



AMERICAN INSTITUTE OF MINING,
METALLURGICAL, AND PETROLEUM ENGINEERS

ORAL HISTORY PROGRAM

Transforming Mining Through Research, Leadership, and A Passion for Teaching

Michael Karmis

2019

PREFACE

The following oral history is the result of a recorded interview with Michael Karmis conducted by Kray Luxbacher on February 26, 2019. This interview is part of the AIME and its Member Societies: AIST, SME, SPE, and TMS Oral History Project.

ABSTRACT

Born in Greece and determined to become the first engineer in his family, Michael Karmis pursued mining engineering through his studies at the University of Strathclyde, Scotland. His career evolved as his desire to go bigger drew him towards his current 40-year position at Virginia Tech. Through various department and director positions, Karmis transformed the mining department. With his unfound passion for teaching, he diversified and expanded the department by instituting changes to the curriculum and student outreach. Karmis' research contributions in ground control, rock mechanics, CO₂ sequestration, and health and safety helped to advance the mining industry. His persistence to combat challenges promoted the growth of the industry in a time of uncertainty. Karmis' contributions as a leader in SME, AIME, the Society of Mining Professors, and the United Engineering Foundation, transformed the industry. With nothing but praise for his mentors, Karmis' admiration of the mining community shows his commitment to furthering its future.

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

00:18 INTRODUCTION

Luxbacher:

Today is Tuesday, February 26th, 2019. This is an interview with Michael Karmis, Stoney Barker Professor of Mining Engineering and Director of the Virginia Center for Coal and Energy Research at Virginia Tech. The interviewer is Kray Luxbacher. This interview is being conducted as part of the American Institute of Mining, Metallurgical, and Petroleum Engineer's oral history project. We are sitting in the Hyatt Regency just across from the Convention Center in Denver, Colorado, where the SME annual meeting and convention is currently underway. And, we are going to discuss Michael's experiences in the mining engineering industry and his contributions to the field. Michael, you were born in Greece just after the end of World War II. Tell me what it was like where you grew up.

01:10 GROWING UP IN A MILITARY FAMILY IN ATHENS, GREECE

Karmis:

Yes, I'll be glad to do that. First, I want to thank AIME for the initiative to develop these oral histories and you, Kray, for being here to interview me. I was born and raised in Greece, in Athens, in the late forties. It was just after the Second World War and a very bloody civil war that Greece suffered, so it was a difficult time. My family were mostly military people and very much involved during the war. So, I grew up in Athens.

My parents were from a very old historic city in the southern portion of Greece in the Peloponnese called Nafplio. It is a beautiful city by the sea, still my favorite place and my children and grandchildren's favorite place. I had a very pleasant, I would say, family-oriented experience in going to school and living in Greece. It was a time, mostly, of Greek re-construction in the '50s. I went through all my schooling in Nafplio and Athens and graduated from high school in 1966.

I was not sure, exactly, what to do next. As I said, we didn't have any engineers in the family. Military was the main occupation. We had some doctors and lawyers in the larger family, but I thought I should become an engineer, and I had an interest to go and study somewhere overseas and travel.

02:37 A GREEK IN SCOTLAND

Karmis:

So, simply because of a series of coincidences, I had an opportunity to go to Scotland, and that's where I went. I did all my undergraduate and graduate degrees there at the University of Strathclyde, which is an urban, historic, downtown university in Glasgow. My first thought was to become a civil engineer. I noticed the civil engineers at that time, they were opening offices and making money, building anything and everything. So, if somebody wanted a career and do well, it was going to be either a civil engineer, a mechanical engineer, or an architect.

That was the time of a building bonanza that was going on, but, interestingly enough, after halfway through my first year, I got a little bit interested in mining. I had friends who were in mining engineering.

I liked that department at Strathclyde. It was a smaller department and very historic—so I moved over from civil into mining engineering. I think that was the first good decision I've ever made.

So, I'm moving forward from Greece into Scotland now. A Greek in Scotland. It was an interesting experience. The Scottish people are tremendously intelligent, very innovative. If you see how many inventions they are credited with, it's quite incredible. The university was very old and historic (its original name was the Royal College of Science and Technology). We worked in the James Watt Laboratory and John Loggie Baird, who was the inventor of television, had also been there—and mining was a very traditional discipline for that university. The faculty was outstanding, a smaller department like we are here at Virginia Tech, very nurturing. I had a very good experience, and I enjoyed every minute of this. And, after four years I earned my B.Sc. Degree, “First Class Honors” and was asked to stay for a doctorate graduate degree, which I did. I was serving as an instructor at the same time. I enjoy teaching, so I thought that was something that I would like to do at some point. I graduated in 1971 with my BSc degree, 1974 with my PhD.

I met my wife of many, many years, Vivian, in Scotland. She was of Italian descent. So, here was a Greek in Scotland and an Italian-Scottish girl. By the time I finished my PhD, we got married, we started having children, and I had to decide what I should be doing next. And, Greece, if you may recall, in 1967, after a military coup, was under a military junta. It was a horrible government. My father, being a military person, totally objected to this. He discouraged me from going back, and I did not. But, the junta was moved away, and a democratic government returned in 1974. At that point, the opportunity for me to go back to Greece was more promising. After spending time in the UK, in Scotland, nine years of excellent time, very productive, technically and academically, making many friendships with people, Vivian and I decided it was time to go back home to Greece.

05:51 FROM ONE YEAR TO FORTY WORKING AT VIRGINIA TECH

Karmis:

So, we took our two kids, boys born in Scotland, and moved with to Greece. I worked for about three years at the National Technical University, which is the premier engineering school in Greece. I enjoyed my time there. I enjoyed teaching. I enjoyed the research. I got close with a number of mining industries, both metal mining as well as coal (lignite) mining. I did, however, feel the urge to do something a bit bigger and more global and, possibly, to make another move. This is an interesting story. I was thinking of going back to Britain on a sabbatical, and Imperial College was in discussions with me. The University of Nottingham and also the University of Strathclyde, where I spend many wonderful years, were also on my mind. One day, an elderly gentleman came to my office. He said he was a professor in an American university. He had an appointment with a colleague, and his colleague was late. So, I said, well, come and sit in my office until your contact arrives. I said to him, well, I'm a lecturer in the mining department, but I will be going for a sabbatical for a few months in Great Britain. He said, Great Britain? Why didn't you come to America? Well, I said, I don't know anybody there. I must be the only Greek that doesn't have a relative in Chicago or in Queens, New York. So, what will I do there? I mean, it does not make any sense to me. No, no, he said, I am a professor at Virginia Tech. He was a graduate of that Greek university, but he had a PhD from MIT in chemical engineering and then in metallurgy. He was one of the original faculty members in metallurgy at Virginia Tech, and he had a very good Greek name, Themistocles Floridis, a very historic, ancient Greek name.

So, he said, I think Virginia Tech would like you to be there. And I said, okay, and I just dismissed this. Then the next day, I get a phone call from the gentleman who said his name is Dick Lucas. He was the Head of the Mining Engineering Department at Virginia Tech. And, he asked if he sends me an air ticket, will I be able to come for an interview? I said you're going to send me a ticket to come all the way over there for an interview? He said, yes. So, I said, why not? I'll do it. In June of 1978, I arrived in Blacksburg, and I loved the campus. I was always in urban universities, so coming to a rural campus as Virginia Tech, with a military school kind of architecture, it was quite impressive. I liked the department and the people that were working there. They offered me a job right there to be a visiting assistant professor, and they insisted that I should know this is not a tenure track position. Now, I didn't know what the term tenure meant. I never heard it before. And, in Britain, you are either permanent or temporary; there was nothing in between. So, I had to ask people what really that means. But, anyway, I said, don't worry, I'm not going to stay here for more than one year, anyway.

I moved on my own because our third kid was just about ready to come. So, Vivian stayed behind in Scotland. She came to Blacksburg, now with the three boys, in December of that year, 1978. I was busy; we had a good time, and they asked me to stay one more year. And, I said to Vivian, what do you think? She said one more year is okay. And then, after one more year, there was another year. Then, at the end of the day, currently, I'm on my 42nd at Virginia Tech.

09:23 EXCELLENT MENTORS FROM THE UNIVERSITY OF STRATHCLYDE – DAVID O. “LEMONADE” DAVIS

Luxbacher:

So, Michael, backing up a bit to your time in Strathclyde, were there any professors that were particularly effective mentors to you?

