

NEWSLETTER

SOCIETY OF MINING PROFESSORS



SOCIETÄT DER BERGBAUKUNDE

Number 9

May 1996



Editorial

Members of the Society will have noticed that their Secretary General has been less than efficient during this past year. For this they have sincerest apologies, but events at Imperial College have regrettably made this inevitable.

There have been two events happening at the Royal School of Mines, both of which have required a great deal of effort. The first was the introduction of the new European Mining Course in conjunction with Aachen, Delft and Helsinki. The second was the fact that there has been and still is a serious attempt being made to close down the teaching of Mining Engineering at the Royal School of Mines. The time of your Secretary General has been very heavily taken up with the effort to prevent this happening. But the story of what is happening at Imperial and why is perhaps a lesson for all of us.

In the United Kingdom over the last 10 to 15 years there has been a movement to make places like universities and schools more accountable. Everything that is capable of being assessed has been assessed for quality and delivery of value for money. In particular teaching excellence and research excellence have been measured. So far there have been three rounds of research assessment and in each of the first two the Department of Earth Resources Engineering (formerly Mineral Resources Engineering) which includes mining, at the Royal School of Mines received a 5, the maximum score then possible. In the latest round the scale has been extended so, though the department still received a 5 this was no longer quite the top score possible, there is now a 5* available. It must be noted that in all of these assessments none of the other three mining departments in the UK got better than a 4. So the Department is by assessment the best in research in the UK.

Teaching has only been assessed once externally, in 1988 and again the department at the RSM came out top, in this case joint top with Nottingham. The second teaching assessment is now due, but may be too late. However, during the years, since external assessment has been being applied, internal assessment has become a norm too, and the Department has always done well in the internal teaching assessments.

Now, one would think that as the top rated mining engineering research department in the UK there would be no problem with closure. This is not so as the decision as to whether to continue to teach mining is not in the hands of the government in the UK but of the individual universities. These are now run, at least in the case of Imperial, on a purely financial basis, with academic matters being relegated to second place. So being rated the best Mining Engineering Department in

the country does not help if the department is deemed to be making a financial loss.

In the UK, in England, money is passed from the government to the universities by the Higher Education Funding Council for England (HEFCE). They give money to the university for teaching and research. The teaching money is nominally an amount per student and the research money is based among other things on the ratings received in the abovementioned assessment exercises. Imperial College then distributes this money to departments on the basis of an internally devised formula. Again this formula is on the lines of the HEFCE one but is not identical and is used by the College to persuade departments to concentrate on research for example. So the money paid per student to the College is not the same as the money received per student by the departments.

In addition to the above funds the College also receives fees from foreign (non-EU) students, which are much higher than the amount per student received from HEFCE, and also receives money as overheads charged on research contracts. All of the above money with the exception of some of the research contract overheads is put into the pool that is distributed by the formula. So for example, the Department receives nothing extra for any foreign student despite the fact that the College does. The ERE department has 40% foreign students so this represents quite a reduction in income.

On the basis of the College formula, the ERE department is running at a loss. It is by no means certain that this is a real loss, as the department does not have the figures to enable it to calculate what the actual intake of money by the College is for the Department as opposed to its actual costs. It is on the basis of this alleged loss that the decision has been taken that mining engineering is the problem and that therefore teaching of mining should cease. So it is apparently no longer enough to do an excellent job of teaching and research. This will only help if first a profit is made.

The result is that the staff of the department have been, lead by their professor, spending a great deal of time lobbying for support from other academics and industry, chasing industrial money to try and overcome the deficit and generally trying to save the section, rather than doing the other tasks that they would normally perform. Unless and until enough money has been raised to save mining, this work will have to continue. Wish us luck in our efforts to save the mining discipline at the Royal School of Mines.

