



AMERICAN INSTITUTE OF MINING,  
METALLURGICAL, AND PETROLEUM ENGINEERS

## ORAL HISTORY PROGRAM

**Ihor Kunasz:**

**Mr. Lithium and His Many Contributions to the Lithium Industry**

## **PREFACE**

The following oral history is the result of a recorded interview with Dr. Ihor Kunasz conducted by William H. Wilkinson on February 27th, 2019. This interview is part of the AIME Oral History Series.

## **ABSTRACT**

Ihor Kunasz, a world-renowned expert in lithium, has had a unique life and career that has led him all over the world. In his childhood, Dr. Kunasz lived in France before he moved to Cleveland, Ohio for college. In college, he was an All-American soccer player for Western Reserve University while studying geology. There, he met Dr. Francis Staley who was a major influence in his studies. After graduating with a bachelor's degree from Western Reserve, Dr. Kunasz attended Penn State for graduate and doctoral school. While there, he focused his research on the lamentations in salt and the geochemistry of it. During this time, Foote Mineral Company had a fellowship opportunity available that dealt with studying salt drilling. Dr. Kunasz took this fellowship opportunity and eventually became a chief geologist for Foote Mineral. In this time, they expanded their company reach from North Carolina, Nevada, and California to locations internationally. Dr. Kunasz traveled throughout the world for business, though his main focus was in Chile. There, he helped define the Salar de Atacama salt flat which has since become the largest producer of lithium brine in the world. Challenges that Dr. Kunasz had to solve were working around the sand and mud to successfully drill the salt flat.

A major accomplishment of Dr. Kunasz' was his defining of brine deposits and developing models to aid lithium extraction. Although many of the deposits appear similar, there are multiple chemical make-ups of the deposits, requiring each to be approached in a different way. Dr. Kunasz helped develop approaches to each of the make-ups, and these models are still used to this day. To be successful, though, Dr. Kunasz had to enter the areas he worked with an open mind. He had to curb expectations and do his best to learn the language and culture upon arriving. Some of the places he had to do this were Russia, Chile, and Kazakhstan with associates such as CORFO in Chile. As a result of his many contributions to the industry, Dr. Kunasz received many prestigious awards throughout his career, among them the Hardinge, Dreyer, and SME President awards. Dr. Kunasz reached the role of presidency with SME over the course of many years with the organization, developing a fraternity like relationship with many of the members. He continues to be an active member of SME today.

Readers are asked to bear in mind that they are reading a transcript of the spoken word, rather than written prose. The following transcript has been reviewed, edited, and approved by the narrator.

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## Part 1

### 00:13 Introduction

Wilkinson:

Hello, I am Will Wilkinson, the 2009 president of SME. I'm here today with Dr. Ihor Kunasz, the 1998 SME president. He is a well-known expert on industrial minerals, particularly lithium and brines, and he's also recognized for his extensive knowledge of global gold, copper, and other mineral opportunities. We're attending the 2019 SME annual meeting in Denver, Colorado. And, we're doing an oral history capture, one of a series that AIME has been doing over the past several years recording prominent members of our member societies. Today is Wednesday, February 27th, 2019. So, let's get started. Ihor, can you tell me about where you grew up?

### 00:58 A Unique Experience – Growing up in France with Ukrainian Parents

Kunasz:

Well, thank you for this opportunity. First, I'd like to make a comment. When we were married 30 years with Zenia, she would say, "Yes, we were married 30 years, but I had you only for 15," because I was traveling all over the world, in pursuit of minerals, lithium in particular. So, my birth is just a little different from many of the interviewees. I was born and raised in France. My mother, at 17 years, had come from Western Ukraine to work on a French farm. The French had lost a lot of people during the First World War, so they contracted a lot of these people. So, 1937, she's there, marries my dad from the same village in Ukraine, I was born in 1938. And, I like to joke that, when they heard that Chamberlain had come back with a letter from Hitler about peace for all times, I must have been created, or something like that. I was born in the town of Montlucon, which is exactly the geographic center of France. And then, we moved to Northeastern France, near Germany, where I grew up. And, I graduated from high school, after which the whole family moved to the United States to Cleveland, Ohio.

Wilkinson:

You said your mother worked on a farm. Did your father as well?

Kunasz:

Yes, from the same village. He was 11 years her senior, and my mother tells me that, well, it was this nostalgia from the same village, you know. Her uncle was really opposed to the marriage. But, after that, we moved to the North side, into the German occupation zone; the Germans were hiring a lot of people to work on their factories. So, my dad went up further into Germany, and then, my mother and I stayed in the small town of Hagondange. My mother had a very good friend who was Ukrainian, who was the wife of a hotel owner where we lived, and helped us. But then, when I was 4, my dad died in a train accident in a factory. Thank God the French government, because they had lost so many people, offered what was called allocations familiales, which is a social security. The French Government paid you to have children. So, at least mom got money for me, and we were able to survive. Eventually, my mother re-married and my brother was born.

Wilkinson

You moved to Cleveland after high school?

Kunasz:

Yes.

Wilkinson:

And, your father had passed away before that?

Kunasz:

Oh, yes, yes. I was four years old when my dad passed, and I was 19 when I came to the United States.

### **04:33 A Geology Degree from Western Reserve**

Wilkinson:

So, who or what influenced you to want to become an engineer?

Kunasz:

I thought about that question. I had a bunch of friends. One of them was a student in Strasbourg. In France, your high school degree allows you to enter any university, but then you had to compete to go to some very special schools. The petroleum school in Strasbourg was one of those, and he was accepted to that school. My best friend, went to study mineralogy and crystallography at the University of Nancy. There was nothing special in my life that said, "Oh my God, I'm going to study geology." You know, this happened in fact in Cleveland, Ohio, when I started the university there.

Wilkinson:

Then you are a geologist and not a geological engineer?

Kunasz:

I am a geologist, yes. My training is in geology, and what is interesting, you asked me why would I go to geology? Well, remember I'm a French kid arriving in Cleveland, not knowing anything about this country, about the system, and so on. So, I decided to go to what was then Western Reserve University, renamed Case Western University after the merger. It was not a good experience because geology was part of the geography department, and they had old people, uninteresting people. I wasn't sure I was going to continue in geology. But, what happened -- these are the serendipities, you know, in my life -- Dr. Francis Stehli had left Pan American Oil Company. And, he created the geology department at Western Reserve University, and that changed everything, because he was wonderful. He was very knowledgeable, he was supportive, and that's why I stayed and finished my four years at Western Reserve and graduated in geology.

### **06:44 A Polylinguist Learning American English Through Television**

Wilkinson:

We might come back to this later, but we all know you speak at least five languages. Did you speak English when you came to the US?

Kunasz:

Oh, yes. I had the King's English in high school in France. When I came over to the United States, I remember two things: that if I attended a party and I drank too much, which I didn't, but the next day I would have an overhang, you know, that was one of my English traits. And, when I had the course in glacial geology, when glaciers retreat, they leave gravel terraces behind. I called them tear asses. So, my friends never let me forget that very fine English. But, it changed obviously. The one thing, I would sit in front of the television, and for six months, I didn't know what was going on because it was American English. Not that I knew the English, you know, we sort of learned it. But, the one, perhaps, story that I like to tell, I would sit in front of the television, and this little puppet would come on stage. And, this is what I heard. He would say, "Daba daba daba, daba daba daba." And, ten years later I realized what it was. It was the Brylcreem puppet. And, he said, "A little dab will do ya." And, for a foreigner, you know, it's, "Daba daba daba da." So, these are the sorts of experiences in English. Plus, the other thing that a joke, friends of mine after I was in Chile, he said, "You know, you really know a language if you understand a joke, because it's a social satire." And then, he continued, and he said, "You know what? You really know the language if you can tell a joke in that language, and they laugh at it." For quite a while, jokes in English didn't mean anything to me. But then, I learned very quickly, especially from mining engineers.