Karmis:

Yes, there were. The department head there was a very well-known worldwide rock mechanics expert. His name was Dewi Jenkins. This is a Welsh name, and he did have a very pronounced Welsh accent. And then, my advisor was a real gentleman. He was also another Welshman in Scotland. His name was David Davies, and he was a wonderful individual. He became a very close friend afterward. They were always motivating. It was not a relationship of student to a professor; it was more a colleague to colleague. They gave me the freedom to do, as a graduate student, anything that I wanted within the confines of my research topic. I was in their houses many times. We had a very long-lasting relationship. They both have passed since then, but they were wonderful people, and, in fact, the entire department was a very caring department. You could ask for help or advice, and it was really a very good environment for everybody. It was also a very sociable department. In Scotland, where everyone had an affinity to have a little glass of whiskey every so often, the entire department often ventured to such activities, led by the department head! But, it was both a socially nurturing department throughout the years, and as well as the professional education was very good.

I will tell you an interesting, funny story. In Wales, there are certain prominent surnames that most of the population shares. Jenkins is one them; Davies, Edwards, Jones, Evans, and so on, are some others. These are really very, very common names. So, David Davies, who was my advisor, was telling me a story when he went to University in Cardiff. There were five students called David Davies. In fact, they had the same middle initial, the letter O. They had to separate the David O. Davies, and they were all asked to pick up a nickname because, at that point, all exams were in writing, right? You didn't put a number or a

code or anything; you wrote your name, so in order to get your grade right, you had to, to use your name. It was just after the war, and many of the students at this time at the University of Cardiff, they had served during the war or the military, so they were much older than him. Since they were five David O. Davies', and my advisor was also a rugby player, he was not drinking any alcohol, he wasn't smoking, he was very athletic. So, he went through school known as David O. "Lemonade" Davies because, every time they went out to a meeting, everyone was drinking beer, and he was drinking lemonade. It was quite interesting time, but all these folks that I met and worked with, and we became very friends, were excellent mentors to me.

12:43 THE MINING INDUSTRY IN GREAT BRITAIN – THE VITALITY OF COAL

Luxbacher:

What was the mining industry like in Great Britain at the time? And, how did that influence your graduate studies?

Karmis:

This is a very important question. It was, at the time, where coal mining was extremely important. You're too young to know this or to remember, but Britain had a very prolonged miners' strike in the United Kingdom. It was so prolonged and intensive that actually toppled the government of Edward Heath, who was then the prime minister. Everybody who lived through this time would remember because the power companies would cut the power around five o'clock at night. I mean, the whole of Scotland was dark. There was no television. That helped improve the birth rate after a few months. In general, it was a horrific time, and, eventually, disputes were settled after a negotiated agreement.

Britain was very much dependent on coal for power generation. Coal mines and coal miners were very unionized. That meant certain things were done because the union did a good job, but other things became more political than actual workers issues, if you will. The coal industry was a very vital industry, and, of course, it was nationalized, as the National Coal Board (NCB). They also had great researchers, and many of the techniques we use here today in coal, particularly in ground control and ventilation and other topics, have come from principles and ideas that were brought out by the UK research community. Britain also, as a country, was a global player in the mining business. Now you have to go back and think, the British Empire in terms of influence, let's say, in Africa. So, while I was a student, there were all the time companies from South Africa, companies from the Far East, big mining countries coming to the university to give seminars and interviews. The domestic mining industry in Britain was primarily coal. There were some industrial minerals that were active, but the university had very close ties with mines in the African continent and the Commonwealth countries, as most British universities did. Within the Commonwealth, we had a lot of Canadians and Australians, for example, coming back and forth. It was, at that point, a coal mining country with a significant dependency on coal. Interestingly enough, when I was an undergraduate, you could, actually, specialize in coal mining or what we called metalliferous mining via electives. I chose metalliferous mining because I thought I would like to do more metal mining, although, later on, when I went to graduate school, all my work was done in coal mines.

15:51 GRADUATE SCHOOL WORK WITH THE COAL INDUSTRY

Luxbacher:

Did you work closely with industry while you were in graduate school?

Karmis:

Yes, we had a number of projects that were mostly with the coal industry. These were on the British (and European) version of longwall mining, and the way it was the practice in the UK, usually, using advancing longwalls. We had a number of projects funded by the National Coal Board, so we work very closely connected with them. But, we also had projects with companies like Anglo American and other international mining companies who came and worked with us on metal and coal mining projects. As I said, the department head was a very well-known figure in rock mechanics within the industry at the time, so students had opportunities to work in industry as interns. When I had the opportunity, I would visit or work for a short period in the mines. I had experience with an underground clay mine in Scotland, which was one of the very few non-coal underground mines in the industrial minerals sector. Then, in Greece, I also was exposed to the underground bauxite mines. Most of my research work at Strathclyde was performed in a coal mine, which was possibly the premier coal mines in Scotland. It was called Killoch Colliery, located in Ayrshire, Scotland. It was a very interesting place, and the manager had taken an interest in my work. Every time I used to go to the mine, he asked me where is the Greek wine? Otherwise, he joked, I cannot get to the mine. But, he was a wonderful person, also a great mentor. It was a very good experience.

17:35 FROM LIGNITE TO MARBLE – GREECE’S DIVERSIFIED MINING INDUSTRY

Luxbacher:

So, you returned to Greece and joined the faculty there, after Strathclyde. Tell me a bit about the mining industry in Greece at the time, and what the faculty were engaged in?

Karmis:

The mining industry in Greece, actually, is very diversified and, for the size of Greece and the economy of Greece, is quite significant. Starting from the coal side, lignite, a lower quality coal, was a major player at that time, with significant production in Northern Greece and a smaller footprint in Southern Greece. At that time (1975) Greece had great dependency on lignite power generation, although the current trend is to significantly reduced and even eliminate lignite-based electricity and close the lignite surface mining operations. Greece was also a significant producing country and exporter of bauxite with a national aluminum industry, so there were both surface and underground bauxite mines. Also, a vibrant production of industrial minerals—magnesite, perlite, bentonite—and, in certain cases, you will find mining operations and mining regions that went back to antiquity, i.e., mining was dated thousands of years ago. In Northern Greece, there was quite a lot of interest in gold-bearing strata, which is still in production. And, there is significant resource base for a number of base metals of interest within the country. Mining was quite a diversified industry and also included a significant marble industry. Marble was and still is a major building and architectural material, and you see a lot of marble sculptures in Greece, dating to ancient Greece, as well as in modern building construction. Greece had quite a diversified and healthy mining industry.

When I went to Greece, in 1975, the National Technical University of Greece was the premier engineering university and the home of the only department of Mining and Metallurgical Engineering. The faculty there, particularly the senior faculty, were very much engaged with industry. They served on boards; they served as consultants, and also led government agencies. When I went there, the head of the department had to take time off from working full time in the university to be the Chairman and CEO for a new company the government has just established, to develop offshore oil and gas deposits.

The company actually still exists, with a different name. It was an active department with a lot of diverse experience. It was a department that consisted of the mining engineering program, the metallurgy program, and the geology program, together as an integrated entity. It was quite a historic department as well. So, it was, from a mining point of view, a very good experience. I worked with very good people there as well, and we had quite significant size of student body, but the research was not as organized and prioritized. Although now Greece is more organized and research is better recognized, the USA, at that time, had the best structure and opportunities to participate in research programs to write proposals and to obtain funding. That's one of the reasons that I wanted to make a change after two years in Greece. When Greece joined the European Union is the time that the research infrastructure became a little more organized, formalized, better funded, and recognized.

20:37 BEGINNING RESEARCH AT VIRGINIA TECH

Luxbacher:

So, when you did come to Virginia Tech? Tell me a bit about your first big research project.

Karmis:

When I came to Virginia Tech, it was fall 1978. We were then in the quarter academic calendar. Let me say this: the faculty loved the quarter system, and the students loved the flexibility of having three quarter year. The administrators disliked the quarter calendar because certain actions were performed three times a year and preferred than twice a year semester system. So, I arrived at Virginia Tech shortly before we went through the painful experience of moving from quarters to semesters. The other difference is that, at that time, we started the year around mid-September, which was what most of the world also follows. But, in our system, in the USA, if you start mid-September, it means that the football season starts a month before the students are at home, and that wasn't a good thing. Summer jobs availability was also a factor. That's why Virginia Tech, as all other major universities, moved from quarters to semesters, and then also transitioned to early semester starting in August rather than September.