In the meanwhile, the rest of the effort of your Secretary General has been being put into the new European Mining Course which started in September 1996. This is a co-operative effort between Delft University of Technology, Helsinki University of Technology, the



RWTH Aachen and the Royal School of Mines. Two students from each university studied on this course and the first results show it to have been a resounding success. Assuming we are successful in the first efforts included in this editorial, then the second success story should continue. It will of course continue for the other three, but the RSM hopes it too will long continue as a member of the European Mining Course.

MINUTES OF THE 7TH ANNUAL GENERAL MEETING MOSCOW STATE MINING UNIVERSITY

August 25 to 28, 1996

The registrants arrived in Moscow on Saturday 24th and Sunday 25th. August, and were accommodated mainly at two hotels in Moscow. On Sunday 25th there was registration and an official welcoming reception at the Mining University in one of its refectories, for all registrants and their accompanying persons.

Day 1

The official opening of the meeting took place on the morning of Monday, 26th. August in the main lecture hall of the Moscow State Mining University.

The members attending the meeting were: Professors Y.G. Agafonov, G. Almgren, V. Badino, U. Bajzelj, V. Brenner, N. Bulychev, I.V. Dementiev, B. Drzezla, M. Duchene, G.B. Fettweis, N. Fotieva, M. Georgescu, H. Gerhardt, M. Hardygora, W.D. Hennies, N. Ilias, V.A. Kharchenko, W. Knissel, F. Kovacs, E.V. Kuzmin, W. Lukas, R. Matikainen, P.F.X. Mousset-Jones, J. Palarski, A.G. Pasamehmetoglu, V. Pavlovic, D. Potts, L.A. Puchkov, J.J. de Ruiten, C.T. Shaw, E. Sokolov, R.D. Stoll, P. Weber, F.L. Wilke, and J. Yamatomi.

Sincere thanks should also be recorded to all those who assisted Prof. Puchkov in the planning and running of this conference, in particular Professor E.V. Kuzmin and Dr. M.K. Peshkova.

(18 countries were represented - Austria, Brazil, Finland, France, Germany, Hungary, Italy, Japan, Netherlands, Poland, Romania, Russia, Slovenia, Sweden, Turkey, United Kingdom, United States of America, Yugoslavia.)

The opening ceremony started with a welcoming address by Prof. Puchkov, the president of the Society. He welcomed the participants to Moscow and the Moscow State Mining University. Professor Kuzmin then gave some details of the programme for the following days. Prof. Puchkov then followed this with a very interesting paper on "Mining, Mining Sciences and Mining Engineering Education in Russia".

Following this talk, Prof. Y. Malyshev, the President of the Mining Academy of Russia and General Director of the Rosugol Company (who had been delayed in his arrival due to urgent government business) gave us an interesting address on the Russian coal industry. This is now in a complex situation, and they had closed 46 underground coal mines recently, putting many thousands of miners out of work.



They were looking to improve the industry with new technology and improvements in productivity and were calling for new approaches to mining technology and mining management. They were speeding up the development of new equipment and in particular were working with foreign companies in this effort. He welcomed the professors to Moscow on behalf of the Academy and the Industry.

After a break for coffee Professor Fettweis started off the meeting with a paper on "Considerations about the Character and Structure of the Mining Sciences". This paper will be published in the Journal later on. It was complementary to the paper by Professor Puchkov and gave an alternative, but not clashing view of the discipline. These two papers were then discussed. The main points of the discussion were the definition of "mining", whether it was all embracing and included the recovery of all minerals from the earth's crust (including oil for example) or was more restrictive and does it only include the recovery of solid materials.

Prof. Wilke felt that it was very important to keep the broader definition, which is accepted in Germany, but Prof. Fettweis pointed out that in the English speaking world the term mining is generally much more restrictive. Prof. Weber indicated that in France water is a mineral resource. It was mentioned that a lot of it had to do with the laws of different countries - with different laws and regulations for differing commodities, and in particular the laws for oil and for solid minerals were very different. At this point it was noted that the Society did not have a member who was an expert in mining law and that this was a pity. The general consensus seemed to be that mining should have the all embracing definition, but that this was not generally accepted outside the mining profession. These discussions lasted until it was time to break for lunch

In the afternoon, the session started with a talk by Professor Wilke on "Future Directions for Mining Research." He believes that there will be four main trends.

