NEWSLETTER

SOCIETY OF MINING PROFESSORS

SOCIETÄT DER BERGBAUKUNDE

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Editorial

Another Annual General Meeting is past and again there was a good turnout for the meeting, but as always it would have been a more effective meeting had there been more members present. There is real work of importance done at these meetings, ideas are exchanged which would not normally be exchanged and generally a lot of good comes from the interaction of professors of mining from all over the world. It is a pity that more could not attend.

One of the main matters which was discussed and decided at this meeting was that the Society would work together with Eurominerals and Euromines to help develop a better image for mining in the world, and to try and ensure that young people in all countries understand the importance of minerals in their lives and, therefore, the underlying importance of there being education in mining engineering.

So next year's conference, which will be in Italy, will be held jointly with Eurominerals and Euromines and will be organised by a joint committee. It will be held from **12th to 16th September, 1998.** It is intended to have a very high profile section of the meeting which will be attended not just by members of the participating organisations, but by politicians, the press or rather the media, and outsiders of all kinds with an interest in mineral production. This meeting will be organised by the joint committee with members from the participating organisations working together to ensure a high profile meeting.

This main part of the meeting will be held in Rome, as this is somewhat symbolic, as the first report of the Club of Rome has been used so much in the past to the detriment of our industry. We hope to redress the balance a little with this meeting also to be held in Rome.

This will be followed by the meeting of the Society and it is suggested that we all move down to Carrara for that part of the meeting. This will allow us to separate from the other two organisations for a chance to do our normal Society work. It will also allow us to enjoy Carrara. For those who have not been there, it is a beautiful town, on the coast with a nice beach. But it is also the centre of the Italian dimension stone industry. This is based of course on the famous Carrara marble which is mined in the mountains above the town.

After the meeting there will be a chance to tour the marble industry and quarries, which have been working since Roman times and before.

This promises to be a most important meeting, probably the most important since the first, foundation meeting in Leoben, and I do hope that as many members as possible will make the effort to attend.

Since the meeting contact with both Eurominerals and Euromines has been maintained and the planning for the meeting has started. It is currently going a little slowly due to the summer holidays, but real work on the planning is expected to begin in September. I will try and keep the members informed as things develop.

It would assist me enormously if all of those of you who are on e.mail could let me have your e.mail addresses as soon as possible as this makes correspondence with the membership much faster, easier and less expensive.

In this connection, you will note that Hans de Ruiter has been voted in as deputy to the Secretary General. He has started well and is preparing a web page for the Society. We hope to post the newsletters there, the membership list, and any other information which we feel the membership should have immediate access to. The page will be at:

HTTP://home.mp.tudelft.nl/mineprofs/

See you all in Italy next September.

MINUTES OF THE 8TH ANNUAL GENERAL MEETING
HELSINKI UNIVERSITY OF TECHNOLOGY

June 1 to 3, 1997

Most of the registrants arrived in Helsinki on Saturday 31st. May, and were accommodated at the Tapiola Gardens Hotel in Tapiola. There was a welcoming cocktail party held at the hotel on the evening of the 31st for those who arrived in time, and registration also started then. On Sunday 1st June there was registration in the morning and then all those registered and their spouses were taken by bus to the Helsinki port where they went on a lunchtime cruise in the Helsinki archipelago hosted by Tamrock and Nordberg-Lokomo. In the evening there was a buffet dinner at the hotel.

Day 1

The official opening of the meeting took place on the morning of Monday, 2nd. June in the main building of the Helsinki University of Technology.

The members attending the meeting were: Professors A. Adamson, Y.G. Agafonov, V. Badino, U. Bajzelj, B. Brady, I.V. Dementiev, B. Drzezla, G.B. Fettweis, M. Georgescu, H. Gerhardt, T. Golosinski, M. Hardygora, M. Karmis, V.A. Kharchenko, E. Lechner, H.J. Lürig, R. Matikainen, P.F.X. Mousset-Jones, J. Palarski, L.A. Puchkov, E. Reinsalu, J.J. de Ruiter, P. Särkkä, C.T. Shaw, R.D. Stoll, W. Vogt, S. Vujec, F.L. Wilke, U. Yamaguchi and J. Yamatomi.

Sincere thanks should also be recorded to all those who assisted Prof. Matikainen in the planning and running of this conference. In particular the delegates were most grateful to Mr. A. Westerlund and Mrs. S. Miettinen for the amount of work they put into the conference organisation and in helping the delegates with bookings and so on.

(15 countries were represented - Austria, Australia, Croatia, Estonia, Finland, Germany, Italy, Japan, Netherlands, Poland, Romania, Russia, Slovenia, United Kingdom, United States of America.)

The opening ceremony was held in the conference room in the main building of the University next to the office of the Rector. The Rector, Paavo Uronen welcomed the delegates and then gave them a very interesting overview of the University and its history.

Professor Matikainen then followed with an interesting overview of the Mining Industry in Finland, covering hard rock metal mining, the dimension stone industry, industrial minerals and the precious and semi-precious stone industries. A copy of this information is included with this newsletter.

Following Professor Matikainen, who has now left Helsinki University of Technology to become Director General of the Geological Survey of Finland, Professor Pekka Särkkä then gave the delegates an overview of mining engineering education at the Helsinki University of Technology with special coverage being given to the Impact course and the European Mining Course, both of which involve the students of other countries.

At this point the delegates broke up and went out to have the traditional photograph taken of the delegates to the Annual Conference of the Society.

After that the Society started its work with the business meeting. The following apologies were received: Profs. Almgren, Arnold, Byzov, Dowd, Duchene, Eichmeyer, Helms, Ilias, Knissel, Kovacs, Kuzmin, Lindqvist, Martens, Panou, Pasamehmetoglu, Pavlovic, Phillips, Potts, Ramirez Oyanguren, Sitz, Strzodka, Wagner and Weber.

The minutes of the previous meeting held in Moscow in August 1996 had been circulated at the meeting and were accepted as a correct record.

Arising from the minutes the Secretary General pointed out that he had failed to send out updated copies of the database on those courses of mining education which he had collected previously. It was agreed that he would now do this, but that he would send them out now on computer disks in their current format which is in Excel spreadsheet form.

There followed a fairly comprehensive discussion on membership and while it was agreed that the Society needed to expand its membership, it was reaffirmed that Professors at European universities should be actively recruited, but that those from universities outside Europe should be recruited on a selective and invitation only basis. The objective still being to have as broad a coverage within Europe as possible and also to have representatives from most major mining countries, but on a selective basis. China and countries in South America other than Brazil which is already represented were mentioned as countries from which members needed to be sought.

It was also decided at this time that, to help with this task and some of the other tasks that were undertaken by the Secretary General, a deputy to the Secretary General should be appointed and Mr. J.J. de Ruiter was suggested as the right person to do this, proposed by Professor Fettweis and seconded by Professor Karmis. He was prepared to stand and was then unanimously elected.

The date and venue of the **next meeting** was the next item for discussion. This will be hosted by Torino, and will be held in **Italy from 12th to 16th September, 1998**. The final venue is not yet known but it will probably be in Rome for the first two days and the delegates will then move on to Carrara for the rest of the conference. It was agreed that the meeting would be held in conjunction with the council meeting of Eurominerals, and that there will be a one day conference, the title of which will be **"The role of mineral raw materials in the 21st Century."** The conference will be organised by the **Society and Eurominerals jointly**.

Since Italy was the next venue for the meeting of the Society, by the rules of the Society Professor Badino

was unanimously elected as the President of the Society for the period from the end of this meeting until the end of the meeting in Italy in 1998.

The venue for the following meeting was then discussed and it was agreed that it would be in London at the Royal School of Mines in September 1999. More details on this will follow later.

For the future there is still the bid in from the Urals for the year 2000, and this was tentatively accepted, though the Society agreed that it only firmly accepts a venue one conference ahead.

As a result of above it was clear that a person from Torino was to be the next president of the Society according to our rules. After some discussion and a phone call, it was decided that this would be Professor Pelizza. However, since Prof. Pelizza was so busy, and since Prof. Badino would be doing most of the conference organisation it was decided that for this year there would also be a vice-President, Prof. Badino.

The composition of the council was discussed next and it was decided that there should be representatives of the retired members and of the members from countries outside Europe on the council. Professor Fettweis was elected as the representative of the former group and Professor Karmis of the latter group.

The Council for 1997/98 therefore consists of Professor Pelizza, President, Professor Badino, vice-President, Professor Shaw, Secretary General, Mr. Hans de Ruiter, deputy Secretary General, Professors Matikainen and Puchkov, the two most recent past presidents, Professor Fettweis and Professor Karmis - see above. It was noted that also due to be on council was the president elect who is the person due to run the next but one meeting. Since in this case that is Professor Shaw and he is on council anyway ex officio, this post will be vacant for this year.

