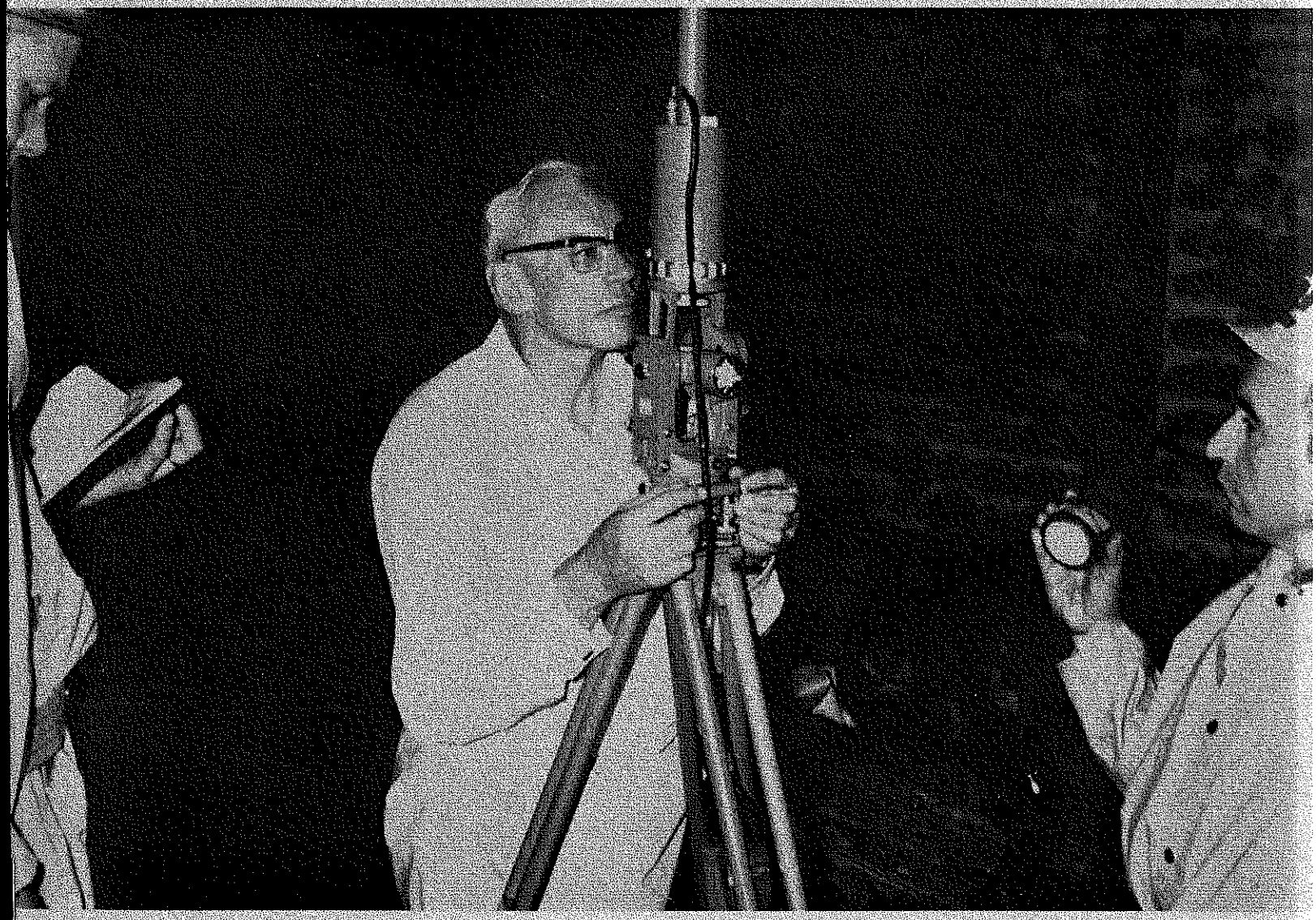
The

MINES

Magazine



Mining Engineering

March, 1970

THE MINES MAGAZINE
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Calendar

1970 API Mid-Continent District Meeting, Broadview Hotel, Wichita, Kans., Apr. 8-10.
1970 API Eastern District Meeting, Ramada Inn, Evansville, Ind., Apr. 15-17.
Annual Engineers' Day, Colorado School of Mines Campus, Friday and Saturday, Apr. 17-18.
Offshore Technology Conference, Albert Thomas Center, Houston, Tex., April 22-24.
1970 API Rocky Mountain District Meeting, Cosmopolitan Hotel, Denver, Colo., Apr. 27-29.
Uranium Symposium and Idea Conference, sponsored by Society of Mining Engineers, N. M. Tech campus, Socorro, N. M., May 6-8.
AMC 1970 Coal Show, Sheraton-Cleveland Hotel, Cleveland, Ohio, May 11-14.
1970 API Pacific Coast District Meeting, Ambassador Hotel, Los Angeles, Calif., May 12-14.
Symposium on Silicon Device Processing, National Bureau of Standards, Gaithersburg, Md., June 2-3.
9th International Symposium, Techniques for Decision Making in the Mineral Industry, sponsored by CIM, McGill University and Ecole Polytechnique, Montreal, Canada, June 15-19.
Convention of Wyo. Mining Assn., Jackson Lake Lodge, Jackson, Wyo., June 18-20.
AAPG-SEPM Annual Meeting, Calgary, Alberta, Canada, June 22-24.
CSM Alumni Luncheon, during AAPG Annual Meeting, Calgary Petroleum Club, June 23.
North American Materials Exposition, sponsored by ASTM, Royal York Hotel, Toronto, Canada, June 22-25.
South African Tunnelling Conference, University of Witwatersrand, Johannesburg, July 21-24.
2nd Inter-American Conference on Materials Technology, Mexico City, Aug. 24-27.
Symposium on Advanced Experimental Techniques in the Mechanics of Materials, El Tropicano Hotel, San Antonio, Tex., Sept. 9-11.
52nd ASM Materials Engineering Congress and Exposition, Cleveland, Ohio, Oct. 19-22.
SME Fall Meeting and AIME World Lead Zinc Symposium, Kiel Auditorium, St. Louis, Mo., Oct. 21-23.

The MINES Magazine

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Front Cover

A problem facing all underground mining and construction projects is that of carrying an accurate azimuth. The more complex the project the more important highly precise and accurate work becomes; and the more expensive. The cover photograph shows Dr. Gordon Lauf, Head of the Department of Surveying at the University of the Witwatersrand, using the gyro-theodolite at AMAX's Henderson Project recently. This is a relatively new device which gives a rapid and precise indication of true north. Dr. Lauf was a visiting professor at the School of Mines from August to December, 1969, under the auspices of the National Science Foundation, teaching the use of this equipment. (Photo by C. O. Frush)

Features

Departments

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Charles O. Frush, Associate Professor of Mining asks:

What Is the Best Education For Mining Engineers?

THERE has been a great deal of change in the mineral industry in recent years, and even more can readily be seen for the years immediately ahead. Rising levels of demand, exhaustion of the higher-grade ores, and increasing restraints on mining activities as the result of widespread interest in environment control all combine to make the task of the mining engineer in the years ahead more difficult.

To meet these challenges the highest quality of mining engineering education is needed, on both the undergraduate and graduate levels. Constant efforts are being made within Mines to ensure that our curricula are pertinent and of excellent quality, but this is not enough. The help of our graduates in the field is needed to point out present deficiencies, and define future trends. We need to know more about what today's graduates should have so as to be best prepared for their first ten years in industry.

Would each of you who may have definite ideas on this subject please take the trouble to write us a letter giving your considered opinions on the following subjects? By all means include other information or ideas which you consider important.

In what ways will the American mining industry be significantly different in 1980 from the present?

What constitutes the best undergraduate preparation for a man entering the mining engineering profession during the coming decade? That is, what subject matter should be emphasized, what new material introduced, and what previous material is no longer so pertinent?

What areas of graduate-level training should be provided? Bear in mind the difference between the professional engineering approach and the business administration approach to graduate work. Where should our emphasis be?

Pertinent research strengthens a school's educational program on all levels, as well as providing useful data for science and industry. In which areas is there the greatest need for research pertaining to mining engineering? Have you suggestions for obtaining the necessary financing so it can be undertaken?

Finally, no school can function without properly motivated students. There is a serious problem in inducing young men to choose one of the mineral options as a career. What do you think we should be doing to help draw attention to the attractive career potentials in this work? How can we attract more of these young men to Mines and thus strengthen our over-all programs?

Please be assured that your responses will be given the most careful attention and that they will be of help to the School as a whole, as well as to the Mining Engineering Department. Please address them to Charles O. Frush, Associate Professor, Department of Mining Engineering, Colorado School of Mines, Golden, Colo. 80401.

Dan Schmidt, Missouri '64, met the challenge in mining at St. Joe

Since he graduated from the University of Missouri at Rolla, Dan found opportunity for progress at St. Joe. He's Plant Engineer at St. Joe's ultra-modern Fletcher mine. There he's responsible for some of the most sophisticated equipment to be found in any mine-mill complex on earth. He works with a young, aggressive team in a company that's tops in the industry. ☐ Dan and his wife Carole and their two sons find life pleasant in Southeast Missouri. He hunts, fishes and competes in softball and tennis. They live in the country but they are only 90 minutes drive from big city attractions such as major league baseball in St. Louis. ☐ St. Joe has challenging opportunities for people with the ability and the drive to meet them. They are located in Southeast Missouri, Pennsylvania, Upper New York State and New York City. ☐ You may find your challenge and your future with St. Joe.

Mining Research*

By James M. Link and Herman Ponder

MINING and agriculture are the two basic industries upon which modern civilization is based and as such are among man's oldest pursuits. When man picked up his first stone to throw at a small animal he became not only a hunter, but a miner.

Flint tools associated with paleolithic man, and said to be 450,000 years old, have been discovered. Since then, man has been more or less continuously involved in the process of obtaining useful materials from the earth's crust—an endeavor which we refer to as mining. The first mining to obtain materials for these tools was obviously confined to primitive surface excavations. However, by about 2500 B.C. copper and gold were being extensively mined, and by the first century A.D. mining had become an important industry to the Romans.

In spite of this long history of mining, far greater quantities of mineral resources have been mined and consumed during the first two-thirds of this century than throughout all previous history of mankind. Yet if the population of the world doubles by the year 2000, as has been predicted, and if per capita consumption of mineral resources remains at the present level, the rate at which we extract materials from the earth's crust must double during the next 30 years. An increase in per capita consumption, as predicted for much of the world, will undoubtedly place even greater demands on our mineral resources.

However, before discussing mining of the future, let's take a brief backward glance. There is probably no better way to do this than by reviewing the first major treatise on the art of mining—Agricola's "De Re Metallica." This treatise, published in 1556, was a compendium of books on the various phases of mining. As such, it represents a statement on the state of the art, at that time, and provides a logical place to begin a discussion of mining research.

Agricola's stated purpose in writing his books was to immortalize in writing the whole length and breadth, and we might add depth, of a complex and already ancient art. He concedes at least a partial failure in his task because he omitted all things which he had not himself seen. However, Agricola has handed down to us a detailed description of mining and metallurgy as it was then known. He has also included numerous drawings of the tools which were employed in 16th Century Saxony. Among the twelve books which comprise "De Re Metallica" are included books on the digging of ore, the surveyor's art, miner's tools and machines, methods for delimiting veins, and assaying of ores, and so forth.

Agricola broke the art of mining into a series of operations which could be more easily understood and therefore improved. Obviously, he understood the interrelationships and interdependencies of the various sciences upon which the miner depends.

In Agricola's time the basic operations included breaking the rock, loading it, hauling it out of the mine, and transporting it to a processing point. He also recognized the importance of ground support, ventilation, mine drainage, safety, and miner's diseases. These operations and problems are still basic to the mining industry.

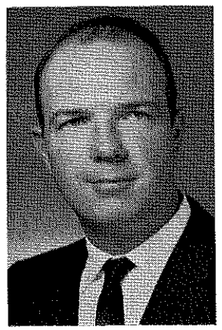
The earliest known methods of rock breakage were primitive indeed. Materials which Agricola described as soft ores were broken by pick. Harder ores were broken by iron tools described as wedges, iron blocks, iron plates, hammers, crowbars, and picks, or they were shattered and broken by fire.

Broken ore was manually loaded into buckets, baskets, or wheelbarrows, either by hand, or by shovel. The buckets or baskets were used to haul ore out of shafts in conjunction with a windlass whereas wheelbarrows were used to haul ore out of tunnels.

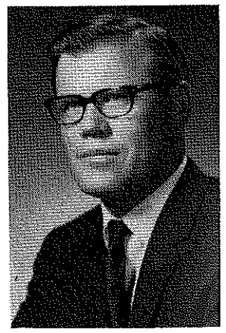
A variety of methods were used to transport the ore to a processing point. The method chosen depended on distance, terrain, season, and other factors. Ore was removed from steep mountainsides in sacks dragged by men, in small sacks carried by dogs, in pack saddles on horses or mules, and occasionally on hand-steered sleds when mountainsides were covered with snow. The latter was described by Agricola as providing some pretty wild

(Continued on Page 8)

*Paper presented at 73rd National Western Mining Conference, Denver Hilton, Feb. 13-14, 1970.



Link



Ponder

About the Authors

J. M. LINK joined the Colorado School of Mines Research Institute at the start of 1968 as a senior project engineer and is responsible for projects in mining and geological engineering. He graduated from the Colorado School of Mines in 1959 with a degree in Geological Engineering. He is a member of AIME, a Registered Professional Engineer, and a Certified Professional Geologist.

Prior to joining the CSM Research Institute, Mr. Link spent six years with the Monsanto Co. as mining engineer and mining supervisor at a mine in Southern Idaho. His work included all phases of exploration, evaluation, planning, development, and operation of a 1.5 million tons per year open pit phosphate mine. Earlier, he spent a year with Kermac Nuclear Fuels at Ambrosia Lake, N. M., where he was responsible for the quality of ore produced and the supervision of miners in room and pillar mining methods, as well as some mine geology and mapping.

DR. HERMAN PONDER has been associated since 1963 with the Colorado School of Mines Research Institute where he has specialized first in process development and later in exploration and mine development studies. In 1967 he was appointed head of the Mining Division, the position he now holds. He is presently responsible for the planning and administration of earth science projects involving field investigations, mineralogy, geology, materials research, and other studies relating to the characterization, evaluation, and mining of various minerals. Dr. Ponder earned his Ph.D. degree in Geology in 1959 from the University of Missouri, is a member of AIME, and is a Registered Professional Engineer in the State of Colorado.

In situ studies of rock and related stresses have resulted in several significant developments in mining. The understanding of stresses around underground openings led to the development of a series of standards for the ideal opening. Among these was the appreciation that the rock immediately adjacent to the opening must be left relatively undisturbed and unfractured. The effort to satisfy this requirement led to a considerable research effort in the field of blasting. A result of this effort was the development of the presplitting and smooth-wall blasting techniques which are widely used today. These techniques rely on a series of closely spaced holes which are loaded with small quantities of decoupled explosives. The action of the explosives is confined to the vicinity of the drill holes and damage to the adjacent rock is minimized.

Both the general public and the mining industry stand to benefit from these and other anticipated improvements in tunneling technology. A very substantial portion of the need for rapid underground excavation during the next twenty years will, of course, be related to mining.

The ore extraction processes themselves may be the subject of systems engineering. The design of a mine is based upon many factors such as the size and geometry of the orebody, depth of burial, and so forth. At the present time we are witnessing an incredible growth in the size of surface-mining machines. A 165-cubic-yard shovel is presently operating in one coal mine and a 220-cubic-yard dragline is being operated at another. These machines have allowed the mining by surface methods of material which previously would have been attainable only from underground openings.

Yet another extractive system is currently being applied to a potash deposit in Canada where development of conventional underground potash mines is difficult because of shaft-sinking problems in the Blairmore Formation. As an alternative to conventional mining methods, one company has undertaken solution mining of potash. Water is pumped down more than 5,000 feet into the potash beds where it dissolves the sodium and potassium salts. The brines are then pumped to the surface where they are collected and pumped to the refinery.

A final and increasingly important system is the world we live in. The mining industry has, of course, been exploitive in nature, and, unfortunately, theories of conservation of resources were viewed by the industry in the past with something less than enthusiasm. Our increasing population is exerting an ever-increasing pressure on available land space, and in recent years organized conservation groups have created powerful lobbies in Washington. Mine managers are now faced with a rising tide of public opinion which is demanding an end to the despoiling of the land. Those men who rejected ideas of resource conservation are being replaced by men who are now fighting for their companies' existence against a tide of resource preservation.

When most people speak of conservation, they mean something entirely different. Simply stated, conservation of resources means that the extractive process of mining must not be allowed to destroy all other resources such as water, agriculture, or esthetics. Much of the public demand today seems to be for the preservation of resources which means that they will not be removed from the ground or changed in any way.

The long-term effects of mining on our environment probably offer one of the most fruitful areas for mining research. The demand for raw materials precludes the elimination of mining from our list of active pursuits. The only alternative, then, is to adapt mining to our environment. Those aspects of the industry which are harmful must be eliminated; those areas which need redevolpment must be re-examined.

In conclusion, mining research is a much-needed and fast-growing sector of the mining industry. Men and women with creative ability, imagination, and technical competence are needed to develop the mining arts into a true science. The mining industry is entering into a renaissance as demands for its materials increase daily.

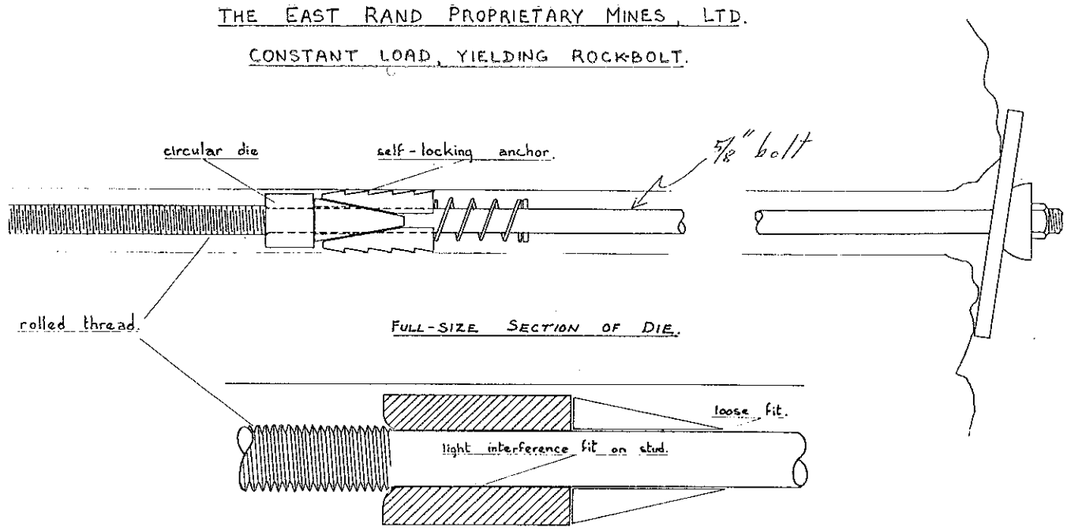


Figure 1. Yielding Rockbolt.

Yieldable Rock Bolts for Shock Loading And Grouted Bolts For Faster Rock Stabilization*

By W. D. Ortlepp and John J. Reed**

RECENT considerations in South Africa and the United States have indicated that yieldable rock bolts should be effective in reinforcing underground openings against shock loading. In a test in South Africa, yielding rock bolts were used to secure wire mesh to one side of a drift, while the opposite side was identically supported with conventional bolts. The test section was subjected to impulse loading by the simultaneous detonation of decoupled explosives in long axial holes spaced around the periphery of the tunnel. Examination showed that the conventionally bolted side was completely destroyed, while the yielding bolts and mesh remained intact and prevented appreciable damage.