### **08:52 Penn State and the Silurian Salt Deposit**

Wilkinson:

One of the challenges I am sure you had. OK, you completed your undergraduate work at Western Reserve, then where did you go for graduate school?

Kunasz:

Well, again, I mentioned the name of Dr. Stehli, and I think he had something about getting me into Penn State. So, I went to Penn State. And, my advisors there were Dr. Lauren Wright, Chairman of the Geology Department, who was a geologist who worked on the Western Plateau, the Mogollon Rim, and Dr. Bob Schmaltz, who was the geochemist, because the topic that I picked was the Silurian salt deposit under Michigan, under Detroit, going all the way to Windsor. I often sort of laugh because Detroiters don't realize they have miles and miles of tunnels under their city. And, the topic of my thesis was the significance of laminations in the salt because salt is not white except in high evaporative cycles, when it appears pure white, and dark during wet cycles. Those laminations continued all the way from Detroit to Windsor. So, I picked up a layer, collected many individual light and dark laminations (called varves), and I studied the geochemistry and tried to understand the depositional environment of the Silurian sea at the time. So, I did that and then went on to my PhD program.

Wilkinson

Did you find it difficult to transition from graduate student life to being a working geologist?

Kunasz:

No, really not, really not. At Penn State we lived in graduate circle. Zenia was doing a master's in Slavic languages at the time. Both our children, they were born at Penn State. In fact, it's Bellefonte not Penn State. Penn State has a hospital today. But then, you get a job. It's interesting coming from a Ukrainian background. My parents and Zenia's parents came from Europe. Life was not easy, and you worked, you know. And, when I mentioned to my father-in-law that, perhaps, I'll go with another company, he would say, "Oh, no, no, no, no, keep your job, keep your job." So, for me, having grown in that environment, you know, you don't question it. It is security. Plus, at the university, I never understood "university life" because the concept did not exist at universities in France. I played soccer at Western Reserve, having come from France, and I'm an all-American soccer player. But, no "university life", because I went to work in a chemical lab. And, at first, I cleaned the dishes, and then I became an analyst. So, that was a little bit of income coming in. But it was never something that was sort of given to you on a silver spoon. You just did it.

### **12:15 Foote Mineral Company – From Fellowship to Chief Geologist**

Kunasz:

At the time of the Second World War, there was a program on critical minerals for the United States. And, geologists would go out west and evaluated the occurrence of many critical minerals. Potash, apparently, was one of those commodities; lithium did not as it was not of interest at that time. Clyde Kegel was the President of the Leprechaun Mining Company. I jokingly asked him, sometimes, "What do you do? You jump from valley to valley, as a leprechaun?" But, he decided to analyze the brine in Clayton Valley, which is the first valley north of Death Valley. He discovered some lithium in it, contacted Foote Mineral Company, which acquired the claims. So now, you basically have a hard rock mining company that knows nothing about salt deposits or brines.

So, Foote Mineral Company contacted Lauren Wright, the Chair of the Geology department at Penn State University. Foote's geologist knew him. He says, "Do you have anybody who knows anything about salts?" There I was. They offered me a fellowship. And, for three years, I would go to Clayton Valley, which is just south of Tonopah, Nevada, and studied the available information. And, that was the basis for my doctoral thesis. And, at that time, it was interesting that Chevron wanted to hire me, because a lot of the oil deposits are related to salt domes, and they wanted somebody who had done work on salt to figure out, "Where do we drill?" If drilling is too shallow, they might miss the oil. If drilling too deep, they might spend too much money. Oil, if you remember, was up and down, up and down. I often joked with my wife, "I could have been today a very rich oil geologist or a very poor one." So, I decided to join the Foote Mineral Company, the largest lithium producer in the world at the time.

And so, after two years, I became chief geologist, and my job was to evaluate, especially since lithium had been discovered in brines. I remember at the defence of my doctoral thesis Dr. Williams asking me, "Well, now that you've analyzed this deposit and you know all about it, where are you going to go find the next one?" I answered, "It's a company secret," and I got a big chuckle out of the committee. But, that's what I did. I tested practically all of the salt flats in Nevada and California. I was responsible for the reserves on the North Carolina lithium pegmatite property, and then, the hydrology and the development of the Silver Peak Clayton Valley brine deposit. It was very interesting for me to do that job. So, this is my educational route. And, after I joined, the history at Foote became a bit complicated because Newmont had acquired a big stake in Foote Mineral Company. At that time, Vanadium Corporation of America was a huge consortium making vanadium pentoxide, ferrovandium, chromium, ferrochromium. And, the company merged into Foote Mineral Company.

So, suddenly, Foote Mineral becomes this big company. You know, that it was, the Ferro Alloys Company was much bigger than we were. So, I did work on vanadium in Canada. I evaluated silica; sources necessary for the production of ferro- silicon and silicon metal. I still have some of those metal samples. So, I worked on a number of mineral commodities, but basically, my job was the lithium. So, I traveled practically everywhere. I had the opportunity to visit the largest lithium pegmatite in the world (Manono-Kittotolo in the Congo). However, the political environment is not very stable.

### **16:30 The Connection Between Lithium, Hydrogen Bombs, and 7-Up**

Kunasz:

In the 50s, the Atomic Energy Commission decided to make the hydrogen bomb, and the hydrogen bomb is based on the bombardment of the lithium six isotope, which is the reactive isotope, to create a tremendous amount of energy, which in the case of a bomb, the purpose is something different. Ultimately, as a side comment, if that thermonuclear energy could be harnessed, there couldn't be any problem with energy in the world. The problem is, that during the initial reaction, you have to contain the temperature of the sun for a nanosecond. There is nothing available today except the Tokamak reactors, which uses a force field that would allow that initial reaction to proceed. And, after that, you're fine. The other interesting thing, besides that, the lithium seven isotope, which is 94%, is the common lithium that goes into practically everything. In those days, there was 7-Up. If you drank 7-Up, the 7-Up was because you had lithium seven isotope in it.

So, sort of a side thing, but perhaps one of the major applications, and I love the history. You heat something, it expands. You cool something, it contracts. If you do it too fast, it cracks. If you put lithium into the formulation of the glass, nothing happens. It can go from freezer to stove without cracking, and that's in Corning Ware. Foote Mineral Company sold the lithium to Corning to make that. These are other uses that I like to talk about. The Air Force had a problem with lubrication. What happens, the lubricant is a stearate, and if it's a calcium-based stearate, what happens is that it becomes a soap at low temperature, not very good. The sodium-based stearate, on the other hand, becomes a liquid at high temperature, not good either. The lithium stearate stays a stearate and behaves as a lubricating grease through all the temperature range, which they love. So, today, if you go buy white grease in the store, it's a lithium grease. All of the greases today, practically, are lithium greases. There are other applications: in air conditioning, in pharmaceuticals. There's a big application, but those are the main ones. Obviously, in electronics, lithium metal is the next major component because that runs all the iPhones, all the computers. They're all based on lithium metal batteries and, perhaps, in the future, cars.

### **19:29 Early Mentors – Doctors Stehli, Wright, and Schmaltz**

Wilkinson:

We'll probably come back to some of that later, but let's go back to school a little bit. Were there any of your professors or any of your classmates that were mentors or influenced you in your studies?