The business meeting was then closed, there being no other business and the delegates then broke for lunch.

After lunch Professor Shaw took the chair to run a session on the Image of Mining. As a start he handed out the draft statement that had been originally produced by him, had then been sent to Eurominerals for their comment and had been faxed back in this new draft by Eurominerals. The idea is that when the two institutions have agreed a draft, the document will be published in every journal published by any member of Eurominerals and also in the Society's journal Mineral Resources Engineering. It is to be a joint statement of belief in the importance of mining, mining education, and the products of mining.

The delegates were given time to read the draft document and then the discussion was started. Prof. Brady read a short section from a document produced by the Minerals Council of Australia (the second attached document in this newsletter) which interestingly supported some of the sentiments expressed in the proposed statement.

There was then some significant discussion of the document and the main changes suggested were that some figures relating to the remaining reserves of coal and other energy minerals in the ground should be taken out and that this should be replaced by a more positive statement indicating that the growth in minerals usage was very likely to continue for the foreseeable future. The words "sustainable development " were important in this context.

It was also suggested that the figures for the number of mining educational institutions within Europe should be left out, but after further discussion later they have been left in. An updated draft that has been sent to Eurominerals since this meeting is included here immediately following these minutes.

The American members also pointed out that there had been a lot of work done in the USA, Australia and Canada on the image of mining and that much material existed. Both Prof. Mousset-Jones and Prof. Karmis undertook to send the Secretary General a listing of the material that they were aware of that was available. Much of this was material for use by school teachers in their classes to make young people more aware of the vital needs that mineral products fulfil.

Various other approaches being used were discussed. In the Eastern USA some of the coal companies have started working with the power generators emphasising the vital need for electric power, which the general public does understand. Then they would add that 60% of the power used came from coal. In this way, the need for mining was being emphasised to the public.

Another approach was the start of new middle of the road journals on environmental management which have appeared in the US. These had very balanced approaches to the industry and were also helping. Prof. Mousset-Jones agreed to let the Secretary General have the details of these, but indicated anyway that at least one of them was being produced by the Mining Journal. Prof. Wilke indicated that Verlag Glückauf was also working on such a journal. More information on these will be passed on to members later.

Other points made included the suggestion by Prof. Vujec that it was not good enough merely to print the document in journals read only by mining professionals, but that we needed to get the message into journals read by the general public. It was also suggested by Professor Puchkov that the importance of mining and minerals in the history of development of modern civilisation needed to be emphasised and brought to the attention of the public. All of these discussions lent weight to the decision taken earlier about the theme for the next meeting in Rome.

After a break for tea Mr. de Ruiter took over the chair to lead a session on mining engineering education. He started with a detailed discussions of the reasons for the starting of the new European Mining Course being given jointly by the RWTH Aachen, the Technical University of Delft, the Technical University of Helsinki and the Royal School of Mines. this had been done taking into account the commercialisation of the universities where academic excellence appeared now to matter less than commercial success. Also there had been a

reduction in student numbers generally in Europe, while at the same time there was currently an increasing demand for good graduates.

The pilot running of this course had started in September 1996 and had been a very big success. The four universities involved were very pleased with the results. In particular they were pleased by the very real interest that had been shown in the programme by industry. This had been manifested by Industry helping with the funding and also offering the potential first graduates good employment opportunities.

The four universities now planned to continue and there would be 19 students on the course starting in September 1997. This was felt to be close to the maximum practical number and amounted to an average of roughly 5 each, though this was not in fact the split, some universities having more and some less students available.

The delegates present showed great interest and there were some who indicated that their universities would like to join the programme. It was pointed out, that it had turned out that four universities seemed to be the right number as if there were more the students would spend too little time on each campus. So if any were to join the existing grouping it might be possible to send students, but that their campus would not be involved.

However, it was suggested that there was another solution. Since each of the existing four only had the students to teach in their fourth year for one quarter of the academic teaching year, it was at least possible that they might be able to use some of the rest of that year by joining a second cluster of four universities. If each of the four did this with three other universities each this could lead to there being a network of universities cooperating in this way. It was not expected that this would happen very fast as the four existing partners were in any case committed for 1997 academic year, so any new cluster would only be able to start in 1988. This might be a good idea anyway as there would then be one more year's experience to build on.

The discussion of all of the above was very lively and lasted until the close for the day of the working session of the meeting.

In the evening the delegates and their accompanying persons were bussed over to the headquarters of Outokumpu Oy where they were first treated to a very interesting talk on the company, where it is now and where it hoped to go in the future. This was followed by a very pleasant dinner and evening of discussion as guests of Outokumpu.

Day 2

Day 2 started with Professor Matikainen in the chair and, after confirming the appointment of Prof. Pelizza as next year's president, was a continuation of the discussions on education in mining engineering. Professor Brady was asked to give a brief overview of mining and mining education in Australia.

He pointed out that the Australian mineral industry produced about $A 80 billion each year which was some 7% of GDP. It accounted for 3% of direct employment and with $A48 billion in exports accounted for 40% of export earnings. There are a number of major mining companies and a much larger number of small mining companies operating in Australia and the requirement by industry for new mining graduates each year was presently over 200.

In education there were three major departments and three minor ones, of which some of the latter may not survive. The major departments are at the University of Queensland in Brisbane, the University of New South Wales in Sydney and the Curtin University / Western Australia School of Mines in Western Australia. These three each produce about 40 graduates per year.

The three smaller ones are the University of Wollongong which is about 40 k south of Sydney, the University of South Australia in Adelaide and the University of Ballarat. Each of the former two produce about 10 graduates per year while Ballarat appears to be on the verge of closing.

Therefore the local supply of graduates is some 140 to 150 per year with a demand of 200 and the balance is mainly made up by imported graduates from South Africa, Canada, the United States and Europe.

He pointed out that the universities operate with small numbers of academic staff. For example there are only 6.5 mining staff in Queensland and 5 at New South Wales.

The University of Queensland mining department has the following:

Year	Mining	Mineral Processing	Manufacturing and Materials
2	48	10	13
3	45	6	12
4	42	14	18
Total	135	30	43
1996 Graduates	41	10	14
Post Graduates	33	10	48

The budget for the Department was reported to be $A 3.4 million per year.

There has been an upswing in mining engineering student numbers since 1992. Before that there were about 20 per year on average for the previous five years, since then there has been an increase and the results are shown in the table above.

There has been a decrease in University funding as is the case in most of the developed world. They are looking therefore to innovative solutions and are considering networking the three major universities. This means that they were very interested in the model produced by the European Mining Course. They are also looking to increase their links globally and hope to forge links with North and South America and South Africa in particular.

Professor Golosinski, who is from the Western Australian School of Mines then added his perspective on mining education in Australia. In particular he mentioned that Western Australia form about half the territorial area of Australia and has only 10% of the population. However it produces 65% of the mineral production. His school has very strong ties with industry with many of the staff teaching part time while holding jobs in industry. In general they tend to teach more than comparable schools in Europe.

Professor Yamaguchi then gave his insights into the problem which are reproduced in full here as the third attached document.

He was followed by Professor Yamatomi who pointed out that Japan now produced less than 0.1% of its mineral needs itself and now had only three coal mines left and two metal mines. As a result the Japanese government was not supporting research into mining. The Japanese universities needed to produce graduates who could work overseas. However, most of their graduates did not go into the mining industry anyway.

This was followed be a short paper by Prof. Dementiev on the situation in the Urals State University of Mining & Geology reproduced as paper 4.

Prof. Mousset-Jones then talked a bit on the situation in the United States, where there are now 15 active mining universities and he expects this to reduce over time to 7 or 8. This would not be planned but would happen by market forces. He pointed out that there was a new problem for the industry, that of professional couples. The industry now needed to be able to offer the other partner a professional job as well as the job for the partner who is a mining engineer, and this can be very difficult.

The Mining universities with few exceptions had very low numbers of students, but with mines now being run in the way they are there may be as few as two mining engineers on a mine. Nevertheless, with the shortages the mining graduates were now being offered very high pay, but are expected to work very long hours for it.

There is now no longer any Federally funded research since they closed the US Bureau of Mines. Since mining companies do not at present do research either, the universities were finding it very hard to find research funding.

Finally he pointed out that the accreditation of engineering degrees was being updated and gave members copies of a document titled Engineering 2000 which gives the basis on which they will be accredited in the future.

Professor Karmis then added that the mining companies were looking for broader graduates, with more management, more environment and especially better communication skills. The also felt that the students needed more exposure to other cultures and his university wanted 20% of its students to have some experience abroad during their degree studies.

The mining schools were largely in the State universities which had gone from being State supported, through State assisted to the point now where they were merely State encouraged. This meant that they had to find industry funding to survive.

