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Conversations With Nobel Laureates

by Sasha A. Cobb

Recently, two Nobel Prize recipients, Dr. Rosalyn Yalow and Dr. Wally Leontief, spoke at Colorado School of Mines on technological change and science in the service of man. Both have championed dogmas in their respective fields--both for physicists and problem solvers, and both believe in human innovation. But more importantly, both Dr. Yalow and Dr. Leontief have accepted the responsibility of questioning not only the basic elements of their work, but also the implications of their contributions and breakthroughs. Imlications which are as controversial as they are important: nuclear power, radiation hazards, and ethics of scientists, planning, unemployment, and allocation of natural resources.

Q. How can the United States avoid a nuclear war?

Dr. Yalow: There is only one way: rely on energy from nuclear power plants. Current nuclear reactors are already running our national arsenals in response to the situation in Iran. I am afraid that there will be a nuclear war unless we become independent of Middle East oil. I am sure that President Carter with his background in nuclear physics does not encourage the development of nuclear energy.

Dr. Leontief: I would much rather live in a world with a nuclear power plant next to a nuclear power plant than a coal-fired plant. Coal is dirty, coal power plants pollute and the pollution cannot be controlled.

Q. Is coal a viable, temporary or other- wise, energy source?

Dr. Yalow: I would much rather live in a world with a coal-fired plant. Coal is clean, coal power plants pollute and the pollution cannot be eliminated without prohibitive costs.

Dr. Leontief: If we want others to use nuclear power plants, we must be planned.

Q. Are nuclear power plants safe?

Dr. Yalow: Nuclear power plants can be run safely; as a matter of fact, people are exposed to more radiation during radiology treatment or during flying from New York to Denver than at Three-Mile Island.

Dr. Leontief: Breakthroughs result from looking at the same problem differently, like Sol Benson and I did with respect to insulin, one makes new discoveries by working on various leads which cannot be planned.

Q. What is the solution to the effective disposal of nuclear waste?

Dr. Yalow: There seems to be a gulf in the communications between scientists and politicians, do you agree?

Dr. Leontief: Yes, as I have said before, the scientists are much to blame for not actively seeking to work with the politicians to make technological advances properly understood.

Q. Should scientists be "superspecialists"?

Dr. Yalow: As a scientist, I must be neutral with respect to political opinions, but not as a person.

Q. How do you encourage the use of input-output analysis?

Dr. Leontief: In your view, what is the solution to the problem of unemployment?

Dr. Yalow: I think the solution is education and planning.

Q. How do you encourage the use of input-output analysis?

Dr. Yalow: Dr. Leontief asked how do you encourage the use of input-output analysis. I think the solution is education and planning.

Q. Can we really control unemployment?

Dr. Leontief: It is absolutely necessary; with a plan it is simple to have reasonably full employment. We must plan for the consequences of policies reasonably full employment.

Q. You mentioned unemployment, Dr. Leontief. Can we really control unemployment?

Dr. Leontief: In the less-developed countries, unemployment is inevitable, but in the more-developed countries, we can control it with a shorter work week, higher wages--a direct transfer of labor to capital.

Q. How long do you think it will be before input-output analysis will be used in the United States?

Dr. Leontief: One hundred years.

Q. How do we encourage the use of input-output analysis?

Dr. Leontief: We already have an input-output model for the world. It is a difficult problem, but it can be solved.
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China's Petroleum Industry—Geology, Reserves, Technology, and Policies

by A. A. Meyerhoff

The People's Republic of China is the world's most populous nation (official estimate of 975.2 million in 1978) and the third largest in size (9,457,385 sq km), after the USSR and Canada. Three main energy sources fuel the nation—coal (68%), petroleum (30%), and hydroelectric power (2%; Table 1). Although China possesses some experience with nuclear power and uranium resources are available, it seems unlikely that nuclear energy will play a major role in China before the year 2000.

Petroleum is assuming a steadily greater role within the energy mix, and production reached 2,080,000 bbl per day during 1978 and 2,120,000 bbl per day during 1979. Because production is greater than refining capacity, China needs hard currency for foreign purchases, approximately 240,000 bbl per day was exported in 1979. This amount will increase during the next few years, but will not reach the large volumes predicted for the mid-1980's. China's offshore geology is far more complex than originally believed, and the offshore potential is relatively small—perhaps only 15-30% of China's ultimate production. The largest undeveloped petroleum potential in China today is onshore, particularly in the northern and northwestern basins. A final reason is that China needs the petroleum for itself—provided that sufficient refining capacity can be constructed.

To develop its petroleum resources China will need large amounts of foreign technology. Much of this technology will be of United States design, although individual units may be of non-U.S. manufacture. China does not intend to become reliant on another foreign power for technology, as happened with the USSR during the period of 1949-1960. China also intends to do most of the actual exploration and production, although foreign contractors may be allowed to participate during the initial stages.