Kunasz:

I would have to say that the one that really pushed me or at least directed me to geology would be Dr. Stehli at Western Reserve. And, the one event I remember --he was a great mentor -- I had to write a senior thesis, and I thought it was brilliant, and it came back all red. And, I learned the



lesson very well because he said, "You know what the problem with your paper was, is that you wrote it assuming I will understand what you're trying to say." He says, "You should write in such a way that anybody could pick it off the street, and perhaps not understand all the technicalities, but they would understand what you're trying to say." So, that stayed with me. That was probably the one mentor; you know, that I can remember well. The other two obviously are my advisors at Penn State, Dr. Lauren Wright, on the geology of my thesis, and Dr. Bob Schmaltz, on the geochemistry of my thesis.

Wilkinson:

You did mention that you had internships with Foote. Did you do any other internships before that?

Kunasz:

No, no, no, no, just that one. It was a three-year fellowship that I had to try to unravel the origins of the lithium in Clayton Valley, Nevada. That's what I did.

Wilkinson:

Did any particular political or cultural events affect your studies? We talked a little bit about lithium and brines.

Kunasz:

There really wasn't. In retrospect, today, my son is a surgeon, and he was in the military. In fact, he just got out two years ago as a full bird Colonel, and his friends were all doctors in the military. And, I remember when I would come back from a trip, two years later there seemed to be a revolution or something. They would look at him and say, "Yes, oh yes, yes, your dad is a geologist. Yes, we know, we know." But, even in retrospect having been in Zaire, what's going on today, and if you look at Zimbabwe, what's going on today, some of those places, it used to be easy to go there and work there, but today I just don't know whether I would go. And, you would know well, because you've been in Zaire, obviously. So, but no. Was there an impact on my decision to change or anything? No, there was not, no.

## **22:20 Expanding Foote Mineral Company from North Carolina and Nevada to Chile**

Wilkinson:

So, you talked about your first international job. What were your job duties like in that first year?

Kunasz:

Well, two things: one, Foote Mineral Company had a spodumene reserve of pegmatite in North Carolina, and the job was to direct drilling so that they would identify the best parts of these pegmatites, and then, also track the resource to be sure that we had enough. The other one was with the lithium brine. So, with the brine, that became, truly, the most important part of my activity. Number one, at Silver Peak, Nevada, obviously you have a finite liquid. So, I was able to develop a projection that would tell them how long and how weak your lithium will become with pumping. In Las Vegas, there was a lithium conference, and I talked to the Silver peak hydro-geologist, and she told me, she says, "You know what? We are right on your projection graph." In brine deposits, you start pumping the rich part, and the peripheral dilute brine moves diluting the reserve. There is no

question about it. And then, looking at new deposits, so, this was -- and I have to backtrack-- If I start writing about it, Clayton Valley was the very first lithium brine deposit from which lithium carbonate is the first product out. Well, later, we'll find out that that wasn't so good because all the costs went to the lithium.

Kunasz:

And, in Chile, I'll address that later, lithium is a secondary product. So, basically, it's free, and that caused a certain revolution within the lithium industry. So, I did the exploration in Nevada, on the playas, the dry lakes in California, and then Chile. In 1974, after Allende is deposed in 1973, correspondence starts between the Chilean government and Foote Mineral Company. "We understand that there is some rich brine." "Yes, we have rich brines, but could you tell us how you process your brine in Nevada?" "Well, we're not willing to tell you until we sign an agreement." And, in 1975, Foote did sign a feasibility study with the Chilean government. And then, my job was to conduct exploration over the whole Salar, 35 miles by 35 miles of salt that is very rugged. It's not smooth; everything is just compressed. So, it had to be done by helicopter, portable drill to test the brine. Thank God the brine was only 50 centimeters below the surface, so we could drill two feet and collect the samples as we went. And, when that was done -- well, I don't know if this is the appropriate time -- but then we started to do the work on drilling to confirm that there is enough flow from the salt. We confirmed that there is; it's like a Swiss cheese on top. For those who might be interested, we pumped a hundred foot well. And pumping at a rate of a thousand gallons a minute, just 50 centimeters. It was like pumping from a lake, and it's still like that today.

Some of the other activities besides tracking lithium, involved limestone, which was used in the original process of recovering lithium from spodumene. [This] was called the calcination, which blended limestone with the spodumene, burned it, and then you would get an impure lithium hydroxide. So, I had to track the limestone reserves of the properties in Virginia, where they had the operation. And then, what else? I evaluated vanadium deposits because the Vanadium Corporation of America had vanadium properties in Northern Quebec. Foote was interested in boron, so I did borates. So, I did a variety of industrial minerals, but the focus really has been lithium in pegmatites and lithium in brines, basically. In Chile, just for comparison Silver Peak Clayton Valley, Nevada, we started about 400-500 parts per million lithium. Then, the concentration started going down because demand for lithium increased and pumping increased. You have to remember, there were only two companies in the world that were producing lithium chemicals, and that was a \$100 million a year industry. That said, today, it's way more than that. In those days, we were not concerned very much about looking for more lithium, because I would have loved to do a lot of research on lithium. But, in a business environment, why do we need more lithium? We have enough of it.

## **27:49 Foote Mineral and Chilean Project Boundaries**

Kunasz:

So, this is what happened: the Chilean concentration, if I said 500 to start, maybe it's 200 today at Silver Peak, it is 2,000 to 4,000 parts per million at the Salar de Atacama. It's extremely rich deposit, and I don't think anybody can compete with it. So now, we are negotiating with the government, and suddenly the government says, "You have a brine operation in the United States. You want to control the Salar at the Atacama; you're not going to develop it. You're just going to sit on it, you know?" So, they forced us to the southern part, and this is where I want to point out a very scientific approach to how to draw boundaries on a salt flat. I am in Paris at the international conference on geology. My family is with me. We're all asleep. Three o'clock the morning I get the

call from Chile asking me to define the boundary of the property that the government will let us have. And, there I am at three in the morning with maps on the bed drawing very scientifically. Well, I knew enough about the chemistry, but to do the property that today Foote Mineral Company acquired, and in the North, nobody did anything.

But, I'll address that because it's a very important part of what happened to the spodumene pegmatites. If I may, Chile is a big nitrate producer. To make the nitrate fertilizer, you need potash. So, when you go buying some fertilizer, you know, you have the NPK, the nitrogen, the phosphate, and the potassium. At the time, Chile was buying the potassium from Canada, too expensive. Soquimich's chemists figured out that the brine is so different in the North of the Salar that, if they blend that brine, they can make potassium chloride. And then, that brine, they would transfer it to different ponds and make potassium sulfate which is preferred by potatoes, tobacco crops. So, they made that, and, in the process, suddenly, what do you do with the residual brine that has a very high lithium concentration in it? So, Soquimich decided to enter the lithium business. They were able to drop the price of lithium by half, and they shut down the two North Carolina pegmatite operations. Foote Mineral company shut down in '97. And, the thing that I'm trying to tell all the newcomers into the business is that Soquimich has so much of that lithium brine, they would kill the market if they produced everything. They're very good businessmen, produce enough to satisfy demand, and they pump the excess back into the salt. And, it is a brine that is much richer than what they pump out. So, as the Chileans say, "Ojo, watch out what you are wishing for as a newcomer." So, this is what happened, and my job also was to track the resource at the Salar de Atacama on the Foote side of the property to be sure that there is enough for a long period of operation. And, there still are.

### **31:27 Transition from Research to Field Work – Ukrainian Background**

Wilkinson:

Going back to that beginning, your first job was to direct drilling exploring for spodumene. You're a graduate student at Penn State. Did you have somebody who taught you how to log drill core or how to act around a drill rig? Or did you just have to go out there and learn it yourself?