After a break for coffee Professor Wilke took the chair for a session on mining research. The list that was introduced last meeting and appears in the minutes of the Moscow meeting was again used as the basis for discussion.

Prof. Shaw suggested that for co-operative purposes it was important that the members of the Society are aware of each other's strengths. Therefore he suggested that each member university should send the Secretary General a short list of the areas in which they consider themselves to be particularly strong in research. This list will then be put up on the Web site that he proposed should be set up for the Society, and thus members looking to co-operate in research could identify the appropriate partner to choose when seeking funds. **All members are hereby requested to send in the information on the areas of strength in research of their university.**

Then professors Matikainen, Badino and Vogt all gave a brief description of research being undertaken at their institutions. There followed discussions of research funding and the importance of the less well recognised sections of the mining industry such as the construction materials quarries and the dimension stone industry. A number of speakers emphasised that we should be working with these sections of our industry. However, it was recognised that at least in some areas, the quarry industry was till not ready to support research work, but that it is getting there, particularly spurred on by the growing pressures of the environmental lobbies.

Prof. Wilke then guided the discussions on to automation, pointing out that this was becoming a part of all research projects. It was pointed out that research into automation could only really be done with the help of manufacturers and mines, and that automation could not be taught except on a practical basis, and the same was true of research. In the light of this the question was asked as to what the universities could do with regard to research into automation.

The point was made that all automation involved at least some mathematical modelling and that this was an area in which universities were particularly strong. In addition, the layout and planning of automated operations was an area in which we had expertise. The universities could also supply staff for the pilot testing of new automation as the companies these days seldom had the qualified staff available for this work.

Professor Brady also pointed out that the universities were well placed also to do the 'product specification' that is to identify the automation which needed to be developed and to specify exactly what was intended to be achieved. The universities also had the staff who would find the development of the necessary software an relatively easy task.

Summing up Prof. Wilke pointed out that financing of research was becoming a serious problem world wide. To help we needed to concentrate on interdisciplinary and inter university research projects, preferably involving industrial partners and where possible government agencies. He also emphasised that automation was becoming a part of all research programmes.

At this point the session on research and automation was closed and the meeting went on to discuss in more detail the proposals for the meeting being planned for Italy next year by Torino. With there being a conference on the topic of **"The role of mineral raw materials in the 21st Century."** attached to the meeting, there was a need to identify important speakers for the conference. If any members have any ideas on this would they please let the Secretary General know.

After the discussion of some of the practical aspects of the Italian meeting the decision was taken to form a small sub-committee to assist Prof. Badino in the organisation - this consists of Profs. Badino, de Ruiter, Shaw and Wagner. Of course, since it is planned to be in conjunction with Eurominerals, there will also be nominees from that organisation.

It was decided also to ask members who are interested to supply short papers on the future of mining in the 21st Century in their country. If enough of these can be collected fairly soon, then it would be possible to have a special section in Mineral Resources Engineering publishing this material. This could also give the subcommittee some ideas on themes for the conference.

At this point the meeting was closed and Prof. Shaw thanked Prof. Matikainen very much indeed for organising what all agreed had been a very useful and well run meeting at which a lot had been achieved. Everything had gone smoothly and to time and it was a huge success. The Society also wished him well in his new position as Director of the Geological Survey of Finland.

The members then went on a tour of the Finnish Research establishment. This has most of its laboratories in a series of huge underground chambers, initially designed as a nuclear shelter for 5000 people, but being used in the meanwhile as research laboratories.

Then in the evening there was a farewell dinner at Seurasaari an open air museum on an island in Helsinki where the final dinner had been arranged in the restaurant there. This was in a building erected in the last century and was a very pleasant location for this very excellent function.

On Wednesday the 4th there were two technical visits to choose from, one to Tampere to visit the operations of Tamrock including the underground rig testing and prototype workshop facilities and also the factory of Nordberg-Lokomo. The second option was a visit to Lohja to Partek Nordkalk's Tytyri underground limestone mine there. Both excursions went off well and were appreciated by those who participated.

IMAGE: THE PROBLEM OF MINING ENGINEERING

'*Mining - and underground mining in particular - is no longer necessary for (economic) prosperity'* is the widespread perception that has developed in European (and other) countries over the past twenty years or so. Newspaper and television reports of mine closures, the environmental impact of mining activity, subsidies for sectors of the mining industry and miners' demonstrations against the losses of their jobs have worsened the public view of the industry. The average citizen does not appreciate how many of the items that are used in modern everyday life originate from mining products. There is little understanding that civilisation is still totally dependent on raw materials - it has always been so and it will continue to be the job of mining engineers to supply economies and people with such raw materials.

Nowadays the term 'raw materials' needs to be understood in a wider sense than in the past as it embraces not only such traditional minerals as metals, fuels, salt and precious stones but the wide range of other basic products that contribute to the growth of civilisation. Industrial minerals, building materials, potable and industrial water and even the ground that needs to be reconditioned in one way or another before it can be reused in our congested landscapes have to be included.

There is no doubt that the future demand for raw materials will continue to increase globally. There is no sign of any slowing down of the growth of human populations world-wide. The lesser developed countries continue to aspire to the standards of living enjoyed by those living in the developed world. As more and more of this increasing population achieve high levels of development the demand for minerals to supply that standard of living must continue to grow. Recycling will certainly expand and help the situation, but at best it can reduce the rate of growth of demand, it cannot replace the growing need for freshly mined mineral products.

The public image of the potential shortage scenario propounded in the first report by the 'Club of Rome' in the 1970s continues to persist. But mineral discoveries have always more than kept pace with demand. The known reserves in the ground are indeed finite, but there is no doubt that for the foreseeable future mineral deposits will continue to be discovered. The minerals required will be there to be recovered when they are needed if permission can be obtained to recover them, and 'sustainable development' of these resources will be the guiding principle.

The negative image of the industry has however led to decreasing numbers of students in the field of mining engineering at most European universities, which, in its turn, has already given rise to a lack of qualified experts that the industry needs and the closing or combining academic institutes or the modification of their areas of interest. This shortage of skilled people has occurred even though the number of mining departments in the European Union (38) and in Europe as a whole (91) is still probably too high in comparison to demand in the

long term. There is a need for rationalisation. This should be effected in a planned manner, however - not at random. It is important that the experience and know-how in this special field be preserved and offered to the industry on a world wide scale.

One thing must be kept in mind very clearly: mining engineering is an international business. Most major mining companies operate world wide in line with the development of the global raw materials market. On the one hand, this puts different burdens on the shoulders of mining engineering students and, on the other, it opens up remarkable professional opportunities. In addition to technological and economic knowledge, it is imperative for a graduate to speak at least one foreign language to be able to 'go international'. Many universities support internationalisation through incentives for students to join different classes or practical courses in other countries.

It must be remembered that the mining graduate is needed not only in the traditional 'raw materials extracting industry'. Adjacent fields of professional activity which require such graduates are, for example, raw materials preparation and mineral processing, the marketing of mining products, including mining machinery, underground roadway construction, tunnelling and shaft sinking. Nowadays, such new fields as the closure of abandoned mines, the reclamation of industrial sites, the recycling of raw materials, the deposition of all types of debris and environmental protection have come into being. Even in peripheral parts of the industry mining engineering knowledge is required in, for example, financial analysis, banking, government agencies and project development in developing countries.

The final objective is to match the supply to demand over a reasonable period of time. At present, growing numbers of universities are being forced to operate increasingly on the basis of financial rather than educational criteria. It may well be that, in the past, too little attention was paid to finance and some inefficiencies undoubtedly arose, but it does seem that the balance has tipped too far, financial imperatives now overruling the academic. On the assumption that the industries that are served by mining education do actually need mining graduates, those industries should make it clear to governments that they expect to be able to continue to recruit 'home produced' graduates as and when they are needed and that the loss of the related experience at universities would jeopardise their viability.

Moreover, direct financial support from the industry for universities is required. The best argument to convince high-quality candidates that they should study mining engineering is a straightforward emphasis on the very good professional prospects of such a decision. Therefore, the industry and related organisations need to provide the appropriate number of highly attractive jobs - which they are willing to do as long as the graduate mining engineer offers the widespread qualifications that are taught in mining engineering studies - different fields of engineering, economic and marketing, law and management included. These topics are normally taught in small classes that allow the professors to react individually to the students' needs.

Accordingly, it follows that the public relations aspects of the whole mining industry, and particularly of mining engineering education, need to be improved by means of lobbying through television, radio, newspapers, magazines, etc. School teachers could well be a good group through which levels of awareness among young people can be improved. Special events inspired by jubilees could highlight the contributions from mining to the development of modern civilisation. More information should be disseminated on the environmental attitudes that have been adopted in mining and the positive effects of mining activities should be emphasised. A large portion of the wetlands that now exist in our cultural landscape and that are so essential for wildlife and human recreation are, for example, the result of mining activity.

