at Africa, South America, and Madagascar. Later on, after I left the Ocean Drilling Program, they wanted me to—A&M is very big in geosciences. I was in the Oceanography Department, which was an all-graduate department. They had a Geology Department as well as Geophysics Department, and they wanted to combine the two, and they asked me to do that. So I went into that department and did that for a number of years.

But I really didn't like academic administration. I just didn't like it. You know, it was okay. I liked working with the faculty [unclear], but higher-ups, not much fun. I did that for about five years, and then about 2000 I stopped that and I just became a normal professor, and that was a great job. It was wonderful. But I was a little bit out of touch with the research I was doing before, so I started doing things with undergraduates. I worked with them for the first time in my career. I never taught an undergraduate class. I was always graduate students, and that was

fun. I published a few papers with undergraduates and did some work in the Caspian with them, the geopolitics of the Caspian, geology and geopolitics and how you do pipelines, but that was another—

TP: How you divide up the Caspian Sea?

PR: Oh, god, whether it's a lake or a sea, yes. Are you familiar with—

TP: Yes. That's been a long-running controversy.

PR: Right. It was not a problem for a long time when it was Soviet Union and Iran, and then suddenly it's Turkmenistan and Kazakhstan and Russia and Azerbaijan.

TP: Right. I'm interested in how geographical boundaries conform to national boundaries or vice versa, or don't conform, and how are boundaries set, determined.

PR: Yes. Well, the Iranians want the condominium approach, which is basically you look at the entire Caspian, and they take whatever it is, one-fifth or one-sixth, I forget. That's because so far they've not been able to find oil off of Iran. [laughs]

TP: Right. More sort of commons approach.

PR: Right.

TP: Do you ever self-consciously think about the ocean exploration you're doing, and likening it to space exploration? I mean, did you ever sort of think about it as, boy, this is just an uncharted frontier, and what we're doing is the same thing that we're doing in space?

PR: Yes, I always thought of it that way. I mean, even with the drilling program, and that was once we really had a feeling for what the ocean floor looked like, when you think about what's below the ocean floor—I may be off on the statistics now a little bit, but if you take all the holes we've drilled in the ocean floor, with the Deep-Sea Drilling Project and the Ocean Drilling Program and divide it by the area of the oceans, it'd be like having just a couple of holes in the State of Texas, and shallow ones, and trying to learn about the geology of Texas from two or three or four holes, whatever the number is.

TP: So there's still a vast amount of territory out there.

PR: Still a vast amount, yes. I mean, this program is an offshoot of the Deep-Sea Drilling Project, which was an offshoot of Project Moho, and Moho was '59 and 1960, around that time, this grandiose idea of trying to drill down to the mantle.

And we still can't get into what's called Layer Three or whatever, well before the mantle. Or we may be able to do that now, but it's still difficult. The technology is difficult, to drill in fractured rock and deepwater.

TP: Beneath salt, around and beneath salt.

PR: Yes. It's just difficult technology, but we'll get there at some point.

TP: Temperature issues when you get down that deep.

PR: Temperature issues. Well, also, drilling—if we were to do that, a Mohaul type, we'd have to drill with a riser system just to get all the cuttings out and so on, just would have to do it, because it'll just clog up the drill pipe constantly, going down. That's one of the problems we've had. And if we did that, it would be very expensive to begin with, and it would tie up the ship we have for a very, very long period of time. The community still wants lots of holes, still wants more regional—they want both.

TP: But you've got to pick and choose.

PR: Right, yes. The money is not there.

TP: Might there be more money coming forward now that there's all this interest in Arctic exploration and, well, deepwater obviously?

PR: Well, the program has changed. We were the science operator for the entire program before. All the cores, we curated all of the cores that we collected. Now, we had core repositories at Columbia University, at Scripps, at Texas A&M. We set one up in Bremen, but we were the curators. We were in charge of it all, and all of the data that was collected and the publications and all, and the whole structure over the last couple of years now has recently changed. We'll still be doing the work on the—well, it's not the Sedco ship anymore. It has a different name, but still on that same ship. The Europeans are going to be doing a lot of the work, and we'll be paying for that part of it 100 percent. Europeans will be doing a lot of the work up in the Arctic, and the Japanese have a riser drill ship that they're using to do some work. But I think each of these groups are having some financial problems at the present time, and it's too bad we're not doing—the Arctic work to me would be fascinating.

TP: Talk about Law of the Sea claims heating up.

PR: Yes, oh, I know. I spent some time a number of years ago—the Russians when they were the Soviets, lost a submarine, a nuclear sub, not the one you read about.

TP: Not the Jennifer project?

PR: No. They lost a submarine off of Novaya Zemlya, a big island in the western part of Siberia, north of it. There was some concern that—and this was many years ago—if there was leakage from the nuclear submarine, and if the currents were going from west to east, that it would mess up the Alaskan fishing grounds. This is another offshore type of industry. And one of the senators from Alaska—I don't know if it was Stevens or not, I don't remember—had the Office of Medical Research fund some research to just check it out. We got the funding to do that, but we had to use a Russian ship, hydrographic ship.

We went along the entire Arctic coast of Russia taking water samples and little box cores, just to see if we saw anything, but whatever contaminants we saw were just background noise. It was nothing, fortunately.