Kunasz:

No, I had to go out and do it, just had to go out and do it, because they don't teach you those practical things in school. For example, Mary Poulton and Hugh Miller, invited me into the University of Arizona to be what they call a Professor of Practice. Well, what I did is organize weekly seminars because, around Tucson, there are so many retirees from the mining industry. So, I brought them in to talk to them an hour about law, environment, pollution, all the drilling, blasting, etc. They would all come in and talk to the students, and I would tell them that this is what you are going to be doing the rest of your life, and I'm not interested in your books. Read your books; this is what you are supposed to do. I'm trying to give you something practical. We did not have this at Penn State. We had field trips, but none of the experience that you were talking [about], but I became very good at it.

### **32:56 Dr. Foote and Dr. Richardson – The Influences of a Mineral Collector and a Computer Guy**

Wilkinson:

At Foote or maybe even after, but specifically at Foote, early in your career, did you have any major mentors or influences there?

Kunasz:

Well, I don't know, this is for history, but Foote was a big lithium producer. Dr. Foote was a great mineral collector, and those who collect know about him. After his death, the Foote family decided to not continue with the mineral business but to supply of a large quantity of unusual and rare minerals. So, this is how the business developed. But, I often felt that they were a bit of a provincial company. You did your job, and you worked with other people. For example, with the research department with Dr. Richardson, brilliant computer guy in metallurgy, and when I talked to him about the salt in Michigan, and that the salt is layered: thin, thick, thin, thick. He said, "Give me your measurements, you know, see what I can do with it." So, he comes back to me, and he says, "You know, you have cycles in you salt formation." The salt was probably twice the height of this room, and I said, "Well, fine, we have cycles, so?" He says, "Well, my analysis says that your layers show 7, 11, and 21 year cycles. And, my computer program can't go beyond that." I said, "Well, fine. I don't know what it is." Dr. Richardson says that these are sunspot cycles, Silurian, 400 million years ago. The sun controls your climate. End of story. So, these are the people I enjoyed very much. But, otherwise, I did my job, resources, reserves, calculate something, and the salespeople are the ones who sell the product. And, the problem at Silver Peak, you know, that one year I remember they wanted more product. And, I said, "Guys, mother nature is going to give you a problem, and 60 feet under that salt flat is a salt layer." They said, "No, no, we need more lithium." So, we started pumping at a higher rate, and what happened? Salt is very porous and permeable, sucked in freshwater, and overnight a wall the brine in the pond was lost because it collapsed due to salt dissolution. So, you know, these are the sorts of things you can't help; you know, we have to sell lithium. You tell us what to do.

### **35:27 Career Development – Working on Interesting Projects**

Wilkinson:

So, how high did you rise in Foote? What positions did you hold? We'll talk a little bit more about your career after Foote.

Kunasz:

No, I was Chief Geologist. That was my position within the company. Later, I became a board member of the Sociedad Chilean de Litio, the joint venture between Foote mineral company and the Chilean government.

Wilkinson:

We talked a lot about lithium and talked about places you've worked. We know you worked in gold, but where else in the world have you worked, and on what kinds of projects?

Kunasz:

In terms of residing, you know, and working, Chile is the main place. The Russian Far east is the second one, where Cyprus Minerals Company developed the very first western gold mine. Interestingly, it was the result of the Eisenhower People to People Program that put together 18 mining engineers. I was one of them with Steve Thomas. And, we traveled all across Russia, and

we ended up in the Russian Far East, in Magadan. After meeting with the geologists, they came back to Cyprus to ask, and I always remember the question, "We have this quartz deposit with 20 grams of gold in it, okay, and we've done all of this trenching, the tunneling, the sampling, which, you wouldn't believe, took 15% out of the deposit." That's the way the Russians worked. And he said, "how long would it take you to develop this mine?" So, I remember we said, "well, 16 months, 18 months." "Enough," he said, "enough." And, they signed a contract because they had been years on this deposit, and they couldn't develop it. So, this is what happened, and I spent quite a bit of time developing the relationship. And, when I was at the U of A with the seminar students, I had one lesson with them on working in foreign countries. In the Soviet Union, and then in Russia, there were three mining schools, big mining schools: Petersburg, Moscow, and Dnipropetrovsk in Ukraine. And when you graduated, you didn't look for a job. A mine called you, and they said, "We need five mining engineers, please. You, you, you, and you are assigned to a given mine." And, the rest of your life, that's where you worked.

### **37:48 Differences Between Russian and American Business Practices**

Kunasz:

Now here come the cowboys, the Americans. So, we go over their plans, their data. "Oh, John, we need you in South America." John is gone, and then Mike appears, and Mike restarts the same process again. And, the third time, I remember the chief geologist comes to me, he says, "Ihor, don't you guys trust us? You keep on sending these new guys. The data is the same, and we signed a contract." It was the first contract in the former Soviet Union where we had the right to export gold, actually to London; they wanted to pay us in rubles. But, no, no, no, no, London where the gold is delivered. They pay us in dollars, and then we split it at that level. So, this is where I spent quite a bit of time. I had to learn Russian, understanding working with Russia. And, because Ukrainian is my maternal language, it was easier to learn. Russian is to Ukrainian as Spanish (which I speak fluently) is to Italian. They are very close. But, you have to learn it. My wife speaks Russian fluently. I had to learn my Russian. I had to learn the 30% differences. Knowing languages helps you develop a relationship with those people, because there are places where nobody speaks English. So many young managers would come with their contract and believe that in two weeks you're going to sign it. No, relationships first develop. You look at him, he looks at you, a shake of hands, and you are in or not. Although they said it, they rarely follow on their contracts. But, this is so different because here, you change jobs every three years here, two years there, and so on. Although I don't know you, you come work with me, I say, "Hey, how are you?" "Well, fine." It doesn't work with them. And, that's [how] many Western companies make mistakes like that. They don't understand it, the underlying structure.

### **39:41 Working for Layne Drilling in Bolivia**

Kunasz:

So, I would say this, in the between period, I was Vice President of Layne Drilling, a water drilling company and the reverse drilling process in Bolivia. And, my job there was a bit quite funny because Bolivia had a lot of French support. They put out the bid, and they were sure that the French drilling company was going to win the bid, not the American. Layne got the drilling bid. So, as a result, they forced on us advisors from BRGM, you know, the French Government Bureau de Recherches Geologiques et Minieres, to be sure that we do the things right. Then, on top of that, some people in the government didn't want the water wells. They wanted to put a dam for water.

So, here I am, in between, you know, yelling in French, yelling in Spanish, and trying to convince our guys in the U.S. that we'll be doing all right. After much haggling, Layne said, we will pick the drilling site, and if it does not produce water, Layne will not charge for the drilling. It turned out the well-produced 1000 gallons per minute. But, this is where I spent about a year in Bolivia on that. And, I was very comfortable with it because that drilling technology for brines, the dual-wall, reverse rotary technique was an excellent method.

#### **41:49 Technical Challenge of Drilling a Salt Flat**

Wilkinson:

Very widespread experiences. Obviously, the challenge you had in Bolivia was between the technical and political aspects. What were some of the biggest technical challenges that you've experienced in your career?

Kunasz:

Probably I would say to try when you're drilling a salt flat and it's sands, it's muds, it's salt, to try to figure out, out of the mud rotary drill, what it is that you're getting under there. So, when the change of technology, the dual-wall reverse rotary, came in that was wonderful because, after that, there really wasn't much challenge. And, the beauty of it is, in a brine deposit, you're looking for liquid. The sediment is a bit irrelevant except to identify the layer – the aquifer from which the brine comes out. What was very interesting, I always joke about it to the people that I can sell you a very expensive testing equipment. You know, when the driller knows when the water starts flowing out of this hole, and I said, "I'll sell you expensive equipment, a 20-gallon bucket, and a stopwatch." That's how, in the early days of exploration for brine, you know how much water comes out, and you don't have to go through all these geophysical things. But that probably would be, in pegmatites, it's very straightforward. You drill, and you know what you have. But, in the brine, this was that technical change that allowed us to really see what we have underground.