There are several reasons for the shift toward a more petroleum-oriented economy. First, in many parts of the country, particularly in the southeast, petroleum is a cheaper energy source. Second, transportation always has been a major bottleneck in China, and new discoveries in the southeast, closer to industrial centers, simplify the supply situation. Third, the modernization of industry, agriculture and transport requires liquid fuels in increasing quantities.

Much of what is forecast here depends on the survival of the nation's...
Shale-oil production declined as an energy source in some areas during the fuel crisis in China since the beginning of the 1970s. Not only was offshore production of both offshore and onshore basins being pursued, but the use of salt mines as storage and production bases. Drilling for salt was conducted for centuries. In 211 B.C., a large field was discovered near Chungking, the gas was flared and used to light street lamps. Later, in the Tang dynasty (618-906), the first commercial field discovered in China was an oil seep in the Ordos, coastal Yellow Sea, China. The gas was flared and burned to light street lamps and in the palace of the Tang emperor. Drilling for salt was continued until the 19th century. The first commercial discovery in China was made in 1955, when a gas field was discovered near the town of Langchow in the province of Gansu. The gas was flared and used to light street lamps.

Coastal basins of Korea Bay, the Yellow Sea, East China Sea, South China Sea, and the Gulf of Tonkin contain around 40 oil fields. Some are active, and one field produces 35.3 million barrels of oil per day. The basins are not fault bounded. The structural trends within these basins are controlled by the tectonic structures close to them. The fields do not have a large potential for future production because of the small size and complex character of the productive structures. The production is from northwest China strata—of the Jurassic-Cretaceous Sungliao basin. The region contains around 40 oil fields, which are not fault bounded. The structural trends within these basins are controlled by the tectonic structures close to them. The fields do not have a large potential for future production because of the small size and complex character of the productive structures. The production is from northwest China strata—of the Jurassic-Cretaceous Sungliao basin. The region contains around 40 oil fields, which are not fault bounded.
present "out-looking"-looking policies and programs. Because of (1) the slow de-
velopment of both offshore and onshore petroleum resources, (2) the limited supplies of foreign exchange, and (3) the very large amounts of coal which are available in many areas, coal production will continue to be a major energy source—though not the major energy source—during the foreseeable future.

History

Coal has been an important source of fuel in China, although the record is not fully rec-
dorded. History. Gas and oil* became
the major energy source—during the
revolutionary regime was firmly
Japan, and the offshore deposits are
coal and gas. The Tsaidam basin, east of the
be drilled in 211 B.C., a
the drilling for salt. In 211 B.C., a
source beds of nonmarine, continental
seeps have been known since
millions of bbls of oil and 1.0
of oil has been used for energy for many
separately. Production of new onshore
century ago and is continental. The basin
the Chrysanthemum anticline, west of modern
coastal and offshore areas. Two
agreement at the 1958 Rio meeting, and the
1950's, oil and gas were exploded by wooden
are now known and gas was found in the
industrial and in the threefold position of
and gas was found in the.
shale oil and gas are used as feedstocks for
with help from
The first commercial field discovered by
the Dzungaria basin. By 1945, eleven
reserves were found in that basin during
the Sungliao basin, and the basins of the
production is in
the Chinese have sent samples of San
retaining characteristics of east-west-striking fault
the Chrysanthemum anticline, west of modern
production to date in
confirmed in the basin by 1949. A

Oil and gas pipelines within these basins will continue to have
some fields with refineries in the
entire coastal length, and a few are
by rail to the more central
under the influence of tectonic movement. The oil in
been completed. Eight new discoveries by 1960, when Soviet tech-
century ago and is continental. The gas is shut in for lack of pipelines and a
the Dzungaria basin, but the oil is taken from the
in the oil production from the Sungliao basin, and 30.2% from the Po
well drilled for gas
major of the offshore areas.
for use in the lower Pliocene and Quaternary ages. These fields are
refined from the Sungliao basin, and 30.2% from the Po
recognized as an energy source.
and gas continued to be a major energy source—if

Table 1. Chinese Primary Energy Consumption, 1950-1977 (Meyerhoff and Willums, 1978a)

<table>
<thead>
<tr>
<th>Year</th>
<th>Coal (10^6 million tons of coal equivalent)</th>
<th>Oil (10^6 barrels)</th>
<th>Natural Gas (10^6 cubic feet)</th>
<th>Percent Share in Total Energy Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>338</td>
<td>28</td>
<td>10</td>
<td>99</td>
</tr>
<tr>
<td>1960</td>
<td>339</td>
<td>26</td>
<td>10</td>
<td>95</td>
</tr>
<tr>
<td>1970</td>
<td>345</td>
<td>24</td>
<td>10</td>
<td>81</td>
</tr>
<tr>
<td>1977</td>
<td>351</td>
<td>22</td>
<td>10</td>
<td>66</td>
</tr>
</tbody>
</table>

*B the term "petroleum" is used here to
corporate history. Gas and oil* became
the first organist to use it as fuel during the
1970's, oil and gas were exploded by wooden
were known since
millions of bbls of oil and 1.0
of oil has been used for energy for many
separately. Production of new onshore

* the term "petroleum" is used here to
include both natural oil and gas. Shale oil
is heated separably in the

concentrated around the basin margins. Examples of such basins are the
the rise in oil and gas production has
been steady in China, but has
dependent upon oil production.