1. Research into methods to improve the existing technology and systems
 - For this topic he presented the list of research areas that had been prepared by the European Commission for Coal and Steel. This was
 - ?? Rock mechanics and support
 - ?? Geophysics and geodetics applied to define the ore structure
 - ?? Ventilation and mine climate
 - ?? Mineral dressing and beneficiation
 - ?? Improving mechanisation, especially under unfavourable conditions of working
 - ?? Information transmission
 - ?? Ecology and the environment

2. Continued research into computerised planning of mines
 - Here Professor Wilke highlighted the following
 - ?? The application of expert systems and neural networks in the minerals industries
 - ?? The application of image processing and pattern recognition techniques
 - ?? The use of animation and virtual reality
3. Research into automation and robotisation
 - Under this heading he indicated that the more important areas were



- ?? remotely controlled automation
 - ?? automatic automation
 - ?? robotic automation
 - ?
 - ? which are in order of increasing independence of the machines and systems.
4. Extensive research into ecology and the environment.
- Here he emphasised the importance of
- ?? Designing mines to minimise their impact on the environment
 - ?? Finding new uses for waste materials
 - ?? The landscaping of old and new spoil heaps and waste dumps
 - ?? Mine drainage and water pollution, particularly acid mine drainage
 - ?? The control of gas emissions
 - ?? The rehabilitation of abandoned mining area
 - ?? The use of abandoned mines as sites for the disposal of other waste.

Professor Badino then gave an introduction to the Italian case - a rather special case. They have a very long mining tradition, and the hard minerals recovery industry has traditionally been split into mines and quarries with different laws for each. The quarries were generally under regional law and these were more strict so most operators tried to have their operations defined as a mine. There were five universities with mining degree courses and at the end of the 80s these all had fast declining student numbers reflecting the declining mining activity in the country. The universities looked at this and felt they had two choices:

- ?? they could follow the destiny of the dying industry
- ?? or they could change direction and go environmental

In 1989, the decision was taken and by government decree there became no such thing as mining. The departments were redefined as departments of Land and the Environment. This was not just a change of names, but also meant that there were substantial changes in teaching and research. They are now departments that deal with the interaction between humans and the natural world, and mining is only one small part of this. So there has been a reduction in the number and content of disciplines and research in mining more than matched by the increase in disciplines and research in the Environmental area.

They have seen a steady increase in the numbers of student entrants each year. Torino now for example has about 200 entrants per year as compared with the 20 or so it was getting in the 80s. The mining element in the department leads to a degree in georesources and still about 10 to 20 students take this option.

There was then general discussion on all the papers heard during the day. Prof. Duchene pointed out that Prof. Wilke's paper included two types of research - the application of others' work to mining, for example image processing, and work that was specific to mining, for example roof support. He would like to separate these two classes and he felt that we should make the second genre our core research target areas. He recommended finding a new legitimacy in our specific areas of expertise.

Professor Wilke agreed that we should concentrate on the core but pointed out that there always needed to be cross-fertilisation between disciplines. And all the research must be done!

Some discussion was started on the membership of the Society and those present were reminded that petroleum engineers, mineral explorationists and minerals processors and metallurgists had been excluded deliberately. Professor Almgren asked the Secretary General to print off old newsletters for the new members so that they could understand the thinking behind these previous decisions taken.

A number of people again emphasised that mining was an interaction between man and the earth's crust and that we should be involved in all such interactions.

Finally, Professor Palarski suggested that we needed to find out how many mining engineers were actually needed for the coming period of time. We should try and find out from industry what they expected to need. But even knowing that we would still have to find ways to motivate youngsters to study mining.

The meeting then closed for the day. There was in the evening a dinner at the Hotel Akademichesky, and this was followed by a very interesting bus tour of Moscow. This was enjoyed and appreciated particularly by all the foreign delegates.