## **Part 2**

#### **00:28 Challenge of Translating English to Russian – Miswordings and What Gets Lost in Translation**

Wilkinson:

What about in the gold work you did in far East Russia, any technical challenges there or was that pretty straight forward?

Kunasz:

No, no technical. Geologically, it was a quartz blow, no overburden, 20 grams of gold because Cyprus then folded. It's the technical challenge because the Soviet approach to exploration, we could never duplicate drilling a deposit the way they did it. First, they trench along the whole exposed vein, then they sample every 20 meters cross-cut, and then sampled each side of the cross-cut. Drilling was then done in 200-meter centers and, if positive, followed on 50-meter center drilling. Once the vein had been defined, they would drive an adit at the 50-meter elevation through the whole vein, sampling every 20-meter cross-cut, followed by an adit at 100 meters elevation and then 150 meters. It would be impossible to do it today That's why they had mined 15% of the ore.

They wanted the geologists who participated in the project to be partners in the joint venture; they wanted 15% of the project because they had already mined it. The more critical aspect was to be able to work with the geologists, because English was not an option. I often caution, I did caution the students at the University of Arizona, when I ran a seminar, don't use a translator because the translator just translates words. You need an interpreter. You need somebody who knows geology, who can translate that for you. Sometimes there are some bad events where you say something to a governor, as I did in Kazakhstan, that, "We are going to help you with schools, we'll help you with medication, medicines." The translator tells the governor that, "We'll build you a hospital, and we'll build you a school." And, that's where I do cut it in Russian because the problem with that is, not only the translation, but six months later the governor doesn't want to talk to you because you are not delivering on your promises. That is the big risk. It has happened a couple of times, I remember. That's the "technical" challenge in those places. Western companies do not seem to appreciate this assuming that Soviets think as Westerners. Oh, yeah.

### **03:05 Technical Contributions – Developing a Model to Understand Brine Deposits**

Wilkinson:

So, technical as well as cultural. Can you please share some of your technical contributions to the industry?

Kunasz:

Understanding brine deposits. I started at Silver Peak trying to develop a model, which apparently is still viable today. The model was really simple, comparing how much brine you pump compared to the decline in lithium concentration. That model is probably still a very valid one. In Chile, the brine deposit is so extensive that it really doesn't matter at this point. However, I did develop the original lithium resource model, and they refined it for the area granted to Foote Mineral Company.

While all salt flats seem alike, but they're not chemically. For each one, one has to understand that it is a complex brine, mostly sodium chloride but with some potassium, magnesium and sulfate. If you just let it evaporate, all of these combine to precipitate complex salts, then your lithium is gone.

The trick is how do you purify the brine before it is ready to pump to the plant. At Silver Peak, the key is the magnesium to lithium ratio which is about one to one. To remove the unwanted elements, you add slaked lime, mix it with the brine; the calcium reacts with the sulfate, precipitating gypsum, and the magnesium combines with hydroxide, and these two precipitates settle out. Now, the lithium is free as lithium chloride.

In Chile, it doesn't work because the magnesium to lithium ratio is seven to one, too expensive to use the Silver Peak process. What I did, because in the southern part of the Salar, there was a dolomitic deposit, and, over time, I figured out maybe there is some calcium in there. Sure enough, I outlined a big calcium brine reserve in the southern part of the Salar, which provided a simple answer to the high magnesium. Once you mix the two brines, you eliminate the sulfate as gypsum. Now, the lithium, it continues to concentrate as lithium chloride.

Bolivia is touted as, contained, the largest lithium resource in the world. The problem is the Salar brine where the magnesium to lithium ratio is 26 to one. It's a magnesium brine. It's really not a lithium brine. On top of that, the President, Evo Morales, who is a socialist, doesn't want to let you to make lithium carbonate. He also wants you to make the lithium metal plant. And then, he wants

you to make a battery plant, and he wants to make the automotive plant. That's what you're allowed to do in Bolivia. So, when it's going to be developed? I don't know.

But, each one of these brines deposits has to be looked at separately. So, as a geologist, you contribute to the understanding of brine and come up with successful solutions of a brine. That's probably what was the best and most satisfying things I've done.

## **06:24 Working in Kazakhstan and Chile – The Importance of Understanding Other Cultures**

Wilkinson:

So, you've worked with a lot of people, different parts of the world. Do you recall any significant experiences working with colleagues that you can share, either good, bad?

Kunasz:

As I say, fundamentally, you have to understand the culture. You cannot go blind. As I told a student, if you know the language, better; if you don't know the language very much, try. I always say we are always so pleased if a foreigner comes to us, and he tries to speak some English. You say, well great. If you don't know the language, be sure you understand their culture. And, the third one is that you better know your U.S. History because they want to know our history. And, it's embarrassing if you can't answer the question. These issues were very important when I worked in Kazakhstan for Pegasus Gold trying to create a joint venture for the recovery of gold. Do you remember the name? I was going to be the General Director, and then Pegasus pulled out. But, I remember we used to all, every Sunday, go to the Dostun, the communist hotel. All the ex-pats would go there on Sunday to meet. So, I go up the stairs, and there are three lovely young girls with a stack of books. I say, "Hi, how are you? What are you doing here?" "Well, we came with the government for the embassy; we're going to work in Kazakhstan." And, I said, "What are your books?" One was the geography of Kazakhstan, another the economics of Kazakhstan. And, I thought to myself, "You're just starting to learn about Kazakhstan now? You're not ready!" This is one of the big problems.

And, as I don't, I know I repeat myself, but they say, you know a language if you can understand a joke in that language because it's a social critique. And, you know when you really know the language if you can tell the joke in that language, and they laugh. With the Chileans, I loved them because they joke all the time; you're serious, serious, and then they joke. My Spanish is Chilean, and my ear is very much accustomed because I worked in the field. I didn't work with the intelligentsia of the city, so my ear is very accustomed to hear chopped words, and so on. Whereas Zenia, who knows Spanish, sometimes has a hard time. But, in any country as a general comment, a geologist, and you would appreciate this Will, is like missionaries. You go to a country, you don't know anybody, and you have to develop relationships. Not convert people, but at least make them work together. I think that aspect Western companies failed, and the big failures I think are the colonialists, English first and then the French. And, it seems to be, when they arrive, they know everything, and assume that everybody under them is not very smart. Yet on the other side, we are mavericks. We think that everybody's going to work just because we're nice guys? And, that doesn't work always.

## **09:48 Developing Relationships with CORFO, Coworkers, and Business Associates**

Wilkinson:



So, we had part of a conversation about colleagues. You mentioned Mary Poulton and Hugh Miller getting you involved at the U of A, but are there any other particular colleagues that you've worked with in far-east Russia, Chile, that have good stories or made an impact as people that you really liked to work with, individuals?

Kunasz:

Well, I must say that at Cyprus we had a very nice team working on the Kubaka Gold deposit in the Russian Far East project. Most were the technical people in the ore evaluation. What I did was really the link between the Russian contingent and then our contingent to make things work smoothly. From that, I think it was very nice, but there are many people who pass through, so I cannot point. Steve Thomas still lives in Denver, and he worked with me on that. Then, Todd Anderson was another guy, brilliant, young mining engineer, computer, very savvy. They developed very good relationships, too, with the Russian contingent.