The general public's negative image of mining and mining engineering education is not based on objective reasoning. Via improved information this view has to be changed by every possible means. Such a change would result automatically in an increased interest in mining-related activity, growing numbers of students and better services to the industry.

Mining Engineering and Civil Engineering

U. Yamaguchi

Mining engineering and civil engineering have a great number of points in common, but there are also significant differences. It is therefore not a good idea to apply only mining engineering technology or the concepts of civil engineering without either considering carefully their applicability or modifying them appropriately.

The most significant difference between the two disciplines is of course their original purpose.

The purpose of mining engineering is the development and exploitation of a mineral deposit. Its function is the recovery of valuable mineral resources from the earth's crust and their treatment and nothing else. Even though the mining operations, facilities and openings created may be very large and impressive, once the mineral reserves have been exhausted, these facilities no longer serve any useful purpose. The value of the deposit should have more than covered the total amount of capital spent on the creation of the facilities and equipment of the mine.

It is most desirable that mining facilities are as safe as possible and efficiently productive during their active life. It is also important that they are developed as economically as possible as they become worthless when the mine is exhausted.

The total amount of money available for the development of a mine is only as much as the maximum sum which can be supported by the deposit and the return on the investment in the mine is the difference between the value of the deposit and the cost of building and running the mine. Obviously, the smaller the develop-

ment and running costs the more valuable the deposit becomes. It is thus obvious that mining engineering technology will tend towards producing the highest possible productivities through the use of smaller and cheaper mining facilities and equipment, and they are designed for temporary use not for permanence.

On the other hand, in the field of civil engineering, the purpose is to construct something to be used. They are constructing covered space for the use of the space by human beings. In the case of mining facilities the only people to use the facilities are the mine workers. However, in the case of civil construction it is the general public who use the facilities and it is not restricted to the construction workers, and in this way it differs from mining. It is for this reason that the civil constructions are required to be very much safer and more designed for use than the mining ones. In the case of civil construction the costs of building are expected to be covered by the people who use the facilities. Civil profits are higher if the facilities are extensively used or if a very high fee can be charged for their use.

An huge construction like a pyramid or a large sculpture of the Buddha appears to be a waste of effort. However, in this case the return on the effort of construction is achieved through the satisfaction of the person commissioning its construction with the result. On the other hand, even a very large mine would not normally be developed simply as a monument to those who built it.

Both mining engineering and civil engineering include similar subjects of study such as natural rock formations and the construction of artificial structures. However there are great differences in their ways of thinking and the procedures followed in handling the subjects. For example, in mining engineering, the intensive study of the mineral deposit is vital, but the mining engineer must work with what is there, he cannot change or alter the nature of the deposit he will recover. All the structure he creates will be defined by the nature of the deposit and any changes to the design to improve the economics are limited by that fundamental nature. On the other hand, when a civil structure is designed, it is made for a purpose that is decided by the designer and he is free to plan, design and modify as he wishes to suit that purpose. Even in the case of the foundations of a bridge or a tunnel, both of which are affected by the natural conditions, a change of design, an alteration of the route etc. is possible and can be done.

With regard to the natural conditions there are other areas in which there are differences between mining and civil engineering. In civil the planning and designing of the structures becomes more important whereas in mining it is surveying and productivity which are vital. The fact that civil engineering is a contracting business has undoubtedly led to the emphasis on calculation and design which have been specially developed in that field.

The NATM method is now very popular in tunnelling. Rock-bolting and shotcrete are the principal technologies for the support of the tunnel walls. The number of rock bolts placed per unit area and the thickness of the shotcrete are adjusted by measurement of rock mass movement carried out just after driving the tunnel. These techniques, rock-bolting and shotcreting, had already been previously employed in mining engineering. Rock bolting was developed in stratified coal mines and shotcreting has been widely used in conjunction with wire meshing in all kinds of mines for the prevention of rock fall and spalling of rock from the tunnel walls.

The idea that timbering should be done just after excavation and before the rock starts of move makes practical sense in mining. Rockbolting and shotcreting are very useful for underground mines due to their simplicity and availability.

A distinctive feature of NATM is that rock mass measurement should be done immediately after the excavation is completed, and the data measured should be fed back to allow the adjustment of the number of bolts per unit area, the length of the bolts, their distribution, the thickness of shotcrete required and so on. Measurement of rock mass movement and feedback of data are in fact more important for the excavation than the application of the rock bolts and shotcrete. It can be said that a similar investigation is carried out in the mine by a patrolling mining engineer who uses his experience to observe the status of the excavation walls.

In the field of civil engineering where there is a separation between client and contractor, and the clients generally lack experience, it is essential to do a systematic investigation of the rock wall situation regardless of cost. On the other hand in mines in which extensive workings at the lowest possible cost are required, except in special circumstances, the cheapest daily inspection by qualified mining engineers and experienced workers is most commonly used.

Mining works are commonly done much deeper underground, while civil constructions tend to be on or near the surface. The differing circumstances of civil and mining engineering have led to the development of specific technologies for the treatment of the earth and rock stability, handling of surface water and pumping technology, surface subsidence and rock burst protection and so on.

It is natural that these technologies have gradually developed and have become more common as civil construction goes deeper underground and the use of surface mining has expanded significantly. Nevertheless, the fundamental difference remains unchanged as each engineering discipline has a different fundamental purpose.

An Address To The Minerals Council of Australia Seminar

National Convention Centre, Canberra. May 29,1997

by Rod Cameron
Managing Director ANOP Research Services Pty Ltd

COMMUNITY PERCEPTIONS - WHY NOT WELCOME THE MINERALS INDUSTRY?

At ANOP we have been researching the Australian community for 26 years and it is rare to find a major issue emerging in middle Australia that politicians and journalists have not yet picked up. In my business you get used to the way in which public opinion reflects mass media and political agendas; and you get used to finding small variations on familiar themes. Telling people what they already know is hardly inspiring material for an address to such a distinguished group of people as you are. My challenge is to give old attitudes and perceptions new meaning and significance at least as it affects the mining industry.

I confess that it was with some trepidation that I agreed to appear here today and review the information gathered from recent general ANOP studies of public attitudes and gathered specifically from a series of focus groups conducted to help me answer the question - why not welcome the minerals industry? Now, as an audience, you will still have to contend with the problem of listening to a speaker more at home suggesting words to come out of the mouth of a business chief or politician rather than his own. But I am pleased to report that the study your invitation prompted, has identified what I believe is a major sleeping issue that is about to break through and become a dominant new theme in Australian community and political life.

At least for a pollster used, as I said, to small variations on similar themes, such a finding is exciting. But, speaking as I am straight after the Premier of Western Australia, it is appropriate that I point out that my conclusions must be tentative, if for no other reasons than the community perceptions of the minerals industry that ANOP has been looking at are what should be called "eastern states capital city perceptions". We have conducted research in Melbourne and Sydney with a wide cross section of people of varying ages and occupations but not with similar groups in Perth. Nor have we, in gathering impressions for this address, ventured into rural and provincial Australia. I am not going to pretend, therefore, that the picture I will outline is the complete one.

What I am confident of concluding from the preliminary study of attitudes in our nation's two biggest cities, is that aspects of industry policy will dominate political debate in this country in the years immediately ahead. It is into this broader context of public attitudes to industry generally that I will attempt to put the views that ordinary people hold about the minerals industry in particular.

Now it is certainly not new to find community support

for simplistic notions of "more Australian industry", “buy Australian", "the need for sensible tariffs to protect jobs" and so on. Sentiments like those have been with us in Australia for decades. What is new is the appearance of a host of triggers that appear to be making those sentiments grow in electoral and personal significance.

The triggers I am referring to include:

1. The seemingly intractable problem of unemployment and people's genuine fears of job security. The community today thinks unemployment is even higher than it actually is. There is a growing bewilderment every time another bank or government department announces that a "benefit" of greater efficiency is the shedding of thousands more jobs.

2. The specific impact of the announcement by BHP that it planned to close its Newcastle steel works and the accompanying "it is inevitable nothing can be done" imagery of the government response. Perhaps no single announcement by a company in recent years has had a greater unsettling impact on ordinary Australians than this one has.

3. The absence of jobs for apprentices when they finish their time has added to the open discussion in the community of what is seen as the decline of manufacturing industry. That decline is regretted by a public that still thinks that real jobs mean at least some forms of work that actually involve making or producing something tangible. Governments might extol the employment opportunities created by the froth and bubbles of casinos but there is an underlying fear that there is something less substantial and permanent about employment in industries like hospitality and tourism. That fear about permanence was enhanced in NSW when hoteliers predicted job cuts following the announcement of a bed tax and is reinforced every time there is a prediction that the views of Pauline Hanson will result in a downturn in Asian visitors.