You asked about the first research project that I got involved when I came to Virginia Tech. There were already a number of active ongoing projects, and the faculty involved needed additional help and expertise in rock mechanics in three of these projects. I had the convenience and the pleasure and the flexibility to work on these research projects, which I did not help bring into the university, but they needed me to work and contribute to their completion. Projects included traditional rock mechanics, exploration, and development topics, and health and safety research and outreach. All of these efforts were funded, as I said, before I came to Virginia Tech. The first project that I got as the PI (Principal Investigator) and wrote most of the proposal dealt with issues of prediction of mining subsidence. That was followed with another big project with another colleague and a dear friend who has passed, Chris Haycocks, to do work on multiple seam mining conditions. These were the first projects that I received, and I was able to hire and support students to work on these projects, which was quite an interesting experience. Although I never admitted to the students, I learned as much from them as they learned from me. It was a back-and-forth experience, and I was very pleased to see over the years, with many, many projects that we did, that a lot of them became successful academics. Others went to work in industry and some completed an MS degree without pursuing further for a doctorate, PhD. I'm very happy that I had very great relationships both with the undergraduate students who have graduated as well as the graduate students.

23:30 CHRIS HAYCOCKS – A GREAT MENTOR WITH AN EXCEPTIONAL SENSE OF HUMOR

Luxbacher:

Who were your early mentors around that time?

Karmis:

Around that time, the department had some real characters, and Chris Haycocks was one. He was, basically, educated as a metal miner from Camborne School of Mines in Britain, and then, he earned his PhD from the Missouri University of Science and Technology at Rolla, Missouri. He worked for DeBeers in-between degrees in South Africa. As a “diamond” miner, he was an expert in slope stability, which was their big issue. Then, when he came back to the US, he received his PhD at Rolla and went to work for the US Bureau of Mines in Denver. From there, he came to Virginia Tech. He fancied himself always as a metal miner, but most of the research funding was related to the coal industry. So, he and I did a lot of work together. He was a great mentor. He had an exceptional sense of humor, not always the most appropriate sense of humor, but he had definitely one. He loved the students, and he was very popular with the students. He was a great ex-rugby player, so he knew all the rugby songs, which he insisted on teaching to his sophomore class that he was teaching then. But, he was also a great teacher, and he was a mentor to me from the point of view that he always insisted that we did a great job when we wrote papers together. He thought teaching was our number one responsibility, but also, he was the most disorganized person when it comes to anything. Because I do remember when I took over the rock mechanics class from him, he gave me his notes, and he said, you don't have to do anything, everything's in these notes. So, I said, fine. I started looking at these notes, and there were things like “don't forget the diagram”, “tell them the joke”, etc. I looked around; I couldn't see the diagram. Tell the joke—no joke. After a while, I said, I can't make heads or tails of these notes; they are only good for you. He was quite funny, but he was doing a great job in class, and I think all the alumni remember him very, very fondly.

25:40 LOU PRELAZ AND DICK LUCAS – MENTORS OF AMERICAN MINING

Karmis:

There was also another different type of professor at Tech with significant practical experience, a breed that you cannot easily find nowadays. Perhaps, maybe we can do this today with professors of practice? But, on the tenure track academic ranks, we don't have many people with an awful lot of mining experience under their belt. There was such a professor at Virginia Tech by the name of Lou Prelaz. Lou didn't have a PhD, but he was one of the leaders and motivators in this country, in computerizing the coal mining industry. There were similar people to Lou Prelaz, with great experience at that point, also at West Virginia University and at Penn State, possibly also in the western mining schools. So, there was a cadre of people who came to academia with a tremendous experience. Even in coal mining, where I thought I knew well, US mining design and practices were different, and the regulatory environment was much more prescriptive and regulated. If I needed something or had a question, I would go to Lou Prelaz. He knew all about coal mining systems. He was a great person.

The Department Head was also very supportive; his name was Dick Lucas, and he was tremendously well connected with industry. When I came to Virginia Tech, I didn't realize how much funding and support we enjoyed from companies and individuals for scholarships and other programs. He was, basically, I would say at that point, possibly one of the few Department Heads that had created an endowment

generated mostly by his efforts under the Virginia Tech Foundation. He understood the power of alumni. He worked with them very closely, and, later on, when I became a Department Head, what I saw him doing helped me a lot to pursue what I wanted to achieve at the department. He was also a great person. I think he did a wonderful job at the department.

27:39 THE MOST REWARDING PART OF MY WORK – EDUCATING STUDENTS

Luxbacher:

I've always admired your approach to work. You genuinely enjoy your work, and working with you is a lot of fun. Was this true early in your career? Or, was it something you developed over time?

Karmis:

I always try to have fun in whatever I do, and, even if I do things that I don't particularly like, I'm trying to make light of it and do the best. But, it's fun to teach. I thought the educational portion is the most rewarding part of what we do. I know in the last 20 years, the emphasis is on money and research, and counting dollars and all that, but I will be surprised if anybody in our business doesn't take more pleasure in teaching, and more pleasure in seeing undergraduates doing well, and more pleasure in doing things with them. It's a tremendously motivating and rewarding experience. That's why I always say we get more out of them than what we give them. So, I tried to do this, and I tried to keep a balance. I mean, you have to be serious and focused, but, at the same time, keeping a sense of humor, I think, is important in life. And, I have tried to follow this path. I have tried to take the negative out of my head. My wife, Vivian, sometimes gets irritated with me for doing this, but I don't have negative thoughts. I always have the good things in front of me, so I appreciate that you have enjoyed working with me.

29:14 CAREER AT VIRGINIA TECH – BECOMING HEAD OF THE MINING DEPARTMENT

Luxbacher:

How long were you at Virginia Tech before you became Department Head?

Karmis:

I came in 1978. I went through the ranks fairly fast. And, around, I think it was 1986; it was a time for a change. During that time, most people saw the job of the Department Head as the terminal sort of goal, and you retired from this position. It wasn't something that you did, and then you stepped down in the faculty, which is mostly what we do now. So, at that point, the department wanted to change and the Dean of Engineering wanted to change—so, it was an interesting experience. I don't think you could do this nowadays: now, when we have a position, we have to advertise, we have to go through all this process and procedures, which is good because you want to expand and diversify your search. At that point, the dean called a meeting, and he said, there's going to be a change, we will need a new Department Head. Then, one colleague, I think, Chris Haycocks, said Michael Karmis can do it, and a couple of others said, yeah, yeah, yeah, he will be a good Department Head. So, Paul Torgersen, who was then the Dean, looked at me, and he said to me, get out of this room! He threw me out of the meeting. He came back after 20 minutes, said, Congratulations, you're the new Department Head.

That's how long it took. And, talking about mentors, Paul Torgersen—who was then our Dean and later became, as you know, the President of Virginia Tech—he was possibly the most innovative academic

leader that I've ever seen. He had tremendous ideas. He was a faculty person. He would be caring about you as an individual. If you asked me for somebody that I thought was an absolutely phenomenal individual and a true mentor, I would say it was Paul Torgersen. I'm glad that I became good friends with him and, as you know, he passed away a few years back, but he was quite an incredible person.

As head, I was basically working for the dean to manage and lead the department, and I thought, "I should do no more than two five-year terms. If two terms is good enough for the President of the US, should be good enough for the Department Head." But, I stayed, eventually, beyond the two terms before stepping back to my faculty position. At that point, I said, "You know what? Everything I wanted to do more or less is done, and if I didn't do something will not be done by serving longer. So, this is a good time to move over." So, I asked to complete my service as Head and return to the faculty ranks. Being a Department Head was a very challenging time, and I don't know if you have a specific question for this.

32:04 DIVERSIFYING VIRGINIA TECH'S MINING DEPARTMENT – PRODUCING MINING ENGINEERS FOR ALL COMMODITIES

Luxbacher:

Well, I think at Virginia Tech, we credit you with diversifying our department, and we were no longer just a coal department. What sort of motivated you and inspired you to do that? How did you do it?

Karmis:

Yeah, that is a very good question and something that I'm proud of, but also, it's interesting how it came up. When I went to Virginia Tech in 1978, it was during an upswing of the coal industry. And, the reason I joined was because the department was growing. We brought people with experience from South Africa and from Britain into the mining department. We ended up having a faculty of 12, which was quite a large faculty for our mining department. I would say, at that point, we were graduating at least 60 to 70 mining engineers per year. By the time we went to the mid-'80s, the coal industry had virtually plummeted. The metal mining industry wasn't doing very well, either. Our metal mining friends would remember the price of metal commodities and what happened, say, to the copper industry at that point. All of that had a pronounced impact on all the mining departments across the country. We had about 22, I think, mining departments then—there are 14 now - and a lot of them were lost during that period, never to be restarted.