In Chile, I was not the only one who was working on the project in Chile: Rex Bell, my staff geologist, spent much time on the exploration, and David Coghlan, a fine chemical engineer, developed the pond system, Pat Brown who solved the phase chemistry, and Gene Dezmelyk designed the chemical plant. I developed a great relation with the other engineers of CORFO. CORFO is the Corporacion de Fomento, the development company of the government. They had done a lot of the work on developing the process for lithium, potassium. And, with them, we became very close and very supportive. There was a little bit of conflict because, here is Foote Mineral Company arriving, and you're going to tell us Chileans how to do these things? We know as well. After a while, they understood that we had the experience, we had a lot of experience, and it worked out in the long run. Now, I will mention something about the lithium: Silver Peak, Clayton Valley lithium, the first product out of the brine. In Chile, we also produced potassium, and lithium suddenly became much cheaper. In the northern part of the Salar, they produced potassium chloride needed for the production of potassium nitrate and produced so much excess lithium that, effectively, lithium now became free. That's why they could cut the price by half and shut down the two North Carolina pegmatite operations

## **12:40 Largest Producers of Pegmatite – Chile, Argentina, and Western Australia**

Wilkinson:

Why don't you mention it now?

Kunasz:

Well, the biggest source of lithium today is brines. Chile, mostly. Argentina is second. Greenbushes, in Western Australia, is the world's largest lithium producer from pegmatite. Spodumene from pegmatite can be very pure or have some iron in it. Most of the pegmatite spodumene has iron in it. When you mix spodumene into a ceramic application, if you have a bit of iron, the ceramic doesn't come out white. It has a slight yellowish tinge, which has nothing to do with technical performance. However, housewives don't like it. At Foote Mineral Company, we had to remove the iron before we could send it on. Well, in Greenbushes, their spodumene has practically no iron. It's very rich, and they can sell it directly to the ceramic industry. And, that's what they do. And, there's a huge pegmatite. I might mention the story: the first time I went there, they were producing tantalum from the weathered part of the pegmatite. And then, they showed me a core saying, "Here is some tantalum in the core, and there is feldspar." And, I looked at it. I said, "You know, guys, this is spodumene. This is not feldspar." And then, they became a producer

of lithium. And, on top of that, when they recover the high-grade spodumene, they have also some lower grade, which they ship this to China where it is converted to lithium chemicals to make lithium metal for battery applications. So, that is it. Nobody can compete with the Greenbushes. Huge, huge, beautiful, beautiful deposit.

#### **14:43 Developing the Salar de Atacama – A Defining Moment in the Lithium Industry**

Wilkinson:

So, what milestones in industry do you think had the biggest impact on the industry? You kind of mentioned, I think, a couple of drilling and different types of drilling, but overall maybe?

Kunasz:

Well, one of the things that one has to remember that the lithium industry, when I started, was a very small market, you know. There was nothing big that was happening. Especially when I was mentioning the Atomic Energy Commission, everything was towards the hydrogen bomb. And then, that stopped because they made the atomic bomb. So now, the ceramic industry came in, and then the grease industry, and so on.

But, in terms of the lithium industry, the big change was the development of the Salar in the Atacama. No question about it. I had been invited by the Argentinians after that to come in, and I spent a lot of time with Dr. Nicolli and others, going all over Argentina looking at their salars. And then, we went to Bolivia. And, that one, it's a little bit funny. In 1977, because of lithium and the government's insistence, we held a lithium symposium. And, the government blamed, us, the two lithium producing companies, "You're not doing enough." They predicted that there's going to be a million electric cars in Washington by 1980. And, you know, it did not happen.

Then, we went to evaluate the Salar de Uyuni. Now you're talking about a hundred kilometers by a hundred kilometers salt flat, and it's flat. You can drive at 60 miles an hour on that one. And, I called that trip the lithium safari because the USGS was there, I was there for Foote, Gerald Blanton was there for Lithium Corporation of America, and Raul Ballon for the geological survey of Bolivia. We all sampled the same hole, and, by God, we all got the same analytical answers.

I was invited with the National Academy of Sciences to go to Tibet, where they had discovered a lake with a thousand parts per million lithium. So, we went. They're still attempting to do something with it. China is trying to develop their own lithium industry. I also did some evaluation in Northern China. The Qinghai basin has a lot of lithium brine deposits, but their chemistry is wrong. They cannot make it happen and make large quantities of lithium from their brines. They're still trying.

Going back to Russia, I looked at some of the Russian deposits, and they are nowhere competitive. They mine pegmatites with tin and beryllium. The lithium is only half of the standard pegmatite. A pegmatite today, by and large, will have one and a half percent lithium oxide or 0.7% lithium. That's it. Now, in Greenbushes and in Canada in Bernick Lake, apparently, that spodumene comes from another mineral that was exsolved and gives you spodumene plus quartz. Very rich, very pure. But, Russia, as far as I know, they haven't had anything, although they had a big industry in making lithium metal, and they were trying to also make the hydrogen bomb.

But I would say that in terms of lithium, that's it. The Atacama Desert, the Chilean one, and the ability of Foote Mineral Company to get in there and become, you know, a major producer of lithium from that rich brine.

## **19:20 Honors – Hardinge, Dreyer, and Past President Awards**

Wilkinson:

Can you tell us a little bit about honors and awards that you've received in your career?

Kunasz:

Well, one, I'm an all-American soccer player. Okay, that's not mining. Basically, it's through SME. I grew through the Industrial Minerals division, becoming Chair and then from Chairman, then SME President in 1998. I have the two awards that I obtained. One is the Hardinge Award, and the other one is the Robert Dreyer award.

Wilkinson:

And, what is the Hardinge award given for?

Kunasz:

That was for my contribution to lithium brines, and I think Dreyer also. I can't remember the exact language that was on the plaque, but it's all related to brine, brine exploration, and lithium, yeah.

Wilkinson:

Those are both very prestigious awards, as well as your Past President award.

Kunasz:

Oh, I forgot about that. But, you know, I was at the luncheon of Industrial Minerals, and there is a Chairman's plaque with a hammer, and I don't know where that is. I'll have to look, but maybe I'll have to build an extra room for all of my stuff.

## **20:42 Becoming President of SME**

Wilkinson:

Good. Let's shift gears a little bit, talk about AIME and SME. How did you first hear about AIME and/or SME, and then how did your involvement progress over the years?

Kunasz:

AIME, in those days, there were the four organizations, right? Foote Mineral Company, because they were producing a lithium metal, attended usually TMS, and they dragged me along, you know, maybe for wine tasting or whatever, I don't know. Technically, I should have been with AGS, because of geology, but then it shifted to SME. And, I started attending the meetings, and then it started moving up the organization. And, the way I ended up to my position of Presidency was because of Bob Freas.

Yes, yes, yes, yes. Bob came to me, and it was a shocking for me actually to hear would you consider being blah, blah, blah. And then, since I was overseas, he took my place in AIME

because the SME president goes to AIME, and Bob took my place. But, this was the evolution. And, there's going to be a question, I think, that although I probably didn't get much from lithium because, I mean, it's such a small segment compared to gold or copper or whatever, or even industrial minerals. But, it was the relationship, and call it a fraternity, if you wish, that I could always rely on somebody or talk to somebody about elements. Spodumene is an industrial mineral, so mining is mining. Those are elements that go together. With brines, it's different. It was very solitary because you don't have that many brine operators.

Wilkinson:

So, did you work your way up through the industrial minerals committee, and then get on the board?

Kunasz:

Yes, starting with Chair of the Philadelphia section (encouraged by Tom Falkie) then program committee member to Chair of the committee and then board member of SME and finally President of the Society in 1998. No shortcuts, just to end up the ladder. Yes.

### **23:15 Career Benefits of SME Membership – A Good Fraternity**

Wilkinson:

So, how has your membership in SME benefited you in your career?