4. A nostalgia for an Australia that was seen as making things, combined with a worry about an over reliance on imported products is leading to an emerging popular consensus that "enough is enough" when it comes to tariff cuts. Presumably if we had been probing the views of people from Adelaide where the future of the motor vehicle industry is at risk then this view would be even stronger but it is considerable enough in Melbourne and Sydney as it is.

5. Toss in headlines about the balance of payments and you have quite considerable concern about the growing absence of Australian made goods and produce. That concern is heightened every time an icon of Australian manufacturing is bought by a foreign owned company. When even governments join the sell-out by privatising basic utilities like power and water into the hands of non-Australians then confusion really grows. It is spurred on further when well known Australian companies announce plans to invest in manufacturing and mining overseas; and when life insurance companies and superannuation funds devote an ever increasing share to off-shore investments.

My tentative conclusion is that these individual triggers are combining to create a state of mind in Australians that is far from relaxed and comfortable. Instead there is an insecure and vulnerable society in which there is:

- a genuine concern about the future of the country;
- a real fear of the permanence of growing youth unemployment; and
- an emerging frustration that government cannot see the sense of supporting and encouraging Australian industry.

In the past we have had commentators reflecting on this new Australian insecurity as a fear of too rapid a pace of change and the pressures inherent in a modem complex society. But the insecurity we have been finding in the last few years is not primarily about a fear of change. Eighteen months ago it was because a federal government was seen to be ignoring the priorities of the majority of Australians. Today it is more related to the emerging conclusion that the government cannot find solutions to the problems it so correctly identified.

The prime minister, a popular and credible figure, at least a few months ago, may well ask what does it take to engender a spirit of confidence if a very good message on inflation, interest rates and growth cannot.

It is just such a mixture of vulnerability and insecurity in the early years of the Australian federation which led to the White Australia policy. Insecure and vulnerable Australians hid for almost the first 50 years of their nationhood under the security blanket of tight controls on the number and ethnic backgrounds of migrants.

It was in the confident and growing country which emerged from World War 11 that attitudes changed to allow and encourage more and more migrants from more and more diverse backgrounds. A country in which political parties of all colours were united in a commitment to full employment, and policies designed to promote the primary and secondary industries of all kinds which could make that full employment a virtual reality, was the country in which colour as a criterion for immigration was finally scrapped with barely a protest.

Were the people in that tolerant Australia which emerged 30 years ago really any different in attitudes to their forefathers who chose a White Australia or different to their children who are now attracted to those calling for a country which again discriminates against Asian migrants? It is difficult to prove correct answers but it is possible to observe that tolerance started to emerge after 20 years of low unemployment and, if tolerance is disappearing and insecurity increasing, it is after a decade of high unemployment.

It is within this broad mix of concern about the future,

accentuated by the high unemployment, that today's perceptions about the minerals industry need to be interpreted. It has been a policy of the Minerals Council in recent years to take a low key role in the public arena - a strategy that has been thus far successful. To a large extent, our research found that mining and the products of mining are not a top-of-mind community issue - with one major recent exception. This exception is of course, BHP which, with the announcement of the Newcastle closure, created an impression that even the Big Australian could not survive in the big, wide competitive world. That announcement created a gloom about an Australia on the verge of returning to be an export quarry that shipped out relatively cheap raw materials only to import the expensive finished steel products.

In addition to the mining industry's low profile, it lacks personal relevance for the urban dwellers of our research groups. The current perception is that minerals are something that are mined out the back of nowhere and thus this stops them being directly relevant to people's lives. Only when you probe a little deeper is there an acceptance that perhaps minerals exports are important - although it is older Australians who tend correctly to place them as being more significant dollar earners than the produce of farms and factories. Certainly among Australian youth there is no ready perception that without mineral production their own standard of living would fall and that there is a correlation between new mines in the bush and their own future job opportunities in the city.

Now, it is not unusual across a range of issues to find that it is older people who are more likely to be well informed about most things. Knowledge is the product of experience as well as the class room but nevertheless I admit to being surprised by the lack of appreciation among the young of the importance of the minerals industry in creating Australia's wealth. Mining, it seems, is regarded as an activity of the past - one of those things that used to be relevant perhaps but is now as unfashionable as wearing a blue singlet in this age of the designer T-shirt. Jobs are seen as being one of the benefits of mining but they are not the kind of jobs that would attract many young Australians out of the city.

Perhaps the lack of interest in, or regard for, the minerals industry among the young is linked with their perception that minerals are a non-renewable resource. The concept of sustainable development very obviously is one thing that has been communicated well to pupils by our education system. Planet Earth eventually running out of minerals is an issue, with the answer for some being that we might as well find alternatives now. The Greenhouse effect from the burning of coal is an issue for some who without a hint of irony suggest solar and wind power instant alternatives. The new buzz word with many young people is 'green power.'

It is not just young people who have had their attitudes shaped by environmental considerations - it is the whole community. As this audience knows, the biggest single factor in changing the public view of the mining industry from something people were proud about and thought of as very beneficial to Australia, to something with a balance of up side and down side, was the rise of environmental consciousness.

If the benefits of mining fail readily to enter the community's mind the same cannot be said of the drawbacks. With very few exceptions, those we talked with in our research groups were quick to express an opinion about the environmental destruction caused by mining. Those television pictures, whether fair and justified or not, of the dirty river downstream from the Ok Tedi mine have been firmly planted in the minds of Australians. Big mining is perceived as creating the potential for big environmental trouble.

(By way of an aside may I also offer some evidence that fails to confirm my earlier suggestion that older people are better informed than younger people. It was a respectably conservative elderly citizen of Sydney who stumped our researcher by launching into a spirited attack on what she called Okay Teddy. Ok Tedi was not okay at all as far as she was concerned.)

The idea of an unfettered mining industry left to its own devices was anathema to Australians of any age. Governments were seen by all as having a necessary and important role in ensuring that care was taken by miners to minimise the damage caused by their activities and that restoration of the environment was an integral part of the mining process. Governments too were seen as filling the role of sensitive umpires who should decide on areas where mining should be prohibited. By and large Australians see their governments as fulfilling quite well this role of obtaining a balance between environmental and production needs. There is a recognition that the mining industry today is cleaning up its act in response to public opinion and to pressure from government. Things like environmental impact studies, community consultation, restoration of the natural environment and so on. This has had the effect of keeping the environmental issue under control but the bar is now set higher and community expectation will demand a consideration of the environment in any resource development.

Where the public believes mining should not be allowed is in any area of great natural beauty like a National Park and preferably there would be no such thing as a mine even close to a suburban backyard. A final go ahead for uranium mining in Kakadu undoubtedly is a potential “hot button" to provoke a political reaction to the mining industry as being insensitive to environmental concerns.

Not that uranium mining per se is a "no-no" for all Australians. It is a hibernating issue at the moment. But when explored, there is a clear cut difference on age grounds in attitudes to uranium mining (outside a world heritage area) with the young being more likely than the old to see something immoral in Australia's benefiting from such a potentially dangerous product. While in general, older people were prepared for Australia to take the money because if we don't, someone else will supply the uranium anyhow, there was almost unanimous agreement between young and old on one aspect: nuclear waste is a problem and there is a substantial fear lest Australia be forced to take back the radioactive end products of its uranium sales.

Attitudes to mining and native title are less clear cut although there is a general lack of understanding of the reasoning behind the High Court's pronouncements on aboriginal land rights. We noticed a tendency to hold back on the topic of land rights which is the result of a sensitivity surrounding the issue. There is still some initial reluctance among urban Australians to say something which others might interpret as being racist. To some extent there was a belief that native title would not in the end prevent mining because aborigines would always be prepared to do a deal if the money was right.

When ordinary people give an opinion safe in the knowledge that their views will not be acted upon, there is always scope for a little inconsistency and nowhere is that illustrated better than in attitudes to underground mining. On the one hand, if given the choice between underground mining and open cut mining, Australians would prefer that the ugliness be hidden and that the surface be left undisturbed. Yet underground mining is perceived as being an extremely hazardous occupation and stories of miners trapped down a shaft spring readily into people's minds. Lives should not be put at risk unnecessarily and health is considered at risk down mines quite apart from the issue of safety. The stories of miners dying from respiratory disease have reached the general consciousness. Clearly there is a belief that responsibility for accidents is not clear cut and that even with the best management in the world they will sometimes happen. What the community wants is the assurance that there are workplace rules and regulations and that the best management practices are followed so as to enforce them.