For conventional rock reinforcement against "static" loading, fully grouted bolts have been found very effective, especially when installed and grouted immediately as the excavation proceeds. Analytical considerations show why this result should be anticipated, and encourage increased application and experimentation in the field.

Functional Requirements of Rockbolting

The confining stresses generated by any practical form of support, either in the form of internal reinforcement or externally applied restraints, are very small compared with the stresses involved in the fracture of the rock within the walls of the excavation. These constraints can thus have no direct effect on the initiation of fracture.

However, Fairhurst and Cook (1966) have shown that, under the conditions prevailing in fractured rockwalls, the strength of the fractured rock tends to promote stability provided that it is retained in position.

It is intuitively evident that the decrease in "strength" of the fractured envelope will be least when movement across the fracture discontinuities is minimum, in other words, when the particles are most firmly held in place. Moreover, this spatial integrity must be maintained in a situation where relatively large displacements are occurring in the fractured shell.

While the above argument is probably phenomenologically sound, it is not yet possible to ascribe any quantities to it. Qualitatively, then, the design requirements are simple: the support must act as soon as possible and maintain its restraining effect while yielding through appreciable displacements.

Because rockbolts can be tensioned during installation, and have a modulus two or three times greater than the rock in which they are installed, they supply the necessary early restraint. Normally their capacity to yield is provided only by the plastic deformation of the steel, and is limited to a few inches. Furthermore, plastic yield cannot occur at high strain velocities of the order of 100 feet per second, and abrupt failure will occur.

*This paper was presented at the AIME Intermountain Minerals Conference at Vail, Colo., on July 31, 1969.

**Mr. Ortlepp is rock mechanics engineer, East Rand Proprietary Mines Ltd., Boksburg, South Africa. Dr. Reed is head, Department of Mining Engineering, Colorado School of Mines, Golden, Colo.

The Yielding Rockbolt

In order to overcome these limitations in conventional rockbolts, a simple yielding device has recently been developed, Ortlepp (1968), **Fig. 1.** This consists of a smooth-bored die of internal diameter slightly larger than the rockbolt stud but appreciably smaller than the crest diameter of the thread rolled on the stud. The stud passes freely through a conventional expanding-shell anchor, then through the die, before terminating in several inches of rolled thread. The large diameter of the thread secures the stud in the anchor until the imposed load exceeds a critical value. When this happens, the thread crest becomes deformed and is forced back into the thread groove, pemitting the bolt to move steadily through the die and anchor. By suitable choice of dimensions of the die, the load at which movement commences can be arranged to be slightly less than that which would result in plastic yield of the bolt itself.

Available testing machines provided a range of displacement velocities from about one inch per minute to about two feet per second, and within this range the yield load appears to be independent of yield rate. For nominally constant die dimensions the variability in yield load was found to be about 9 per cent.

Yielding rockbolts have been developed in the U. S. in prototype form, using a tube drawing or enlarging mechanism instead of the wire drawing scheme described above. They would be more expensive and complicated to manufacture, and have not been field tested.

Test Procedure

It was decided to test the yielding bolts vs. conventional bolts in a suitable test drift, using controlled peripheral blasting to cause large and high-velocity displacements believed to be characteristic of rock bursts.

Site: At a depth of 9,400 feet, the development of a main fan installation was in progress in quartzite which, although somewhat argillaceous, was not prominently bedded. As a result of complete and extensive mining of the thin stratum of ore 60 feet above, the field stresses were low. Moreover, there was no indication that the over-mining had induced any fracturing in the rock surrounding the fan chambers.

A 9 feet high by 10 feet wide heading, which would finally form a 12 feet high by 19 feet wide motor chamber, was advanced 25 feet from the main fan chamber. Decoupled charges were used in the peripheral holes to minimize blast damage of the wall rock.

Method: Two parallel, horizontal wires were stretched between surveyed points to form a guide from which identical rows of rockbolt holes were drilled at 2½ foot intervals along the heading. The distances from the guide wires to the ends of the rockbolts were measured with an accuracy of about one-half inch.

To minimize end-effects, radial "pre-split" blasts were effected 10 feet along the tunnel and near its end. This enabled two tests to be carried out as indicated in **Figs. 2 and 3.**

In each test conventional rockbolts and yielding rockbolts were symmetrically opposed about the center-line of the heading.

All the rockbolts were ⅝-inch diameter, high-tensile studs with spring-loaded, self-locking anchors, tensioned against a double layer of 8-gauge linked wire mesh of 2-inch mesh size. The rockbolts were effectively four feet long in the first test section and five feet long in the second section, with an additional 9 inches or 12 inches of yielding thread provided for the yielding bolts, in each case, respectively.

Using the guide wires as a base, 24 peripheral holes, 10 feet long and uniformly spaced about 17 inches apart, were drilled parallel to the axis of the tunnel about 2 feet from its surface.

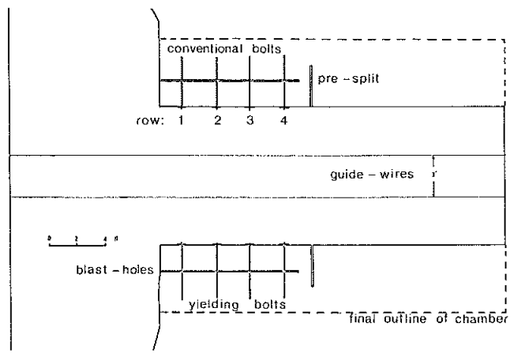


Figure 2. Plan of 68 L Fan Chamber—First Test Blast.

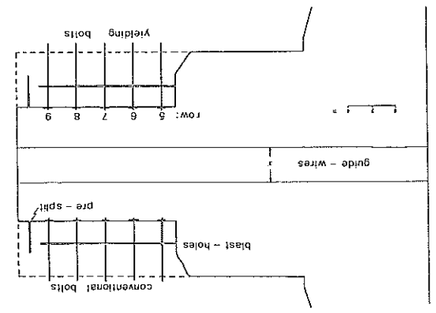


Figure 3. Plan of 68 L Fan Chamber—Second Test-Blast.

Figure 4. View East into test heading before first test blast. Outer paint line is final periphery of chamber.

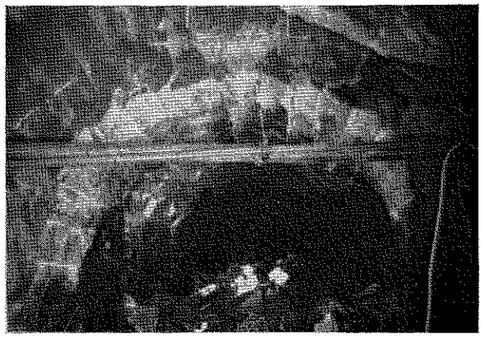


Figure 5. View into heading after first test-blast (15% coupling), showing complete removal of both sidewalls, mesh and majority of bolts.

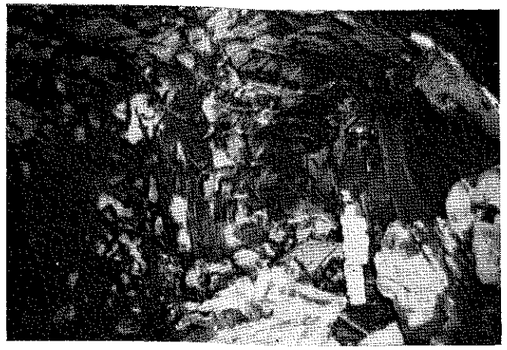


Figure 6. View North-East after second test-blast (8% coupling), showing complete removal of conventionally-bolted sidewall and mesh. Painted and meshed South sidewall visible in top right corner.

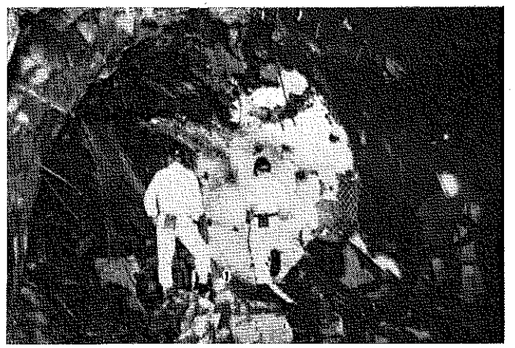


Figure 7. Apart from upper edge, mesh is intact between yielding bolts. A few protruding conventional bolts are visible on otherwise clean north-side.

The simultaneous detonation of de-coupled explosive charges in these peripheral holes provided the desired impulse loading to the tunnel walls.

Results: First Test

Four rows of rockbolts nominally 4 feet long were anchored with two-component expanding shells of malleable cast iron which effectively provided only line-contact with the sides of the holes. Each row consisted of 6 conventional bolts on one side of the heading and 6 yielding bolts with 9 inches of yielding thread on the other side. The appearance of the mesh, the irregularities in the walls of the heading and the detonating-cord connection of the blast-holes are shown in **Fig. 4.**

The explosive charge consisted of 4 inch by ⅞ inch cartridges of 40 per cent dynamite uniformly spaced to fill 15 per cent of the volume of each hole.

The energy of the blast was sufficient to split and eject the rock and destroy all the bolts and mesh, leaving a clean "post-split" surface—**Fig. 5.**

The majority of the bolts—37 of a total of 48—had failed as a result of ineffective anchorage. A close examination suggested that the metal along the line-contact between anchor and rock was so highly stressed that it sheared and was rapidly abraded away.

Four of the conventional bolts were partly, but not completely dislodged and, in two of these, the domed plates had failed.

In seven instances, all 9 inches of thread on the yielding bolts had been forced through the dies, leaving anchors and dies still locked in their respective holes.

Second Test

An improved type of anchor, with three expanding segments, was used in two of the five rows of rockbolts, viz, rows 6 and 8, in the second test, **Fig. 3.** As before, one side of the tunnel was bolted with conventional rockbolts, nominally 5 feet long, while the equivalent yielding bolts, with 12 inches of yielding thread, were symmetrically opposed on the other side.

The spacing of the 40 per cent dynamite cartridges in the blast holes was increased to the extent that the explosives occupied only 8 per cent of the volume of each hole.

After detonation, this amount of explosive was found to have been sufficient to completely split and fragment the conventionally bolted rock-wall, **Fig. 6.** Of the 18 bolts equipped with two-component anchors, 2 failed in tension and 8 were completely dislodged, while the rock had broken away around the remaining 8 bolts.

Tensile failure occurred in 6 of the 12 bolts equipped with the three-segment anchors, 2 were completely dislodged, and the rock had broken away in four instances.

A visible split developed between the peripheral holes on the side which was bolted with yielding bolts, but no bolt failed, the mesh remained completely intact, and no

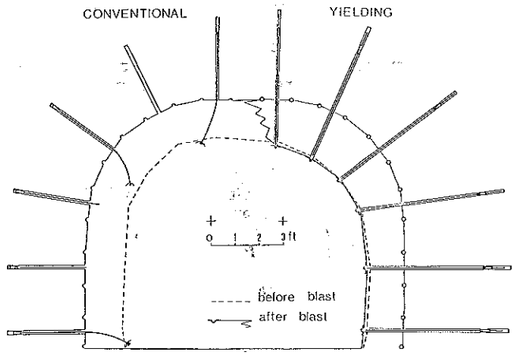


Figure 8. Typical Profile Second Test Blast.

rock was dislodged except at the crown of the tunnel adjacent to the conventionally bolted side, **Fig. 7.** Some fracturing of the painted rock surface was visible behind the wire mesh and measurable displacement, relative to the guide-wires, was observed at the ends of 12 of the 30 bolts. A typical profile is shown in **Fig. 8.**

Energy Considerations

The analysis of the stability of the fractured walls of a tunnel at depth, anticipated that the most important requirements of support would be the ability to yield while maintaining undiminished resistance. Although no refined measurements were made, the visual evidence conclusively showed that yielding rockbolt support was much more effective than conventional bolting, in preventing damage due to impulse loading. In this respect the analysis appears to be substantiated by the experimental results.

However, the results would be of little more than academic interest if the experimental situation bore no resemblance to any failure that might occur in practice.

Unfortunately very little is known about the mechanism of rockburst damage in tunnels. It is conceivable that damage could result in two distinctly different ways.

Firstly, the passage of a shock wave arising from some large energy release, originating at some distance, could accelerate and eject already fractured and partially detached slabs of rock. Seismic measurements have shown that energy releases of as much as 10^7 ft.-lbs. are not uncommon in South African gold mines. A tunnel 100 feet away from such an event would experience a shock wave intensity of the order of 10^3 ft.-lbs. per square foot of surface area. The velocity of propogation of the shock wave

(Continued on Page 16)

(Continued from Page 14)

would vary between about 11,000 feet per second in fractured rock and 19,000 feet per second in solid rock.

The second form of rockburst damage would occur when, under certain external loading conditions, the sudden enlargement of the fractured envelope around the tunnel would itself constitute the energy source. For a cylindrical excavation at 9,000 feet depth, it can be estimated that an increase in radius of the fractured envelope from 6 to 8 feet would be accompanied by energy release of the order of 10^6 ft.-lbs. per foot of tunnel or about 5×10^3 ft.-lbs. per square foot of surface.—Cook (1966).

This latter type of damage probably occurs less frequently than the first but, in its effects, is more analagous to the artificially induced collapse of the experiment.

The energy imparted to the rockwalls by the test-blast can only be estimated within very wide limits.

Consideration of the amount of explosive necessary for the test blast revealed so many imponderables that the calculations were more intuitive than empirical. Estimates indicated that space charges occupying eight per cent of the volume of the holes would split the rock. The residual gas pressure, after initial movement of the order of one-half inch, would be such that only 0.5 per cent more explosive would ensure failure of the conventional rockbolts even assuming that each possessed an impact strength of 20 tons.

This estimate, which proved to be quite adequate in the second test, involved 0.7 lbs. of explosive per hole which was equivalent to 0.06 lbs. per square foot of tunnel.

It is generally accepted that the strain-wave energy equivalent of one pound of explosive is 10^2 ft.-lbs., while the total chemical energy equivalent is about 5×10^6 ft.-lbs. Since the conventionally bolted tunnel wall was not only split, but ejected and fragmented, it is obvious that much more than the strain-wave energy of the explosive viz. 60 ft.-lbs./sq. ft. was involved.

Since some considerable portion of the chemical energy was dissipated in heat and noise, the energy involved was less than 3×10^4 ft.-lbs./sq. ft. It is unlikely that the efficiency of the blast was less than 30 per cent; therefore, the energy involved in damaging the tunnel wall was probably about 10^4 ft.-lbs./sq. ft. which is of the same order as that experienced during rockbursts. Thus it seems probable that a tunnel supported by yielding rockbolts and mesh could survive all but the most severe rockbursts.

Grouted vs. Ungrouted Rock Bolts for Rock Stabilization

Fully grouted rock bolts have been used and specified for some years in construction projects for two primary reasons. They enhance permanency against corrosion, and loss of anchorage. However, grouting has usually been done long after rock excavation and stabilization is concluded in order to simplify the bolting procedure and eliminate the effects of nearby blasting on freshly grouted bolts. Therefore, the effects of fully grouted bolts on early rock stabilization after rock excavation have not been noted generally. In those cases where fully grouted bolts have been installed early, however, even as untensioned dowels, they have been observed to be remarkably effective in stabilizing the rock mass and preventing displacement of individual blocks and fragments. The calculations which follow show why this should be so.

Bolt Action in a Moving Rock Mass

When an excavation is made in solid rock, the walls and roof move inward until they either stabilize or collapse. This movement is a combination of elastic motion, which **must** occur, and is largely simultaneous with excavation; and block and fragmental relaxation and readjustment, which involves dilation of the mass and cracks within it. This latter action takes time, but under critical conditions, if uninhibited, will result in collapse of the rock mass. The sooner and more positively this block relaxation is arrested the more of the inherent strength of the rock which remains, and the higher the probability that permanent stability will be achieved and collapse avoided. The action of a fully grouted bolt is much more positive and rapid than that of an ungrouted one in preventing rock dilation and shifting. A tensioned, but ungrouted bolt invariably loses tension due to creep and subsequent blasting, and is usually retightened several times before being finally grouted. All this permits rock dilation with time.

Let us examine the situation when a joint perpendicular to a 10-foot bolt opens 0.1 inch somewhere within the bolt's length. With an ungrouted bolt, the extra 0.1 inch of strain will be distributed uniformly through the length of the bolt, and be equal to:

Strain $= E = 0.1''/120'' = 8.33 \times 10^{-4}$ "/"

The added stress in the bolt will be

Stress $=$ E x E, where E $=$ Young's Modulus

Stress $= 30 \times 10^6 \times 8.33 \times 10^{-4}$

Stress $=$ 25,000 psi

which is approximately equivalent to the initial installation stress in a normally tensioned bolt. Therefore, at this point the bolt would be developing about 50,000 psi, or say 40,000 lbs. force in a 1-inch bolt tending to inhibit the rock dilation of 0.1 inch. The longer the bolt, the less force is developed, and therefore the "softer" it acts and the less it inhibits rock dilation.

In contrast, with a fully grouted bolt under the same conditions, the 0.1 inch of dilation strain will be distributed over only that short length of bolt on each side of the joint where the bond between bolt and grout is broken. If this is 5 inches on each side of the joint, then the strain in the steel is: $E = 0.1''/10'' = .01$ "/" and Stress $= 30 \times 10^6 \times 1 \times 10^{-2} = 300{,}000$ psi, or say 240,000 lbs. force in a 1-inch bolt inhibiting rock dilation, which would be far in excess of the yield and ultimate strength of the normal bolt steel. If the bond were broken 10 inches on each side, this figure would reduce to about 120,000 lbs. In either case, the conclusion to be drawn from these considerations is the same, any finite movement of the rock will cause a very rapid increase in the restraint offered by a grouted bolt.

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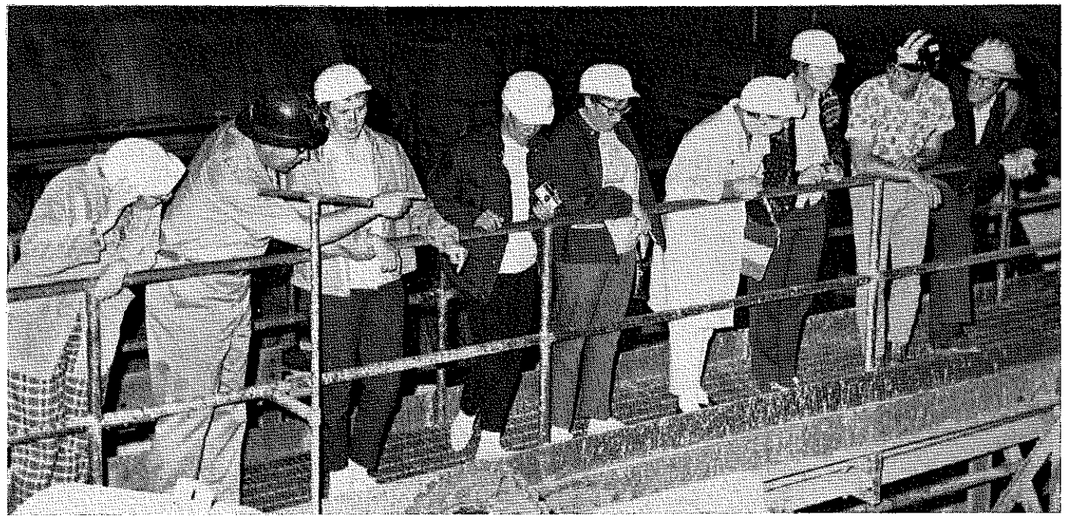

STUDENTS FROM THE 1969 SUMMER COURSE, "A Total Concept of the Mining Industry," visiting the mill at the Urad Mine.