Day 2

This day started with a talk by Professor Dementiev on the "Main directions of researches in Russian Higher Schools of Mining". This paper is printed later as part of this newsletter.

Prof. Mousset-Jones asked how the research topics were chosen and how much the results were used. It was explained that the research topics were based on State priorities and that as most of the research was done in conjunction with industry the successful results were used.

Before the coffee break, Prof. Sabirov, in charge of physical education at MSMU, then gave a brief talk on the importance of this to the mining student. They have done extensive research into the physical de-



mands on the mining engineer and have developed physical programmes for each variety of specialist. It was an interesting comment that they have found that the combative sports such as wrestling are best for underground miners.

After the coffee break there was the business session of the society. Apologies had been received from Professors Abdel Khalik, Brady, Karmis, Lechner, Martens, Pelizza, Ramirez, Simic, Strodka, Vogt and Wagner.

The minutes of the previous meeting were accepted as an accurate recording of the proceedings of that meeting.

Matters arising from the minutes were then discussed. The main item here was the creation of the committee consisting of Professors C.T. Shaw, F.L. Wilke, V. Badino and W. Vogt who were to look into the matter of publicity for the mining industry and the mining educational institutions. This committee was mandated to report and make proposals to the next meeting of the Society in Moscow.

Professor Shaw reported that the committee as a whole had not actually met, but that he and Professor Wilke had held a meeting with Dr. Nemitz and Dr. Segers from Eurominerals. At this meeting a wide ranging discussion of mutual problems was held and the minutes of this meeting are included later in this Newsletter. There were four decisions made at this meeting:

1. The Mining Professors would prepare a paper, of about one to two pages in length, with the intention of demonstrating the requirement for action. It should demonstrate the necessity for action and suggest topics as to how action might be forwarded. If such a paper were presented then Eurominerals would be in a position to pick it up and take action on it.
2. A further paper on highlighting the problem and the action planning to be taken should then be written and this paper should then be published in all the journals of all the member societies of Eurominerals and in Mineral Resources Engineering, the journal of the Mining Professors.
3. A joint committee comprised of one or two members from each Association or Society involved would also then be formed.
4. Possible sources of funding should be explored such as:
 - The appropriate EC division
 - The European Bank of Reconstruction and Development

There followed some discussion on this and Professor Fettweis mentioned the Hanover Millennium exhibition the theme of which was Man, Nature, Techniques. He suggested that the Society should work with Eurominerals for this. Prof. Wilke welcomed this and

pointed out that one of the ideas discussed had been the targeting of exhibitions or attractions for publicity purposes. Euromines could also be involved.

For the benefit of those members not from the EU Prof. Badino, who is on the council of Eurominerals and is chairman of their Education and Training Committee, explained what Eurominerals and Euromines were. In the new brochure of Eurominerals, co-operation with the Society is specifically mentioned.

It was agreed that this initiative should continue and that the committee should continue its work.

Prof. Almgren then asked that the updated database, the one that had initially been issued in Newsletter 3, be published again and sent out to members. Members would be encouraged to send in corrections to the entries for their universities.

The Secretary General reminded members that in 1995 the annual subscription for 1995/96 had been set at £75, which sum included the subscription to the journal. There were no changes to the price of the journal and so he suggested that the subscription for 1996/97 should remain at £ 75.00 (or its other hard currency equivalent) which would cover the journal subscription and the small running costs of the Society. **It was agreed that the subscription for 1996/97 would be £ 75.00.**

The Society learned with regret of the Passing of Professor Adler in June, 1996. The membership of the Society has increased again as was evidenced by the presence of many new members. Eight new members had been admitted of whom 6 were able to attend the meeting in Moscow. There had also been three resignations, so the membership is still hovering just under the 100 mark.