When I became a department head, I knew how many people we had in the senior class because I used to teach the senior class, and we had only two. And, one of them never graduated! He told me, "I'll move over to civil engineering, maybe I can get a job in civil. I sat back and thought, "If I was a dean, would I keep a mining department at that level?" The answer is, "No, I wouldn't." So, I talked to the faculty and said, "You know, we need to expand, not only just to expand, but do it within a small period of three years, otherwise forget about this department; we need to change our culture and reach." At that point, it was obvious to me that the aggregate business, the construction material business, and the industrial mineral business, they were still booming, although, the coal and the base metals industries were depressed. I realized that occasionally we would send a student to these other mining businesses, but they were not really our customers or our clients. I spent a lot of time visiting god knows how many of those aggregate companies and trying to sell them to hire some students for summer internships, because I don't think anybody was prepared to hire anybody in a permanent position. I believe the first company who said, yes, we'll do some recruiting, was Luck Stone—a company out of Richmond, a very

progressive company in the stone industry. Then Vulcan Materials came up, and I think we impressed them with our students. “So, within a very short period of time Martin Marietta followed, and we started producing graduates for that entire sector. We became active participants in their national association, and we developed even a student chapter for then National Stone Association (NSA), now renamed as National Stone, Sand and Gravel Association (NSSGA), and that made a tremendous difference.

We did the same with industrial minerals as well, and that made a great difference, not only in terms of counting student numbers but also in terms of diversity. We were able to recruit more women. We were able to recruit different kids from different areas. We recruited people from Northern Virginia. And, people would tell me, well, but these guys will never want to go and work in coal. Wrong! We had so many people from urban areas who really enjoyed working in the smaller areas, you know, the rural regions where most mining occurs. Gradually, going step by step, we ended up having, by far, the largest mining program in the country. And, I do recall in the late '80s/early '90s, Virginia Tech was graduating 30% of all the undergraduates in the US. My advice to everybody is to keep broad: we're really producing mining engineers for all commodities, all types of methods and systems, and our curriculum should reflect that. You don't want to have 20 courses, all focusing on coal or in another area. They will learn so much more themselves, as practicing engineers, later on. That helped us quite a bit to become diversified, and I think that helped the department tremendously.

One of the issues—I think, I was the first who coined that expression—people would say in other sectors, well, you know, the quarries and other smaller mining operations, they don't have the same issues as a big underground metal or a coal mine. And I said, “Well, you try to practice ‘urban mining.’” What I meant by urban mining is you develop an operation close to a very dense metropolitan area where all the neighbors are different, where all the neighbors are monitoring vibrations in their houses in case blasting shakes something. This is the first time that operators understood well mining “beyond compliance”. Because meeting the law is not going to help you to get the permit or to operate. You have to go far beyond that, and you have to learn to be a good citizen and a neighbor. So, maybe the mining problems, per se, they were a little bit more simplified, but the overall mining problems of engagement, community, and all that, the aggregates community understood these so much better because they were operating in that environment. I thought that brought another component and a dimension to our educational thinking in mining engineering.

Yes, we became diversified, and I think that helped us a lot. And, even to date, as you know, we're still very diversified, and not only in terms of the student body also some of the faculty. I think we're the only department that has four women in a faculty of 11 or—how many are we now? —12? I think that's quite a significant accomplishment, and I am personally more energized working with women and the younger people in the faculty—and you are one of them—but we have quite a few men, also, who are under the age of 40 or thereabouts. We're a young department with a lot of people with ideas, that keeps us all active and engaged. Occasionally, I will meet with a young female colleague, also, very capable and very motivated, and I try to give her some advice; I supposed to be her mentor. Occasionally, she will tell me, and, you know, Emily is brutally honest, , “Michael, this is a terrible idea.” And, I thought for a minute to myself, and I knew she's right. My response to her was simply “Who the hell is mentoring who here?” So, I think I get mentored by you also as much as any help you get from me.

39:33 SIGNIFICANT TECHNICAL CONTRIBUTIONS – GROUND CONTROL PREDICTION TECHNOLOGY

Luxbacher:

Michael, you've made considerable technical contributions to our field. I wonder if you can talk about some of the ones that you feel are most significant, starting with your work in subsidence in early years.

Karmis:

Right. One issue that there was always a very important issue in mining is the type of movements that you get in the surface because of activities in an underground mine. When I was a graduate student, I focused a little bit on ground control and rock mechanics, and I looked at the whole system. In other words, not only look at the roof, the supports, the pillars left or the mine floor, but examine the whole strata as a system and how it behaves. That system at some point will cause enough collapse of the roof and cave-in that you will end up with some surface movements called surface subsidence. Now, it is a necessary part of mining, in most mining methods, that you create a large enough underground cavity which eventually cannot support itself, and it will fail or cave. So, it is very important to be able to understand what kind of forces propagate from the mine level to the surface, what is the ability of those forces to cause damage to any structure or facilities. Equally important is to be able to mitigate damages in those exposed facilities or to decide when the problem will become an issue that you have to take care of it. I believe, I focused on developing certain technologies or techniques, if you will, which would allow you to predict the amount of movement in the surface, both in terms of vertical as well as in terms of horizontal movement and try to interpret that movement into what it may do to surface structures. In some cases, you can control that movement by your mining system, but that's not always possible, particularly in the current modern longwall methods.

That is one area that I spend a lot of time. I was fortunate to receive significant research funding and had about a dozen graduate students, some of whom are professors or established researchers now, all doing PhDs focusing on this particular topic. We also, with co-workers, did quite a lot of work on ground control conditions in coal mines, which are impacted by multiple seam mining. We tried to develop better methods of prediction, better methods of support, and trying to see whether you can use multiple mining in a synchronous way so you can minimize the impacts overall to the ground control activities. My technical contributions are focused on the ground control movements, both at the underground level and the surface, and looking at it from a systems point of view.

42:25 THE ANNUAL INSTITUTE OF COAL MINING, HEALTH, SAFETY, AND RESEARCH

Karmis:

Another area that there was quite a bit of interest, as also involves rock mechanics, is Health and Safety. When I came to Virginia Tech in 1978, it was just a year after the passage of the Health and Safety Mining Act, and, at that point, many people thought that was an act that would go away after a year. There was a bit of a negative, I think, approach by industry; -not sure whether this is going to be here to stay or it's going to go away. So, it took time for both the government and industry to fully realize that there is a new set of regulations, that you have to live with this new set of regulations, and we should be looking at the technology to be sure that regulations make sense and are enforceable.

When I came to Virginia Tech in '78, the first meeting I attended was a meeting called the Annual Institute on Coal Mining, Health, Safety, and Research. This was a particularly important meeting. It was designed to bring government, operators and mine workers together to talk about issues of health and safety. It was a meeting that was sponsored by the research agency in mining, at that point, which was

the U.S. Bureau of Mines, the Mine Safety and Health Administration (MSHA) recently created to enforce the Act; just about every major coal company was a participant at the level of vice president of safety and the workers union. So, many operational and research ideas were generated out of that series of Institutes. The professor who was coordinating all this for the department left Virginia Tech a year after I got there. So, somehow, as a young faculty member, I was asked to be in charge of this Institute, which was a tremendous experience. We were able to address not only technical and regulatory issues involving health and safety-whether in ventilation, gas control or ground control and support systems, but also to begin to think more about the issue of health and safety management. Because we all realized, at that point, that that Institute actually created that opportunity, that the rules are there, engineering is there, but how people are managed and the culture of safety are also greatly important. This is the first time, I think, there was a serious discussion about all that during that series of meetings.

We then tried to introduce the work of the Institute to our research priorities of the department and address the technical aspects of health and safety, keeping in mind that that's not enough to get you to where you want to be in safety, in zero incidents! Very soon after that, there was a national competition by the U.S. Bureau of Mines to establish what they called Generic Centers in various aspects of mining, and they established five. The areas of influence were very diverse. We were fortunate enough to win the Center that was called the Generic Mineral Technology Center in Mine Systems Design and Ground Control. Later on, the term safety also became part of the title and part of the agenda. The other centers were in pyrometallurgy, one in hydrometallurgy, one in comminution, and, later on, there was another center established in dealing with dust. Through that center, there was a significant amount of funding available for research by the participating researchers. In our Generic Center we had partner universities, wonderful people, both in the East (University of Kentucky and University of Alabama) and West (University of Idaho, University of Nevada-Reno, and University of Alaska). Metal miners and coal miners working together, and this system was funded for about ten years. It was close to a million dollars per year, which, in the early eighties, was a significant amount of money. And, a tremendous amount of work was performed during the funding period of this particular initiative. Again, looking at technical as well as other issues, we did start thinking about the psychology of safety at that point and trying to somehow connect the technical controls to the behavioral controls for the improvement of health and safety, which is now the basic book as to how you implement safety. We were able, at that point, to connect what we did technically with what we did behaviorally, so I thought that was quite an important piece.