A Total Concept of the Mining Industry

DURING the summer of 1969, the Colorado School of Mines and the Colorado Mining Association co-sponsored a course entitled "A Total Concept of the Mining Industry." The course was designed for Secondary School Teachers, Counselors, and Administrators, for which they receive six hours of credit to be used for the renewal of teaching certificates, credit in earth sciences, administration and graduate work.

S. Power Warren, chairman of the Education Committee of the Colorado Mining Association, and his Ad-Hoc Committee of Mines graduates, were instrumental in raising the funds and arranging for the speakers for this course. Professor Grosvenor of the Colorado School of Mines was the Coordinator for the Mining Department to conduct the classes and administer the examinations.

A total of 34 students were enrolled during the summer session of 1969. The course is being offered for the second time starting on June 8 and will be for six weeks. The course includes lectures, films, and field trips.

Yieldable Rock Bolts for Shock Loading

(Continued from Page 16)

Conclusion

A fully grouted rock bolt placed and grouted immediately after rock excavation, even though untensioned initially, should be several times more effective than a tensioned **but ungrouted** bolt in preventing rock dilation.

In making this statement, it should be recognized that fast setting, high early strength, resilient grouts or mortars are indicated. Some minor bond deterioration must be anticipated with subsequent blasting, but this will diminish rapidly as the face moves away, and in any case its effect will be less objectional than the loss of installation tension, which now occurs in ungrouted bolts with adjacent blasting, and permits easier rock dilation.

Ideally, a bolt fully grouted at installation should also be given an initial tension, although this complicates the hardware and installation procedure. Also, to minimize the cost of expendable components, it should not, and need not, be a hollow bolt if improved systems such as pneumatically blown mortar are developed to fill the borehole completely without air pockets. However, even if the unit is a simple untensioned dowel, it should still be more effective than an ungrouted bolt as shown by the analysis given.

Acknowledgement

The experiment described in this paper was carried out on the East Rand Proprietary Mines, Limited, as part of a programme of studies into the support of haulages, sponsored by the Chamber of Mines of South Africa.

The permission granted by these two organizations for the publication of this work is gratefully acknowledged.

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Some Impressions of Rock Cutting In South Africa

By William Hustrulid

Preface

DURING the summer of 1969 the author had the opportunity to work at the Mining Research Laboratory (MRL) of the South African Chamber of Mines and to become familiar with the efforts being made to develop a radically new method of mining gold. Because of the effect the success of this method, rock-cutting, would have on the South African gold mining industry and on the free world's gold supply, it was felt that a short discussion of this topic might be of interest to the readers of The MINES Magazine.

Introduction

Gold was discovered in 1886 on the Witwatersrand on a farm close to Johannesburg. The surface outcrops which stretched for many miles, were the sites for the early workings. Mining continued down dip through the years until today the deepest workings are somewhat over 12,000 feet below the surface. Plans are being made at one mine to go to 14,500 feet in the not too distant future.

Most of the gold (1) lies in the narrow Vaal, Basal, Kimberley and Carbon Leader reefs whose average thicknesses are given in the table below.

Table 1. Thicknesses of the Reefs on the Newer Goldfields After Cook, et al (1)

Goldfield	Reef	Average Thickness
Evander	Kimberley	25 in.
Far West Rand	Ventersdorp Contact	30 in.
	Carbon Leader	10 in.
Klerksdorp	Vaal	20 in.
Orange Free State	Basal	15 in.

It is not possible to mine only the gold-bearing portion of the reef because of minimum space requirements for men and machinery. The minimum stoping widths of about 40 in. presently being used, have been developed on the basis of many years of experience. This means that at least an equal amount of barren rock must be mined, transported, hoisted, and milled for every ton of gold bearing material. As depths increase, the costs associated with this waste rock can make mining of all but the richest material uneconomic.

At the Doornfontein gold mine (2) in which the rock cutting experiments are being performed by the MRL, the average stope width is 40 in. Drilling and blasting is presently being used as the standard mining method in panels 120 ft in length. Hand held 2⅝ in. percussion machines are used to drill the required holes, (42 in. in length, having diameters of 30 to 35 mm or 36 to 40 mm). The average burden per hole is 10 inches. The larger holes (36 to 40 mm) are loaded with 40 percent by 1¼ in. diameter dynamite whereas the smaller are loaded with 50 percent x 1 in. dynamite. Fuses and igniter cord are used to achieve sequential firing. Roof support in the stope is by 2 ft. by 2 ft. solid or spaced mat-packs at 10 ft. centers on dip and strike. Faces are cleaned with 30 h.p. scraper winches. The average face advance for this mine is 15 ft. per month. This method is representative of most other deep South African gold mines.

The revenue derived from mining is proportional to the area of the reef mined whereas the costs are proportional to the total material moved. The ventilation costs and strata control problems are directly proportional to the "effective stoping width" which, when using present methods, is 40 in. Because of the costs associated with this method, 500 million ounces of gold existing in known South African gold fields cannot be profitably mined (3). As mining goes deeper and assuming current methods are continued, even more gold will be left in the ground. Therefore great monetary returns are to be realized through improvement of present mining methods. The researchers in the Mining Research Laboratory of the Chamber of Mines are aiming at this very result with rock-cutting.

Rock Cutting

As discussed in the previous section, strata control, ventilation problems, and other mining cost items increase almost directly with the effective stoping width. It is obvious that any reduction in amount of material which must be mined, hoisted and milled will be directly reflected in the cost to produce an ounce of gold. Rock-cutting as depicted in **Figures 1 to 3** is a method which substantially reduces the effective stoping width. The basic set-up as shown in **Figure 1-A** consists of the cutting machine, hydraulic props for temporary support and a chute for removal at the gold bearing reef. At the great depths (8,000-12,000) at which mining is presently being done, the stresses in the rock at the working face are extremely high. The cutting machine has been designed to cut slots above and below the reef, thereby removing the high vertical stresses and creating free faces to which the remaining material may be broken. The gold reef, because of the high stresses, tends to slab off between the slots.

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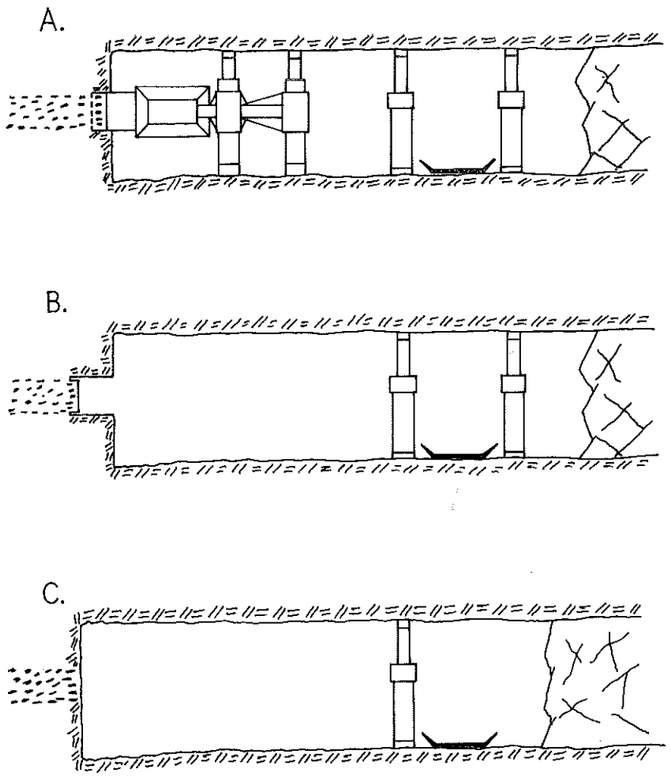

Figure 1. Diagrammatic Representation of Rock-Cutting Mining Method After Cook, et al (3).

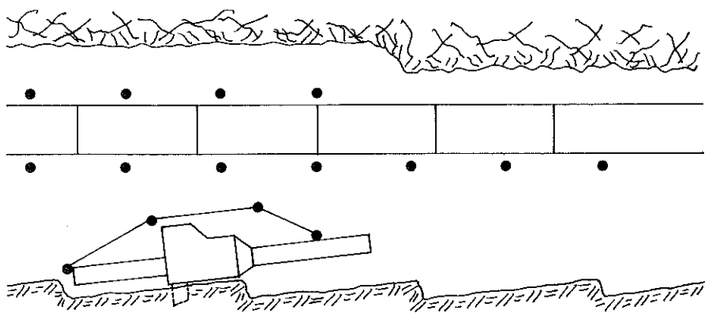

Figure 2. Plan View of Stope Showing Panels, Props, Ore Chute and Packed Waste After Cook, et al (3).

(Continued from Page 18)

This is similar to the disking observed in diamond cores drilled in highly stressed ground. After the slots have been cut, the machine is moved to a new panel using a winch. The gold bearing material is hand sorted and placed in the chute for transport to the haulage level. At this stage in the process, only a 10 to 20 in. width of material (the valuable material) has been mined. Holes are now drilled along the upper and lower edges of the stope and the waste rock broken to the free surfaces using any one of several methods (explosives, wedges and feathers, impact driven wedges, or combustion breakers). Because of the additional free surfaces produced by cutting, this material is easily broken leaving the roof in much better condition than with presently used methods. The waste rock broken from above and below the slot is then packed into the back area away from the face **(Figures 1 and 2)**. This eliminates the need for the timber or concrete packs presently used. Assuming some method other than explosives can be employed to break the waste rock, this mining system would be continuous. The effective stoping width is equal to the width of reef which was cut and removed from the mine.

Some advantages expected of rock-cutting over the methods presently used are summarized below.

1. Less material must be mined, handled, hoisted, and milled.
2. A smaller capital investment is required for the same production.
3. Better strata control results in reduced likelihood of roof falls and rock bursts.
4. Wooden or concrete permanent support in stopes is unnecessary.
5. Thermal control and ventilation are improved since the worked out area is filled with waste rock.
6. Continuous mining is possible.
7. The hanging wall is left in a better condition and stoping width control is improved.

At the present stage of development, however, the cost of rock-cutting is approximately 3 times that of conventional methods (3). This is due to mechanical breakdowns of the cutter, blade failures, and rather large times required to move the cutter to a new position. The first and third are engineering problems on which significant progress has been made during the past year by the MRL. Makers of tungsten carbide are presently working on carbide cutter improvements. It is not surprising that some cutter trouble occurs since the comparative strength of the quartzites in which the gold is found varies from about 20,000 to 50,000 psi.

Figures 4 through 6 show the cutter in operation in a stope in the Doorn fontein gold mine, approximately 8,000 ft. below surface. This particular cutter is designed to give 1 ft. of face advance per shift with a panel length of 10 ft. Figure shows the prototype machine set up in a narrow stope. The condition of the roof is very much better than in adjacent areas mined using ordinary methods.

Often the footwall contains the more shaley quartzites which are easier to cut than the hanging wall. In this case it may be only necessary to cut one slot below the gold bearing reef, (see **Figures 5 and 6**), thereby relieving the high vertical stress across the face and producing an additional free surface. A row of holes would then be drilled above the reef and non-explosive means used to break out the valuable material. The process could then be continued as described earlier. In **Figure 6**, the holes drilled at the head and tail of the slot allowing the cutter to begin and end at a free surface are visible. These are easily drilled using a hand held percussion machine.

Conclusion

As man goes deeper to extract from the earth, materials which are needed to maintain our present way of life, it is obvious that new, or at least clever adaptations of present mining methods, must be introduced. In South African gold mines which are

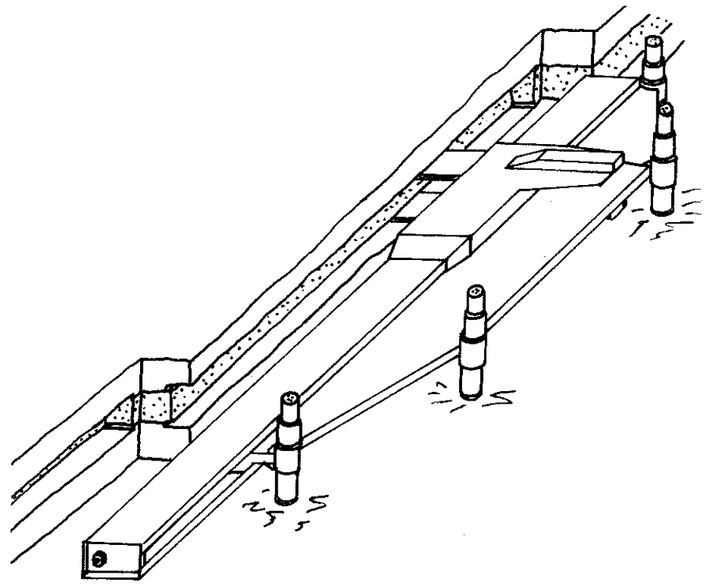

Figure 3. Isometric View of Rock Cutter in Stope After Cook, et al (3).

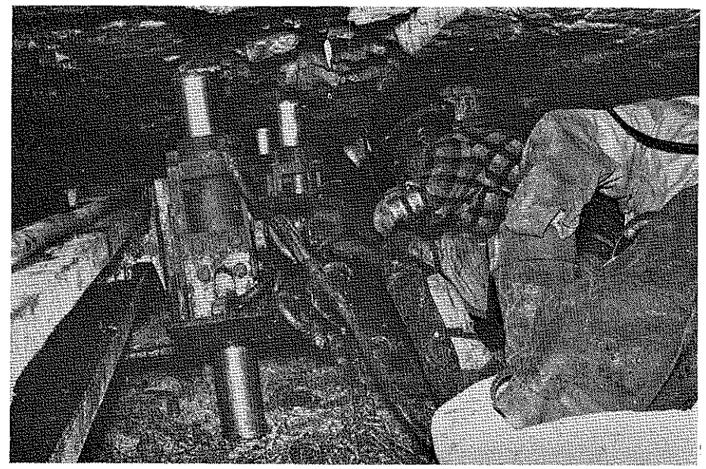

Figure 4. The Rock Cutter Operating at 8,000 feet Below the Surfact in the Doornfontein Gold Mine, South Africa.

presently at depths greater than 12,000 ft. below surface, new methods must be introduced if all but the richest gold is to be economically mined. The rock-cutting method being developed by the Mining Research Laboratory of the South African Chamber of Mines holds great promise in reducing the cost of gold mining at great depths. We in the mining industry should watch these developments with great interest.

Acknowledgements

The author wishes to thank the South African Chamber of Mines for making the visit possible. Special thanks must go to N. G. W. Cook, N. C. Joughin and G. A. Wiebols of the Mining Research Laboratory.

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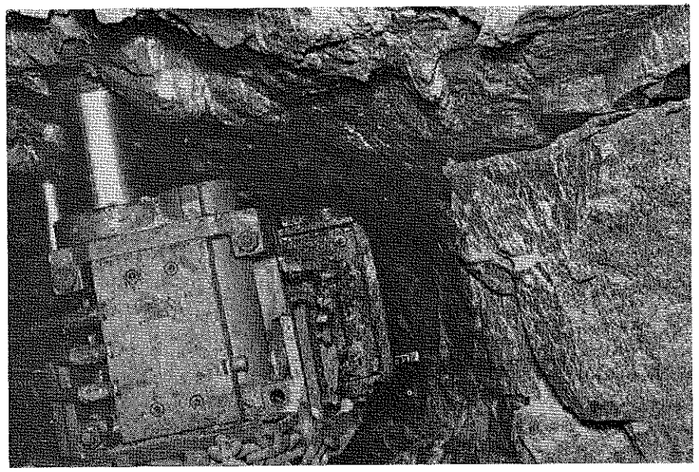


Figure 5. Close-up View of the Cutter Head. Note that only one cutter is being used. Doornfontein Gold Mine, South Africa.

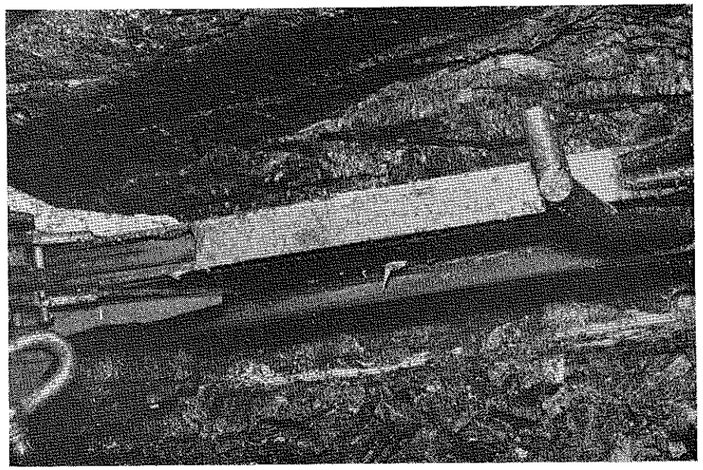


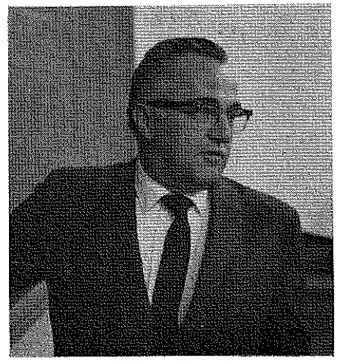
Figure 6. First Pass by the Rock Cutter. Note the drill holes used at the ends of the cutting path. Doornfontein Gold Mine, South Africa.

Faculty Changes

In the Mining Engineering Department

NO changes in the faculty of the Mining Engineering Department have occurred since the previous March issue of Mines' Magazine, but there have been two most interesting part-time additions.

MR. WILBUR DUVALL began work with the Bureau of Mines in September, 1939, and has been with the Bureau ever since. During this time he has authored or co-authored over 50 research papers. He is now Physical Research Scientist for the Ground Control Science Group, Denver Mining Research Center. He received a group Naval Ordnance Award in 1945, a Superior Performance Award in 1957 and the Department of the Interior gold medal Honor Award for Distinguished Service in 1966. He also was a co-recipient with Dr. Leonard Obert of the AIME first Rock Mechanics Award in 1968. Mr. Duvall is a member of the American Institute of Mining Engineers, American Geophysical Union, Seismological Society of America and Eastern Section of the Seismological Society of America, and has served on the National Academy of Science, Rock Mechanics Committee, for three years. Mr. Duvall, in cooperation with Dr. Leonard Obert, has also written a book entitled, "Rock Mechanics and the Design of Structures in Rock," which was published in 1967.



Wilbur Duvall

DR. GORDON LAUF, whose picture is on the cover of this issue, served as Visiting Professor during the Fall Semester, under the auspices of the National Science Foundation. Dr. Lauf, whose normal function is that of Head of the Department of Surveying, at the University of the Witwatersrand, at Johannesburg, South Africa, is one of the world's outstanding experts in the use of the new gyrotheodolite, and has taught people from all over the world how to use it. The gyro has had exceptionally fine acceptance in the mines of South Africa, where the great depths and large scale of operations make its use essential. Dr. Lauf pioneered the introduction of the gyro in these mines and has contributed much to the development of the present light-weight equipment and simplified techniques. He is a delightful person and was much-missed when he had to return. The Department hopes that he will be able to come back from time to time.

Dr. Orlo E. Childs Announces Resignation As President of Colorado School of Mines

DR. ORLO E. CHILDS, president of the Colorado School of Mines since 1963, announced his resignation Feb. 18 at a meeting of the faculty. It will be effective at the end of the school year, sometime after commencement (May 29), he stated.

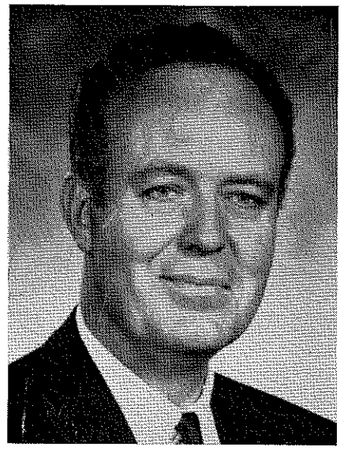
His decision to resign, he said, was made last fall, but he explained he and the Board of Trustees delayed making it public in order to avoid a "lame duck" administration through the first semester, and at the same time give the Board sufficient opportunity to choose a successor.