The next item on the agenda was the venues for the next meetings. **The meeting for 1997 was confirmed as Helsinki, Finland.** After much discussion the dates were set as **31st. May (Saturday) to the 4th June, 1997.** It was decided to suggest that people arrive on the Saturday as most airlines give discounts on fares if a Saturday night is included in the stay. With arrival being suggested on Saturday Helsinki is asked to arrange cultural events for the Sunday, 1st. June, which members may wish to take part in.

The following meeting of the Society will be in 1998 in Italy and the one after that is expected to be in Turin in Italy. There are now bids from the Urals State Mining University in Ekaterinberg, Russia, Ecole Nationale Supérieure des Mines d'Ales, and Belgrade University for 1999. It was decided to leave that decision until the next meeting. It is pleasing to see that there is still strong interest in holding the Society's meetings.



Arising from the selection of the venues, and according to the Constitution of the Society, Professor Matikainen of Helsinki University of Technology, was elected as the President of the Society of Mining Professors/Societät der Bergbaukunde for 1996/97. In addition, Prof. Pelizza, as the host for the next but one meeting was elected to the Council of the Society. The Council for the year 1996/97 therefore consists of Professors Kovacs, Matikainen, Pelizza, Puchkov and Shaw.

The main business of the meeting now being complete, discussions were started on developments over the preceding year in the various universities for which members were present.

Information on Nottingham was given by Professor Potts in a very interesting talk on the introductory economics course that is given there. He was followed by Prof. Pasamehmetoglu who gave a brief description of the situation in mining education in Turkey. They have 55 universities with an intake of 1000 odd mining students each year. They are graduating up to 350 per year, but the quality of the students goes down every year. The universities are not happy with the situation as the mining & geology Departments tend to be the worst departments in quality in the universities. Some discussion followed this paper.

Mr de Ruiter then gave a brief talk on the new European Mining Course being mounted on a pilot scale by Delft, Aachen, Helsinki and the Royal School of Mines under the new Socrates programme of the EC. This was about to start in late September of 1997 and would have two students from each university on it initially.

Prof Yamatomi then gave a talk on the situation in Japan which has 7 remaining mining schools but this is expected to reduce to four, namely Hokkaido, Akita, Tokyo and Kyushu in the not too distant future. They too had been experimenting with new names for the discipline coming up with Geosystem Engineering, Geoengineering, System Analysis of Geosystems and Geoenvironment. There followed brief discussion on this paper.

Prof Weber then gave a brief description of the French system. They too now have 7 mining schools Douai, Nancy, Paris Nantes, St. Etienne, Ales and Albi. However only Paris, Nancy and Ales still teach mining engineering.

Prof Almgren gave a brief update on the situation in Sweden highlighting the changes since he last reported in Ljubljana. They are tied in with the Civil Engineering and are now Rock Engineering and deal mainly with mining and underground space.

Prof Mousset-Jones then updated the US picture pointing out that there are now only 16 mining universities left in operation, and in his opinion they would end up

with 10 to 12 when all the weaker ones did finally close. The currently strongest universities were Virginia Polytechnic Institute & State University and the University of Missouri Rolla.

There followed some general discussion about the jobs and careers taken by mining graduates, in particular those in the cities such as mining analysts. After these discussions the meeting was brought to a close. The delegates thanked Prof. Puchkov for a well run meeting

MAIN DIRECTIONS OF RESEARCH IN RUSSIAN HIGHER SCHOOLS OF MINING

Prof. I.V. Dementyev, Rector

The Ural State Academy of Mining and Geology

At present scientific research work in the mining higher schools of Russia is realised through the State budget and economic agreement financing on subject programs of Goscomvuz (State Committee on Higher Schools) on systems of Scientific-engineering programs grants, agreements. Scientific research is carried out also by enterprises in which higher school act as co-founders.

Besides the concrete results of the research it serves as the basis for training highly qualified personnel through postgraduate courses, transfer of personnel into positions of senior researchers for finishing the work for their Doctorate dissertations, and the development of the creative abilities of the students.