The rise in oil and gas production has
been steady in China, but has
dependent upon oil production.

GEOLOGY AND GEOLOGIC CONDITIONS

The Chinese petroleum industry probably is
approximately equal to that of the
to the oil industry. The
and geological conditions are
major oil field is the
the Taching oil field. The
offshore basins are known from the onshore and off-
formation by 1900.

The rise in oil and gas production has
been steady in China, but has
dependent upon oil production.

The rise in oil and gas production has
been steady in China, but has
dependent upon oil production.

Other Basins

Four areas of oil discovery in late
and early Metorozoic include the
the development of both offshore and onshore
The rise in oil and gas production has
been steady in China, but has
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Production and Reuse

The rise in oil and gas production has
been steady in China, but has
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The rise in oil and gas production has
been steady in China, but has
dependent upon oil production.
The gas estimate is likely to be without basis in geology or geophysics. "East" are press speculations that have been described by Willums (1975)-30 billion based on the computer model reserves are uncertain, but 200 Tcf is a speculative. Estimates of onshore gas are covered by sand and therefore uncertain and were calculated from information, and were calculated from the number of known drilled and un-drilled surface structures. Because large areas of the north and northwest are covered by sand and therefore suitable for oil and gas production, the 42-4 billion-bbl figure is conservative. Of this amount, more than 5 billion bbl has been proved, and production has passed the 774-million-bbl peak year. Only about 11 billion bbl of proven plus probable reserves remains. The difference—26 billion bbl—is potential or speculative. Estimates of onshore gas reserves are uncertain, but 200 Tcf is a realistic figure.

Role of Foreigners in Chinese Petroleum Development

China cannot develop its petroleum resources to the degree that it wishes without large influxes of foreign capital and high technology. To this end, several Western and Japanese companies will do extensive offshore geophysical studies in the hope of obtaining a role in the exploration for and exploitation of China's offshore reserves. Large-scale development of the remote interior basins will also require technology assistance. The question of how much foreign participation will be permitted is still very much "up in the air." China's long-term policy is to be self-sufficient in both exploration and exploitation. All mineral resources are the property of the state, and this policy will not change significantly in the foreseeable future. China has purchased or copied more offshore rigs, and has replaced most of its oil business with high technology (turbodrills and seismic equipment). Much of China's future depends on the future direction of Chinese policies—both internal and external. At present, however, even with the "looking outward" group in power, the prospects for significant exports by 1985 are slim.

Domestic Demand and Exports

Domestic demand currently is about 1,880,000 bbl per day, and exports are about 240,000 bbl per day, mainly to Japan. Only recently has refinery capacity caught up with domestic demand. The presently exported oil goes principally to Japan, with smaller amounts to North Korea, the Philippines, Hong Kong, and Thailand. Some Chinese crude will be sold to other circum-Pacific countries, including the United States. The volume of exported oil, however, is not large. Some writers have predicted that China will be a major oil exporter—1,000,000-2,000,000 bbl per day—by 1985. Production for the mid-1980's has been predicted at 6,000,000 bbl per day, but a 4,000,000 bbl per day figure seems more realistic in view of the low discovery rate and the increasing delays in developing the offshore. It is unlikely that China will export much more than 1,000,000 bbl per day by 1985. China has the geologic potential to develop 6,000,000-7,000,000 bbl per day of production by the late 1980's, but the present slow progress offshore, the remoteness of the huge interior basins, and the huge capital expenditures, will be required to finance both offshore and interior basin operations place such large-scale development beyond China's reach of its financial and technical capabilities. A more serious problem concerns China's future political policies. The likely "looking outward" group still will be a powerful force in Chinese politics. This group wishes to develop China slowly and to keep most of its oil for domestic purposes. The present "looking outward" group wants to develop China rapidly, and to this end desires to export larger volumes of oil and other materials for hard currency to purchase technology. Much of China's future depends on the future direction of Chinese policies—both internal and external. At present, however, even with the "looking outward" group in power, the prospects for significant exports by 1985 are slim.

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Arthur A. Meyehoff has attained world-wide fame in the petroleum industry and through geological exploration and the writing of his eighteen books. He has been associated with a number of companies, the USGS and was professor of geological sciences at University of Chicago for some years. He is currently a partner in Meyehoff and Co., Inc., in Tulsa. He is a member of a number of professional societies and has published extensively in various professional journals.
Production of tin (in concentrates) from the countries of the free world is estimated to have been approximately 196,000 metric tonnes during 1979. There are some differences of opinion concerning comparison between supply and demand of tin metal (which has to take into account the factors of stocks and speculative trading) but consumption of primary tin metal is estimated to have been slightly lower than production for last year.