If it seems that I have devoted more time to what could be called the negative aspects of the minerals industry rather than the positive aspects then that is simply the result of sticking to the brief and reporting what the perceptions are rather than what we might like them to be. The truth is that the immediate image of mining is of a dirty, hazardous and environmentally damaging industry. The Australian people when they think about mining at all, associate it with big business. There simply is not any of the sympathy from urban Australians for big mining companies that there is for farmers. Farming is associated in the public mind with little people battling the vagaries of weather and the unfairness of restrictions on their exports. Mining companies are regarded as being big enough to look after themselves.

These negatives regarding mining are real but the industry recognises them and is dealing with them. Part of the strategy is to keep response to community negatives low key so as not to present a stationary target. There have been considerable advantages in maintaining this low-key approach and of appearing to get on with the job - quickly, efficiently and professionally. Changing the emphasis in official nomenclature from mining to minerals has been a subtle but prescient move, because minerals connote the valuable end product of a less favourably regarded industry.

But in the current climate the industry should also consider the potential downside of a too low-key approach. This downside is that people will forget, and in the case of youth never realise at all, the importance of mining to the national economy and standard of living. Related to this is the danger of being absent in the growing call for increased protectionism.

Which makes dealing with those findings about insecure and vulnerable Australians with which I began even more of a challenge for you in the minerals industry. There must be a real danger that the lack of understanding of, and public regard for, the mining industry means that the interests represented by the Australian Minerals Council will be disregarded when politicians feel compelled to react to what is a clear public message. Australians are demanding that their leaders produce a plan - a plan for industry - that shows them how jobs will be created in the cities where they want them.

The fact that prime minister John Howard has not done so already is proof of one of two things: either he is not the poll driven prime minister which he has so often been described as or his pollster has been on a long holiday. But nothing so concentrates the mind of a party leader on what the public is thinking than reaching the half way mark of a three year term. Remember, after all, that the average gap between elections over the last 25 years has been barely two years. Sooner rather than later this government will realise that it must turn its mind to industry policy as the only way of stopping those hard-won battlers being lured away by Pauline's siren song. The only alternative to doing so is substantially to decrease the time before this government is voted out to be replaced by one which does see a role for governments in interfering with the free market in an effort to recreate industrial growth.

No industry should realise better than your industry that when one sector is a winner from government intervention another sector is at risk of being a loser. Those halcyon days of full employment in the late 1950s and 1960s were for miners a time of input costs padded to pay for the cost of protection of others. A battle for the level playing field might have been won in recent years but if I am any political judge the war is far from over.

The Great Protection Debate which has been a recurring feature throughout this country's political life is re-emerging because the voters of Australia are demanding that it re-emerge. The challenge I see you having as an industry is to develop a strategy that will enable you to influence that debate so that this coming swing of the pendulum does not result in changes that are at your expense.

Dementiev I.V., Prof. Acad. ANS RF
Rector of the Ural State Academy of Mining and Geology

THE URAL REGIONAL MINING-GEOLOGICAL EDUCATIONAL COMPLEX - AS A SYSTEM OF PROFESSIONAL TRAINING OF SPECLALISTS

The beginning of special mining education in the Urals is related to the first half of XVIII century and is connected with the name of V.N.Tatishchev. Up to the beginning of the XX century it was a primary education and the higher mining education in the Urals started with the organisation in 1914 -1917 of the Ural Mining Institute. Now the Ural State Academy of Mining and Geology (USAMG) is going to celebrate its 80th jubilee in October of 1997. It was the first engineering higher school in the Urals after Perm University (1918).

Eventful development of the mining industry beginning in the 30s demanded a great number of specialists of middle level who were trained by secondary special educational institutions (SSEI) being subordinated mainly to different departments. Up to the present there was no continuity in getting secondary and higher education: the graduates of SSEIs having special training, began their studies from the same level as the graduates of schools.

Nowadays, in the Ural economic region the training of engineers, technicians and workers in the mining and geological specialities is carried out at one specialised higher school (Ural Academy of Mining and Geology), at two Mining Faculties of engineering higher schools (Perm and Magnitogorsk), at 12 mining, mining-industrial and geological-prospecting schools (colleges) and at 10 vocational schools (VS). These institutions of primary, secondary and higher professional education annually train 1000 engineers (including 300 by correspondence), 700 (150) technicians and 700 workers in mining-industrial specialities.

Of the mentioned 1000 graduates of higher schools approximately 70% start working in the region.

More than 3500 mining engineers work at mining and geological enterprises of Sverdlovsk region and in the whole Ural area the amount of such specialists may be equal to 10 thousand.

If the volume of mining-industrial enterprises is maintained at the modern level and the average period of labour activity of an engineer is about 30 years then the annual demand of the area in specialists with higher mining and geological education may be as much as 500 persons.

Engineering schools of the country provide for higher levels of fundamental and professional training of specialists, but were oriented on a socio-economic system with centralised planning and as a rule with concrete, addressed, forced assignment of the graduates. That is why mining engineers were specialised in narrow spheres (for example, there were more than 300 technical specialisation's).

The new economic conditions and the declaration of

freedom and rights of a person demanded from higher schools there has been a transfer to wider training of specialists and the introduction of several levels of higher professional education.

That is why higher and geological education in the engineering higher schools of Russia is carried out at present on two main directions: “Mining” and “Geology and Prospecting of Mineral Deposits”. After 4 years of studies at Bachelor level the graduates will get good fundamental and general professional training. After 5 years of studies on the level of graduated engineers on traditional specialities they master specialised addition to the Bachelor programme and after 6 years of studies at the Master level the graduates on the basis of Bachelor level are prepared to scientific and pedagogical activity.

According to the general governmental conception of reforms of Russia higher school and the tendency of the world development of higher mining education the Ural Academy of Mining and Geology has realised a number of measures in the re-orientation of its educational activity.

In accordance with the Law of RF “On Higher and After Higher Professional Education” (p.7, art.11) and on the basis of the Resolution of the Scientific Council of USAMG No. 6 of 21.02.92 and beginning from 1992, the training of specialists is carried out during a shortened period on the basis of secondary professional education of the corresponding profile. Enrolment of graduates of colleges and schools as the lst-year students is made after the interview accounting their final results of studies at secondary special educational institutions: in this case only those graduates are enrolled who have good and excellent marks.

The students taken to the first course are taught on special programme for linking-up with the operating curriculum in concrete specialities. See Table.

If the students successfully pass certification exams and credits they are transferred to the 3rd course of the Academy and continue studies on the current curriculum. To co-ordinate educational and methodical work, to provide for methodical continuity and succession of studies in the system of “college -higher school” the Ural Regional Mining-Geological Complex (URMGC) was established at the Mining Academy on voluntary basis. It united 15 schools and colleges, located in the Sverdlovsk, Perm, Chelyabinsk, Kemerov regions and in Bashkortostan. During the years 1992-96, 833 graduates from 32 schools were admitted. Of 833 persons admitted to the first course 737 students were transferred after attestation to the third course including 637 students who had finished technical schools within the Mining-Geological Complex.

Educational institutions belonging to various sectors are represented in the Complex.

The Council of URMGC represented by leaders of educational institutions carries out regular co-ordinating meetings “weeks of technical schools”.

One of the main directions of the activity of the Complex is a collaboration methodical work when the teachers of Secondary Special Educational Institutions have practical works at Departments of the Academy and the teachers of the Academy visit Technical Schools and Colleges aiming to exchange information and experience.

In 1995-1996 more than 100 teachers of SSEI had short-time practical works at departments of USAMG. The plans of complete training of specialists are being elaborated allowing to avoid duplicating in teaching of special disciplines. The material base of secondary Special Educational Institutions is used as the base of educational and production practices of the Academy students. Bilateral agreements have been concluded with all Secondary Special Educational Institutions entering UMGEC stipulating the rights, responsibilities and interests of the sides.

Close relations with SSEIs having different sectoral subordination mutually enriches the content of educational-methodical process. Five-year experience of work of the Complex allows to make the following conclusions:

- technical schools have got the opportunity to orient their students on quick receiving of a complete higher professional education. Realising the scheme the pupils and later students get two diplomas: on a secondary and higher professional education. The value of the present aspect is increasing with the possibility to get an allied speciality at the higher school. For example, a mining electrician after finishing of a SSEI and a mining-production engineer after graduation from the Academy.

- The increasing interest in this system of training from the part of pupils is confirmed by permanent growth of those ones who wish to receive higher education. It is quite natural that it strengthens the position of pedagogical Councils of SSEI on all aspects of academic and educational work, the wish of the students to have education of high quality;

- the Academy gets the contingent of students distinguished by high personal characteristics together with good professional training;

- the experience of the activity of UMGEC shows the essential shortening of the adaptation period of the given category of students to the conditions of higher schools that is very important in modern situation;

- the statistic analysis of discharges and the results of examination sessions indicate that the given contingent of students surpass in some aspects the middle level of contingent of the Academy students;

- purposeful training of specialists in shortened periods on the basis of secondary professional education of the corresponding profile is confirmed by the possibility of evaluation of the training content depending on the demands of production in specialists in the new economic conditions.