TP: Yes, fortunately. Wow. So is there anything else you can tell us about your career and why you're sitting here today, being honored?

PR: I don't know. I don't understand why I'm being honored. I've had a good career.

TP: Companies really, now that they're so far out there in the Gulf of Mexico, but like I'd say, all around Africa, they need some kind of regional picture.

PR: The regional picture, and we did one other thing, is we had to develop the technology to collect these cores out in the deep ocean, so we did a lot of that, which was really important for the industrial sector.

TP: Did you work with contractors in developing this technology?

PR: Well, I hired an engineering staff, and I worked with them. I even changed directions a little bit in working with them a little bit, and we also had contractors, subcontractors as well. So our engineers worked with a number of subcontractors, and we tried to develop some mining systems for getting to the hard rock. It didn't work, but we had put a really major effort into it. It was called diamond-coring system, where you have to put a rapid rotation with little weight on the bit, and that was a problem. So we had like a secondary system within a system.

On our ship we had the largest, at that time the largest heat compensator that was ever—and that probably damped out 80 to 90 percent of the up-and-down motions. But that's not enough if you really have to have the weight on bit to be precise. So we built a secondary heat compensation within a heat compensation, and that damped out 80 to 90 percent of the remainder. But it's still not enough. If we were in extremely calm seas—but when you're doing it in a few kilometers of water and there's any movement of the sea, it's just you really—maybe it'll be a tertiary system.

TP: Did you do any work on, when you were defining the continental margins in the Atlantic, on turbidite sands?

PR: Yes. In fact, turbidity currents were discovered at Lamont by Ewing and Hazen in an interesting way. I mean, I'll go back in history a little bit. In the fifties and earlier, a lot of physical oceanographers did not think there were any major currents on the bottom of the ocean, outside of tidal in the deep ocean, outside of tidal currents. What Ewing and Hazen did was they knew of an earthquake on the Grand Banks in 1929. I mean, it's amazing how sometimes great discoveries are made and they're so simple. You don't have to be a mathematical genius.

So they knew of this earthquake on the Grand Banks, and they knew that there were trans-Atlantic cables that crossed the Grand Banks. The earthquake caused a landslide, basically, and at least turbidity currents going down slope. And one thing we can measure very precisely is time, and the timing of these cable breaks as it went was measured, and they were able to demonstrate that you had these turbidity currents that were breaking cables going down slope, and this is how we get the turbidites from. The whole sequence of turbidites come from that. It's simple, and you say to yourself, "Why couldn't I think of that?" But that's what made Ewing a great scientist is he thought of things like that. But that's how it was recovered, and the turbidites are sort of a leveling part of the ocean floor. It's like the deserts of the ocean floor.

TP: Yes. I'm just interested in about how geologists came to understand those turbidite reservoirs, because that's what made deepwater.

PR: That's right, yes.

TP: And when they started thinking about them, thinking about the porosity and maybe as reservoirs and things.

PR: Right. So it was 1959 before they even knew they existed. Then we have a scientist at A&M [unclear]. He was at A&M. He's not there now. The sequence of turbidites are named after him. He's done a lot of work on it.

TP: I'll have to go back and look at that.

PR: I'll get the name before we leave.

TP: Well, can you think of anything else you'd like to share with us?

PR: I'm trying to think. Oh, there's one. I mean, this is really not offshore industry, but when I was at Lamont I remember I did a lot of work in the South Atlantic, mapping the ocean floor, and the Office of Naval Research was a possible funder. I remember applying for funding just to map the bathymetry and gravity magnetics, and they said there was no Navy relevance. Okay, so I didn't get

funded. Then I did the work, and it was about a month or so later. In fact, I already had mapped the bathymetry. A whole contingent of military people with the Navy came by and wanted to see any maps I had of that part of the area. And I said, "Oh, I thought there was no Navy relevance."

And they said, "The President of the United States wants to see it." They used that term, you know. Jimmy Carter was president, and I was amazed.

TP: Whereabouts was this?

PR: Off of Capetown in the western part of South Africa and the southern part of South Africa. And I didn't know what they were talking about. The President of the United States is not going to look at my maps. Well, what had happened was there was what they thought was an A-bomb blast offshore in that area, and one of the satellites picked up a spark. There were some hydrophones they had in one of the islands in the South Atlantic that picked up a noise. But one of the problems is, they didn't know if there was. They weren't sure if it was maybe Israeli or South African. They're the only countries that probably could have the technology, and whether if it was a bomb, whether it was tethered onto a C-mount and so on. I have no idea what the end result of the story is, but in order to model the difference in time between seeing this spark in the satellite and then hearing a noise somewhere, they had to know enough about what the bathymetry looked like to see how the sound waves would bounce off the different ridges and things like that. So I gave them the maps.

TP: Don't know what happened to it?

PR: Well, it's probably secret. I don't know. That really was not my business.

TP: It's interesting, though.

PR: But it is interesting, yes. And after that, they funded me for things. I really got nice funding from them.

TP: There you go.

PR: Yes. Well, ONR was always pretty good with oceanography.

TP: Good. Well, we can stop here. I want to thank you again and congratulate you on being honored.

PR: Thank you.

[End of interview]