A breakdown of production figures from non-Communist countries for the year 1979 is not available yet, but percentages of this production are likely to be in the following pattern, judging from the preliminary half-yearly figures.

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>32%</td>
</tr>
<tr>
<td>Thailand</td>
<td>16%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>14%</td>
</tr>
<tr>
<td>Bolivia</td>
<td>14%</td>
</tr>
<tr>
<td>Australia</td>
<td>6%</td>
</tr>
<tr>
<td>Zaire</td>
<td>2%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>1%</td>
</tr>
<tr>
<td>Other countries combined</td>
<td>15%</td>
</tr>
</tbody>
</table>

100%

The importance of Southeast Asia as a source of tin, with 62% of the free world's primary production, can be seen.

Tin is one of the few commodities that is covered by an agreement, the International Tin Agreement negotiated under UNCTAD, designed to stabilize the supply and price in relation to the demand. The fifth I.T.A. is currently in force, with each Agreement lasting five years. The Agreement is generally recognized as being the most successful of all commodity agreements.

Malaysia Mining Corporation is a holding company with controlling interest in a number of publicly quoted tin mining companies in Malaysia and Thailand. Its sister company, Pernas Charter Management is responsible for the overall management of these mining companies. The group controls and manages a total 41 dredges, four of them offshore, and one open pit mine, which together produce approximately 12% of the free world's output of tin.

Occurrence and Exploration

In S.E. Asia tin occurs almost exclusively in its oxide form, cassiterite. The most common associated minerals are ilmenite, monazite and zircon. The first two are recovered and sold as by-products, whereas there is a little commercial demand for the quality of zircon occurring. Gold is found only in a few localities, as is struvite.

Hardrock mining for tin is not carried out on a significant scale in the region since the deposits occur predominantly in alluvial form, and many are considered eluvial in nature. Primary mineralization, from which the alluvial deposits were later derived, is considered to have occurred when the granitic magmas, which now form the main range of the Malayan Peninsula, intruded marine deposited limestone and shales during the late Mesozoic era.

Subsequent erosion and weathering has created alluvial deposition in what are now both offshore and onshore loose sedimentary strata. These mostly overlie eluvial or weathered granitic bedrock, or the older limestones, or schists that were metamorphosed. The thickness of known mineralized deposits can range from a few feet up to over 300 feet, although current alluvial mining technology places an economic limit at around 200 feet. Offshore, a significant proportion of this depth may be seawater.
Examinations methods include the geophysical location of anomalies, detailed examination of isolated faults, and the geotechnical characteristics of the immediate vicinity, particularly for offshore construction. Onshore, geophysical prospection for suitable locations and the geotechnical characteristics of the area are widely used.

Detailed examination of the area will be conducted by Bangka chain drilling, either mechanically or manually operated, depending on accessibility with the heavier components. Onshore evaluation is done from a boring barge and utilizing a vibracore for deposits up to 20 feet thick which are not too compact, or a mechanism Bangka drilling for the thicker and more compact sediments.

If a bucket boring indicates encouraging results, infilling is carried out. A grid of 8 x 8 chains is sufficient to prove a deposit of evenly distributed grades, whereas a 4 x 4 chain grid or less is necessary for erratic values. Values are traditionally stated in decimal parts of a local unit.

The results are infilled with the lighter components. Offshore conditions. Suction cutter dredges have generally not been found to be efficient in recovery of heavy minerals, but various designs of submerged bucket-wheelers are currently under investigation by the tin mining industry. In the offshore areas of some countries in the region there are small scale miners who operate, usually illegally, by using various suction devices with or without divers.

The principal evaluation in the design of bucket line dredges over the past two decades has been towards greater digging capacity, and more extensive and efficient treatment capacity. This has reduced costs per cu. yd. and improved recovery, particularly of the fine material, and has put into the economic category deposits that were previously considered sub-economic.

A typical new dredge being designed and constructed presently would have a pontoon hull 320 feet long by 90 feet wide with a 9-foot draft. The digging ladder with its chain of buckets would be designed to reach only to bedrock of the intended area; maximum digging depth is limited to about 100 feet below the padock water surface, due to the size and weight of components, but increased depth can often be obtained onshore by reducing the padock level and dry-stripping ahead of the dredge. Close-connected buckets of 24 cu. ft. capacity would dig at a typical rate of 20 buckets per minute at a typical efficiency of 87% digging efficiency.

A bucket dredge excavates in a series of benches underwater so as to maintain a stable face of advance. The dredge works a face of approximately 1200 foot width, in three sections, moved by a long heading holding the digging buckets into the face, and traversing from side to side at 3 to 5 feet each bench by winching itself on a side bow and stern line on each side. The advance of each bench is typically 15 feet and excavation of a bench is carried out by lowering the ladder 15 to 1 foot with each traverse of the 400 foot section of the dredge being worked.