Dr. Childs said he plans to return to industry in his chosen field of petroleum geology.

Dr. Childs, 11th president of the 96-year-old mineral resources engineering university at Golden, said it was an opportune time for Mines to have new leadership.

An emerging national minerals policy, he said, is putting increased emphasis on education in mineral resources. "There is a promise of more public support for institutions such as Mines in providing education for the exploration and development of minerals, metals, and fuels to meet the ever-growing national demands," he said.

During his presidency, the Colorado School of Mines has experienced expansion of the graduate school, development of a continuing education program, increase in enrollment, realignment of the degree program to offer bachelor's, master's, and doctoral degrees in the nine degree-granting departments, and physical improvement of the campus, including the $8 million Cecil H. and Ida Green Graduate and Professional Center now under construction.



Dr. Orlo E. Childs

Commenting on his move, Childs noted, "There are new reactions to the environment in which we live which feed the vitality of the institution and call for a new president to meet the challenges of the future."

Of the nine presidents of state colleges and universities in Colorado, Dr. Childs has served in office longer than all but one, Dr. Harlan F. Bryant of Western State College.

Dr. Childs, who came to Mines in July, 1963, is a petroleum geologist with extensive professional experience in both industry and education.

Born in Loa, Utah, March 28, 1914, he attended Weber State College, Ogden, Utah, from 1931 to 1933, and then the University of Utah, where he received his bachelor's degree in 1935 and his master of science degree in 1937. He gained his doctorate in geology at the University of Michigan in 1945.

Dr. Childs instructed at Weber from 1937 to 1942, and at the University of Michigan from 1944 to 1945. He served as a geologist for the Sinclair Wyoming Oil Company at Casper from 1945 to 1946 and then returned to teaching. He was an assistant professor at Colgate University from 1946 to 1948 and at the University of Wyoming in 1948-49.

In 1949 he was named exploration projects director for the Phillips Petroleum Co., and served in that capacity for 13 years with offices in Denver. He moved to Menlo Park, Calif., in 1962 to supervise the new program in Oceanography for the United States Geological Survey, a position he held when named president of the Colorado School of Mines.

Dr. Childs is a member of the Advisory Council of the Public Land Law Review Commission, past chairman of the Western Region White House Fellows Program, member of the Colorado Fulbright Scholarship Committee, a fellow in the Geological Society of America, charter member of the American Institute of Professional Geologists, member of the American Association of Petroleum Geologists which he served as president in 1965, and member of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME). He was president of the AIME Colorado Section in 1968.

He served as chairman of the Educational Division of the Denver Mile High United Fund in the 1969 campaign and was honorary vice president of the Mile High United Fund in 1968.

Dr. Childs and his wife, the former Elizabeth C. Swisher, have three children, Bradley D., 22, part-time student at the University of Minnesota and working at the Minneapolis First National Bank; Barry E., 20, a junior at Wittenberg University, Springfield, Ohio; and Elizabeth C., 15, a sophomore at Golden High School.

Visit to Vallarta

By W. W. Fertig

ALTHOUGH I am no longer a student at Mines, I took advantage of the semester break to visit some of my old haunts in Arizona. Mary and I, together with our grandson (who is a freshman at Mines), left for Tucson. I had heard a lot about the recent discovery of the large copper deposits in northern Mexico and decided to visit one such project. We left Tucson early on Monday morning and drove to the Port of Entry at Sasabe, Ariz. From this point a dusty road crosses the high Sonoran Desert for some 30 miles to the south, passing through a ranching area almost devoid of development.

We arrived at the prospect shortly after 11 o'clock as the road was in surprisingly good condition. The mine area is covered with huge Sajuaro cacti while the hills are dun-colored with drying grass. The temperature was delightful, and the rattlesnakes were all in hiding, so it was possible to move about readily. The desert is covered with knee-high grass, due to the heavy rains of last fall, and the cattle are in excellent condition.

From the prospect, I brought back several fine specimens of cuprite, malacite, and azurite. The outcrops are widely scattered, and there is a possibility of finding a substantial deposit of oxide copper ores in the vicinity.

Bob, our grandson, acting as chauffeur, and I returned to Tucson that same evening.

The next two days we visited Mission Pit of Pima Copper Co., the new pit being developed by Anaconda at Twin Buttes.

These enormous stripping operations are extremely large. Lying out in the flats to the south of Tucson, they are detached from any of the small mountains in the vicinity. The waste piles and tailings dumps have been stacked so high that they rival the hills to the west.

Just as Denver has been bothered with a pollution problem, Tucson is in the midst of considerable difficulty. No longer can you view Mt. Lemon and the surrounding peaks in detail, as a haze of dust and possibly some sulphur dioxide gas hangs over the landscape.

ON Thursday (Feb. 29) Bob returned to Golden for registration, while Mary and I left by Air West for Puerto Vallarta. The flight in a DC-9 was broken with stops at both La Paz and Mazatlan, where the other passengers landed. From Mazatlan on, the two of us had the DC-9 and her crew for our personal use.

Arriving at Puerto Vallarta we drove to the Hacienda del Lobo, which had just been dedicated in December. It is a delightful new hotel and the closest to the airport along the northern limb of the great bay along which Vallarta has grown.

The Hacienda does not have its own beach, but we enjoyed those privileges at the nearby Posada Vallarta. The climate could not have been better, the temperature in the mid-70s, the Pacific just right for swimming with enough surf to make it interesting.

We had been told by the hotel agency in Phoenix that reservations would be difficult in Puerto Vallarta this time of year. Upon arrival we found that this was not true. Many hotels had been built during the past year. Now there are 25 or more beach-front hotels of 30 or more rooms, plus two new large hotels—the Delfin and the new Camino Real.

These hotels stretch for miles along the beautiful beaches of Vallarta, while mountains rise almost directly from the sea. Perched on a cobblestone lane which climbs one of these steep hills is the home of Elizabeth Taylor and Richard Burton. The area is now called "Yankee Gulch," and many retired Americans live behind those barred gateways.

Of course, we visited the location where the movie, "The Night of the Iguana," was filmed. The old boarding house used as the setting for the story has fallen into disrepair. A new sign states that a resort hotel will be built here as Misaloya.

For the last three days of our stay we moved to the Posada Vallarta and enjoyed all of the conveniences of an extremely modern resort hotel—fine pool, lovely beach, music and good food. The Posada was designed by the man who has since become the leading architect of Mexico and who was in charge of the architectural designs at the Olympic Games. With the many palm trees, wide-swept lawns, and beautiful beaches, it was very easy to imagine that we were back in the area that we still believe is the crux of all resort areas, the beautiful island of Kauai, Hawaii.

After a week of leisure it was difficult to return to Colorado, but we did find the good weather of February with us, rather than the disagreeable storms of October.

From the Executive Secretary's Desk

Col. Fertig

Mines Magazine — Monitor Publications, which has published The MINES Magazine for several years, has merged with Publishers Press. As a result both the January and February issues were delivered late. We will try to have that corrected by the time this issue (March) is printed.

Convention Notes — The Annual Mines Breakfast held during the Colorado Mining Association Convention (Saturday, Feb. 14) at the Denver Hilton was very successful. The Mines Alumni acted as host, inviting the graduates of all other mining schools to attend the breakfast.

On Tuesday, Feb. 17, the Denver Local Section hosted a luncheon for the Miners, who were here for the Annual AIME Convention. The crowd was so large that many left the Press Club without lunch but did have the pleasure of meeting old friends. (See story under Local Section News.)

Athletic Committee—Ken Nickerson, chairman of the Athletic Committee, has received many responses to his last letter. He needs your help in recruiting scholarly athletes for Mines. You will hear from him again.

Class Reunions—If you are planning on being here at commencement, remember the Annual Banquet will be held on Thursday evening, May 28, 1970. This is a stag affair but we try to arrange some social event for the ladies.

Room reservations are frequently at a premium during this period. For that reason we ask that you complete the reservations card which you will receive about April 1st.

Honor Class Reunions—If you are a member of an honor class (1925, 1930, 1935, 1940, and 1945), you will have a Class Reunion. Plan now to be here for your own celebration, the annual banquet, and attend Commencement on Friday, May 29, 1970.

The physiology class was having its final exam and one of the questions was "What are the last teeth to appear in the mouth?"

One student scratched his head for a moment, then wrote "False."

Catalogs and Trade Publications

SPIRAL BUTTWELD PIPE (495)

To fill a variety of piping applications in the construction, dredging, mining, petroleum, materials handling and industrial plant fields, Naylor Pipe Co. of Chicago now offers a line of spiral buttweld pipe. Typical uses, standard specifications, popular connections and ordering information are given in Bulletin NSB, available free upon request from Naylor Pipe Co., 1262 East 92nd St., Chicago, Ill. 60619, or **Circle 495 on Reader Service Card.**

AIR POLLUTION CONTROL (496)

A profusely illustrated new bulletin (977-D) published by The Wheelabrator Corp., 400 S. Byrkit St., Mishawaka, Ind. 46544, describes the company's role in helping the steel industry achieve pollution-free productive atmospheres and better steel products at a lower cost by mechanical abrasive blast descaling. Included in Bulletin 977-D are a great many case histories describing both air pollution control systems and mechanical descaling installations in the steel producing industry. Wheelabrator Dustube fabric filter collectors and Wheelabrator electrostatic precipitators provide highly efficient air pollution control in ore mines, limestone quarries, coal mines and coke oven operations. In melting operations, they eliminate dust and fume from blast furnaces, open hearth furnaces, basic oxygen furnaces and electric furnaces. In semi-finishing mills, effective air pollution control is obtained in ingot mold production areas. **Circle 496 on Reader Service Card.**

SAMPLING EFFLUENT STREAMS (497)

"Principles of Sampling Effluent Streams" is the title of a new bulletin, G3-B144, by J. E. Carr, Professional Engineer, Denver Equipment Division, Joy Manufacturing Co. The bulletin points out that effluent streams are normally one of the most neglected areas of plant operation. Yet, if the quality of the stream must be known and be known with both reliability and confidence, the spotlight of attention must be focused on plant effluent and how, despite all its obstacles and inaccessibility, a reliable sample can be obtained. Bulletin G3-B144 sets down certain accepted standards for sampling as used in various industries and applies them to the practical benefit of those responsible for monitoring the quality of water leaving a plant. Sampling of plant effluent can be achieved automatically, economically, and reliably with simple, dependable units. The bulletin asserts that the advantages of a properly engineered sampling system so completely outweight the risks involved in cheap systems that no person of responsibility can afford to compromise the specifications for a sampling system. **Circle 497 on Reader Service Card.**

TY-SPEED SCREEN (498)

Catalog No. 96, "The TY-Speed Screen," is now available at The W. S. Tyler Co., 8200 Tyler Blvd., Mentor, Ohio 44060. This Tyler machine is designed to match each fine-screening job precisely. Its speed can be varied and its throw can be changed to suit the prevailing screening conditions. Maintenance is low and air pollution is controlled because of air seals and dust covers. Optional accessories include step washing plates and Ty-Electric heat. **Circle 498 on Reader Service Card.**

URANIUM PROSPECTORS' HANDBOOK (499)

A 95-page Uranium Prospectors' Handbook is available from Geophysical Instrument and Supply Co., 900 Broadway, Denver, Colo. 80203. The handbook has 22 chapters dealing with such subjects as: What is Radiation, Methods of Detecting Radiation, Where to Find Uranium, Mining Laws, Selection of Equipment and Assay. **Circle 499 on Reader Service Card.**

M-R PELLET (500)

A new booklet about highly metallized pellets developed as feed for electric furnace steelmaking is available from Midland-Ross Corp., 55 Public Square, Cleveland, Ohio 44113, requesting "M-R Pellet, A New Dimension in Steelmaking." The Midland-Ross process converts iron ore and ore concentrates into a 95-per-cent-metallized material, which is used as a replacement for scrap steel in electric furnace steelmaking. The material increases the production capacity of an electric furnace 35 per cent or more, the company reported. **Circle 500 on Reader Service Card.**

Send Us Your Bulletins

Send your publications to The MINES Magazine, 2177 W. 7th Ave., Denver, Colo. 80204, for review in these columns.

To all MINES readers these publications are FREE, and may be ordered by giving index number.

On requesting publications from manufacturers, please mention the MINES Magazine.

ELECTRIC POWER UNIT (501)

Multiple uses and savings delivered by the portable electric power unit, PEP IV, are illustrated and explained in a colorful new brochure from Power Electronics, Inc., 403 Main Building, Houston, Texas 77002. This compact power source is 4" x 4½" x 9½", fits under the instrument panel of practically any vehicle and delivers pulsating DC current for charging batteries, for operating power hand tools, for remote emergency light source and for checking defects in electrical systems. PEP IV, a 12-volt negative ground unit, is easy to install in about 20 minutes and powers AC/DC universal motors, operating off the vehicle's generator or alternator. **Circle 501 on Reader Service Card.**

SPECTROPHOTOMETRIC ANALYSIS (502)

A wall chart designed to simplify the selection of the correct solvent for spectrophotometric analysis has been produced by Beckman Instruments, Inc., 2500 Harbor Blvd., Fullerton, Calif. 92634. Bulletin 310 opens out to a 33 x 34 sheet suitable for posting on a wall near to a spectrophotometer. It includes IR, near IR, and UV curves for the company's 11 Spectro-Solv solvents as well as information on the solvents' physical properties, specifications, solubility, and uses. Since it is sometimes necessary or desirable to examine liquids or solids in solution, selection of the correct solvent will depend on the wavelength region to be covered. The chart shows the absorbance characteristics and useful wavelength ranges of each solvent, as it may often be necessary to use more than one solvent in separate scans. A twenfth graph shows the infrared "windows" of the various solvents for an easy, quick reference. **Circle 502 on Reader Service Card.**

GRADERS ON HAUL ROADS (503)

Motor graders used to properly maintain a haul road can increase scraper productivity as much as 22%, proves a test conducted by Caterpillar Tractor Co. and described in a new brochure (Form AEC18093) from the company. On a million-yard job, the motor grader could save $10,000 through increased scraper efficiency alone. Lower tire costs and reduced scraper repairs, a sizeable cut in overhead and greater scheduling flexibility are additional benefits. **Circle 503 on Reader Service Card.**

ELECTRODE FOR BUILD-UP (504)

A new 6-page catalog sheet in Rexarc's easy-to-follow format gives all the information necessary to select the best electrode for any build-up or hard-facing job. Rod size, nominal analysis, grain structure, physical mechanical properties, deposit properties, physical characteristics, welding procedures and typical applications are listed in detail for each of the 18 electrodes described in the new chart. (Rexarc, Inc., West Alexandria, Ohio 45381.) **Circle 504 on Reader Service Card.**

ADJUSTABLE SCRUBBER (505)

The unique Flooded-Disc scrubber, which has no nozzles to clog, needs no high water pressure, and has a turn-down ratio of more than 20:1, is described in a new 12-page illustrated bulletin published by Research-Cottrell, Inc., Bound Brook, N.J. 08805. The scrubber is used for in-process gas cleaning, product recovery, plant environmental control, and air pollution control, collecting dusts or mists or both. It can also remove gaseous pollutants. Applications include primary ferrous and non-ferrous production, foundries, mineral products production, pulp and paper production, and the fertilizer industry. The bulletin describes and pictures the scrubber's operating principle, and features, includes tables of dimensions and weights, and details applications. **Circle 505 on Reader Service Card.**

PROFITABILITY ANALYSIS (506)

"If yours is a typical company, you can be pretty sure that you have some customers and products that cost you more than they are worth —and other customers and products that you make more money on than you realize. The trouble is that you can't tell which is which." This is the view of Robert M. Sutton, a director of Drake Sheahan/Stewart Dougall, Inc., New York City, who claims that most firms know their costs to the penny down to the end of the production line, but are considerably less sophisticated in identifying costs beyond that point: costs of selling, order processing, warehousing, handling inventory, order assembly, packing, transportation. The solution to this problem, he says, and the way to turn "losers" into "winners" is a computer-engineering technique he has developed, called Profitability Analysis. His technique is based on such well-known industrial engineering techniques as time study and work sampling, an approach which produces specific numbers for the cost of a salesman's call, or the cost of processing an order through the office, picking stock for each line item, packing a shipping container, answering a customer inquiry, shipping orders singly or in consolidated lots, and so on. Copies of the issue of "Marketing for Profit" containing Sutton's explanation of Profitability Analysis are available without charge by writing to Burr W. Rupp, Director, Drake Sheahan/Stewart Dougall Inc., 330 Madison Ave., New York, N.Y. 10017. **Circle 506 on Reader Service Card.**

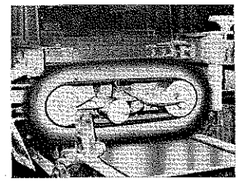
KELEX 100 (507)

Assembly and operation of a copper solvent extraction circuit is described in Technical Bulletin 1181 now available from Ashland Chemical Co., 8 E. Long St., Columbus, Ohio 43216. The publication, entitled "KELEX 100 for Copper Solvent Extraction," includes results of tests on several types of leach liquor processes. It also explains the reagent itself, its selective extraction of copper ions in leach liquors with a pH of one to three, and variations in efficiency. KELEX 100 was developed by Ashland Chemicals research and development personnel over a period of several years. The goal of their efforts was to synthesize an organic molecule which would strongly and selectively chelate copper ions in acidic solutions to form an oil-soluble complex stable in contact with an aqueous phase having a pH of about one. The resulting product, KELEX 100, shows economic utility attractive to mining operations. **Circle 507 on Reader Service Card.**

MAGNETIC ROAD SWEEPER (508)

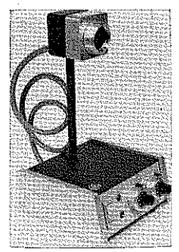
Answering a demand for an efficient magnetic road sweeper smaller and lighter than heavy duty electromagnetic models, Eriez Magnetics has developed a new permanent magnet sweeper which can, in effect, be turned on and off like an electromagnet. Designed to reduce tire punctures by clearing tramp iron from roads, airport runways, construction sites, mines, parking lots and other areas, the new Eriez Permanent Magnetic Road Sweeper is equipped with a magnet made of high strength Erium 25, a permanently magnetic material. **Circle 508 on Reader Service Card.**

With the Manufacturers



Conveyor Belt Cleaver (345)

Schaefer's new Model BBLD, S-VECO Conveyor Belt Cleaner prevents wear causing material to build up on conveyor idlers thus eliminating recirculation of imparted material. The Model BBLD consists of an electrically powered V-belt fitted with a brush of the customer's choice including long wearing nylon and stainless steel wire. It may be applied on conveyor belts of 18" and larger and the brush has a 5" width of effective linear cleaning area. **Circle 345 on Reader Service Card.**

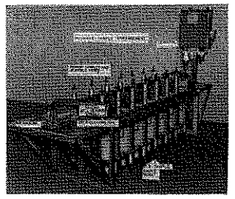


Laser Eye Receiver (346)

General Electric's newly formed Space Technology Products (P. O. Box 8439, Philadelphia, Pa. 19101), recently introduced its second highly sensitive laser receiver at the second Laser Industry Association Conference and Exhibit in Los Angeles, Calif. The new Laser Eye Receiver is a unique, low level optical pulse receiver specifically optimized for use at the 0.9 micron gallium arsenide laser wave length. **Circle 346 on Reader Service Card.**

Computer Directory (342)

A new computer directory that will speed the use of computer programming and eliminate costly duplication of efforts was published late in 1969 by CCM Information Corp., 909 3rd Ave., New York, N.Y. The directory, the ACM Joint User Groups Program Directory, lists detailed descriptions of more than 1200 programs available to members of user groups of most major computer manufacturers. **Circle 342 on Reader Service Card.**