Analysing the main directions of research work in the mining schools of Russia it should be taken into consideration that there are 3 varieties of mining geological conditions in regions where these higher schools work. St. Petersburg, Moscow, Tver, Tula, Vladikavkaz, Ekaterinburg, Perm, Magnitogorsk, Irkutsk, Krasnoyarsk, Yakutsk, Vladivostok mining higher schools and faculties practically cover all regions of Russia from north-western in the west of the country up to Chukotka, Primorye in the east. The availability of various mineral resources and long time exploitation of them (Ural region about 300 years) promoted the development of mining sciences and practices of the mining industry. A great contribution in their development was made and is being made by higher schools included into the Educational Methodical Association on Higher Mining Education.

The scientific potential of the mining schools permits many problems of the mining geological branch to be solved, from mineral prospecting and exploration up to preparation of mineral raw materials for metallurgical production. Nowadays great attention is paid to



research and development of technologies for reprocessing of technological waste materials and to the ecological problems of Russia.

Elaboration of applied methods of geoinformation to support systems of automated design (CAD) of mining geological production and on this basis to establish the technologies of mathematical modelling of mineral deposits, mining development, mining processes, design of software for the interpretation of geophysical data and automated data bases for various purposes are the main directions of scientific research work at the mining schools at present.

Application of highly productive PCs with modern mathematical support allows more exact modelling of mineral deposits to be undertaken. For example, at Moscow State Mining University (MSMU) a new mathematical model of a rock mass has been worked out which is oriented on the investigation of the influence of a complex structure on its deformation and a method of numerical modelling has been developed allowing one to model a great number of structural elements of rock masses both of natural and technological origin.

At St. Petersburg State Mining Institute (Engineering University) (SPSMI-EU) on the basis of modelling, a new solution has been developed for hydro-break-displacement of structural blocks on filtration tectonic fractures.

Numerical modelling carried out in a computer program shows that the geometrical characteristics of structure of block rock masses affect greatly the mechanism of hydro break, comparable to the influence of tectonic tension. In this case the mathematical model of weakly permeable rocks and its realisation on PC is detailed.

At Tula State Engineering University (TSEU) an algorithm and packet of applied computer programs has been developed for the calculation of two layered shaft supports. For underground mining of mineral deposits the programs have been produced for a general method of calculation of the tension deformed state and displacement of layered rock masses during their development. In this case the modelling of joint work of support and mass is carried out accounting for their operation beyond the limit of elasticity.

At the Ural State Academy of Mining and Geology (USAMG) on the basis of the idea of the Earth's crust as a mobile discrete system, a dislocation fluid model of sedimentation medium (DFM) and "DFM technology" of processing of seismic data has been worked out

based on some theoretical investigations. The technology allows the forecast of oil and gas deposits. On "DFM technology" the areas of prospecting of hydrocarbon raw materials are processed in Western Siberia, France and China. True recommendations on location of oil gas deposits are given.

Practically at all the mining schools research connected with the building up and algorithmisation of multi level information systems of control and predictions of the state of the mine atmosphere, rock mass, and the main and auxiliary mechanical and electrical equipment is well developed.

The current state of the economic development of Russia is a serious change in the structure of raw material bases of the main industrial branches. A break of traditional contacts with the producers in the former USSR has taken place. At the same time there is a great potential in Russia for the production of a number of valuable mineral resources from non traditional sources of raw materials, firstly, from the wastes products of the big industrial enterprises. Establishing new capacities for reprocessing of this kind of raw material is of great economic, ecological and social importance. To solve the problem of reprocessing of industrial waste materials a scientific direction has been developed on a feasibility study of the technology of reprocessing raw materials taking into account the physical chemical properties of these waste products and maximising the extraction of valuable components. For example, at MSMU together with SPSMI-EU and USAMG a technology has been worked out for the reprocessing of slime produced by the plant for the neutralising of waste liquids of Kirovgrad DP which contain copper and zinc. For Khrustal MOP together with MISAA a technology has been worked out for the concentration of weathered tin containing tails of many years storing. Together with the institute MECHANOBR a technology has been worked out for the reprocessing of old tailings of the Sredneuralsk Copper Plant and also a technology for the dry processing of the overburden of Kestomukesky MDP.