As each bucket in the chain, or band, reaches the driving upper roller it tips over to discharge its spoil into a drop chute. High up in the treatment plant on both sides of the slip-way a scuttle is open in the drop chute to enable all material to by-pass the treatment plant and be discharged astern of the dredge via a stripping chute. When the dredge is treating however, all ore is fed through the padock via parallel trommels. Each trommel of our new dredge is 9 feet in diameter with 3/8 inch perforations over a typical length of 50 feet, and has high pressure jets delivered from a sparge pipe running up the centre of the trommel. Over-size is discharged immediately over the stern of the dredge, while undersize is collected into a hopper and fed evenly by gravity through a distribution spltter to the primary jigs.

If the ground to be worked is assessed to have 40% 250 trommel oversize, this new dredge would have 45 primary 4-cell jigs of modified Yuba design. Tailings from the primary jigs are immediately disposed of far enough as to not cause re-digging and recirculation.

Hutch products from the primary jigs are then elevated by pumping the slurry to a secondary jigs, and any material in excess of these is again treated on tertiary jigs. The dredge concentrate as derived from the primary jigs runs at approximately 30% cassiterite by weight and constitutes the feed to be transported by pipeline to a number of the secondary jigs. These are planned ahead as and when necessary, and are then also carried out on three shifts. Regular maintenance is carried out as far as possible while operating and during two 'stopday' periods of approximately 6 hours each twice a week. Major repairs or modifications which require an extended shutdown are planned ahead as and when necessary, and are then also carried out on a daily basis.

A typical new dredge will cost over $10 million to design and construct, excluding other necessary mine facilities and infrastructure. Permas Charter Manager agement will cost estimate and design such a dredge, producing detailed equipment specifications, and oversee the installation of equipment and components simultaneously. The contract hull is constructed initially on a slip-way, and then launched into a dock; fabrication and erection of the superstructure and installation of equip­ment and components subsequently takes place on the floating hull. The time required to design and complete the construction of a new dredge is 2 years.

Milling

The mill is traditionally termed the 'finishing'. With the bulk of the feed from the dredges running between 30 and 250 mesh B.S.S., no initial comminution is necessary. Hydroclassification is the usual initial process. Dredge concentrates from many locations contain a high proportion of one, or more of the by-products, and in these circumstances wet magnetic separation is carried out early in the flowsheet to extract the bulk of this mineral material. Flowsheet flowsheet separation procedures using hydraulic up-rush classifiers, shaking tables, and sluice-plate separators, these pre-concentrate most of the cassiterite in their...
Smelting and Marketing

Many of the larger corporate mining companies, and practically all the smaller miners sell their tin concentrates directly to one of several smelters located in S.E. Asia, available to world markets.

Management

The management of the Malay Mining Corporation group of companies is the responsibility of Pernas Charter Management. Continuous operating management is the main role of P.C.M. and staff is provided for this both at mine location and at the supporting and marketing offices. In addition the company is responsible for all aspects of engineering design and construction, exploration, and feasibility studies for these companies.

Smelting services provided include mining, mineral processing, mechanical, and electrical engineering, geological and prospecting expertise, purchasing facilities, secretarial and accounting functions, share registration, personnel management, security control, and communication services.

In addition to its regular marketing functions P.C.M. undertakes specific assignments in all aspects of alluvial mining both for companies within the group and at request from other clients.

Michael D. Russell, E. M. ’53, is an Executive Director of Pernas Charter Management, an organization which operates the world's largest group of publicly owned mining companies. After graduation he started work as a Shift Engineer in Malaysia, where his family also has other business interests, with Anglo-Oriental which was a forerunner of P.C.M. Over the intervening years he progressed from Area Mining Manager, Mine Manager, Area Manager, and Operations Director to become Chairman of Anglo-Oriental. That company merged in 1978 with Associated Mines, also based in Malaysia, to form Pernas Charter Management.

Peter I. Bediz, ’41, ’42
Bediz Exploration Consultants Ltd.
Geological Consultant—Copper
1510 8th Street S.W.
Phone (403) 262-2826
 Calgary, Alta. Can.

ADOPTIVE INVOICE NO. 1073
COPPER CONCENTRATES (in Bulk) loaded
No. 2" on October 30, 1979.

PROVISIONAL INVOICE NO. 1073
SOLD TO: A New York One Buyer
COPPER CONCENTRATES
SHIPPED 375 Tons
Produced at the Minesite

Metal marketing is an aggregate of functions connected with procuring concentrates from producer to consumer, buying, selling, storing, transporting, standardizing, financing, and supplying market information.

Prospectors, geologists, miners and metallurgists have carried on the search for mineral deposits and have exploited them to supply the needs of mankind. The following is from an American Mining Congress publication: “Without minerals, we could not till our soil, build our machines, supply our energy, transport our goods or maintain any society beyond the most primitive.”