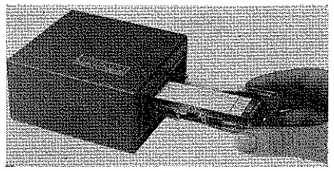


Denver Gang Sampler (348)

New Denver Gang Samplers are available for either wet slurries or dry material. The samplers have fixed cutters and the feed streams from a number of different sources are moved across the cutters at specified time intervals. Resulting samples are then programmed in rotation to the X-ray sensing head for a continuous reading of stream quality. **Circle 348 on Reader Service Card.**

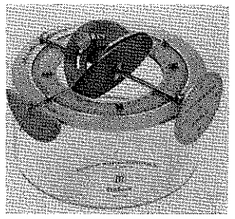
Robbins Model 41R Raise Borer (352)

The Robbins Model 41R Raise Borer is a 13-ton machine, electrically driven with hydraulic controls, which drills a 9⅞-inch hole down from an upper to a lower level. When a holing has been made the tricone cutter is replaced by a raise head which is reamed back to the upper level, producing a smooth-walled cylindrical excavation 48 inches in diameter. **Circle 352 on Reader Service Card.**



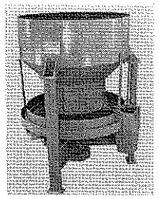
Eraser Clears Cassettes (354)

The new Voice-Master MX-500 Erase-O-Matic instantly wipes off all previous recordings on Memocord, Philips type C30, C60, Norelco 85, Mini-Memo, and other magnetic tape cassettes. The unit is service-free, and guaranteed indefinitely. (Audio Applications, Inc., 78 E. Palisade Ave., Englewood, N.J. 07631.) **Circle 354 on Reader Service Card.**



Mechanical Computer (349)

GeoComp is an easy to use mechanical computer for mining geologists to make strike and dip calculations from horizontal drill holes. It works on information set in for a known parameter such as the structure angle recorded on the core log, and a separate dial setting, known or assumed, such as the strike of the stratum. The other two angles, in this case the core orientation angle and the dip of the stratum, are automatically read out to an accuracy of 5 degrees. **Circle 349 on Reader Service Card.**



Automatic Feed Bin (356)

Prab Conveyors, Inc., 1807 Portage St., Kalamazoo, Mich. 49001, has introduced a new Automatic Feed Bin which resolves long-standing problems with materials that tend to "bridge" or "compact." Consisting of a hopper with capacities up to 10,000 pounds, the unit serves as a surge bin and provides any desired rate of output. **Circle 356 on Reader Service Card.**

Grouting Process (353)

ITT Rayonier Incorporated has commercially perfected a new chemical grouting agent called Terranier* to strengthen and seal ground formations which are unstable, or have a water-seepage problem, or suffer from both conditions. This chemical has a promising future in road, dam and building construction and repairs, as well as in tunneling and mining. **Circle 353 on Reader Service Card.**

Plant News

Gisler

Gisler Promoted to Manager Of Deco's Domestic Sales

Henry J. Gisler, internationally known metallurgist and former manager of DECO's Eastern Sales Division, has been promoted to manager, Domestic Sales Division, Joy Manufacturing Co., Denver Equipment Division. The announcement was made in Denver by General Sales Manager James E. Quinn.

Mr. Gisler's headquarters will remain in Denver. The company's Eastern, Central and Western Sales areas have been consolidated under the Domestic Sales Manager who has responsibility for performance of all branch offices.

With Bachelor of Science and Master of Science degrees in Metallurgy from the University of Idaho and the University of Utah, Mr. Gisler joined Denver Equipment Company's Ore Testing Division in 1937. He served for many years as chief metallurgist prior to his promotion to manager of the Eastern Sales Division.

Power Generating Facility To Be Located Near Fairbanks

Energy Co. of Alaska, a majority-owned subsidiary of Earth Resources Co., has authorized the awarding of a contract for final design, engineering and site-selection studies for its proposed refinery-electric power generating facility to be located near Fairbanks. The facility is to be built and operated by Energy Co. and should be in operation by fall of 1972 to coincide with the completion of the Trans-Alaskan Pipe Line System.

Timken's Rock Bit Operations Moved to Colorado Springs

As part of an expansion and consolidation program, The Timken Roller Bearing Co. will move its rock bit forging operations from Wooster, Ohio, to Colorado Springs. Currently rock bits are forged at Wooster, then shipped to Colorado Springs for finishing. A building will be constructed at the Fillmore Street location to house the forging equipment. The present rock bit manufacturing building will be enlarged.

Bougainville Orders Equipment From Allis-Chalmers Australia

Allis-Chalmers Australia Pty. Ltd., a subsidiary of Allis-Chalmers, has received an order for process equipment to be built for the huge Bougainville copper project in the Solomon Islands.

The order, which was awarded by Bougainville Copper Pty. Ltd., calls for the Allis-Chalmers subsidiary in Sydney to supply 22 "Ripl-Flo" vibrating screens to the $300 million complex.

In addition, Allis-Chalmers said that its licensee in Japan, Kobe Steel Co., Ltd., of Kobe has received a multi-million dollar contract to manufacture eight grinding mills and two gyratory crushers for the project. They will be built by Kobe according to Allis-Chalmers designs and specifications.

The grinding mills measure 18 feet in diameter and 21 feet in length and in respect to their diameter are the largest ball mills ever built for the mining industry. Steel balls tumbling inside the mills will pulverize the copper ore prior to concentration by flotation.

Copper Recovery Plants To Be Built in Magna, Utah

The Swindell-Dressler Co., a division of Pullman Incorporated, has received a multi-million dollar turnkey contract from the Utah Copper division of Kennecott Copper Corp.

The contract calls for Swindell to engineer and construct two copper recovery plants in Magna, Utah, approximately 15 miles west of Salt Lake City. Each of the plants will be capable of recovering up to 80 tons of copper concentrate a day from approximately 54,000 dry tons of mine waste. Field construction will start this Spring; completion is scheduled for 1971.

American Cyanamid Increases Pension Checks to Retirees

Approximately 3,000 American Cyanamid Co. retirees or their beneficiaries received an increase of 5% to 15% in their monthly pension checks, starting in January, 1970.

The pension increases range from 5% to 15%, depending on how long ago an employee had left the company. Retirees with less than ten years of service would receive a minimum monthly addition of $5.00, whereas those who had been with Cyanamid longer would receive a minimum increase of $10.00 per month.

Cerium Oxide Production

Production of high-purity 99.9-percent cerium oxide in truckload quantities by means of new solvent extraction process is announced by Molybdenum Corporation of America, world's largest producer of rare-earth materials for industry. Price reductions up to 75% have been made in both high-purity cerium oxide and chemicals.

The new production unit is on stream at the firm's York, Pa. chemical plant. It draws cerium concentrate feedstock from Molycorp's large bastnasite mining and separation complex at Mountain Pass, Calif.

Mt. Newman Iron Ore Project

John Payne, Jr., vice president for the AMAX Overseas Mining Activities Group, reported on progress on the Mt. Newman Iron Ore Project in Australia, in which AMAX has a 25% participation. He said that the mine, which began shipments on April 1, 1969, had produced 4 million tons of iron ore in 1969. Production in 1970 is expected to reach 12 million tons, cimbing to 19 million in 1971 and 30 million annually by 1975, "which is likely to make it the largest iron ore mine in the world," Mr. Payne said.

EARTH SCIENCES, INC. EXECUTIVES, President Douglas N. Stevens (left) and Vice President Duane M. Bloom overlook one of two newly constructed chemistry labs on the Colorado School of Mines campus. Dr. Raymond Bisque, CSM Chemistry Department head, (right), said that their $3,000 gift would purchase equipment for the new laboratories. Major emphasis of the chemlaunch program will involve pollution, with graduate chemistry students devoting the majority of their time to advanced research in direct application.

Personnel Placement

THE COLORADO SCHOOL OF MINES ALUMNI PLACEMENT SERVICE functions as a clearing house for alumni and former students who wish to receive current information about employment opportunities for which they may qualify. It also serves the oil, gas, construction and related industries and many government agencies by maintaining current listings of openings they have for qualified engineers, technical and management personnel.

Companies needing qualified men with degrees in Geological Engineering, Geophysical Engineering, Metallurgical Engineering, Mining Engineering, Petroleum Engineering, Petroleum Refining Engineering, Engineering Physics, Engineering Mathematics, and Chemistry are invited to list their openings with the CSM Alumni Placement Service, Guggenheim Hall, Golden, Colorado.

Listed below are coded references to the graduates of the Colorado School of Mines who were available for employment at the time this issue of The MINES MAGAZINE went to press.

Client's Code Number	Degree	Age	Marital Status	No. of Children	Preferred Fields of Work	Locality Preferred	Languages Spoken
MN 18	Mining	44	M	2	Mining-Metals Mill	Colorado	English
MN 19	Mining	34	M	2	Mining Engineer	Western U.S.	English
MN 25	Mining	28	M	0	Mine Engr./Submarine Mining	Southeast U.S./Alaska	English
MN 26	Mining	23	M	0	Engr. Management	Open	English
MN 28	Mining	39	M	2	Mining Engineering	West U.S.	Spanish/Portuguese
MN 29	Mining	51	M	0	Sales Management	U.S.A.	English
MN 30	Mining	26	S	0	Mine Exploration or Heavy Equipment	Alaska/Western U.S.A.	English
MT 41	Metallurgy	29	M	2	Metallurgical Engineering Management	U. S.	English
MT 42	Metallurgy	25	S	0	Sales or Technical Representative	Open	English
MT 43	Metallurgy	28	M	2	Metallurgical Engr./Nuclear Fuel Rod Mfg.	U. S. except N.E.	English
MT 44	Metallurgy	28	M	2	Mechanical Metallurgy	Open	English
MT 45	Metallurgy	33	M	5	Physical Metallurgy	Western U.S.A.	English
MT 46	Met. Eng.	28	M	0	Metallurgy or Related Fields	Rocky Mtn. West	English
GE 26	Geology	44	M	3	Petr. Geology	Foreign	English French
GE 29	Geology Eng.	37	M	0	Geological (Petroleum Exploration)	Alaska	English
GE 30	Professional Engineer	35	M	3	Engineering—Civil—Geology	Open	Thai, Spanish and English
GE 31	Professional Degree	25	S		Geological Exploration Development, Management	Western U. S. A.	English
GE 32	Geological Engr. N/A	35	M	3	Chief Mine Geologist or Senior Geol. Eng.	Western U. S. A. Will consider other	English
GE 33	Professional Degree	25	S		Mineral Exploration	Southwest U. S. South America	English
GP 15	Geophyics	49	M	3	Petroleum Expl.	Rocky Mountains	English
GP 17	Geophysics	34	M	1	Geophysics	Colorado	English
GP 18	Geophsyics	23	S	0	No Mgmt. Trainee	Rky. Mtn.	English
GP 19	Professional Engineer	24	M	0	Mineral Exploration	Southwest U. S. or South America	English
PE 10	Pet. Engrng.	48	M	2	General Management/Administrative or Financial	Open	English French (slightly)
PE 11	Pet. Engrng.	26	S	0	Pet. or Sales Engineering	Denver	English
PE 15	Petroleum	24	S	0	Reservoir Engr.	Rocky Mtn. Region	English
PE 16	Pet. Eng.	27	M	2	Prod. Engr.	Rocky Mtn., Canada or Alaska	English
PE 17	Pet. Eng.	34	M	4	Pet. Engr.	Open	English
PH 02	Physics	23	S	0	Engineering Physics	Rocky Mtn. Region	English
PR 11	Masters in Petroleum Refining Engineering Chemical	30	M	2	Management Systems	U.S.A.	English

Alumni Headliners


Klingmueller


Davison

Klingmueller's Fellowship Extended to July in Australia

LOTHAR MAX L. KLINGMUELLER, Geol.E. 1965, has just been notified that his Fulbright Fellowship has been extended to July at Macquarie University, North Ryde, N.S.W., Australia. He writes: "I have been in Australia nearly a year now, and at this time it looks like I might be here even longer than June, because I would like to finish all of my dissertation work in Australia."

Mr. Klingmueller is attached to Sydney's third and latest University, Macquarie. His home base is still the University of Arizona from which he received an M.S. in Geological Engineering in 1967 and from which he expects to receive his Ph. D. in the near future.

In a recent letter to Colonel Fertig, Lothar states that "the research I am now engaged in deals with the mineralization associated with the diapiric structures in the Northern Flinders Ranges in South Australia. Actually that part of Australia is similar to the Southwest, except that the 'gum' tree (Eucalyptus) takes the place of the various cacti plants. . . . Although you may not recognize me in the picture above, you may recall giving a couple of bearded seniors a push on the Safeway parking lot when our old and tired truck would not start."

Stanley C. Holmes Put in Charge Of Open Pit, Underground Mining For Phelps Dodge at Bisbee

STANLEY C. HOLMES, E.M. 1953, is now in charge of all open pit and underground mining operations for Phelps Dodge Corp. at Bisbee. He has been mine superintendent of underground mining operations of the Copper Queen Branch since Sept. 1, 1968. Since joining Phelps Dodge in 1953, Mr. Holmes has held positions of mucker, miner, shift boss, assistant pit shift foreman, assistant mine foreman, mine research foreman, and assistant mine superintendent.

R. P. Davison Named President Of Colorado Mining Association

ROBERT P. DAVISON, Geol.E. 1943, was elected president Feb. 14 of the Colorado Mining Association. He succeeds Douglas V. Watrous, E.M. 1940, of Idaho Springs.

Mr. Davison received his Geological Engineering degree in 1943 from the Colorado School of Mines and his law degree from the University of Colorado in 1950. He is a partner in the law firm of Holland & Hart in Denver. A veteran of World War II and of the Korean War, Mr. Davison has business associations in newspaper publishing, mining and milling, and life insurance.

Mr. Davison is a former mayor of Cherry Hills Village and has served for the past three years as chairman of the Denver Area Council for community colleges.

Gfellers Enjoy Retirement

Mr. and Mrs. Roy Gfeller, who designed and produced 100 field cases of a certain type for the **CSM Geology Department,** are looking forward to happy years of semi-retirement at their new home overlooking Flathead Lake on U.S. 93 in Polson, Mont. Products made by their family-type business range from simple leather laces and belts to instrument cases. Many of the products are purchased by the U.S. Forest Service; some have gone to the space program for use by astronauts.

L. M. Bonnefond Now Serving As Conference Coordinator

LOUIS M. BONNEFOND, Met.E. 1957, is now serving as conference coordinator at the Battelle Seattle Research Center. His responsibilities include planning and conducting an augmented program of technical meetings and conferences at the Center.

Mr. Bonnefond was employed as metallurgical engineer, primarily in the administration of technical contracts with the U. S. Atomic Energy Commission. He served as staff consultant with National Staffing Consultants, Inc., and later directed and supervised a program aimed at recruiting technical personnel for various organizations.

He served as professional specialist from August 1966 to July 1968 at Battelle-Northwest, interviewing and recruiting Ph.D. candidates. He was presented an outstanding performance award. In July 1968 he assumed responsibilities for Battelle - Northwest academic affairs.

From October 1968 to June 1969, he was manager of professional placement at Gulf General Atomic in San Diego.

Eugene E. Davis Observes 40 Years With Mountain Bell

EUGENE E. DAVIS, Class of 1929, plant engineer for Mountain Bell in Cheyenne, recently observed 40 years of service with the company. Born in Denver, Colo., Davis obtained his early schooling in that city, completed high school at Wheat Ridge, Colo., and attended the Colorado School of Mines.

He began his telephone career in Denver in 1929 as an engineering draftsman and after serving in various jobs in the plant department was promoted to junior engineer in 1933.

He was transferred to Wyoming in 1939 and to Montana in 1940. In 1941 he enlisted in the Army and was assigned to the amphibious engineers in the South Pacific.

Upon his return from military service in 1946 he was promoted to plant engineer in Cheyenne and with the exception of a brief assignment in Idaho in 1951 has been in Wyoming ever since.

Mr. Davis is a member of the Wyoming Engineering society, the Colorado School of Mines Alumni Association, the Masonic Lodge and the Telephone Pioneers of America. His hobbies are automobiles and automotive engineering.

R. A. Boyers Assumes New Duties At Williamsport, Pa. College

RALPH L. BOYERS, Geol.E. 1950, chairman of the Department of Geology and Geography at Williamsport Area Community College, Williamsport, Pa., has also assumed duties as assistant to the president for research. In this assignment, Mr. Boyers is responsible for assisting college personnel to update present curriculums and develop new ones to meet community needs, to improve existing teaching techniques, and to develop new methods of instruction specifically designed to meet community college needs.

He is also responsible for seeking funds from private foundations and state and federal agencies to support studies related to college research projects. He retains the academic rank of associate professor.

A native of Indiana, Mr. Boyers is a graduate of the Colorado School of Mines. He earned a master's degree from the Pennsylvania State University in 1962 and is presently a doctoral candidate in educational administration. He joined the local college in 1966 after 15 years as a geologist, engineer, and consultant in the petroleum industry and is a member of several professional geological and research societies.

Mr. Boyers is married to the former Stephanie Lockspeiser of this city. They and their three children live at 265 Lincoln Avenue.

Frank G. Horino Employed By U.S.G.S. in Denver

FRANK G. HORINO, Geol.E. 1944, is a geophysicist with the U.S. Geological Survey, Denver Research Center. He has written more than 20 geophysical surveys for clients and has published investigations on "Surface Texture of Rock," "Comprehensive Strength of Mine Pillars," and similar papers. In private industry Mr. Horina was party chief, seismologist and interpreter for 12 years before joining the U.S. Bureau of Mines in 1963.

About careers in Mining he says: "Very good—the adventures of travel plus the challenges and demands for metals and nonmetallics certainly stirs imagination."

E. M. Feely Petroleum Engineer For Sage Oil Co., Los Angeles

EDWARD M. FEELY, P.E. 1950, a veteran of nearly 20 years in the petroleum industry, has been appointed petroleum engineer by Sage Oil Co., Inc., of Los Angeles. In his new assignment, Mr. Feely will supervise Sage's drilling and production operations in the United States and Canada.

Mr. Feely, who resides at 460 West Doran St., Glendale, Calif., comes to Sage from Standard Oil Company of California, where he was area engineer for three years. Prior to that he was a consulting petroleum engineer in Ohio and a field supervisor with Kinsell Oil Co. of Denver.

A native of Denver, he received his professional degree in Petroleum Engineering from the Colorado School of Mines in 1950.

R. L. Wells Associate Professor Of Engineering at Univ. of Wyo.

RONALD L. WELLS, Met. E. 1959, a native of Hutchison, Kan., is a new associate professor of engineering at the University of Wyoming. Mr. Wells received his Metallurgical Engineering degree at the Colorado School of Mines, and his master's and Ph.D. degrees from the University of Denver. He is a member of Alpha Sigma Mu, Pi Tau Sigma, and American Society for Metals.

Prior to coming to the University of Wyoming, he was a scientific officer with the Central Intelligence Agency, an assistant professor at Texas A&M, a senior engineer with the Martin Company, a graduate research associate with the Denver Research Institute, and a junior engineer with the Ames Laboratory, U.S. AEC.

Someone dropped a rubber band into the office computer. Now it makes snap decisions.

Editorials

As It Looks to Me

THE Chicago Seven are dominating the news in a manner completely beyond their expectations. No action of theirs could have resulted in the coverage given them during the trial. Unfortunately, the defendants mistook this publicity as evidence of their influence. The defense lawyers and the defendants defiled the tenets of the legal system. In turn they were appalled when the Judge began sentencing each for contempt. Later the jury brought in a verdict of guilty, and Mr. Kunstler, the chief defense counsel, took to the microphone preaching continued disruption of every court where the activists were being tried.