Kunasz:

Simply because having the support of professionals. No question about it. I had a lot of relations with USGS, but it was probably the other way around where they wanted to have more information from me than I could get from them because they're generalists, in a way. But, even today, if you look at coming to a meeting like this, I said, "Well, do I want to go?" You attend, and then you meet all of the people that you have known through all these years and, from that standpoint, it's very good. And, you hear things about companies, about mergers, and all that. So, it was a good relationship, a good fraternity.

Wilkinson:

So, you would say a society membership is still a benefit to the industry today?

Kunasz:

Absolutely. Especially, you heard me this morning, I mentioned that besides the fact that I'm the bag carrier for my wife as she goes through the exhibit collecting giveaways she sends to orphanages, I would stop and talk to the exhibitors, introducing myself as the last century SME president. I would comment that, 20 years ago this looked different, and not only because of participation increase but also the technology that has come into the industry. And, the people, the younger guy[s] who are coming in see something that 20 years ago we wouldn't have seen. There was even one fellow who had a drone. I said I want a drone so I can track my wife. But, you know, when did that appear in exhibits here? I don't remember seeing it last year or two years ago. That is the big advantage, that, with this kind of a group of people, you can jump ahead. During my career, I worked my way through, just because I never had much exposure. You sort of were on

your own, or you didn't have the support. But, I think that is especially important, and I think it's one of the questions for the young people. This is the opportunity you have to really get ahead in the world, by being a member of SME.

### **25:43 The Need for Educational Change – I Use Copper Every Day**

Wilkinson:

So, that is a question that comes up. You answered, that in your opinion, what can we do to attract young people to the industry? Are we doing enough? Are we doing the right things?

Kunasz:

Well, I'm not sure. One of the things that I do remember back in Pennsylvania, when I still was with Foote near Philadelphia, and I remember looking at science books in high school education. It used to be something like “minerals and the earth and mining”. And then, the new books came up, “minerals, the earth, and the environment”, and then it became “minerals and the environment.” And, finally, it became just “the environment.” And, I think over 30 or 40 years, the brainwashing of the young people has come in, totally un-focusing them from what the reality is. I mean, Pam (Wilkinson), I don't know if she experienced that, but I do go to schools and see how little students know about minerals and mining.

My presentation has three parts. One is crystal shapes, colors, which students really enjoy. Since we are in Tucson, with early Indian history, I show silver and turquoise jewelry and how they make arrowheads. Then, I have all of this practical stuff, the gypsum for the wall, the glass for the bulbs, and so on. Then coal, oh, that's a good one. They don't know what that is; they have never seen. My first question is, “Where does electricity come from?” Well, they point to the wall. They have been so, well, brainwashed, basically to think that stuff exists without having to really take it out of the ground. I think, “How do we change that image?” And, I think industry, by and large in those days, reacted to environmentalists with, “What can they do to us?” They did. You have to really take charge of changing that, and, today, there was a discussion about how do you change that image. And, there is so much new technology in mining. We must and are changing the image of the dirty miner.

No, no, things have changed enormously, and there is the opportunity because today it's all click, click, click, with young people, I mean. You tell them that there is another aspect to mining. You can contribute to benefit the society by understanding what's happening.

The Santa Rita mountains where Hudbay is going to try to develop copper. Save the Santa Rita Group, they're going to pollute our water. They're going to destroy our water, and often they'll publish wrong information. I comment, and sometimes the Arizona Daily Star will publish my story. And, I say, “You know what, let's start talking facts. The mine is going to use 4,000-acre feet of water a year. Okay. And, they recycle a lot of it. Now, your pecan growers down the hill use 40,000-acre feet per year. Okay, they have dried up the Santa Cruz River.” And, I said, “You know what? I use copper every day, but I don't eat pecans every day.” But, these anti-mining stories keep on recurring. I just keep on writing; however, they'll allow you only one letter a month.

It's good that we have the high school teachers' programs, the national meetings, and so on. The more you do to that, the better the young people will realize the opportunities they have. However, they want instant gratification. That's the way it is, and, a few years back, we had three of the top

people from mining. And, one of them said -- it was very funny -- he says, "Kids come to me, they want a VP job out of the school, they want to work three years and retire with a golden parachute."

### **29:49 Success Isn't Handed out on a Silver Platter – What You Should Expect**

Kunasz:

This concept of no, you have to work your way through to make something happen. I'll mention that the University of Arizona offered weekly seminars to junior and senior students. Tucson is very lucky to have so many professional retirees. Will came to talk about copper. Students had to write a couple of papers for which I gave (I was an adjunct for seven years) them the format of the whole thing. What points the speaker made. What did you learn? They all flunk on the first pass. I restructured their papers, 40 of them, to say you're going to be writing reports the rest of your life unless you become President. And, if you rewrite it this way, give it back to me in two weeks, you get a better grade. Half of them wouldn't do it; half of them wouldn't do it! The girls were much better than the guys, by the way. But, this is something that you see happening. Then, to top it all, I talked to a Vice President of, I think it was SRK at the time, talking about this. He says, "Are you kidding me? I've hired some, not my students, but some of these people. I sent back the report to them for correction so they can send it back to me, so it's legible." And, he says, "You know what? I pay them a salary on top of that." Something has happened to our society. I blame high schools. Number one, they don't teach how to write anymore, and today it's texting. It's two words texting. How do you fight that? How do you change that, so they understand that they have to come up with a rational thought development in their professional life? Because all of the professionals that I brought in, I was telling them, "This is what you should expect when you start working. There is legal matters; there is water problems; there is environmental; you cannot show up on the job, 'Oh, I didn't know about this.'" This is what I did for seven years, every time, giving them this opportunity to understand the real world out there. Mining schools ought to be doing that, continue to do something like that to hone the students.

Wilkinson:

SME has a fair number of student members plus, what we call, young members. Have you had an opportunity to talk to any of them while you've been here?

Kunasz:

Only casually when I bump into them. But, I make the first effort. Where are you from, etc.? And, talk to them. But, not in a formal setting like this. Becoming a mentor, I thought about it, but somehow it never developed.

### **32:56 Serendipity - The Value of Working in the Lithium Industry**

Wilkinson:

All right, to wrap up, what is it, either one thing or several things that has made working in the industry meaningful to you?

Kunasz:

Well, one was serendipity. Remember where I'm coming from. I finished school in France; you arrive in the USA, and don't know how things happen, you don't know where to get money or

scholarships. Because when I arrived, the society that I joined was the Ukrainian ethnic society. And, traditionally, the children of the emigres became professors of history, doctors, lawyers, but very few technical. You just didn't have anybody to go to and say, "Can you help me with this or that? What schools should I go to?" I ended up in Western Reserve University. There I was, and then everything after that fell into place: graduate assistantship at Penn State followed by a fellowship from Foote that started my career in industrial minerals and lithium. Then I joined SME, and everything just kind of fell together. This is the way it went. I wish I had known more.

The one I'll mention, for example, one of the biggest shocks, I went with a retired president, and I can't remember which company, looking at a borate field mine in California. And, halfway through the trip, he tells me, "Don't you want to be the President of a mining company?" And, that was an absolute shock for me because it could never have entered my mind to think about those categories simply because of where I came from. You have a job, hold onto it. You don't think about these career changes or trying to jump over or something. In Chile, for example, what was interesting, when we had conflicts, we had an excellent top lawyer there. And, he told me, "You know, Ihor, stay technical; don't get involved in the politics." It was sort of interesting that this is not what I wanted to do. Later, I became involved in Russia and so on. But, that's what I was good at. I was good at being a technical person, the best in the lithium.

Wilkinson:

Mr. Lithium.