The fossil fuel, iron, was the precursor of precious trade mediums such as gold and silver. Extensive amber deposits were mined along the shores of the Baltic Sea. Flint, amber and salt—found in quantity in Sabbatt, Austria, were the major commodities of commerce 3,000—2,000 years B.C. This trade surely became the forerunner of marketing functions, probably by barter—“I'll trade my flint point spear for your amber necklace and six hands full of salt.”

An early silver baron was mined in Laurium, Greece around 480 B.C. and for centuries these state owned mines enriched the treasury of Athens. Did the early earth's major group of silver mines played an important role in preserving Greek civilization, against incredible threats, from waves of attacking Persians? Not only were Persian Oriental traditions repulsed, but Athens long held a silver monopoly in the Mediterranean world.

The early treasury gave Athens a sustained economic growth that enabled Newton's call Greece's Golden Age of Commerce and Culture. Here was an early development of metal smelting when the trade by barter of commodities began to be replaced by establishing a silver standard of value.

A generous distribution of silver in a great many of the world's on deposit was a catalyst in developing an industrial demand for metals past its primary production. This low last has culminated in causing silver to crash through the $5.00 per ounce barrier in the third and fourth quarters of 1978, skyrocketing to over $22 per ounce for a one day high in late 1979. (End Note: As of this writing, the price is $19.75.)

An October, 1979 shipment of a Pacific Beon producer of a silver bearing copper concentrate brought a London Metal Exchange (LME) settlement of $15 per troy ounce. 85% of the silver content was paid. It carried a total refining charge of about $0.15 per ounce and a $0.20 refining charge deducted from the $15 base settlement. These miscellaneous charges are variable and dependent upon mutual agreement between seller and buyer. The silver was part of the residue, including gold, other noble metals and minor amounts of various metals below copper in the electrolyte series, that dropped as anode sludge (slimes) in the tanks during the electrolytic refining stage of copper from (flotation) anode cake to cathode.

A $0.50 treatment charge per dry metric ton of concentrate, including cream freight and handling of the material from shipper's loading port to the Smelter's unloading port and all marine insurance amounting to 0.20255 of estimated value of the shipment, was deducted from net metal payment. Since the concentrate contents were settled on LME monthly averages of refined, marketable metal, all refining costs for each metal were deducted in the computation presented in the provisional invoice settlement. 90% immediate provisional drawing is customary, with the final invoice and balance of payment coming some 90 days later.

The pertinent figures of the provisional invoice are set forth below.

| Copper: 24.10% | 2,556,414.52 Lbs. | $2,031,838.26 |
| Silver: 1,600 oz | 4,811,500 | ($0.20 refining + $0.15 seller/buyer contract) | ($0.20 refining + $0.15 seller/buyer contract) |

Provincial: Copper 5.20% (net $0.003/Lb. refining charge from anode to cathode) | $1,131.72 |

Gold, the eternal treasure. The largest gold nugget ever found weighed 83 kilograms (183 pounds). Its fine gold content in December, 1979 would have been worth in excess of $1 million but the size of that huge nugget would bring many times its metal value as a museum piece as part of a normal display.
Looking at the gold settlement sheet of recent shipments, the potential is obvious:

PROVISIONAL INVOICE NO. 1072
SOLD TO: New York Ore Buying Company

COPPER CONCENTRATE
SHIPMENT #375
Produced at the Mine

COPPER CONCENTRATES (in bulk, treated and trimmed) shipped per MS "Ocean Wave No. 2" on October 30, 1970.

Quantity: Shipped Weight—2,500,000
Wet Metric Tons (Moisture 6.35%) = 4,811,500 Dry Tons

Value: $2,375,562.72 90% Provisional Invoice Price = $2,138,066.45

The foregoing settlement figure became a technical adjustment" after receiving $438 per ounce on the Zurich metal market a few weeks before. 33 cents an ounce for days after this $390/oz on the LME, it was back at $424/oz, and it sold on the world bullion markets at $524/oz. December 31, 1970, in 1971, having $27/oz. one year earlier.

Consolidated Gold Fields (South Africa) review, "Gold 79," reported: "It is certain that the acquisition and use of bullion will prove a constant feature of the industry." In the form of surplus stocks due to world overproduction, the world market for copper—a summary is stated as follows:

One of the main benefits of the metal exchanges such as LME (London Metal Exchange) and Comex (New York Commodity Exchange) is the establishment of common prices which provide highly positive terminal markets for some of the world's major metals.

Most of the newly refined copper is sold at prices which are fixed exclusively by producers or at prices which are related to quotations on one of the commodity exchanges.

The problem of marketing our accumulated concentrates was resolved through shipments for new markets—The People's Republic of China, totaling 25,300 WMT of concentrates by the end of 1976.