The defendants held a press conference following their conviction and invited their followers to disrupt and demonstrate. Revolution is a word that this group has used frequently; yet none have considered the consequences. Seven more disparate leaders (?) could not have been gathered in one group. Comes the Day, the cat fights between the Seven would so decimate the ranks of their followers that none would survive as an important leader.

It is easy to speak of revolution—but better speak to one who has survived the chaos before embarking on such a cause. The early leaders of splinter groups are always the first victims. The final dictator arrives there over the bodies of his former colleagues and supporters.

The Chief Justice of the U. S. Supreme Court took notice of these problems as reported by Barry Schweid in **The Denver Post** of Sunday, Feb. 22, 1970. He covered the address given by Chief Justice Burger before the American Bar Association at their convention at Atlanta, Ga. Two quotes are important because they seem to confirm the opinion held by many Americans.

". . . that in multiple trial and multiple appeal cases the accused continues his 'warfare' with society for 10 years or longer.

"The Chief Justice said he had examined one such case and estimated that it cost about a quarter of a million dollars.

" 'The tragic aspect,' he continued, 'was the waste and futility since every lawyer, every judge and every juror was fully convinced of the defendant's guilt from the beginning to the end.

" 'It is a hard fact, however, that in the present state of the law there are more and more cases in which a defendant is tried and retried and re-tried again so that the trials and appeals may extend anywhere from two to five and occasionally as much as ten years.' "

The legal system of the United States has the last word to say on nearly every activity of our country. If the dissenters can destroy the respect of the majority for the system, then our country is truly in danger.

The present climate in our country is not revolutionary. The people seem to be simply fed-up with confrontation and agitation. —Wendell W. Fertig

Oredigger vs. Mines Magazine

Editor, Oredigger:

Enclosed is $5.00 for a one-year subscription to the **Oredigger**. You've certainly come a long way since we put out the paper. I think you're doing a great job. It's too bad I can't say the same thing for the school itself, or the alumni magazine. The school seems to be slipping farther and farther behind the times and the magazine is losing more and more donations and renewals by the alumni.

Your sample issue brought me more up to date on what's happening at Mines than 7 years of the Alumni magazine. Don't let anyone give you any crap. Keep it up.

Yours truly,
Jack Rivkin, '62 CSM

February 18, 1970

Mr. Jack L. Rivkin
316 Sound Beach Avenue
Old Greenwich, Conn. 06870

Dear Jack:

Your letter, which was printed in the Oredigger of February 17 was read with considerable interest. It is certainly your privilege to compare the two publications and to criticize the MINES Magazine. I have checked your file and during the time you have been out of school we have never had a word of criticism from you concerning the contents of the magazine.

Your letter said "— the magazine is losing more and more donations and renewals by the alumni." I do not know where you obtained this information but it is seriously in error. For that reason, I am writing to offer you the correct data.

1. Compared to 1968 the donations received during the year 1969 increased by almost 20%.

2. The average monthly print order for the MINES Magazine has increased from 4670 in 1968 to 4940 in 1969. The first two issues in 1970 have averaged 5150.

I am taking the liberty of reprinting your letter in the MINES Magazine together with a copy of my reply to you.

Sincerely yours,
Wendell W. Fertig
Publisher, Mines Magazine

5910 W. 14th Ave., Apt. #1
Lakewood, Colo. 80214
February 26, 1970

Wendell W. Fertig, Publisher
The Mines Magazine
Golden, Colorado

Sir:

It is not the policy of the former *Oredigger* staff to answer the numerous criticisms we receive. Such an attempt would be an exercise in futility; first, because such an attempt would leave us precious little time to do anything else, and, second, because few of our opponents are interested in meaningful dialogue.

Nevertheless, the increasingly strident attacks and misrepresentations in your magazine merit a reply. That you would actually misquote us in one of your editorials (i.e., " 'anti-administration' liberals") is bad enough, but the rambling allegations of your February editorial are clearly too much, for they promote the intolerance which leads to confrontation.

In that editorial you state "Further evidence of this crime when a reporter for the Oredigger . . ." Exactly what is meant by this is unclear, since you omitted the verb, but it is obviously some kind of accusation.

Exactly what Dr. Benjamin Spock or "living off the allowance given by 'the old man' . . ." has to do with student unrest, liberals, or the *Oredigger* is equally unclear.

However, it is abundantly clear, Mr. Fertig, that a great deal of unreasoned animosity is being displayed. Perhaps you feel Jack Yench and myself really are trying to destroy America and/or the Colorado School of Mines, but I think your readership deserves an alternate view.

In your editorial, you rejoice an imagined bloddying of the *Oredigger* ideological nose, supposedly performed by Math Professor Gene Woolsey. We realized when we interviewed Dr. Woolsey that he does not subscribe to our social philosophy. The article was printed because it was interesting, enjoyable, and intellectually stimulating.

You could do the same, Mr. Publisher. Let us debate, within the pages of your magazine, a topic of general interest.

As a tentative suggestion, such a debate could center on such topics as: "The role of an engineer in society," "Mandatory ROTC," "The 18-year-old-vote," or perhaps "Should CSM concentrate on 'mineral engineering' 'earth science,' or neither."

Note that "student activism" was not listed. Students are not as easily pigeon-holed as you think; generalizations are risky. Besides, neither Jack nor myself is any further "left" than Eugene McCarthy.

In the words of Gene Woolsey, "I think the confrontation is healthy."

Right on,
David Gulley

cc: file, the *Oredigger*, the *Technocrat*

(Editor's note: Colonel Fertig's editorial was printed on page 38, February 1970 issue of The MINES Magazine.)

Technical Societies

152 Attend Breakfast Sponsored by CSM Alumni And Colo. Mining Assn.

The Colorado Mining Association and the Colorado School of Mines Alumni were co-sponsors of the annual breakfast held during the Colorado Mining Association Convention. This year the breakfast was held on Saturday morning, Feb. 14, 1970, with 152 in attendance.

For the second year the breakfast has been open to the graduates of all Mining Schools and this year, in addition to the Colorado School of Mines, eight other Mining Schools were represented. These were Idaho School of Mines, MacKay School of Mines (University of Nevada), Michigan Tech., Minnesota College of Mines, Missouri School of Mines (University of Missouri at Rolla), Montana School of Mines, South Dakota School of Mines and Washington State School of Mines.

This is an annual event during the National Western Mining Convention and it is hoped that representation from all the mining schools will continue to increase.

Wyo. Mining Convention

Those planning to attend the Wyoming Mining Association Convention, June 18-20, at Jackson Lake Lodge, should make their room reservations prior to June 1. Assurance has been given that rooms will be available if requested prior to that date.

Offshore Meeting Schedules Discussion Of Recent Oil Spill

The costs of the recent oil spill in the Santa Barbara Channel, the National Science Foundation's Sea Grant Program, and the legal problems connected with the coastal regions of the U. S. will all be discussed during a technical session at the second annual Offshore Technology Conference. The Offshore Conference will be held April 22-24 at the Albert Thomas Convention and Exhibit Center in Houston, Texas.

The three topics will all be the subjects of technical papers to be delivered during a session on Thusrday morning, April 23. The session, entitled "Sea Grant Program," will feature six papers covering topics in the general area of management and financing connected with the development of the oceans.

AIME'S 99TH ANNUAL MEETING HELD FEB. 15-19 IN DENVER

THE American Institute of Mining, Metallurgical and Petroleum Engineers held its 99th Annual Meeting at the Denver Hilton Hotel Feb. 15-19. According to the Annual Meeting General Chairman, Edward H. Crabtree, over 4,500 engineers, scientists, educators and executives working in mining, metallurgy and petroleum attended from all over the world. Mr. Crabtree is director of the Colorado School of Mines Research Institute at Golden.

More than 300 technical papers were delivered during the five-day meeting. Four major symposiums were featured — Oil Shale, Hydrocarbons, Copper Metallurgy, and Light Metals. Attention also was focused on offshore mineral and energy resources in relation to national goals, and environmental quality and resource development. Key meeting sessions covered the regional impact of the mineral industry, issues of mineral policies in the United States, applications of economics to the minerals industries and problems of mineral resources availability. Other meetings treated management problems in engineering and construction of foreign ventures, and the worth of the engineer in salary.

This year, the Institute honored 13 of its outstanding members with the presentation of medals and awards at the Annual Dinner on Wednesday evening, Feb. 18, 1970. The awards and recipients were as follows: Honorary Member, Lloyd E. Elkins, production research manager, Pan American Petroleum Co.; Engineering Achievement, Vincent D. Perry, director and vice president-geology, The Anaconda Co.; Erskine Ramsay Gold Medal, Dr. Charles E. Lawall, retired vice president, Chesapeake and Ohio Railway; James Douglas Gold Medal, Dr. Reinhardt Schuhmann, Jr., head, School of Metallurgical Engineering, Purdue University; Benjamin F. Fairless Award, Edumund R. Martin, chairman and chief executive officer, Bethlehem Steel Corp.; Hal Williams Hardinge Award, J. R. Simplot, founder and president, J. R. Simplot Co.; Anthony F. Lucas Gold Medal, Henri G. Doll, retired chairman of the board, Schlumberger Well Services and current head, Doll Research, Inc.

Also, Charles R. Rand Memorial Award, Michael L. Haider, retired chairman of the board and chief executive officer, Standard Oil Co. (New Jersey); Robert H. Richards Award, Stuart R. Zimmerly, retired director, Kennecott Copper Corp. Research Center; William Lawrence Saunders Gold Medal, Elmer A. Jones, chairman, Lead-Zinc Producers Committee; Mineral Economics Award, Elmen W. Pehrson, retired professor of Mineral Economics, Columbia University School of Mines; Mineral Industry Education Award, Dr. Donald L. Katz, Alfred Holmes White, professor of Chemical Engineering, University of Michigan; and Rossiter W. Raymond Award, James H. Swisher, Research Department, Bell Telephone Laboratories.

In addition, 80 AIME members of the Class of 1920 were elected to the Legion of Honor Fifty-Year Member.

AIME presented 12 cash awards at the dinner. Each of the six Student Paper Contest winners received $250. The five faculty sponsors of the Outstanding Student Chapter Contest winners accepted $50 for his chapter.

The Annual Meeting marked the official installation of AIME's 1970 president, John C. Kinnear, Jr., vice president-operations, Metal Mining Division of the Kennecott Copper Corp Dr. James Boyd, president and director of Copper Range Corp., was the outgoing president.

AIME has over 45,000 members and is the international professional and technical organization for mining, metallurgical and petroleum engineers and scientists. The Institute was established in 1871 "to further the arts and sciences necessary for the economic production of the useful minerals and metals."

Dobbins Reelected President of AMC

Cris Dobbins, president and chairman of Ideal Basic Industries, Inc., Denver, has been reelected to a third one-year term as president of the American Mining Congress. Also reelected were four vice presidents: L. J. Randall, chairman, Hecla Mining Co., Wallace, Idaho; E. McL. Tittmann, chairman, American Smelting & Refining Co., New York City; W. A. Marting, president, Hanna Mining Co., Cleveland, and William Bellano, president, Island Creek Coal Co., Cleveland.

Address Changes

1900-1919

Herbert R. Hammond, '13. 12313-13th Helena Dr., Los Angeles, Calif. 90049
Madison F. Welsh, '14. 246 Montgomery St., Fall River Mass. 02720

1920-1939

G. F. **Kaufmann,** '21. Dogwood Drive, Yorktown Hgts., N.Y. 10598
Dr. J. Harlan Johnson, '23, 103 Trinity Circle, St. Francis Village, Crawley, Tex. 76036
Philip W. Simmons, '29, 1320 E. Gardner St., Las Cruces, N.M. 88001
J. Watts Scott, '31, Route 1, Box 126, Jemison, Ala. 35085
E. W. Markwardt, '32, 104 E. Monroe, P. O. Box 98, O'Fallon, Ill. 62269
Howard A. Wolf, '32, 8405-112 St. N., Bldg. 7, Seminole, Fla. 33540
Lester D. Knill, '33, 115 So. 3rd East, Apt. 103, Salt Lake City, Utah 84111
Clyde E. Osborn, '33, 5315 East Broadway, #104, Tucson, Ariz. 85711
Lt. Col. Robert T. Krueger, '34, 8500 W. 10th Ave., Lakewood, Colo. 80215
William Z. Bancroft, '36, 425 Fairview Ave., #34, Arcadia, Calif. 91006
Jean W. Pressler, '36, USAID (USGS), APO New York 09254
Herbert Z. Stuart, '36, 133 Newmarket Road, Garden City, N.Y. 11530
Albert C. Harding, '37, 10726 Hatcher Road, Sun City, Ariz. 85351
Robert L. Olund, '37, 6780 East Cedar Ave., Apt. 602, Denver, Colo. 80222
Raymond W. Snyder, '37, 270-700 6th Ave. S.W., Calgary 14, Alberta, Canada
C. R. Holmgren, '38, P. O. Box 1917, Estes Park, Colo. 80517
Wesley G. Moulton, '38, 2424 Harvard, Clovis, Calif. 93612
Stanley A. Wickstrom, '38, Route 3, Box 8-D, Marble Falls, Tex. 78654
Lewis D. Anderson, '39, P. O. Box 22, Hawaii Volcanoes Nat'l. Park, Hawaii 96718
William H. Breeding, '39, 7 Hanover Square, New York, N.Y. 10005
Charles R. Criss, '39, 113 Gordon Blvd., Apt. 98, Woodbridge, Va. 22191

1940-1959

Manuel C. Javellana, '40, 1069 Consuelo St., Singalong, Manila, Philippines
M. A. Patton, Jr., '40, 5714 S. Delaware Ave., Tulsa, Okla. 74105
Dr. I. Milton LeBaron, '41. P. O. Box 3808, St. Thomas, V.I. 00801
Norman V. Lovett, '42, 2638 N. Windsor Dr., #203, Arlington Heights, Ill. 60004

E. S. Rugg, '43, 412-510 W. Hastings St., Vancouver, B.C., Canada
Edgar F. Gerould, '45, 10911 W. 63rd Ave., Apt. 201, Arvada, Colo. 80002
Richard I. Kuehl, '47, Kalmthoutsesteenweg 54/1, B-2080 Kapellen, Belgium
John J. Carver, '48, 20 Coronado Court, Walnut Creek, Calif. 94596
R. B. Colman, '49, 700 Winfield Place, Modesto, Calif. 95350
Dr. Arthur W. Ruff, '49, Companhia Meridional de Mineracao, Caixa Postal 2857-ZC-00, Rio Janeiro, G.B., Brasil, S.A.
B. L. Bessinger, '50, P. O. Box 726, Moab, Utah 84532
John H. Church, '50, 10113 Dellwood, El Paso, Tex. 79924
Philip V. Doyle, '50, 1659 W. 2nd Ave., Durango, Colo. 81301
Lawrence A. Garfield, '50, 65 Hemlock St., White Pine, Mich. 49971
Robert E. Hudson, '50, 330 So. Center, Suite 205, Casper, Wyo. 82601
D. G. Little, II, '50, 21 York Ave. E. Ivanhoe, Melbourne 3079, Australia
David H. McMurrin, '50, c/o Mrs. D. L. McMurrin, R. #2, Box 805, De Land, Fla. 32720
Earl H. Ramsey, '50, 5097 Forest Bend, Dallas, Tex. 75234
Charles R. Carrington, Jr., '51, 210 Second N.E., Calgary, Alberta, Canada
Willie T. Kinoshita, '51, 792 Matadero Ave., Palo Alto, Calif. 94306
Robert I. Peters, '51, 925 Delaware S.E., Minneapolis, Minn. 55414
Robert A. Steele, '51, 7104-17th St., Anchorage, Alas. 99504
Bruce C. Wentner, '51, P. O. Box 1863, Tehran, Iran
Robert H. Fitch, '52, 15990 W. 74th St., Golden, Colo. 80401
Rustam H. Irani, '52, 249 No. Euclid Ave., #303, Pasadena, Calif. 91106
Murray C. McKinnon, '52, Central Del Rio Oils Limited, 205-9th Ave., S.E., Calgary 21, Alberta, Canada
Fred W. Ward, '52, Box 14, Star Rt. A, Anchorage, Alas. 99502
Foster J. Witthauer, '52, P. O. Box 135, Tyrone, N.M. 88065
Edgar T. Gaulke, '53, 112 Elwood St., Edmond, Okla. 73034
Howard C. Kaylor, '53, 1455 Belvedere, Beaumont, Tex. 77706
Donald H. Quam, '53, 32 Oban Road, City Beach, Western Australia 6015
Haldon J. Smith, '53, Pan Ocean Oil Corp., 515 Majestic Bldg., Denver, Colo. 80202
James H. Endacott, '54, c/o Courtage Occidental, 113 bisi Avenue de Nevilly, 92 Nevilly-sur-Seine, France
Carl F. Harpke, '54, c/o Amoco UAR Oil Co., P. O. Box 2409, Cairo Egypt, U.A.R.
T. Wilson Little, '54, 2513 Boyd, Fort Worth, Tex. 76109
Aldon H. Strobeck, '54, 1659 Country Club Dr., Redlands, Calif. 92373
Vance P. Burton, '57, 2028 Longview Dr., Ft. Collins, Colo. 80521
Robert H. Chase, '55, 1019 King St., Olean, N.Y. 14760
Moshe I. Ettinger, '55, Ministry of Development, Jerusalem, Israel
J. Don Thorson, '55, P. O. Box 338, Newcastle, Wyo. 82701
Ralph H. Dougherty, '56, 573 Surfside Drive, Pittsburgh, Pa. 15239
Carl R. Piercy, '56, 3581 Brook St., Lafayette, Calif. 94549
William Yopp, '56, c/o Mobil Sekiyu KK, Central P. O. Box 862, Tokyo, Japan
Alex Chisholm, '57, P. O. Box 333, Hibbing, Minn. 55746
Dr. Norman E. Goldstein, '57, 2383 S. Willow Court, Denver, Colo. 80222
John E. Litz, '57, 11010 W. 29th Ave., Lakewood, Colo. 80215
Z. A. Sancevic, '57, Apartado 80243, Caracas, Venezuela, S.A.
Sathit Tandanand, '57, 1359 W. Maynard Dr., St. Paul, Minn. 55116
Alves Badini, '58, Via Solferino 129, Pescara, Italy 65100
Richard E. Dawes, '58, 6823 Old Chesterbrook Rd., McLean, Va. 22101
James L. Elvis, '58, 169 E. Oak Cliff Court, Peoria, Ill. 61614
Donald Shaw, '58, 1124 Navajo Trails So. Dr., Indianapolis, Ind. 46260
Bert B. Davidson, Jr., '59, c/o Churny Co., 37 Medford St., Somerville, Mass. 02138
Fred H. Patterson, '59, 2100 Howell Branch Rd., Apt. 6-C, Maitland, Fla. 32751
Paul J. Ellis, '59, 1522 Robin Hood Lane, Johnson City, Tenn. 37601
Charles H. McKinnis, '59, 5170 East Asbury, Denver, Colo. 80222
James D. Shambach, '59, 161 Henry St., Apt. 10, San Francisco, Calif. 94114
Richard B. Egan, '60, 836 Forest Ave., Wilmette, Ill. 60091
John F. Evers, '60, P. O. Box 247, Laramie, Wyo. 82070

Class Notes

1930

W. P. Morris, E.M. 1930 & Medalist 1962, is president of Duval Corp. and a director of Pennzoil United Inc. Last year he received the Charles F. Rand memorial award from AIME for distinguished service in mining administration.

1934

William W. Little, E.M. 1934, is assistant general manager for Phelps Dodge Corp. with offices in Douglas, Ariz. Prior to Oct. 1 of last year, he was manager of the company's Tyrone Branch operations at Tyrone, N.M., where he directed the development of a new open pit copper mine, concentrator and related facilities. Mr. Little first entered the employ of Phelps Dodge in 1937 as a miner in the Copper Queen Branch operations at Bisbee, Ariz.