46:55 EVOLVING RESEARCH – CO₂ SEQUESTRATION AND GAS RECOVERY

Karmis:

In research, I think, you also have to evolve, and, if you become stagnant and you say, well, say ground control or subsidence is my expertise, and that's the only subject I want to be involved, you become a bit stale, I think. So, a while back. I got interested in the issue of carbon dioxide (CO₂) and methane gas. And, I figured out that the mining engineers are in this space, by drilling wells and degasifying the mines. The coal-bed methane was the problem, basically, so that is an area that is more mining than petroleum engineering, in my view. We became quite interested on the area of CO₂ sequestration, which is basically capturing the CO₂ from the power station emissions stream or from another CO₂ emitting industrial facility. Maybe you can sell some of it to as a valuable product, but most of it will have to be disposed by geologic storage. For example, CO₂ can be injected into unminable coal seams (even using depleting methane gas wells) or can be injected in shale-gas wells, in a way that the injection will

stimulate and enhance additional methane gas to be recovered. So, you have CO₂ storage and, at the same time, enhance coal-bed or shale gas methane recovery. We were fortunate that we received a series of very large projects and were able to do demonstration-scale projects with gas companies, both injecting CO₂ in coal-bed methane wells as well as in shale-gas wells, and we are still very active in this topic.

Also, looking at the potential of other emerging shale-gas plays that are close to our area. At that point, and after I stepped down as a Department Head, the university asked me to serve as Director of a center that we have at the university called the Virginia Center for Coal and Energy Research. This is a unique center, established by the Commonwealth of Virginia as a Virginia Commonwealth center, and managed by Virginia Tech. As the Director of this center, it was an opportunity for me to enter more seriously the energy space and the CO₂ management. We do a lot of that research through that center, and a number of younger colleagues at the department have received a significant amount of funding and earned expertise in that area. So, I wouldn't say we're competing with our colleagues in petroleum engineering, but we also work alongside with them because we do have significant knowledge to contribute on the issue of gas recovery, drilling wells and performing well injections. We've been doing this for a long time, and, as you know, in mining we have been practicing fracking, or what we better like to term "hydraulic fracturing", for many years. That is a way we diversified into these areas, which I think is critical for the coal industry, to be able to have technologies of managing the CO₂. So, that is a brief summary of technical interest that I have in the energy arena, and I am still active and seeking additional opportunities to expand research in this area.

50:03 RECOGNITION AND HONORS – PRIDE IN MY TEACHING AWARDS FROM VIRGINIA TECH

Luxbacher:

With all of your technical work and your other work, you've received many honors and awards over the course of many years. Which has been the most meaningful to you?

Karmis:

That's a tough question. I think being an Honorary Member of AIME and SME is a great recognition, and I'm very, very proud with that. Getting an honorary PhD from a Russian university is something different that I also value. But, I actually take a lot of pleasure on three awards that I got consecutively every year, every quarter for teaching at Virginia Tech. It was the time that we first started teaching awards for faculty, and I got one every year for the first three years that I was there. So, Dean Torgersen (I talked of him before), he told me, I'm not giving any more to you. So, he sent me a VT cardigan or jacket instead of a framed award! It was very rewarding for me to receive these from the students on the basis of teaching. That meant a lot, but I do cherish everything, although Vivian complains that we need a bigger house for all the memorabilia that I have collected over the years. So, she says, we cannot move to a smaller house, we can only move to a bigger house. I enjoy and appreciate very much every recognition I received from colleagues and professional societies.

51:42 A COMMUNITY OF COLLEAGUES SUPPORTING COLLEAGUES

Luxbacher:

Michael, I've noted that you always take great care of your colleagues, which I appreciate. I've known you for 20 years, since I was a student. And, one thing I always remember is, around the time of the

mass shooting at Virginia Tech in the early 2000s, I was a graduate student. And, we all had just come back to work, and we just didn't know what to do with ourselves. And, you came down the hall and took a bunch of us out to lunch. I think it was a three-hour lunch, and you really just wanted to check on people and make sure they were okay. And, I wonder if you could just reflect a bit on how that was a seminal moment in Virginia Tech's history, on how the university has changed and how, for good and bad, we're still taking care of people.

Karmis:

Well, first, I have enjoyed working with colleagues. As you know, I work with people from around the world, and I know people all over the world. And, we all have very close connections and relationships. I had the good fortune, in a way, to be a cancer survivor, as you know. And, many people around the world sent me notes of encouragement. I do recall when a good friend, an Indian colleague, told me that he was praying for me to his gods. Then a friend from China sent me a similar note and his Chinese gods, and my Muslim friends told me the same. So, I keep these emails and have appreciated everyone's support and help during this difficult time. We have so many capable younger colleagues that I feel, with a little help, they can reach where they can be. I enjoy doing helping and appreciate that we all need some help at some point in our careers.

The shooting at Virginia Tech was a terrible experience that changed profoundly people. I was attending, I remember very vividly, a meeting in Washington, and I was on a table sitting beside the Governor of West Virginia, who is now the Senator from West Virginia, Joe Manchin. I had my phone on vibrating mode and suddenly kept buzzing. I quickly looked, and was a warning about a shooting at Virginia Tech. And, I said, "I don't know about that, cannot be possible, must be a mistake." But then, the phone buzzed again, and then the number of deaths came up, and it was such a horrendous number. I still thought, "This can't be true." I couldn't find anybody at the university to connect. Eventually, when reports appeared that everything was happening in the building next door to our mining building, I was really shocked. Everything happened in the building in full view of my old office. It was a shocking thing to realize it, and, as you know, all of us knew people that were involved in that shooting. I think the faculty needed help and support, particularly those who were there and experienced it first hand, at that time. The university was very good in closing ranks and providing motivation for everybody and help and support, and I think the university did that very well. The President, who was a good friend, Charles Steger, did an excellent job in trying to bring the community together. Beyond that, though, I have enjoyed working with people all over the world. And, I have written letters for promotion and tenure for many people, I have helped people with research and papers, and it is fun to do this. I take a lot of pleasure when they do well. There are some of my students that will get awards at this meeting, as you know, and I would much rather enjoy them getting recognitions than me. It's fun. It's part of the job, and it's a rewarding experience.

PART 2

00:16 MY SUPPORTIVE WIFE AND SONS

Luxbacher:

Michael, your wife, Vivian, as much as you, is a mainstay at mining events, with her lovely Scottish brogue. Tell me about her role in your career.

Karmis:

Well, Vivian and I met in the late sixties. We got married in '72. We've been together for all these years, and she knows more mining people than most mining people think they do. She's visited many mining universities with me and a number of mines. She's been tremendously supportive, and so have my three boys, my three sons. I'm trying to stay close with the grandchildren now as well. I have the pleasure of having a very supportive family. With my schedule at Virginia Tech, and also my activities with SME and AIME, SOMP and others, I travel a lot. They have been very patient with me traveling back and forth and visiting places, and, where we can, Vivian will come with me, and she will enjoy visiting with other mining friends. It has been a great time, and, as I said, I'm very fortunate to have a very supportive family. Vivian is an accomplished cook and chef and a very demanding person. We go to a restaurant; they ask if you have any allergies. She thinks bad food is the worst allergy that we all have, so we're having good fun. She's enjoying this SME meeting as well.

01:53 GROWTH WITHIN SME

Luxbacher:

Well, speaking of societies, could you tell me a bit about the role they've played in your career, all the societies you're a member of and your leadership positions in those societies?

Karmis:

I joined SME when I came to this country. I was already a member of another great institution, which is the Institute of Mining and Metallurgy, which was a very global institution at that time, headquartered in London. It changed nature in the last years. It became more of a materials community than mining. The first SME meeting that I went was in Las Vegas, and, as a young guy who had never been to Las Vegas, I thought this is a great society, and they take me to the right places. Then, I do recall at that time SME had also fall meetings, and the fall meetings actually were even more technical than the annual meeting, because they were more focused on sessions in technology. I remember, believe it or not, being in a fall meeting in Hawaii, and Paul Chugh, a colleague from SIU, and I ran a short course and a symposium before the meeting on longwall mining and subsidence in the middle of Waikiki beach! Quite an oxymoron, but it was a great place. I started moving through the usual way, through some unit committees. It was the SME Rock Mechanics unit committee that was involved first, and then some other committees, and my mentor was somebody who also became a president of SME and AIME, a wonderful person by the name of Don Gentry. He was at Colorado School of Mines. He served there as a Dean, and head of the mining engineering department. Don was a mentor for me and a great friend. He was a motivator. He was brutally honest. If he didn't like something, he would tell you straight out, and he always said, "Don't ask Gentry to do something, because he will do it." He was a doer, and he was a

motivator. He moved to be the President of SME, so he encouraged me to move to SME leadership roles. At that point, the board of SME was very large. I had the opportunity to run for an election to be a President of SME, which of course, I lost! But [I] was nominated and elected by colleagues later, who thought that I should be the president.