1976-1977. Price volatility became the feature of this six-year period attributed to a series of small and moderate increases in consumption, higher costs of operation, marketing problems caused by political difficulties in Zambia and Rhodesia, labor problems in Chile and particularly the 1976-1977 U.S. copper strike.

1977-1972. Price averages for the two years were $1.0255/kg ($0.445 lb) and $0.9813/kg ($0.4452/b) respectively, continuing for many months in the doldrums until a steady rise ended the price range up in 1972.

1973-1977. The company's output was sold at an average $1.668/kg ($0.7577/b) and $1.091/kg ($0.494/b) respectively for the two years. All sales represented sharp gains over previous levels but in the second semester of 1974, an economic slowdown of increasing severity ensued, triggered by the four or five fold increase in petroleum prices. 1975 will surely be a challenging year with a depressed copper market, and demand rising costs.

1975-1976. Copper concentrate markets were in some instances cut back—in our case 15% in 1975 and subsequently extended through 1977. Average prices received were respectively, $1.162/kg ($0.5273/b) and $1.404/kg ($0.637/b). The problem of marketing our accumulated concentrates was resolved through shipments for new markets—The People's Republic of China, totaling 25,300 WMT of concentrates by the end of 1976.

1977-1978. Average prices received were respectively, $1.296/kg ($0.585 lb), $1.349/kg and $1.349/kg ($0.612/b). Despite the current extremely low copper price there is a recently developed demand for copper concentrate due to closure of a number of producing mines in several areas of the world. As of this writing the forecast of copper prices for 1977 appears to have justified.

Arthur J. Wilson in the recent book, "Gold and the Monies", Mining Journal Books, Ltd., discussed the pricing of metals with particular emphasis on copper—a summary is stated as follows:

One of the main benefits of the metal exchanges such as LME (London Metal Exchange) and Comex (New York Commodity Exchange) is the establishment of common prices which provide highly positive terminal markets for some of the world's major metals.

Most of the newly refined copper is sold at prices which are fixed exclusively by producers or at prices which are related to quotations on one of the commodity exchanges.

There has been some confusion with the cramping of the producer system in the USA following adoption of Comex as a reference price for some of the major exchanges.

In addition, renewed attempts are being made by the governments of copper mining countries in the developing world to evolve new formula aimed at bringing some stability into what has historically been a highly fluctuating market.

As with the marketing of any other commodity, the laws of supply and demand must be the root of all metal trading. The exchanges should reflect this balance at any one time, but they do so only in relationship to the tonnage which is sold on any particular Exchange. In the case of copper, this is a very small proportion of world primary production.

The producer price system for copper tends to establish a price which is not strictly determined by supply and demand but rather on assessment of the balance between production and consumption.

Each system is often roughly in line.
with the other under normal conditions but copper is seldom normal.

• Costs of production by those who supply the market have a vast spread. Low cost producers make lots of money when prices are up, while high cost producers barely get by or face closure when prices drop and the price slump continues. Prices existing in fourth quarter 1979 were a bonus for almost any mine in operation at that time.

• Arie Koosman, EIU Editor from 1955-1969, once said of their "Metal & Mineral Markets" (Now, "Metal Week"): "We get nothing out of metal pricing except responsibility of doing an accurate job—one we are proud to have."

A mistake of a half cent a pound in copper on even a small shipment would mean someone was getting several thousand dollars more or less than he was really entitled to. Some years ago there was a copper slump and the true market price was at $0.37/kg ($0.35/lb). Chile was demanding $1.10/kg ($0.50/lb) and temporarily was not selling any. Should their price be included in the compilation? Because of immediate past past averages and future projections, the Chinese price was thrown out and corrected listed price was not distorted. This was a courageous decision considering the potential cost of a major copper producing nation.

Backwardation and Premiums

During recent years, there have been major changes in both production and marketing copper concentrate and metals. Forward and backtracking have become common in both cases. Production prices, once so stable and precise, have succumbed to rather disjointed and erratic behavior. These primary producers who once declared the volatility of quotations in so-called terminal markets (LME and Comex), now closely follow these markets.

Most primary copper concentrate producers sell their output outside the United States based on LME average prices for current and some specific future months. Sales in the U.S., on the other hand, are dependent on whether concentrate or metallic copper is the product, and these closely follow Comex prices. In other cases, back or forward pricing are accepted within certain limits.

In the past, copper was usually priced without reference to quality, provided acceptable standards were met. During the past two years, more attention has been paid to the quality of copper concentrate and the copper metal and, as a result, premiums are being paid in many instances for the higher quality product.

Students of copper markets should read the October 5, 1979 issue of Copper Studies, an affiliation of the Commodities Research Unit, Ltd. This issue thoroughly covered the major changes that are affecting pricing and marketing. Metal marketing is a challenging and exciting activity for today's producers. It also brings great satisfaction in terms of the knowledge of your product's effects on the world's needs.