It is possible to expect that in the next 10 years higher mining education will be developed towards wider, integrated specialities that are predetermined by the character of mining production itself as it is complex, multiple-factor, multiple-connected with other production and natural surroundings and by the availability of single world market of mineral raw materials. The specialists must appear who orient well simultaneously in geology, prospecting, technology of mining and processing of mineral deposits, who know the principles of economics, marketing and mining law.

Narrow specialisation of graduates of higher schools on a concrete type of mineral deposit, method of its development (open pit or underground) should be acquired in the process of production activity and post-higher school qualification improvement. During the period of basic studies it may be justified only on new appearing directions on which there are no essentially developed productions, for example, such as geotechnology, geoecology, secondary reprocessing of technogenous raw materials, burying of industrial wastes, rehabilitation of landscape, hemmology and the like.

Taking into account the above it is possible to assert that the list and contents of curricula in the field of geological prospecting and mining must correspond to the main demands of the system of professional training of specialists.

Speciality profile	Subject	Time consumed (including)				
		total	obligatory classes	lectures	practicals	independent study
Automation and Monitoring; Mining Electric Engineering; Electromechanics and Electrotechnology; Technological Machines and Equipment; Geology and Prospecting of Minerals	Mathematics	257	182	70	112	75
	Physics	215	140	84	56	75
	Information	158	98	28	70	60
Underground Mining Mine Surveying Mine and Shaft Sinking Open Cut Mining	Physics and Rock Mechanics	64	49	28	21	15
Mine Surveying Underground Mining Mine and Shaft Sinking	Principles of Mining	64	49	28	21	15
Mineral Dressing Technology and Techniques of Mineral Prospecting Mining Machines and Equipment	Theoretical Mechanics	128	98	56	42	30
Electric Drive and Automation of Industrial Installations and Technological Complexes	Applied Mechanics	128	98	56	42	30
Electric Drive and Automation of Industrial Installations and Technological Complexes Automation of Technological Processes and Enterprises	Theoretical Principles of Electrotechnics p.l	128	98	56	42	30
Automation of Technological Processes and Enterprises	Electronics part 1.	64	56	14	42	8
	Machine Graphics	32	32	4	28	
	Applied Programming	32	32	428		
Mining Machines and Equipment	Strength of Materials part 1.	128	98	56	42	30
Geology and Prospecting of Minerals Search and Prospecting of Underground Waters and Engineering Geological Prospecting Technology and Techniques of Mineral Prospecting	Mineralogy Petrography Geochemistry	158	98	28	70	60
Geology and Mineral Prospecting Search and Prospecting of Underground Waters	Chemistry	128	98	56	42	30

Note: Total length of training - 16 weeks, including 2 examination ones.

Raimo Matikainen & Jukka Pukkila
30.5.1997

MINING IN FINLAND

Mining is a basic industry which has a permanent place in the world as long as metals and minerals are used. The thought of mining being a universally diminishing industry is false. The population will continue to grow with accelerating speed and at the same time the main objective everywhere is to raise the standard of living. This means that there is a need for production of all base metals, metallic and mineral products as well as growing demand for new commodities from mineral raw materials. Even the expectations to replace the growing demand by recycling or distilling sea water, lifting nodules or other means are not realistic, at least not in the near future.

Survey of the Finnish mining industry

Mining in Finland is comparatively young when compared with other European countries. The first iron ore mine, Ojala, was established in 1542 and the non-ferrous mine, Aijala, in 1581. The bases for the Finnish mining activity throughout the 1900s has been the founding of the Outokumpu copper deposit in March 1910. The actual production in Outokumpu started in 1913 by company named Outokumpu-Kopparverk. Since 1924 the mine has been operated by Outokumpu Oy, which today owns all metal mines in Finland, except the gold mine at Pahtavaara owned by Terra Mining Oy, which started in 1996.

Some other significant events related to Finnish mining and mineral reprocessing worth mentioning are:

- first cement furnace was brought into operation in 1914,
- Fe-V-mine was opened at Otanmäki in 1950,
- Zn-Pb-Cu-mine started operation at Vihanti in 1954,
- Cu-Zn-S-mine started at Pyhäsalmi in 1962,
- chromite mine at Kemi opened in 1969,
- talc concentrator started operation at Lahnaslampi in 1969,
- apatite mine and concentrator started operation at Siilinjärvi in 1980
- dolomite mine at Paltamo started production in 1985
- Au-mine at Orivesi started operation in 1994,
- and Au-mine at Pahtavaara started operation in 1996

Today there are 39 active mines in Finland with total ore production of 16.4 million tons:

- 6 metal mines (Cr, Au, Ag, Cu, Zn, Ni, Pb, Co) with total ore production of 3.3 million tons,
- 17 limestone mines (limestone, dolomite, wollastonite, Ca, Mg), with total ore production of 3.4 million tons,
- 10 industrial mineral mines (P, Talc, Soapstone, Quartz, Feldspar), with total ore production of 9.3 million tons,
- 6 other mines (Al, Fe, Mg) with ore production 0.28 million tons.

The production of Finnish mines increased continu-

ously until 1984. Due to the closing of many metallic mines, production decreased. New high grade metal mines have not been found at the same rate as before, but the increasing production of mineral mines has kept the annual production at about 30 million tons of which 16 million tons is ore (see appendices).

The share of domestic raw material for Finnish metallurgical industry, 50 - 60%, is decreasing. This has increased the interest of Outokumpu Oy, the owner of metal mines in Finland to invest in mining abroad. The company's mines abroad exceed domestic production.

The production of mineral mines has increased since 1975. This has been mainly due to opening of Siilinjärvi and Lahnaslampi mines and to increasing demand for agricultural fertilisers and industry feed additives.

Two significant characteristics in the Finnish mining industry today are the difficulties in exploitation of mineral deposits and relatively young functional units. Most of our ore deposits have been low grade, small and difficult to mine and process. This have caused us to develop and apply newest technology without prejudice, unlike in many "traditional" mining countries. For these reasons our technology level has been one of the highest in the world.

The production gross value of the operative mining industry in Finland has been around FIM 3 billion annually, which is approximately 1% of all industry gross value. This has employed about 4000 people directly (approx. I % of industrial workforce). In the chain from ore to metals, the mines share of the metal prices is 50 - 70%. In the case of precious metals it is even more. The production gross value of associated industry is around FIM 5 billion annually and it employs

5000 people. In addition to the importance which the basic mining industry has had and has today, it has had also great decisive part in the start up of other industrial operations, i.e. specific production chains. For example, finding of Outokumpu ore deposit resulted in development of Harjavalta and Pori smelter- and metal refinery industries, and chrome ore deposit at Kemi was the start of steel industry in Tornio, which again has strengthened this special industry around the country. Existence of domestic raw material is also the fundamental link to the production of sulphuric acid and fertiliser production chain in chemical industry.

Metal mining is much more fluctuating than other mining activities, depending on continuous changes in metal prices. Mines are closed as prices drop and as the prices will go up mines are reopened or new ones are started. With industrial minerals the situation is more stable.

Although metal mining in Finland has been decreasing, the mineral and dimension stone quarrying is growing (Fig. 1). Rock engineering excavations have decreased but is at the moment showing signs to start growing as the economic situation will become better.

It is believed that mining industry will start to grow again in the near future as new mineralisation will be exploited. Although open pit mining has been increasing in the past years, underground mining will still continue. New underground mine will be started at Kemi in the near future and the old underground deposits will be mined until the economic limits are reached.

New technology and automation which is coming fast into the mining industry world-wide will make possible the mining of ores and mineral deposits that today are not economical. It has already had an effect on the lifetime of old underground mines.

Mine automation

The advanced mining countries, like Finland, are facing the problem of increasing labour costs, decreasing metal prices and low grade orebodies. In addition, the increasing production of low wage countries as well as the increasing use of substitutive materials, have set high requirements to keep up competitiveness. These requirements are: increasing the productivity, decreasing the costs, improving mining quality as well as safety.

Best results in other than mining industry have been reached by automating the production phases, increasing the automation level of machinery and developing real-time communication and data transfer systems. The same is being done now in mining and the results will be seen in the near future.

Research and development work on mine automation has been done at least for 10 years in Finland. This work has been done in close co-operation by the mining industry, the mining machine manufacturers and the Rock Engineering laboratory of the Helsinki University of technology. Some mining processes such as crushing and hoisting, ventilation, and ore concentration processes have already been automated for a long time. Computerised mine planning and managing systems have been developed and are in use, but automatic data acquisition systems are still to be fully utilised. Mining machinery has been mechanised and some of their functions have been automated for some time.