1935

Joseph B. Kennedy Jr., E.M. 1935 & Medalist 1964, has been named president of Imperial-American Resources Fund, Inc., and Imperial-American Management Co., subsidiaries of The Colorado Corporation, Denver, Colo. He was formerly executive vice president of Atlantic Richfield Corp.

1940

Marvin E. Gantz Jr., Met.E. 1940, is vice president, manufacturing—mill products, Aluminum Company of America. A native of Denver, Mr. Gantz has been with Alcoa since graduating from Mines in 1940. He was formerly vice president in charge of fabricating. He and his wife, the former Mary Esther Ivey, live at 102 Saxon Drive, McMurray, Pa. 15317.

1942

Charles E. Muller, Met.E. 1942, has been named to the newly created position of manager of manufacturing operations, Foundry Division at the Phillipsburg Plant of the Ingersoll-Rand Co. A native of Pueblo, Colo., Mr. Muller joined Ingersoll-Rand as a foundry engineer in 1942 following his graduation from the Colorado School of Mines. His address is 415 Oak Tree Lane, Easton, Pa. 18042.

1949

Eugene C. McMahan, Geol. E. 1949, is senior staff geophysicist in the Offshore Division of Shell Oil Co.'s New Orleans office. Joining Shell in 1949 as a junior geophysicist at Houston, Mr. McMahan has had assignments as a seismologist, seismic party chief, and geophysicist in Oklahoma, North Dakota and Texas. He moved to New Orleans in 1963.

Frank M. Monninger, Met.E. 1949, has been promoted to assistant manager of Chuquicamata operations of Chile Exploration Co. Mr. Monninger had been general superintendent at Chuquicamata since July 1967.

1951

Wesley H. Parker, Met. E. 1951, has joined Kaiser Steel Co as a process engineer-pelletizing at Kaiser's Eagle Mountain, Calif. mine. The Parkers' address is P.O. Box 672.

Marco J. Rossetti, Geol.E. 1951, has moved from Argentina to Balmat, N.Y., where he is assistant division manager of St. Joseph Lead Co.'s zinc mining and milling operations. He and his wife, the former Elena Tonkoglaz, and their three children are living in Gouveneur, N.Y.

1953

Stanley C. Holmes, E.M. 1953, is in charge of all open pit and underground mining operations for Phelps Dodge Corp. at Bisbee, Ariz. He was formerly mine superintendent of Phelps Dodge's Copper Queen Branch.

1957

Robert B. Steck, Met.E. 1957, is an account executive in the Asbury Park, N.J. office of Hayden, Stone Inc., international investment firm. He has held management positions with Titanium Metals Corp., National Lead Co., Westinghouse Atomic Power and Multi-Amp Corp.

1958

William C. Bagby, P.E. 1958, president of Five Resources, Inc., Houston, Texas. Address given is 265 Chimney Rock, Houston, Texas 77027. Congratulations, Bill.

Donald A. Beattie, M.Sc. 1958, had an important role in the Apollo 11 lunar landing mission. He is a program manager in the National Aeronautics and Space Administration's Office of Manned Space Flight in Washington, D. C. He and his wife, Patricia, live at 13316 Artic Ave., Rockville, Md. 20850.

1959

John T. Chandler, P.E. 1959, has been named vice-president of Deposit Guaranty Bank, Jackson, Miss. A native of Jackson, Mr. Chandler joined the staff of Deposit Guaranty on Jan. 20, 1968 as petroleum engineer. He is a registered professional engineer in the states of Colorado and Texas.

1960

George J. Beattie, E.M. 1960, is project manager for Callahan's mile-long tunnel from Daly Gulch to the Placer Creek area due north of Wallace, Idaho. The tunnel is expected to open up an entirely new and unexplored region which old-time geologists predicted would someday produce the richest mine in the district.

John F. Evers, P.E. 1960, is an assistant professor of Petroleum Engineering at the Univerity of Wyoming. Born in Topeka, Kans., Mr. Evers is presently working on his Ph.D. degree from the University of Kansas. He has been employed as an engineer for Atlantic Refining Co. and Mountain Fuel Supply Co.

Maj. Ronald A. Krizman, P.R.E. 1960, has received a Bronze Star for his Service in Vietnam. Major Krizman was awarded the medal at Yale University in New Haven, Conn., where he is an assistant professor of military science. His parents, Mr. and Mrs. A. L. Krizman, live in Leadville, Colo.

1962

Alex R. Jacobs, E.M. 1962, is a project engineer in Tucson, Ariz., for Smith Tool Co.'s industrial and mining industries.

1969

James M. Riddle, E.M. 1969, writes: "Please note that my address is now Croyden Apts., Apt. 17, Leadville, Colo. 80461. After seven months with the U.S. Bureau of Mines in Minneapolis, my wife and I decided we should get back where we belong, so I am now working for Climax in the Industrial Engineering Section. It's great to get back to Colorado!"

1969

Scott Sissman, P.E. 1969, is employed as a staff chemical engineer by Procter and Gamble Mfg. Co., in their Kansas City plant. Scott's home address is 8842 England, Apt. 201, Overland Park, Kans. 63212.

In Memoriam

Brown

Roy H. Miller

ROY H. MILLER, E.M. 1916, retired superintendent of copper refining for The Anadonda Co. in Great Falls, Mont., died in Great Falls on Nov. 22, 1969.

Born July 9, 1889, at Silvercliff, Colo., Roy (more familiarly known as "Doc") was graduated from Canon City, Colo. High School. He entered Mines in the Class of 1913 but was obliged for financial reasons to discontinue his scholastic training temporarily. During the next three years, he was employed as assayer and chemist by the Butte and Superior Copper Mining Co. in Butte, Mont. "Doc" re-entered Mines in the fall of 1914 and was graduated with an E.M. degree in 1916.

Mr. Miller joined The Anaconda Co. in 1916 and was transferred to Great Falls the following year when the new zinc plant opened. He was transferred to the copper furnace refinery in 1918 and became superintendent of that department in 1923. Later he became head of the electrolytic copper refinery and in 1929 became assistant superintendent of copper refineries. He served as superintendent from 1945 until his retirement on Jan. 1, 1958.

Mr. Miller was a member of the Great Falls Chamber of Commerce, Presbyterian Church, Kiwanis Club, American Legion, Elks Lodge, Red Cross, and the Colorado School of Mines Alumni Assn.

Survivors include his widow, Ella, Great Falls; son, Dale R., Dallas, Texas; daughter, Mrs. James F. (Carol) Bowen, Wichita Falls, Texas; brother, Guy E. Miller (also a graduate of Mines, E.M. 1919), Whittier, Calif.; sister, Dr. Edith I. Miller, Petersburg, Va., and three grandchildren.

Roland T. Litheredge

ROLAND T. LITHEREDGE, E.M. 1922, whose address has been unknown for the past several years, died in February, 1969, at his home in Michigan.

James E. Brown

JAMES E. BROWN, E.M. 1947, assistant manager, Fuel Department, Southern Services, Inc., died Nov. 19, 1969, in a Birmingham, Ala., hospital. He was a loyal member of the CSM Alumni Assn. and served for several years as president of the Birmingham Section. In 1966 he was finalist for AIME's Birmingham Engineer of the Year.

Born in 1921 in Bluefield, W. Va., Mr. Brown received his E.M. degree in 1947 from the Colorado School of Mines, where he was a member of Scabbard and Blade, Sigma Gamma Epsilon, and Beta Theta Pi. He was awarded a research fellowship at the University of Washington, obtaining his Master of Science degree in Mining Engineering.

After graduating from Mines, he worked for three years as a mining engineer with the Cardox Corp. For four and a half years he was superintendent of the Deerfield Mine, Pocahontas Fuel Co. In 1958 Mr. Brown became manager of Coal Operations, Southern Electric Generating Co., and seven years later (April 1, 1965), he joined Southern Services as assistant manager of the Fuel Department. He was a registered Professional Engineer in the states of West Virginia and Alabama.

During World War II Mr. Brown was a captain in the Marine Corps and participated in the campaigns of Guadalcanal, Okinawa and Iwo Jima. He was awarded the Silver Star with oak leaf clusters.

Mr. Brown was an active member of AIME, serving as chairman, Southeast Section, and as program chairman of AIME's Coal Division. He was chairman-elect of the Coal Mining Division of AIME.

Survivors include his wife, Ann Lankford Brown; two sons, James Brown, III, and Donald Brown, all of Birmingham, and a sister, Mrs. James Rose, West Brookfield, Mass.

Charles A. Masten

CHARLES AVERY MASTEN, a retired civil engineer for the U.S. Bureau of Reclamation, died Feb. 15 in St. Anthony Hospital.

Born June 7, 1889 in Denver, Mr. Masten attended Denver public schools and the Colorado School of Mines. He worked on the design of many reclamation dams built between 1925 and 1950, including Hoover, Eisenhower and Grand Coulee.

Survivors include his widow, G. Church; a son, Charles W., Boulder; a daughter, Mrs. Zoe A. Leppanen, Phoenix, Ariz., and five grandchildren.

Stouder

Robert D. Stouder

ROBERT D. STOUDER, Class of 1917, passed away Oct. 24, 1969, in Springfield, N. J. Services were held in St. Martin's Chapel of St. John's Cathedral in Denver with interment in Crown Hill Cemetery. Mr. Stouder was a long-time employee of American Smelting & Refining Co. and held many positions of responsibility with the company.

Born in Denver in 1896, Mr. Stouder attended Wheat Ridge High School and the Colorado School of Mines. In 1917 he was employed at AS&R's Globe Plant in Denver, transferring in 1918 to the Leadville Smelter as chief chemist. In 1926 he was employed as chief chemist at AS&R's Arkansas Valley Plant, and in 1928 was transferred to the company's Globe Plant, then a cadmium refinery. In 1940 Mr. Stouder was made assistant superintendent and chief chemist in charge of sampling, laboratory and cadmium recovery at the Federal Plant, Alton, Ill. From 1959 to 1962 he was research chemist at AS&R's Central Research Laboratories in Plainfield, N. J. When he retired in 1962 he had been with AS&R for over 44 years.

Survivors include his two sons: Philip E. Comstock, Belledune, New Brunswick, Canada, and Robert P. Stouder, Short Hills, N. J.; and two daughters: Mrs. Mildred A. Beggs, Cupertino, Calif., and Mrs. Jane E. Bleckley Washington, D. C. Mr. Stouder's wife, the former Eleanore E. Simpson, died in 1966.

Adam Thomas

ADAM THOMAS, Geol.E. 1952, died unexpectedly of a heart attack on Feb. 3, 1970. At the time of his death he was a consulting photogeologist in Houston, Tex.

The funeral service was held in Houston on Feb. 7 and another on Feb. 11, at his former home in Montrose, Colo., where he was buried.

An appreciation of this fine young man is being written by his two close friends and former partners, Clement Lehnertz and Bob Turley and will appear in the May issue of The MINES Magazine.

John R. Mullen

JOHN R. MULLEN, Class of 1938, general superintendent of mines, Atlas Minerals Division of the Atlas Corp., died suddenly January 8, 1970, in Moab, Utah.

Born in Denver, Colo., Aug. 11, 1913, Mr. Mullen attended Denver Public Schools and was graduated from Manual High School. He attended the Colorado School of Mines during the years 1935 and 1936.

After leaving Mines, Mr. Mullen was employed by the Colorado Highway Department. In 1939 he was employed by Climax Molybdenum Co. and served in various mining capacities over a 13-year period, advancing to assistant project engineer for the Storke Level Project.

During the next four years Mr. Mullen spent a short period with American Chrome Co. and, because of an interest in uranium mining, was employed by Beaver Mesa Mining Co. located on the Colorado Plateau, as general superintendent.

In 1956 he joined Hidden Splendor Mining Co., later to become a part of Atlas Minerals, operating in the Big Indian Mining District near Moab, Utah. Mr. Mullen was general superintendent of mines at the time of his death.

Mr. Mullen assisted in the development of the Southeastern Utah Section of AIME and served a term as chairman. Being active in civic affairs, he was serving a second term as a city councilman. As a licensed pilot, he enjoyed flying as a hobby and served in the Civil Air Patrol.

Mr. Mullen is survived by his wife, Fern; two daughters, Mary and Pat, and a son, Robert, of Wallace, Idaho.

Albert C. Norton

ALBERT C. NORTON, E.M. 1907, a consulting engineer and former city engineer for Madera, Calif., died sometime during 1969. Mr. Norton was a long-time and loyal member of the CSM Alumni Assn., and we regret that we have been unable to obtain additional facts about him.

Robert A. Martin

TRAGEDY continues to pursue the Martin family of Spokane, Wash. **Robert A. Martin,** E.M. 1951, was killed Sept. 2, 1969, in a traffic accident, and Robert's parents, Mr. and Mrs. **Armor B. Martin,** E.M. 1923 and Medalist 1952, were lost in a private plane crash in 1968.

Robert Martin, president and chairman of the Coeur d'Alenes Co., died in a Seattle hospital after the car he was driving hit the rear of a slow-moving semi-tractor trailer rig on Highway 90 near the summit of Snoqualmie Pass. His wife, Carol, and infant son, Nicholas, were injured in the accident.

A native of Montana, he was reared in Great Falls. After graduating from the Colorado School of Mines in 1951, he spent two years with the Army Corps of Engineers, including one year in Korea. He later graduated with a Master of Science degree in Civil Engineering from the University of Washington.

Mr. Martin came to Spokane in September, 1968, to succeed his father as chairman of the board of the Coeur d'Alenes Co. It was not until April, 1969, that the wreckage of the plane in which the elder Martins died was found. The pilot of the plane was also killed in the crash. Prior to coming to Spokane, Robert Martin was employed by Pacific Power & Light Co. in Portland.

Surviving Robert Martin, in addition to his wife and son, Nicholas, are three other children living in Portland, and a sister, Mrs. Donald Makela, Seattle.

Harry B. Williamson

HARRY B. WILLIAMSON, Class of 1927, died Oct. 1, 1969, in a Boulder hospital following an illness of about six weeks. Private services were held at Geddes-Hibbard Mortuary with the Rev. Ralph Henard of the First United Methodist Church officiating.

Born Aug. 10, 1903, Mr. Williamson attended Colorado A & M and the Colorado School of Mines. For two years (1926-1927) he was a chemist for Nevada Consolidated Copper Co. at Chino, N. M. From 1928 to 1932 he was employed as a mining engineer by Anaconda Copper Co. in Butte, Mont. He was a managing partner with his father in mining efforts in Boulder County from 1934 to 1959. The operation was centered mostly in Jamestown. Mr. Williamson was president and general manager of the Williamson Mining Co. in Boulder.

He was a member of First Congregational Church of Boulder and the American Institute of Mining and Metallurgical Engineers.

In addition to his widow, he is survived by a son, Harry R. Williamson of Torrence, Calif.; a daughter, Mrs. David J. (Joan) Crawford of Jamestown; three sisters, Mrs. H. S. (Hazel) Looper of Boulder, Mrs. K. H. (Marguerite) Colley of Santa Barbara, Calif., and Mrs. R. G. (Bertha) Jarrett of Baltimore, Md.; and six grandchildren.

Campus Headlines

McMechen

Gore

McMechen at Mines As Assistant Manager Buildings, Grounds

EDGAR R. McMECHEN, registered Colorado architect, has been appointed assistant manager — Buildings and Grounds at the Colorado School of Mines.

Mr. McMechen comes to Mines after being employed in the physical plant department at the University of Colorado.

After attending Colorado State College, he received his B.S. (Architectural-City Planning) from the University of Denver.

Active in the Elks National Foundation as chairman for the State of Colorado, McMechen resides with his wife, Catherine, and daughter, Patricia, in Lakewood, Colo.

Mines Professor Found Dead in Car

DR. JACK H. GORE, associate professor of Economics at the Colorado School of Mines, was found dead Feb. 7 near Meeker Lodge, 36 miles northwest of Boulder, in his car.

Dr. Gore had been an assistant professor of Economics at Mines from 1962 to 1965. During this time he received his doctorate from the University of Colorado. For three years, following 1965, Dr. Gore worked with a Boulder labor organization as an economic researcher, until his return to CSM in the fall of 1969 as associate professor of Economics. He had been active with the Democratic party both locally and nationally.

Dr. Gore, who resided at 4200 Hanover, Boulder, is survived by his wife and two children.

Doctor: "You've got a slight case of Dunlop's disease."

Patient: "Is it serious?"

Doctor: "Not very. Your stomach's done lopped over your belt."

Environmental Committee

A "Committee on Environmental Factors in Mineral Engineering" has been formed at the Colorado School of Mines under the chairmanship of Dr. Frank S. Mathews of the Physics Department.

The original membership of the committee, composed of faculty, administration, and a representative of the student body, was appointed by Dr. Albert W. Schlechten, vice president for Academic Affairs.

One of the chief aims of the committee will be to broaden its scope to involve all faculty and students who are interested in environmental problems.

The Committee will have subgroups for the specific purpose of encouraging and coordinating research efforts, curricular offerings, and general information efforts such as seminars and conferences.

Attention will be given to efforts already underway on the CSM campus. An example is the problem of tailings and mine dump material in Clear Creek, which has been for some time the subject of a study by Dr. Paul G. Herold of the Metallurgy Department, with the help of several graduate students.

Some encouraging results have been produced so far. Material from the big dump so prominent at the east end of Idaho Springs (by the old Argo Mill), when added to Colorado clays being used for structural products, has marked beneficial effects. It is possible that the dump can be utilized by ceramic companies to advantage, and at the same time the eye-sore on the landscape and the source of some of the roily sediments in Clear Creek will be removed.

"The growing interest in environmental matters among the faculty, administration, and students should stimulate participation in the work of the committee," Dr. Schlechten said.

High School Students Participate in Seminar

MORE than 300 junior and senior high school students participated in a one-day seminar of the Colorado-Wyoming Junior Academy of Science Saturday, Feb. 7, at the Colorado School of Mines in Golden.

The seminar entitled "Engineering Our Environment" was conducted for the North Central Zone of the junior academy of science. This zone includes the eastern frontal range of Colorado from Denver north.

Group discussions of water and air pollution, engineering problems, and other related subjects began at 9:45 a.m. following registration.

Concurrent seminar sessions took place during the morning, led by 13 scientists, teachers, and governmental officials. Students selected their sessions according to their interests.

A luncheon began at 12:45 p.m. in the College Union with guest speaker William Davidson, NASA representative to the Denver Division, Martin-Marietta Crop. Mr. Davidson talked about "Apollo—Circling the Earth and the Moon."

The afternoon program included the students' choice of several tours, including the School of Mines Computer Center, Geological Museum, several academic departments, and the Cecil H. Green Geophysical Observatory at Bergen Park. Other tours included the U. S. Geological Survey facilities at the Denver Federal Center, the Jefferson County R-1 School District planetarium, the Adolph Coors Co., and a geology field trip to Red Rocks and the Interstate 70 highway "cut" through the hogback nearby.

Oil Shale and Hydrocarbons Symposiums

The Sixth Oil Shale Symposium was held in conjunction with the Hydrocarbons Symposium at the Feb. 18 and 19 AIME in the Empire Room at the Denver Hilton.

This two-day event was jointly sponsored by the college, the Colorado School of Mines Research Foundation and AIME, under chairman Dr. James H. Gary, head of the Department of Chemical and Petroleum Refining Engineering at CSM.

Previous symposiums have dealt only with oil shale, but this year, the combination has brought about three major sources of synthetic fuels from coal, tar sand, and oil shale.

The programs were divided into three sessions, the first dealing with political and economical problems. During the first session, Senator Peter Dominick, one of the four speakers, spoke on "Legislation and Government Role in Synthetic Fuels Development."