At USAMG within the present program "Reprocessing of Technogenous Formations of Russia" investigations are carried out of rare metal and radioactive mineralisation in products of Ural enterprises and the territories surrounding them. A number of complex technologies have been worked out and tested on the reprocessing of ferro titanium slimes for the production of aluminium and titanium oxide with additional production of aluminium sulphate. They have also developed methods for reprocessing of wastes of copper metallurgical production to extract non ferrous and precious metals. Investigations are being undertaken



on leaching of gold by sulphur acid chloride solutions from cinders. A technology has been worked out for the production of composition materials on the basis of caustohiolithes and industrial wastes.

The testing of new technologies under industrial conditions allows the reprocessing of numerous industrial wastes to be carried out.

At Krasnoyarsk State Academy of Non Ferrous Metals and Gold the theoretical principles were elaborated and a new technology was suggested for the extraction of precious, rare and non ferrous metals from mineral and secondary raw materials and industrial wastes.

In the conditions of the market economy, the problem of evaluation of the cost of raw materials and mineral resources becomes very important. A scientific group was formed at the USAMG which is actively working on elaboration of methodical recommendations of determination of individual rates of payment for development of mineral deposits for the right of the use of mineral resources and arrangement of documents for receiving of a licence on such activity.

At SPSMI-EU methods of economic evaluation of mineral resources and geological economic evaluation of mineral deposits in conditions of the market economy are being developed. Regional geological industrial classification of gold ore deposits has been suggested on the basis of which methods for the group geological economic evaluation of resources of mining industrial complex are substantiated. Criteria and main indications of economic evaluation of mineral resources at various stages of their development and use in conditions of market relations have been worked out.

At MSMU the analysis of mining geological conditions of coal deposits of Russia has been made which permitted the most promising areas which may serve as the base for development of coal industry in the nearest future to be identified. The analysis has been made of mine fund which must be closed in Localities near Moscow. dznetsl- . ~nd Dunetsk basins. Modern methods of utilisation and purifying of wastes have been analysed.

Great volumes of scientific investigations have been devoted to the evaluation of the state of in situ rock masses. At SPSGI IU within the framework of a scientific engineering program "Coal of Russia" elaboration was carried out of experimental analytical methods of evaluation of geomechanical and gas dynamic state of the in situ rock mass in mining of bedded deposits in complicated mining geological conditions. A method has been developed for the evaluation of the control of

mechanical state of rock masses in the selection of a mining method in a suite of gently sloping adjacent beds. On the example of Intin deposit calculation parameters are formulated of a geomechanical model on the control of the rock mass state surroundings repeatedly used primary openings. The main result of this work was the establishment of a method of engineering evaluation of the state of the rock mass on technological parameters and the establishment of its functional relation with tense deformed state of rocks and their gas dynamic properties. Scientific methodical principles of investigations and forecasting of hydrogeological and mining technological processes in deep horizons have been worked out. Experimental investigations of forming mechanisms of fracture pore space and filtration properties of rocks have been made in wide range of conditions. Mechanisms of development of dilatation processes at great depths are revealed.

At Perm State Engineering University (PSEU) investigations have been made into the role of the gas factor in deformation and destruction of rocks of water protection thickness. Gas as a component of a rock mass brings specificity into physical properties of gas bearing rocks and into the character of their deformation and destruction. Detailed geological information and data on gas emission, gas dynamic phenomena and the presence of gas in points of mine investigations is collected. Forecast maps of gas presence are pre-prepared on mine fields of JC "Uralkalium" and JC "Silvinite".

At Irkutsk State Engineering University (ISEU) works are carried out on the evaluation of stability of surrounding rocks in stoping of ore bodies.