In the beginning of 1992 the Finnish Mining Automation Group, consisting of the above mentioned three sectors, decided to start a mine automation program to further develop the mining technology and automate mining machines using the highest technology available. The technology program was named "Intelligent Mine" and was financially supported by the Finnish Technology Development Centre. Its total cost was approximately FIM 54 million and it was finished in Five years ending in the beginning of 1997. The realisation organisations were:

- Outokumpu Oy (mining sector)
- Tamrock Oy (drilling, LHD and hauling) Nordberg-Lokomo Oy (crushing)
- Orion Corporation Normet (charging, shotcreting)
- Helsinki University of Technology, Laboratory of Rock Engineering (co-ordination, economics, safety)

The main research and development areas were:

- Real-time control of resources and production, consisting data acquisition, data transfer, processing and utilisation.

- Machine automation, consisting the automation and remote control of drilling, charging, loading, hauling, crushing and shotcreting.

- Automation of production and production maintenance, consisting the maintenance management, mine planning and safety as well as new mining methods.

The results of the program were the developed advanced mining machinery with integrated automatic systems, mine management systems, mine-wide data communication systems, new equipment and systems for effective mine planning and quality mining. In addition, the know-how to build a mine using advanced technology and the understanding the effects of mine automation have been achieved.

Similar technology development program is advancing on ore concentration sector and it will provide the necessary addition to the development of Finnish mining technology to be one of the most advanced in the world.

Testing the complete integrated system - the Intelligent Mine, has not been possible in one location. The systems and machinery were tested in various locations in Finland and abroad. However, in the beginning of 1997, a new technology program with same participation and Outokumpu Chrome Oy Kemi Mine, was started. This program is the implementation of the Intelligent Mine Technology Program. The objective is to apply and further develop the machinery and systems already developed in the newly planned underground mine at Kemi. The machinery and systems will be integrated by a fast mine-wide information and data transfer networks. The mine will be managed in real-time and most of the production machinery will be operated remotely or teleoperated from centralised operation centre.

The automation will change the mining considerably and require adaptation from both, the management and workers. It require more training as well as change the organisation of the mine. The monitoring systems and other computer applications will provide information in real-time to all levels of the organisation and enable decision making to lower levels. This means also that much more is expected from the work force. However working conditions and safety are expected to improve since most of the hard work is automated and operation will be done in comfortable surroundings.

Conclusions

Mining in Finland, especially metal mining, has in the past years been effected by changes in metal prices and exhausting of economical ore deposits. It is believed that to keep up the competitiveness, it is necessary to increase productivity, decrease mining cost and improve the safety and motivation of miners. To be able to do this, utilisation of advanced technology and automated machinery are required. This has been proven by achievements in other industries using advanced information technologies and automation.

The advanced technology and automation have been applied to mining in close co-operation between the mining industry, mine machine manufacturing industry and Helsinki University of Technology, in a technology development program called "Intelligent Mine". The results of this program used in the next stage, which is the implementation of the developed technology in a underground mine being planned at Kemi. The implementation will prove its feasibility.

Mining in Finland 1996

Mine	Location	Main products	Company	Hoisted total metric tons	Hoisted ore metric tons	Mine personnel		
						surface	u/g	total
Metal mines								
1 Kemi	Keminmaa	Cr	Outokumpu Chrome Oy	12 383 840	111	22	133	
2 Pahtavaara	Sodankylä	Au	Terra Mining Oy	1 485 487	317 510	22	0	22
3 Pyhäsalmi	Pyhäjärvi	Cu Zn S Au Ag	Outokumpu Mining Oy	1 478 835	1 040 940	0	105	105
4 Hitura	Nivala	Ni Cu Co	Outokumpu Mining Oy	588 090	588 090	0	64	64
5 Orivesi	Orivesi	Au	Outokumpu Mining Oy	273 713	162 342	0	32	32
6 Mullikkoräme	Pyhäjärvi	Zn Cu Pb S Au Ag	Outokumpu Mining Oy	219 600	167 100	0	7	7
Metal mines(6)			Total	16 429 565	3 391 352	133	230	363
Limestone mines								
1 Skräbböle-Limberg	Parainen	Limestone	Partek Nordkalk Oy Ab	1 527 015	1 005 619	24	6	30
2 Ihalainen	Lappeenranta	Limestone Wol	Partek Oy Ab	1 328 549	927 222	23	0	23
3 Vampula	Vampula	Dolomite	Partek Nordkalk Oy Ab	382 760	130 798	9	0	9
4 Ryytimaa	Vimpeli	Dolomite	Partek Nordkalk Oy Ab	321 756	257 938	8	0	8
5 Ruokojärvi	Karimäki	Limestone. Dol.	Partek Nordkalk Oy Ab	232 918	232 231	0	12	12
6 Förby	Särkisalo	Limestone	Karl Forsstrom Ab	176 659	172 956	0	12	12
7 Sipoo	Sipoo	Limestone. Dol.	Partek Nordkalk Oy Ab	168 618	154 944	0	14	14
8 Siikainen	Siikainen	Dolomite	Partek Nordkalk Oy Ab	165 377	90 295	14	0	14
9 Tytyri	Lohja	Limestone	Nordkalk Oy Ab	161 053	161 053	0	11	11
10 Ankele	Virtasalmi	Dolomite	Saxo Oy	73 190	69 190	3	0	3
11 Kalkkimaa	Tornio	Dolomite	Saxo Oy	66 000	66 000	l	0	1
12 Siivikkala	Vampula	Dolomite	Partek Nordkalk Oy Ab	56 849	23 949	0	0	0
13 Mustio	Karjaa	Limestone	Nordkalk Oy Ab	45 937	45 937	4	0	4
14 Vesterbacka	Vlmpeli	Limestone	Partek Nordkalk Oy Ab	26 562	19 152	0	0	0
15 Paltamo	Paltamo	Dolomite	Juuan Dolomiittikalkki Oy	23 000	22 000	0	0	0
16 Juuka	Juuka	Dolomite	Juuan Dolomiittikalkki Oy	13 500	12 000	4	0	4
17 Varmo	Kesälahti	Ca Mg	Partek Nordkalk Oy Ab	13 241	13 241	0	0	0
Limestone mines (17)			Total	4 782 984	3 404 525	90	55	145
Mineral mines								
1 Siilinjärvi	Siilinjärvi	P Limestone	Kemira Chemicals Oy	10 396 540	7 840 801	82	0	82
2 Lahnaslampi	Sotkamo	Talc Ni	Finnminerals Oy	1 051 068	480 297	16	0	16
3 Horsmanaho	Polvijärvi	Talc Ni	Finnminerals Oy	667 960	360 191	9	0	9
4 Lipasvaara	Polvijärvi	Talc Ni	Finnminerals Oy	322 301	126 567	6	0	6
5 Tulikivi	Juuka	Soapstone	Tulikivi Oy	299 610	55 610	22	0	22
6 Kemiö	Kemiö	Quartz Ms	Partek Nordkalk Oy Ab	208 000	175 000	1	0	1
7 Kinahmi	Nilsia	Quartz	Partek Nordkalk Oy Ab	188 207	185 471	0	0	0
8 Nunnanlahti	Juuka	Soapstone	Nunnanlahden Uuni Oy	149 310	35 076	11	0	11
9 Ristimaa	Tornio	Quartz	Saxo Oy	57 000	57 000	0	0	0
10 Haapaluoma	Peräseinäjoki	Feldspar	Partek Nordkalk Oy Ab	16 000	16 000	1	0	1
Mineral mines (10)			Total	12 922 253	9 306 783	139	0	139
Otber mines: Minerals for rock wool an cement producdon								
1 Ybbernas	Parainen	Al Fe Mg	Paroc Oy Ab	120 000	69 900	3	0	3
2 Sallittu	Suomusjärvi	Al Fe Mg	Paroc Oy Ab	119 200	86 300	3	0	3
3 Metsäsianniemi	Kiiminki	Al Fe	Paroc Oy Ab	42 313	41 363	1	0	1
4 Näträmälä	Imatra	Al Fe Mg	Paroc Oy Ab	33 700	33 700	1	0	1
5 Vanhasuo	Savitaipale	Al Fe Mg	Paroc Oy Ab	28 691	28 691	0	0	0
6 Mustamäki	Lemi	Al Fe	Oy Partek Ab	24 920	24 920	0	0	0
Other mines (6)			Total	368 822	284 874	8	0	8
All mines (39)			Total	34 937 364	16 412 764	379	285	664

Source: Ministry of Trade and Industry