04:30 THE CHALLENGE OF BEING PRESIDENT OF SME DURING A TRANSITIONAL TIME

Karmis:

So, I became the President at a very difficult time. The two or three presidents before me and two or three presidents after me, we all faced the same problem: it was yet another, and this time major, down cycle of the mining industry. Very few jobs out there, and companies were in distress. The universities were going through the experience that I mentioned before, that they were losing students. Companies were not very supportive in attending SME meetings, and the membership was dropping at an alarming rate. We all were trying and struggling with how we can arrest this, and it was not anything that could do quickly, but I tried some initiatives that I will talk about it later on. It was a very transitional time because we witnessed a huge drop; I can't remember the exact numbers, in membership, to the point that we were concerned if we have the critical mass to operate as a professional society should.

I became a President in 2002, and that was one of those bad years. The people before my term had made a decision to have an annual meeting in Cincinnati, Ohio. Everybody, particularly the metal miners, thought that was a horrible idea, and an eastern USA location was not going to be successful. That was the year of my presidency, and I gave the baton to Tom O'Neil in Cincinnati. It was an interesting meeting, and I did a tremendous amount of work to motivate members to come to the Cincinnati meeting. In fact, we held a meeting in Cincinnati that had more industrial minerals and aggregates professionals than attended the meeting before, but very few metal mining professionals attended. The coal community also was a strong participant at Cincinnati. That crystallized to me the simple fact that coal mining people travel anywhere for a meeting, and aggregates and stone people have no problem, they will travel anywhere, but metal miners don't travel east of the Mississippi. That's the fact, and is what it is. When I became President of SME, learning from the experience I had at the mining department at Virginia Tech, whereas Department Head I had successfully diversified and increased student enrollment. I asked some friends from the aggregate industries, because by that time I knew the aggregate business very well, why you do not attend the SME meeting? Why are you not members? And they said, well, programming-wise, we don't have that much to do there. I responded by noting SME has the Industrial Minerals Division. They said we're not in industrial minerals but in construction aggregate materials, we're different.

I tried through SME to see what can we do. I established, by a presidential decision -- I must tell you not everybody agreed with me at that point—a committee, because I could do this as the President, a committee, whose role was construction materials and aggregates. I asked certain motivating friends that I knew-- one that later became President of SME--if they can help me to motivate more people from that community; so, that was one thing that actually bore fruits. Later on, as you know, we expanded, and we do have a great section of the aggregates community now engaged and attending this meeting. I think that was a good move to try to become even broader. I'm glad that it's helping SME the way it helped my mining department.

08:12 CREATING SME'S SUSTAINABLE DEVELOPMENT COMMITTEE

Karmis:

Also, when I was at SME, it was the beginning of the discussion of mining and sustainability, and I was quite a bit interested in this topic. I'd never thought of the sustainable development concept, but the way it was presented to me and the industry push made so much sense in order to try to get the social license to operate, as we say now. I did realize the mining industry was a bit hesitant about all that for quite a while, particularly the US mining industry, so I tried to push this concept. I helped create, during my president time, the sustainable development committee, which now works very well with many other committees, and we did something which was quite unique, I thought. At that point, many companies had created a sustainable development community. The large companies with global presence—Rio Tinto, for example, or BHP -- believed in corporate responsibility, sustainable development as company values. Later on, the US-based companies did the same. If you open any major mining, publicly traded company, you would see corporate responsibilities reports. But SME is not really a trade association. It's a group of members, of individuals, and I felt that we ought to develop a statement to say, not what our companies believe but what we believe as professionals about sustainability. I relied on the help and vision of colleagues, including Dirk van Zyl, Deb Shields, and Carol Russell.

09:54 MILOS DECLARATION – A GLOBAL STATEMENT OF HOW WE, AS INDIVIDUALS NOT OUR COMPANIES, SEE SUSTAINABILITY

Luxbacher:

Michael, you're passionate about sustainable mining principles. Tell me a bit about your work with the SME and sustainability.

Karmis:

Yes. At that time, it was obvious that the global mining industry was moving into a sustainability and sustainable development (SD) culture. There was a very large, complicated study that was undertaken, known as the MMSDS study and report, and everybody in the mining community was very active. Although some companies remained skeptical, the SD grew rapidly. Companies around the world now are engaged and report sustainability performance and corporate responsibility performance. As I said, a company should present their own culture, their own shareholders' view, but they do not represent individual professionals. They are companies, but SME, and the AIME societies, represent individual professionals; so, I felt we ought to be doing a bit more through the societies, to show and demonstrate our commitment to sustainable development mining practices and sustainability reporting.

I developed a sustainable development committee at SME and asked some key members of that committee, as mentioned before, Dirk van Zyl, Deb Shields and Carol Russell, to help. I said, let's do this: why don't we develop a document, which states the sustainable development aspects of our profession? What do we believe sustainability as mining professionals? We don't want a twenty-page document; we want a two-page document. At that point, the industry had signed a declaration, as companies, on sustainability, and I said that we should have a declaration as individuals, represented by our society, of what we believe sustainability should be all about in our disciplines. So, we created a draft, and all these individuals worked very hard with me to develop it in the form of a declaration. I took this draft as President of SME, and I went to the Canadian colleagues, and I asked CIM, their professional society, if they could endorse the declaration draft with us, as the large North American

societies in the minerals area and [they] gladly accepted and endorsed the document. Then, I talked to the Australian Institute, and they approved; the South African Institute also approved. And, in short, the declaration we drafted was endorsed by all major global professional societies in the mining and minerals sector.

Then, we organized an international meeting, the first Sustainable Development Indicators in the Minerals Industry (SDIMI) meeting that continues today as a vibrant bi-annual meeting with host locations in Germany, Canada, Greece, Australia, China, and the next scheduled in Namibia. The first inaugural meeting was held in the historic Greek island of Milos. The island is famous because of Aphrodite de Milos [Venus de Milo], which is the statue of Aphrodite that was discovered in this island. Milos is a beautiful island but also an island where mining has been going on since thousands of years ago. Even now, it's one of the world's largest producers of bentonite and perlite, and you have an island where you have history and archeology and tourism, all thriving with a minimum amount of conflict, trying to maximize and learn from each other. So, at the first SDIMI meeting in Milos, in 2003, cosponsored by the Society of Mining Professors, the declaration we worked was formally unveiled and is now known worldwide as the Milos Declaration. It is a wonderful document, and I can send you a copy later. I think that was a great contribution that the professional societies and technical societies came together to support, that it is basically how we, as individuals, not our companies or employers, see sustainability and what it means.

14:01 CREATING AN ADVISORY BOARD FOR SME – ADVICE TO GROW COMPANY PARTICIPATION

Karmis:

Since then, the SD concept has progressed in a big way, and the next task for me was how do we incorporate sustainability into the mining curriculum. All the universities with mining departments, I think, have accepted SD successfully. We talk a lot about sustainable mining practices nowadays, and we cover also engagement and responsibility in the communities; we have tried to bring up aspects of what happens globally with artisanal mining and smaller indigenous mining communities. We have gone a long way, not only in talking about sustainability but trying to introduce it to the new generation of engineers and scientists via the curriculum. I'm very proud of those initiatives that were initiated when I was President of SME.

One additional action I did at SME President, learned from my experience in universities, is having industry advisory boards that can provide support and advice. Now, when you receive advice, you must follow through with some action. So, I set up an advisory board for SME, primarily comprised of mining leaders from all segments of the industry. We had two meetings during my tenure, and there were representatives from major metal, coal, industrial minerals and aggregate mining companies. We were able to get a better understanding of what the CEOs felt SME should be doing, and we were able to, I think, better explain to the CEOs what we need from them. That provided support at a time difficult for SME and the industry.