Mine surveying geodetical investigations of Far East State Engineering University (FESEU), USAMG, ISEU were devoted to the problems of stability of quarry edges, dams and hydro engineering structures. For example, methods of mathematical and imitation modelling of the location of valuable components of deposits of solid minerals, their prospecting and sampling were worked out at ISEU. Improved methods of forecasting of stability of deformed natural and quarry slopes have been developed based on the data of mine surveying and geodetical observations, they are based on thermodynamic models of ground deformation.

A number of investigations of mining schools have been devoted to the problems of mining of deposits of continental shelf and coastal zones and also to the use of non traditional methods and technologies of mining and energy generation. The theory has worked out at MSMU for outlining a new type of shelf coastal disconnected deposits of solid minerals in fields located



on the shelf of the arctic seas and in their coastal zone. New principles have been established of wide range separation of cobalt containing crust from substratum in sucked flow from sea bottom under cover.

At ISEU investigation and feasibility study has been made of the possibility of mining of coal beds under the bottom of Amur and Ussurtysk gulf of Japanese sea and out of balance reserves of operating coal de-positions with the help of gasification and borehole hydro mining.

Multi factor evaluation has been made at SPSMI-EU of the dependence of technological parameters of systems of geothermal heat supply (SGS) from geological, geochemical, tectonic, energy producing and economic conditions of construction and exploitation of geothermal stations. Scientific principles of safe technology of development of geothermal resources of Russia have been worked out.

Researchers of MSMU worked out a method of receiving of thermal and hydrostatic energy of the ocean with the help of heat of under water volcanoes.

Problems of ecology and influence of mining production on the environment were studied by a group of mining schools. Scientific methodical support of ecological economic evaluation of results of mining production is obtained. Methodology of analysis has been developed of geotechnical systems developing on the basis of mined copper pyrite deposits aiming to optimise technology and quality of the environment of living in mining industrial centres of Russia. Recommendations are elaborated on ecologically safe distribution of wastes of mining, on filtration leakages at mining objects. Hydrobiological evaluation of the state of water system around a number of mines and pits is made. Practical application of researches of selection of kinds and types of plants is made at the USAMC; together with Swiss colleagues in solving of problems of recultivation of soils disturbed as a result of mining, purifying of the surface from radionucleides, heavy metals and other admixtures dangerous for health.

Interesting works appeared in the field of usage of excavated mining space. In particular, some works on development of recommendations were made at MSMU and USAMG on the choice of principal directions of the use of extracted space of mines for purifying and storing of wastes, construction of underground car parking, trade and servicing institutions accounting the set of ecological, economic and social factors.

This rather incomplete review of the main directions of scientific investigations covers wide range of fundamental and applied problems in which many branches of science are integrated. Scientific schools formed at higher mining schools, the level and quality of training of scientific personnel, in our opinion, provide for the solution of many necessary problems of mineral raw material potential of Russia.



Professionally Applied Physical Education
in Preparation of Mining Specialists
(Summary)

Moscow State Mining University

Prof. Yuri A. Sabirov, Head of Physical Education Department

The increasing complexity of technological requirements and evolution of coal extraction process has led to the enlarging of the number of situations that require high level of physical and psychological development in mining industry personnel. This problem at the present time is being dealt with using effective methods of professionally applied physical education.

Physical education in Russia is an obligatory discipline at every level of educational institution.

The Physical Education department of Moscow Mining State University over the last few years has undertaken a complex research programme using various pedagogical, medical and biological methods the aim of which is to define the most professionally applicable physical qualities and abilities of mining specialists.

The leading physical abilities and special sports relevant to the majority of specialities in mining industry were defined as the following:

- ?? general stamina
- ?? static endurance
- ?? strength endurance
- ?? the ability to differentiate the muscle activities in time and space
- ?? strength of back, arms, legs, and abdominal muscles
- ?? speedo-strength abilities
- ?? flexibility

On the basis of this research a special program of preparation the students was designed. It is currently widely used in all the mining institutions of Russia.

Implementation of applied physical education to the system of preparation of the future specialists of any profession provides better results in the production sphere, and regular sports exercise in general is both pleasant and beneficial to all individuals.