The afternoon session on Wednesday dealt with the design and operation of oil shale retorting plants, the potential in-situ retorting of northwestern Colorado Piceance Creek Basin oil shale, shale oil resources in the Green River formation, and finally with the disposal and secondary uses of oil shale ash and spent shale.

The final morning session on Thursday dealt with specialized techniques in production of synthetic crude oil, coal liquefaction, and synthetic fuels industry based on Rocky Mountain coals.

The symposiums were concluded during a noon-day luncheon Thursday with Herbert M. Sampson, vice president, Corporate Development Northern Natural Gas Company of Omaha, Neb., speaking on "Some Solutions for Future Gas Supply."

Ph.D. Program InMathematics

The Colorado School of Mines has gained approval to offer the degree of Doctor of Philosophy in the Mathematics Department.

The go-ahead was given recently by the Colorado Commission on Higher Education after full study of the department's proposal.

The Ph.D. program will specialize in operations research and linear analysis in mineral engineering.

Operations research is important to management in developing new methods of exploration, recovery, and commercial processes; linear analysis represents the most comprehensive area of modern research in mathematics.

Dr. Joseph R. Lee, head of the department, said, "The long-range plans of the Colorado School of Mines indicate a continued emphasis on mineral engineering and concern for industrial, governmental, and educational progress in this area. I believe that mathematics, and especially the two major fields involved in our new Ph.D. program, will play an increasing part in this progress."

CSM Wrestling

Colorado School of Mines wrestlers were handed a 21-15 defeat by Colorado State University Feb. 11, at Fort Collins.

Mines was forced to forfeit the heavyweight event. Coach Jack Hancock commented, "We have suffered greatly this year, losing 11 of my starting 25 wrestlers." Injuries have plagued the Orediggers to the extent that their junior varsity team was forced to cancel their last two meets against Trinidad Junior College and the Air Force Academy JV. "We just don't have the back-up wrestlers to compete this year," Hancock said, "and it is alarming to know that Mines has never been forced to cancel out a season before in their modern history of wrestling."

Coach Hancock was best pleased with freshman Gary Geddes' (134) decision over Chuck Annand and John Funk's (126) draw with Gene Arnesen after returning, following a severe shoulder dislocation in November.

SEASON PLAY

Utah University 22, CSM 15
CSM 17, Fort Hays State College 15
University of Colorado 29, CSM 7
University of Wyoming 30, CSM 5
Colorado State College Tournament
—6th place out of 8 teams
U.S. Air Force Academy 33, CSM 2
Western State College 32, CSM 8
Adams State College 28, CSM 8
Colorado State College 32, CSM 0
Colorado State University 21, CSM 15

Colorado School of Mines Basketball Season

W-L	DATE	MINES	OPPONENTS	OPP. SCORES
W	12/ 3/69	58	Metro State College	43
W	12/ 8	75	Colorado State College	74
W	12/12	99	Rocky Mountain College	90
W	12/13	92	Rocky Mountain College	90
W	12/19	87	Metro State College	69
W	12/20	108	Metro State College	66
L	12/29	83	Grand Canyon College	91
L	12/30	79	Fort Hays State College	100
L*	1/ 9/70	90	Southern Utah State College	92
W*	1/10	101	Westminster College	81
W*	1/23	94	Western State College	85
W*	1/24	80	Fort Lewis College	76

*Rocky Mountain Athletic Conference games, mountain division

Weekend Sports Roundup

On Feb. 6 the Colorado School of Mines dropped their fourth RMAC conference basketball game to Western State College in Gunnison. Western State led with a comfortable 15 points during the first half, but the Orediggers came back cutting their lead to five after WSC's starting five were benched. At half-time both teams were tied at 42. During the second half the game continued in a trading of points until the last minute when the Miners who were only down one 83-82 witnessed Western State reeling off three straight baskets to increase their lead to 89-82 and a victory over CSM.

Eric Bryant of Western State was top scorer for the game with 23, while Mines was backed with Dave Roller who scored 21, and Chris Babbitt who picked up 18.

On Feb. 7 the opposite for the Orediggers occurred when Fort Lewis College fell 75-71 following a fantastic scoring record by Joe Butkovich of CSM who hit 14 baskets for 28 points.

Mines led at the half 36-32, but was forced to play headsup basketball during the final minutes as Fort Lewis attempted a late surge. Top scorer for Fort Lewis was Weatherspoon with 20 points.

In season play the Orediggers have an 11-8 season with a 5-4 record in RMAC play of the Mountain Division.

Mines placed second in their own triangular indoor track meet Saturday afternoon (Feb. 7) against Southern Colorado State College and Regis College. Southern Colorado State picked up eight first places to help bolster their 71 total points over CSM's 64 and Regis' 21.

Charles Crew, senior in Metallurgy, was the only Mines trackman to win two first places in both the 50-yard high and low hurdles. Crew ran the highs in 6.5 seconds which ties the 1968 record for Mines, followed by a 6.1 seconds for his first place in the lows.

From the Local Sections

Section news should be in the Alumni Office by the 20th of the Month preceding Publication.

SECTION	PRESIDENT	VICE-PRESIDENT	SECRETARY-TREASURER	TIME AND PLACE OF MEETING
Alabama Birmingham			Wm. Haynes, '54	On call of the president.
Alaska Anchorage			Reginald S. Y. Lee, '67 628 E. 5th Ave., Anchorage 99501	
Arizona Arizona	Guerdon E. Jackson, '52	William E. Saegart, '53	James D. Sell, '55 2762 W. Holladay St. Tucson, Ariz. 85706	Annual Meeting, Dec. 7, 1970, Western Motel, Tucson.
California Bay Cities	Carl Foget, '61	Dave Strandburg, '61	Tom Aude, '62 54 Woodford Drive Moraga, Calif. 94556	Meetings held on call of the Secretary.
Santa Clara Valley			Stanley Y. Ogawa, '53	
Sacramento	Gail Penfield, '56		F. B. Sweeney, '57 6619 Auburn Blvd., Citrus Heights	
San Joaquin Valley	R. A. Ganong, '47		B. A. Ellison, '61	
Southern California	Dick Richards, '62		Neal Schmale, '68, Sec.	
Colorado Denver	Earl Osting, '54	Allen McGlone, '54	Ted Seep, '68 2790 S. Steele St., Denver	Luncheon meeting held third Tuesday of each month, Denver Press Club, 1330 Glenarm Pl.
Grand Junction	Arch F. Boyd, '26	Robert H. Sayre, '34	Robert F. Barney, '35	
District of Columbia Washington	A. A. Wyner, '25	Louis DeGoes, '41	Charles T. Baroch, '23 2001 N. Daniel St. Arlington, Va.	Regular meeting at noon, second Tuesday of each month at the Shrine Temple, 1315 K St. N.W.
Illinois Great Lakes	C. R. Fitch, '49 7915 Exchange Ave. Chicago 17, Ill.			
Kansas Wichita	Francis Page, '39		James Daniels, '51 307 Schweitzer Bldg., Wichita, Kans. AM 5-0614.	Meetings called by secretary. Contact secretary for date of next meeting.
Louisiana New Orleans	John Petrocco, '50	Chas. D. Tyler, '53	Joseph L. DuBois, '50 Mobil Oil Corp., 1111 Gravier New Orleans, La. 70112	Regular luncheon meetings — last Wednesday of the odd-numbered month except July.
Lafayette	John J. Wallace, '51	Edward J. Gibbon, '68	Stephen D. Chesebro, '64 P. O. Box 51345 Lafayette, La. 70501.	Regular luncheon meetings at Lafayette Petroleum Club on fourth Thursday of each month.
Minnesota Iron Ore Range	Paul Shanklin, '49			
Missouri St. Louis	H. A. Dumont, '29 227 Crane St. Edwardsville, Ill.			
Montana Butte	John M. Suttie, '42 Continental Dr, Butte			
Nevada Northern Nevada	Paul V. Fillo, '40	H. R. Fitzpatrick, '36	James B. Bright, '52 1450 E. 2nd St. Reno, Nev. 89502	Meetings held four times per year at call of the Secretary.
New Mexico Carlsbad	John Magraw, '53			
Four Corners	Bill Cutler, '48		Lou Amick, '50.	Special meeting at the call of the president.
New York New York	Robt. B. Kennedy, '38	Board of Governors: Ralph Hennebach, '41 C. D. Michaelson, '32 C. Bellm, '34 R. B. Kennedy, '38	E. T. Benson, '33 1175 Broadway, New York, N. Y.	Meetings on call every month or six weeks from September to May, usually at Uptown Mining Club, 49th and Park Ave.
Ohio Central Ohio			Raymond M. Schatz, '35 Battelle Memorial Institute Columbus	
Cleveland	Bob Garrett, '45	Carl Nowak, '62	Richard Pitney, '60	Meetings held on call of president.
Oklahoma Bartlesville	G. T. McIntyre, '30	Bill Fredrick, '56	Charles Strong, '58 Box 336, Bartlesville, Okla.	Regular meetings held every Tuesday at noon, YWCA, 411 S. Johnston St. After September, group will meet every Friday.
Oklahoma City	Ed Johnson, '49 844 First Nat'l Bldg.			Regular meeting held at call of the president.
Tulsa	Todd C. Storer, '47		Jerry McLeod, '57 1708 East 60th Pl. Tulsa, Okla. 74105	Meetings held at call of the president.
Oregon Lower Columbia River Basin	Michael DiLembo, '58	D. H. Griswold, '30	Wendell Cloepfil, '62	On call of the president.
Pennsylvania Eastern Pennsylvania	Samuel Hochberger, '48	Arthur Most, Jr., '38 1345 Woodland Cr., Bethlehem		
Pennsylvania-Ohio	Vincent G. Gioia, '56		David P. Rihl, '58 Dravo Corp., Pittsburgh and Terrace Rd., Carnegie, Pa. 15106	Meetings held first Wednesday of each month (noon), Cafe "B," Golden Triangle YMCA, 4th and Wood Sts., Pittsburgh.
Texas Coastal Bend	Robert B. Owen, '51	Ray Gouett, '52	Charles R. Russell, '54 Petroleum Tower Corpus Christi, Texas	Luncheon Meeting — First Wednesday of each month at the Petroleum Club.
El Paso	Peter A. DeSantis, '51	William F. Dukes, '50	L. G. Truby, '48 4320 O'Keefe Dr. El Paso, Texas 79902	Meetings held on last Wednesdays of January, March and May. Special meetings on call.
Houston	John A. Jameson, '50	Ronald E. Diederich, '57	James K. Applegate, '66 Marathon Oil Co. 2300 W. Loop, South	Luncheon meetings held at 12 noon on first Thursday of each month at White Horse Cellar, 1211 Fannin St.
Permian Basin	Hal Ballew, '51	Harry B. Hinkle, '59	Al Wynn, '65 4313 Princeton, Midland, Tex. 79701	Meetings held in Jan., Mar., May, Sept., and Dec.
Dallas-Ft. Worth	Wallace Tucker, '49	Frank A. Ausanka, '42	Peter H. McQueen, '50 2129 Hildring Dr. West Ft. Worth, Texas	Meeting held on call of president.

Denver Alumni Section Sponsors Meeting Before AIME Convention

The Denver Local Section meets regularly on the third Tuesday of each month at the Denver Press Club, 1330 Glenarm. A few days before the AIME Convention began Ted Seep, '68, suggested that the Denver Section should invite visiting Miners to their regular luncheon.

Notices were posted at the AIME registration desk where a large number signed up. However, no one had any idea of the number that would actually try to attend. Lunch was served to about 140, while at least another 100 dropped by for a drink and conversation before going back to the convention.

Jim Darden, basketball coach, reviewed the activities of the current season and developed the personalities of the men who make up his team.

Dr. Orlo Childs accepted the invitation to answer questions from the group and there were many. The meeting lasted until almost 2 o'clock. Those who attended had an opportunity to meet old friends and learn what is happening at MINES.

The Golden Office wishes to thank the Denver Local Section for their energetic sponsorship of this exceptionally fine meeting.

Life Members of CSM Alumni

Neil Mac Neill, 7M. 1914; D. D. Riddle, EM. 1918, and S. Y. Ghorpade Met. E. 1962, have become life members of the Alumni Foundation.

Permian Section Meeting In Midland, Tex., Feb. 11

On Feb. 11 Premain Section of the CSM Alumni Assn. had its so-called "Business Meeting" with wives present, a talk by Walt Powers '39 on his trip to Samoliland and then Bingo as promoted by Stan Schaeffer '41.

New officers elected for the coming year were as follows: President, Hal Ballew, '51; V. President, Harry Hinkle, '59; Sec.-Treas., Al Wynn '65.

CSM Alumni Section in Calgary Will Host Luncheon June 23

On Tuesday, June 23, during the A.A.P.G. Annual Meeting, a Colorado School of Mines Alumni luncheon will be held at the Calgary Petroleum Club from 12:00 to 1:30 p.m. Tickets will be available at the registration desk for $3. However, if an alumnus misses the opportunity to pick up a ticket, a call to 267-4430 in Calgary will provide a reservation.

R. C. Siegfried is President of the Colorado School of Mines Alumni Chapter in Calgary.

SECTION	PRESIDENT	VICE-PRESIDENT	SECRETARY-TREASURER	TIME AND PLACE OF MEETING
South Texas			William A. Conley, '19 1515 Haskins Rd. San Antonio	Meetings held at 7 p.m. on first Thursday of February, May August, November at Old Town Inn, 416 8th St., San Antonio.
Utah Four Corners	See N.M. for officers			
Salt Lake City	Allen D. Trujillo, '62	Wallace W. Agey, '48	Carl D. Broadbent, '64 5750 Glenbrook St. Salt Lake City, Utah 84121	Four meetings annually on dates set by officers.
Washington Pacific Northwest	Sidney B. Peyton, Jr., '54		Boyd Watkins, '64 10427 Aqua Way S. Seattle, Wash. 98168	
Eastern Washington			Arden Bement, '54	Meetings on call of president; annual August picnic.
Wyoming Central Wyoming			George S. Rogers, '59 3209 Aspen Drive Casper, Wyo. 82601	
Canada Calgary	Richard C. Siegfried, '50 Canadian Superior Oil Ltd. 703 6th Ave., Calgary Tel.: 267-4110 Local 429			Calgary Section meets for a noon luncheon on the 3rd Monday of Sept., Nov., Jan., Mar., May—at Calgary Petroleum Club. Visiting alumni invited to attend.
France	Resident or visiting alumni may contact Bernard Turpin, '60, 33 Rue de la Tourelle, 92-Boulogne, France.			
Libya	Haldon J. Smith, P.E.53, Corresponding Secretary, Derbasi-Geode Co., P. O. Box 529, Tripoli, Libya.			
Peru	Martin Obradovic, '53			Meetings first Friday of each month (April thru December), 12:30 p.m., Hotel Crillon. Other meetings on call
Philippines Bagulo	Francisco Joaquin, '26			
Manila	J. R. Kuykendall, 41	Jesus Jalondoni, '40	M. E. Natividad, '40 c/o Northern Motors United Nations Ave., Manila	Meetings held at noon, second Tuesday of each month.
Puerto Rico	Resident or visiting alumni may contact L. L. Hagemann, '60, Apt. 17, El Monte Apartments, Avenida Munoz Rivera, Hato Rey, Puerto Rico.			
Turkey Ankara	Alumni visiting Turkey contact Ferhan Sanlav, '49, Turkiye Pet trolleri A. O. Sakarya Caddesi 24, Ankara, Telephone 23144.			
Venezuela Caracas	Z. Sancevic, '57	Jean Pasquali, '60	Ian Achong, '58 Cia. Shell de Venezuela Aptdo. 809, Caracas	

Advertisers' Listings

Book Reviews

Technical Career Index

A new study, detailing the current salaries, benefits and personnel policies of nearly 500 major American companies has been published under the title **Technical Career Index.** This report also contains a candid description of current on-campus recruiting procedures and provides advice to the new college graduate on company evaluation and selection.

The **Technical Career Index** was compiled by Professor James L. Lubin, director of Placement at Newark College of Engineering. Professor Lubin is also the author of the recent **Lubin Report,** a graphically-presented statistical summary of the salaries, benefits and personnel policies of major American employers.

Both the **Technical Career Index** and the **Lubin Report** are published by Padric Publishing Co., Box 393, Bernardsville, N. J. 07924.

MGS Publications

Four new publications are now available from the Minnesota Geological Survey at the University of Minnesota.

"The Cryptostome Bryozoa from the Middle Ordovician Decorah Shale, Minnesota," a booklet by Olgerts L. Karklins, sells for $3.

"The Geology of the Middle Precambrian Rove Formation in Northeastern Minnesota," by G. B. Morey, is $2.

"The Geology of the Isaac Lake Quadrangle, St. Louis County, Minnesota," by W. L. Griffin and G. B. Morey, is $2.

The fourth publication, a map of Embarrass Quadrangle, St. Louis County, Minnesota, by W. L. Griffin, is $1.00.

These publications can be obtained by sending a check or money-order to Minnesota Geological Survey, University of Minnesota, Minneapolis, Minn. 55455.

Energy's Tomorrow

"Future Energy Outlook," Colorado School of Mines. Paper-bound, 8½ x 11 inches, 147 p. $4.00 (1969). Dept. of Publications, **Colorado School of Mines,** Golden, Colo. 80401.

Here is a worthwhile collection of eight major addresses given in a symposium on the outlook for energy during the 53rd Annual Meeting of the American Association of Petroleum Geologists in Oklahoma City, April 22, 1968. Widely known authorities provide separate presentations on petroleum, natural gas, coal, oil shale, tar sands and other bitumens, nuclear sources, geothermal energy; and a commentary on interfuel competition.

Mineral Industry

A Decade of Digital Computing in the Mineral Industry is a new technical book recently published by the Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. (SME of AIME). It covers the proceedings of the International Computer Application Symposium held in Salt Lake City in September 1969.

Edited by Alfred Weiss, the book presents a comprehensive and authoritative look at the whole spectrum of computer applications and operations research in the mineral industry.

Mr. Weiss is director of the Scientific and Engineering Computer Center of the Metal Mining Division of Kennecott Copper Co. in Salt Lake City. He was assisted by scores of international science and engineering leaders in persenting this outstanding work.

The 952-page hard cover book, with illustrations, indexes, and glossary, is a penetrating guide to the salient activities of the mineral industry in the use of digital computers. It affords a keen insight into techniques, such as "Kriging," popular abroad but not here.

In addition to providing answers to hundreds of questions in the mineral industry, the book offers a means of reviewing the state of the art after ten years or gaining an understanding of digital computing. The scope of the volume is international.

The list price for **A Decade of Digital Computing in the Mineral Industry** is $23. It is available to AIME members for $18. Orders should be sent to AIME, 345 East 47th St., New York, N. Y. 10017.

Science Thesaurus

Vital to the development of information systems for professional and scholarly rseearch, a new computer-based thesaurus series will begin publication this month, it was announced by CCM Information Corp., a subsidiary of Crowell Collier and Macmillan, Inc.

The first thesaurus to be issued will be the **Engineering Index Thesaurus** compiled by Engineering Index, Inc., a major indexing service sponsored by professional engineering societies.

The new series has been established to increase the availability of the many new thesauri being developed for computer-based information systems. The thesaurus series is under the direction of Dr. Maurice F. Tauber and Dr. Theodore C. Hines of the School of Library Services at Columbia University where both have been active in subject analysis and applying computer techniques to Library and information sciences.

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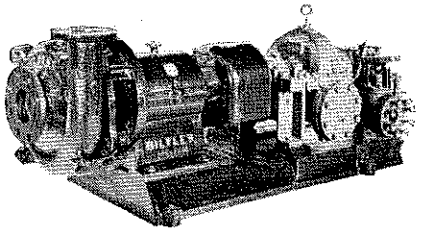

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