Kunasz:

Well, that's somebody just walking by says, "You should write a book, 'My Life with Lithium.'" Well, I'm trying to write one, not like that.

### **35:50 Put Knowledge to the Test – Don't Just Focus on Research**

Wilkinson:

So, what advice would you have for today's young leaders in the mining industry and exploration?

Kunasz:

You know, it was interesting with Dennis when he gave his Dreyer presentation, why would you want to be in the metals business? It goes up, it goes down, but industrial minerals, you always need to build houses. What I would say is that mining is a very rewarding career, talking about underground mining or the tunneling, and so on. It's mostly [a] civil engineering job. Talk about open-pit mines and underground mines, you move dirt and rocks, you achieve something that is important for society. If you're in copper, copper is needed. If you go in gold, all the wives of the world need the gold. No, just joking about this.

But, there is a contribution there that, unfortunately, the society, by and large, has made it a dirty business, and this is not what it is. Today, that's how they look at it. But, the technological advances, I mean, you look at all the equipment that was in the exhibit, just in terms of the new ways, even the conveyor belts, all of these things that are coming through. There is such an opportunity to be a good chemical engineer, a physical, a hydro metallurgist. All of these use chemistry and physics, all of the applications, they can be put to very good use instead of theoretical stuff. So, this is what I say, and SME obviously is the place, or AIME, TMS, whoever,

wherever you want to fit in a slot, that's where you really can develop a great-- it's a great opportunity for them to realize, you know, their future opportunities. That's the way I see it.

### **37:55 Interesting Personal Stories from Throughout Career**

Wilkinson:

Okay. As we kind of get to the end here, is there anything else you'd like to discuss that you've thought about?

Kunasz:

We were having lunch, and Zenia was reading my curriculum. And, she says, "My God, you've traveled all over the place." And, yes, it was. When you think about it, it's really mind-boggling actually where I've been. The President of Foote always wanted to travel with me because we could talk for hours on the plane. And then, we would read, and then, the language. In the Congo, in Zaire, we went to see the largest pegmatite in the world. And, we came back through Lubumbashi, and I wanted to get these beautiful malachites. Well, they tell us they're not [allowed] on the plane. Oh no! So, the driver of the car, and I still have, by the way, I have a letter stating that I am a member of the Legion of the Leopards with a stamp. So, there I had the letter from the General Manager, Mr. Claeys. The driver tells me, go talk to that guy at the airport. I went, and I sort of delicately showed him, and I saying that we need to go back to Kinshasa (naturally all in French). He says, "No problem, no problem." He says, "Oh, it's going to cost you 100 francs", or whatever the hell it was. I didn't have it; I had a thousand. I give it to him, and he says, "Not to worry, not to worry, our accountant will give you the change back." He comes back, and he says, "You know what, he didn't have any change." I said, "Keep it, keep it, keep it."

Now, we are coming back through Kinshasa, and I go through with my passport, and, again, I showed my letter with the stamp of the leopard. He moves me along. But, I said, "He (the President of Foote) is with me." When we were married 30 [years], my wife said "I only had you for 15," because of my international travels, and she raising the children at home. If I make any comment, I was very grateful for my wife for being the support that she has been. It was good.

### **40:15 The Value of Knowing the Language and Understanding Motivations**

In Kazakhstan, one of the things I did is very interesting. There's always a double door to the office of the Minister so nobody can listen. So, I'm sitting here, and I have an appointment at 10. At 10 o'clock, a guy knocks on the Minister's door, and he goes in. Another one, same thing, goes in. Then, I got fed up, you know. I went up, I knocked, and I went right in, and the Minister had a meeting. I knew the Vice-Minister very well, actually. They're talking Kazakh. So, I stand next to them, and, in Russian, I say, "I don't agree with you." And, you should have seen their reaction. The minister thought I understood Kazakh. But these are the sorts of little things that are easy. And, in Kazakhstan, there was a gold deposit that was being bid, and Pegasus Gold, (I was with them at the time) had the best bid, no question about it. And, we were going to pay \$20 million just for the rights to negotiate. And then, the bid results come back as an Australian company, with no mining operations, wins the bid. I go to Marat, the Minister, I said, "What is this, Marat, what the heck?" He goes to the table, his desk; he says, "There are three feasibility studies here: yours, the French, and the Australians. Could you please pick them up, and tell me what's in it because we don't understand it?" That's what we did. And, the Australians got kicked out because of the way we do an economic viability, but the French got it anyway. Later, I found out that it turned out to uneconomic. However, the French had won the bid with \$2 million.



But you invite the Minister to France, treat him to fine foods and wines, present beautiful gifts to his wife, schooling for his children, and a little villa for retirement. And, what happens when we invite them here? A barbecue? We lose against those guys. But, it's very interesting how you approach. You can't yell at them. I learned it very quickly, because I was the president of Newmont Uzbekistan Limited, the 50/50 partner. And that time, at the mine, they had poured gold. There was always an Uzbek who came into the gold room to be sure they weighted it on the rough scale then shipped it to the refinery where they really got the correct weight, and then ship to London on their airplane.

That time, the Uzbek came with another fellow, perhaps a trainee, and the sign in the gold room said, "One only." The Uzbek got so mad, he shut the operation for two weeks.

In the Soviet Union, everybody yells, I mean, I would yell you down, then you yell him down. So, I called the Minister, and I said, "You know what? We are partners, aren't we?" He said, "Yes, we are partners." "Do you realize you just lost \$250,000 in two weeks?" Man, that phone went hot, and he fixed the problem immediately. It depends on your approach. You have to really understand the motivation of these people.

And, in the development of one of the deposits, there was a second gold deposit we wanted to do. We knew the directors, and you had toasts in Russian with vodka, dinners with him, and he lobbied against us, and I figured out why it was. He was a mining engineer. But in those schools, you're a mining engineer-electrician, you're a mining engineer-driller. He was a mining engineer-driller, and his fear was, I was sure, uncertainty. You'll see how Newmont operates. He was afraid that he wouldn't understand the technology. And, once that happens, his iron curtain falls down, end of story.

And, it was the same with the young guys who worked at the mining department. I mean, all Savile Row suits, spoke English perfectly. However, in the US, if you send me a project, and page 23 to 25 is not clear, you call me up. Says, Ihor, "Can we get together over coffee, discuss this?" They would never do that. And, I figured it out because their mindset now was, if I asked Kunasz of Newmont to clarify some portion of the report he sent me, Kunasz would think that I'm stupid because I didn't understand what was in that report. And, they wouldn't do anything about it. They would shove it to the side, and nothing happened. They could not risk making a mistake because that would cost them their job.

After four years, I just had enough. I just said, "You know, Newmont paid me well, but what are you doing with your life?" That's the way it was, and we were lucky by the way, Zenia speaking Russian, and I learned my Russian. We did not have to have a translator for our daily life. Big, big difference, and, therefore, the Uzbeks would invite us to weddings, to circumcisions, to funerals. Another very interesting story, because you can't get to talk to somebody in the ministry, but when there's a funeral, they're all standing there outside, you know, after they feed you. And, if the minister is in attendance, you stop by at the receiving line and you say, "Mr. Minister, could I see you tomorrow morning maybe?" And, it's done. That's the way you do these things. Unless you know how to do that, it's a miserable life. That's part of life, in countries with radically different cultures than ours. And, our house, if you come to our house, it represents our international lives, world where we lived. We didn't buy anything special to decorate. We just had it collecting all over, all these days.

Wilkinson:

Ihor, a fascinating career. I always enjoy listening to you talk about your career and your stories. It has a lot of meaning, and, hopefully, people can learn something from it.

Kunasz:

Thank you. I'm sorry I didn't have any bad jokes to tell you in Russian.