I do recall—and I won't mention the company-- one major company -- and remember these are the time of decreasing membership—and I asked their CEO, maybe you can help SME by having all the mining engineers and scientists in your organization having their SME membership paid by the company? He said, that's a great idea, let me talk to my guys. He calls me up a day later and said, Mike, we already have this benefit in the company, but nobody knows to ask! Actually, the mining professionals who worked for the company didn't even know that option. One other case, a major coal company this time,

a very supportive President, who was also a mining engineer, had put a travel moratorium company wide. That was the time that I was SME president, and I was calling up companies, you know, making sure their employees will come to the meeting. Many members told me they would love to attend the SME meeting, but the company says we cannot travel, and I said, Oh! So, I went to see this CEO and Chairman, who was a member of SME as well, and I said, you've got to do something, and let your people travel to the meeting; he said, of course, they should travel and attend, this is an important meeting. I said, your employees will not travel because their mine managers read your travel moratorium and took the easy way out, basically nobody travels for any purpose. That's not what he had in mind, so I asked him, could you send a memo out that the travel moratorium doesn't include professional meetings? He did, and his company participated strongly that year.

We learned a lot from the members of the SME Advisory Board, and that was at the time when we were desperately trying to get more members, more participation from the companies and getting back to providing more value to members and support for universities. Very soon after I finished my term at SME, the industry started to recover, and we had the beginning of the mining “supercycle”. And, that was the longest such cycle in history, about 11 or 12 years of increased prices, increased valuation of the companies, and a significant upside for SME in members and participation. It was a different story. SME began to mushroom again and provide so many new programs and value to the members. I have enjoyed, quite a bit, my involvement with SME.

17:39 PRESIDENT OF AIME – BUILDING A CLIMATE OF COMRADERY

Karmis:

You asked for societies, so I need to talk about AIME a little bit. I represented SME on the AIME board, which is a tradition that SME has. I was a board member, and I did join in at a time that was quite a bit of friction, if this is the right word. But, let's say a difference of opinion between the four member societies of what AIME should be doing and where it should be located. The previous Presidents of SME that also served at AIME warned me that this is a bit confrontational, and I said, Well, let me see what is the problem there. When I joined the AIME Board I could sense this, but there was one thing that all the societies agreed, and they were very passionate about; and, that is they wanted to get out of having a head office in New York. It was an expensive way to conduct business. There was an opportunity to sell the building and, you know, make some money for all the societies in AIME, and the contentious point was where should AIME go? Because, at that point, it wasn't a virtual AIME; it had to have an office somewhere. There was a number of societies that they felt AIME should move in with them.

I, of course, being an SME member on the AIME Board, thought they should be joining SME in Colorado. AIME was, in a way, the precursor of SME and was established by coal mining leaders and felt AIME should co-locate with SME. There was a competitive process—it was a little bit sensitive at the time, tense, but nevertheless, the decision was made to bring AIME back with SME as an independent group headquartered in Denver. When I became President of AIME, the move decision was already implemented, and the other societies realized that the AIME roots were from SME, in fact, out of the anthracite coal miners. So, there was a lot of tradition and history. Since that time, and during my tenure as President of AIME, the climate on the Board changed, is now totally different, and the AIME member societies work well together. At my tenure, we focus on reorganization, how to support common projects and pursue common goals. I'm very pleased to see AIME has developed and thrived since then, working well with the societies and assigning more responsibilities to the societies with the awards. So AIME was a very pleasant and productive experience.

20:19 UNITED ENGINEERING FOUNDATION – A GREAT EXPERIENCE

Karmis:

I also served a term—as a Vice President of the United Engineering Foundation (UEF) Board of Trustees. There it was a different experience. We had our issues, as well, because you have under this foundation all the founding engineering societies represented, Civil, Mechanical, Electrical and Chemical Engineering Institutes. Some of the societies were humongous in size, but we worked well together; and, it was a great group of people and dedicated professionals. I learned a lot about broad engineering issues, and we worked very well together. We were supporting projects performed by the various societies/institute members, and we developed some very important common activities. They had a very accomplished Executive Director, by the name of David Belden, who had been, before, the Executive Director of the Institutes of industrial engineers, then the mechanical engineers. He was an ex-military, who ran everything with a military precision, but was a wonderful person. So, that was a great experience, and it was good to be able to be in a position to give money away rather than, on my early faculty days, asking for money. That is a better concept!

21:45 THE SOCIETY OF MINING PROFESSORS – MOTIVATING DIVERSITY AND CAPACITY BUILDING

Karmis:

The other group that I have enjoyed, and I still spend a lot of time with, was a group called the Society of Mining Professors. This is an interesting group. It was originally founded in 1762 in Schemnitz (Banska Stiavnica), in what was then the Austro-Hungarian Empire (but is now in Slovakia). It was between Slovakia and Czechia and Hungary and Poland and Germany. That was where was the primary membership, but it was the first-ever technical society. So, if you were an engineer or scientist, and you didn't have any society in your discipline, you joined the Society of Mining Professors. Although it was “mining professors,” it was the only scientific and technical society that was out there. And, that society had mushroomed over the years, but then European wars and conflicts helped the demise of the group in the late 1700s. Many different societies were formed since then, and are available for professionals to join. And, due to the dedication of a small group of professors in mining engineering, the Society of Mining Professors was reborn in 1990 in an inaugural meeting in Leoben, Austria. The basic principle was to engage academics globally, share resources and experiences, develop joint programs, and work together as, at that time, a number of mining departments, globally, were shutting down.

With the leadership of few senior professors from of Austria, Germany, and Britain, the Society of Mining Professors (SOMP) was re-birthed; that also retains the original name of the society from the 1700s as the Societät der Bergbaukunde, which is the German name for society of mining professors. The original group was very realistic, and, although the original members were mostly German speakers, they decided the formal language of SOMP should be English, as an international society. I had the pleasure to be asked first to be the representative of the US academic community in SOMP. I assumed a leadership role, and, over many years, with the help of many great people, I think I helped to transform this society from a central European to a truly global society. Now, we have 251 members, representing 111 mining schools in 43 countries. More importantly it's not a society for senior academics only, but we are heavily involved in helping and mentoring young colleagues to succeed as mining academics.

So, a major goal of SOMP is to promote capacity building. We work with countries in the developing world, who have limited resources to develop mining programs, we help young professors with advancement in what they do. I was the President for one year and then I served as the Executive Secretary for a long time. I am now Emeritus! They have great leadership at the moment, and I still work with them on many projects and initiatives. In fact, SOMP is represented here at this meeting very well – as you know, we have members from around the world participating at this SME meeting because of SOMP (Society of Mining Professors), and I do get a lot of pleasure working with them. We are also engaging on issues of diversity both in terms of gender [and] in terms of ethnicity and color, and that is quite important because we have groups around the world that we're trying to recruit and motivate. We do, interestingly, a lot of regional meetings, because in many parts of the world it is very difficult to travel to a big annual meeting in the US or in another place. So, we try to bring some of our expertise and advice to regional meetings. We've had regional meetings in Columbia, in Chile, in Peru, Thailand, Vietnam, and in and many other places. I take a lot of pleasure being in SOMP. It's also a great group as we all are friends and have a good time when we get together.

25:45 THE POWERFUL BOND OF THE MINING COMMUNITY – LOYALTY OF ALUMNI, UNIVERSITIES, AND INDUSTRY AS A WHOLE

Luxbacher:

What has been your favorite part of working in the mining industry?

Karmis:

We are in a university that is part of an industry, but I will step back and look at those who are not in academia. I have enjoyed working with alumni. I'm always amazed that—and this is unique to the US education system, maybe with a few exceptions— the loyalty that you get from the students you graduate. It's quite phenomenal. They will help you financially. Sometimes with tremendous generosity, but they will help you by giving you access to mines and facilities, advise you and help you in projects. The connection that you get between those who graduated and us as educators, it's a bond. It's quite an incredible, powerful bond, and I have really enjoyed that. As you know, we can call just about anywhere and can find an alumnus and friend willing to help.

I have enjoyed working with certain leaders within the industry. I will not mention all by name, but they were innovators. Some did things a different way and many enjoyed tremendous loyalty from their own miners and employees. You can see when you visit a company and you have a chance to go with a senior manager or the president of the company around in a mine; you can see people's respect and trust between people. It's quite phenomenal. You don't see this in many industries, which I think this connection is unique in the mining industry. And, finally, I think you get a lot of camaraderie. I mean, even if you know anybody personally, you go to an operation asking something or you want to work on a project, and you say, I'm a mining engineer at this university, and I do work with other companies. And, I would like to work with you on an initiative; what do you think? You'll get help and support and advice and everything. So, this is like a fraternity, between the universities, the alumni, and the industry as a whole. You don't get the same kind of connection and feeling that you get within the mining community in other industries. I include the universities, the industry, the government, the community that we're engaged. It is quite phenomenal, and I think you don't see it anywhere else. So, it's been a pleasure working under that kind of a system that gives you so much.

28:39 LEADERS IN THE MINING INDUSTRY – INDIVIDUALS WHO LEFT THEIR MARKS FOREVER

Karmis:

Since we're talking about the mining industry, one of the items I would like to talk about is that I have been very fortunate and very privileged actually, to meet, work, and do all sorts of joint programs with a great number of people who were leaders in the mining industry, individuals who left their marks forever in our industry. I will mention a few people by name, because they were so unique.

29:14 BOBBY R. BROWN – CHALLENGING “THE DEATH OF MINING”

Karmis:

For the first person, I would like to mention—I need to take you back to the mid-1980s. This is when I became a Department Head. At that point, the mining industry—and I'm talking about all segments of the industry, coal, metal, and industrial minerals—they were all under a terrible depression, to the point that one of the major magazines produced one monthly report with a big picture on the front page that simply said, The Death of Mining. At that time, companies weren't recruiting, and that had the tremendous negative impact on the enrollment in all mining departments in the country. I was trying to think what one could do about that to reverse it at some point. I sought a meeting with the person who was, at the time, the President and CEO of Consolidation Coal Company, or Consol Energy, as it became later. At that point, that company was a subsidiary of Conoco, and the CEO, a gentleman by the name of Bobby R. Brown, had come from Conoco into Consol. His responsibilities with Conoco had included, for a long time, human resources. So, in coming to a mining company, he knew an awful lot of things about building human capital, building a workforce, and he was a great supporter of human resources and the development of relationships with universities.

Karmis:

So, through a friend, I was able to go and see in Pittsburgh, Mr. Brown. Mr. Brown looked at me and heard me. He was a short man with a very commanding voice, and [he] said, well, I thought we were recruiting and hiring people in all the mining schools in the country. I said, well, no Mr. Brown, actually, you're not doing any of that. He was really astounded by that. So, even at the time when companies were losing money, he directed his human resources and the manager of that unit, a fellow by the name of Ivan Rahn, to visit every mining school in the country, even schools who had no interest in coal mining at all, and start hiring summer students, and eventually permanent position students. In essence, Consol was, for a while, the only company that had invested so much in every mining school in the country. The old-timers, who are my cohort, they really understand, appreciate the fact that we survived this terrible down cycle, simply because of the initiative and the responsibility that Mr. Brown showed in ensuring that there is a viable mining industry out there for the country. I have to mention him by name because he was really a true leader, an individual with a unique contribution. Actually, he passed away recently, and, I must admit, I always remembered him because of his contribution.

32:15 MICHAEL J. QUILLEN – A LEADER AND PARTNER OF THE COMMUNITY

Karmis:

The second person that I would like to mention is a person, or a fellow, by the name of Michael J. Quillen. He's not a mining engineer; he is a civil engineer, but he spent all his life working in coal companies. He worked in production, in engineering, in operations, in sales, and also as a CEO of a number of companies. Eventually, he built one of the largest coal mining companies in the country. I like to mention him because he's an incredible individual in building relationships with everybody, including his miners. He had a very personal, and not easy to describe, connection with people who work for him, and people had every faith and trust in him and his decisions. And, even after retirement, he's living in an area in Southwest Virginia very close to the coal mines. He spends most of his time in trying to find out ways of developing economic activity and economic development opportunities for the displaced miners and for the community as well. So, he's really a unique resource for Southwest Virginia, for his leadership, and what he has done, and what he is still doing.

33:43 F.D. "RED" ROBERTSON – A MENTOR FOR HIS SINCERITY, GENEROUSITY, AND WISDOM

Karmis:

The last person that I would like to mention is a fellow who is quite unique, a mining engineer, graduate of Virginia Tech from the early fifties, but also an attorney, a graduate of that other [dreaded] university in Virginia, the University of Virginia. As a lawyer and a mining engineer, he has been a pillar of the community in Southwest Virginia. He always lived in the coal fields. He worked out of the coal fields. He has retired in the coal fields. He has helped numerous causes. He is generous. He is a tremendously sincere and direct individual. He is a mentor, not only to me but to many people that I know for his sincerity, his wisdom. He's also another resource for our area and for the coal industries. He goes by the name of F.D. Robertson, but his nickname is Red, I assume because of hair color when younger. He was a cadet at Virginia Tech, and, believe it or not, even at his later stage and age in life, the only thing he wanted to do is to ensure he still maintains his PE registration in mining engineering active. I used to teach a short course once a year, to help engineers with the PDH hours needed to renew registration. He was right at the front desk of the class, asking questions, a unique person with a very great heart, and very generous to the community and towards his friends. And, I think he's somebody that I would like to mention as well.

35:28 CHANGE – THE BIGGEST CHALLENGE FACING THE MINING INDUSTRY – TRAINING THE DIGITAL GENERATION

Luxbacher:

What do you perceive to be the single biggest challenge, right now, facing the mining industry?

Karmis:

I think the biggest challenge we have, and it is facing the industry and mining operators as well as the universities, is we are right on the border or the edge of a huge change in what do we do, and that is because of digital technology, digital information, and everything else. We've already seen it in our house and lifestyles. After my kids showed us, for about two years, Vivian and I communicate with Alexa, we can do an amazed number of things remotely and can face time or zoom with people around the world. And, I thought to myself, who knew that? I remember when the remote control for the television changed from being connected with a huge wire that you take it so far. I mean, it is incredible

what has happened; so, if you look toward the future, the new breakthroughs are already here. The industry will change tremendously. It will become a totally different industry from what it is now. And, digital operations, artificial intelligence, autonomous machines, remote control are aspects we understand as technical people. But, digitalization will/is entering human resources, economic systems, supply chains, and everything that a company does, and this is nothing revolutionary. It's coming, and it is here! Some companies move faster than the others, so, within a very few years, we will have a totally different industry. That industry will require totally different employees, not only the mining engineers who graduate but also everybody who works in the mine.

I was recently in a mine safety meeting in Lima, Peru. One of the safety directors discussed how they train miners and noted that companies had their own ways of doing it. You can use coursework, reading materials, there are videos, VCRs, there is augmented reality that you can integrate to enhance safety training. But, he said, at the end of the day, if you want to recruit a new young miner, unless you can train them with the power of your cellphone, you will not be successful. That's where we are. So, basically, we need to learn to train people differently, including the students that we have in our universities, and also to train people who want to get into the mining business differently. We are training the Z generation, which is the digital generation, through the web. I'm amazed what young people routinely can do, including my kids. They rarely go shopping; they just order everything on their phones. They pay bills through their phones. They do banking through their phone.

I will tell you how fast things have moved, and I will give you an example from China. I was in China, not long ago, and I realized nobody was using any money, cash, and nobody was using any credit cards; they're all paying through their phones. Now, you see this occasionally here, but I've never seen it in such extended usage. I was there with a friend of mine, an Australian who happens to be of Chinese descent. We were walking one day, and there was a beggar in the street. Well, as we were walking, he picked up his phone and said something in Chinese, and it was translated to me, that he was asking if I can put some money from my phone to his phone! And, I thought to myself, Really? I mean, unbelievable! We are moving, faster than we understand, to the next stage and the next phase. So, the challenge for the industry and for us is how we're going to get into this transition and move forward and be prepared for it because that will change everything that we do.

At the university, we are always struggling with breadth versus depth and traditional subject versus new subjects. However, we will balance these issues, and we will, at the end of the day, produce graduates that are different from what they are now. They will be able to do more things remotely, and the industries will be different as well. I am interested on this transition. The benefits of digital operations are including, not just the technical stuff but everything that the company does—everything through all of their systems, from human resources to recruiting to managing systems—and that's what we will see happening. We're seeing this now, up to a point, but it is difficult to even imagine what our industry and education systems will look even ten years from now. So, let's get ready for it.

40:30 THANKS TO AIME AND MY COLLEAGUES, FAMILY, AND FRIENDS

Luxbacher:

Is there any story or point you'd like to make that we didn't discuss here?

Karmis:

No, I think I talked too much. My wife says, usually, I'm known to do that. But, I want to thank AIME for their initiative. I want to thank you, Kray, for doing such a good job asking these questions. I need to tell everybody that we didn't rehearse either, so I was not sure what you will be asking me. But, I just wanted to say I consider myself lucky that I've worked with so many good people, not only in my own place, my own institution, but around the world. I'm fortunate to count a lot of friends, and I have enjoyed traveling, and I have enjoyed working with everybody. So, keep up the good work.

Luxbacher:

Well, thank you, Michael.