"What Mining Means to Americans: American Mining Congress.

Henry A. Brimo, president and founder of Phelps Dodge Corporation, has been active in mineral development in the Philippines for four decades. He has been involved in every level of the industry and contributed greatly to both the mining and petroleum advancements in his country. He has served as president or chairman of a number of organization in the mining and petroleum fields. His current position as chairman of the Philippine Export Council and chairman of Phelps Dodge Corporation is a direct result of his vision and leadership.

"What Mining Means to Americans: American Mining Congress.

Larry Smith, EIU Managing Editor, is vice president for operations of Phelps Dodge Corporation, a major copper and gold producer in the Philippines. He has been involved in gold mining in Mindanao, iron ore mining in Luzon, and copper mining in the Visayas and northern Luzon. He was responsible for the opening of the Balito Copper Mine in Mindanao, to the opening of the Balito Copper Mine in Mindanao, to the opening of the Balito Copper Mine in Mindanao.
A new century ago, the Victorian poet Matthew Arnold spoke of an unparalleled convulsion which was a moment in which the past that is fading under the assault of altered and at a pace never before relatively unchanged for most of human recorded. Consider five configurations which to create a response.

1. In 1900, only 15 percent of the world's population lived in or near cities, by 2010, approximately 60 percent will live in urban settings.

2. In 1900, only about 5 percent of the human kind was literate; by the year 2010, approximately 80 percent will be able to read and write.

3. In 1900, the average global life expectancy was around 40 years old, by the year 2010, it will be close to 70.

4. In 1900, the dominant experience of human existence, which was physical confrontation, in the United States considered relatively more important, by the year 2010, work will be for the most significant and the amount of individual disposable time will be higher than ever before.

5. In 1900, the political landscape was dominated by empires and colonialism, but since the mid-1970's, conditions began to shift and there is a new recognition that the balance between states. And, for the first time in about five centuries, the poles do not tilt toward Western powers.

Thus, the capacity to influence policy, a relatively new influence, is now increasing in a world where the nations are divided by different ideologies and political regimes. The crises of World War II enhanced the political and societal recognition of scientists and engineers. The technology of engineering was hailed by the public as a triumph of science because it expected a dramatic social and economic consequences for the world. Productivity has become a vital role of engineering to the global economic and political situation of the first time in about five centuries, the poles do not tilt toward Western powers.

Since World War II, America's economy has been based on the diplomat's early research, and the cold war, the United States pursued a variety of other things. The crises of World War II enhanced the political and societal recognition of scientists and engineers. The technology of engineering was hailed by the public as a triumph of science because it expected a dramatic social and economic consequences for the world. Productivity has become a vital role of engineering to the global economic and political situation of the world. The crises of World War II also created significant new economic and political situations as the tensions of a non-technical nature. Six of these are of particular significance:

1. Sustained resource shortages became a reality. Conservation and creation, once considered a matter of urgency. Industry has become more interested in making things work better than in making things work in the market.

2. Economic pressures have increased. Inflation and unemployment have reached levels that have never been seen before. The government and Congress have articulated a variety of solutions to the problem of unemployment, including new social programs, public works, and education. The government has been doing this for several years now with varying degrees of success.

3. There are no clear-cut and glib responses to these challenges. Their range and impact must be considered in the light of political, economic, social, and technical constraints. Six of these are of particular significance:

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21. Sustained resource shortages became a reality. Conservation and creation, once considered a matter of urgency. Industry has become more interested in making things work better than in making things work in the market.
No matter how you break it down,
Skinner pyro-processing sets the standard.

In technology and craftsmanship, efficiency and durability, Skinner multiple hearth furnaces have become a standard for pyro-processing operations. Introduced in 1915, they come a standard for pyro-processing efficiency, and durability, Skinner furnaces are designed to use a variety of fuels, molybdenum, magnesite or a host of other minerals—whether you need drying, roasting or calcining—you'll do it more efficiently with a Skinner furnace, no matter how you break it down. Mine and Smelter, Division of Barber-Greene Company, 3800 Race Street, Denver, Colorado 80205

1980 Colorado School of Mines Commencement Events
May 8-10, 1980 (Thursday thru Saturday)

Name: ___________________________ Year: __________
Address: ____________________________________________

☐ YES, I am planning to attend the 1980 COMMENCEMENT Events! Please send a detailed schedule of events.

☐ YES, I'd like to reserve tickets for the Alumni Cocktail Party and Banquet.

☐ YES, we would also like to sponsor _____ 1980 graduates for the Cocktail Party and Banquet.

☐ YES, I'd like to reserve tickets for the Alumni Cocktail Party and Banquet.

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alumni update

27 Edward C. Borrego E.M., Hon. Mem. 1969, Medalist 1972, was one of thirteen BSEE graduates to be inducted into the Alumni Association as Legion of Honor 50-year members. The newly inducted members of the Legion may display the insignia of the Legion on letters or stationery.

29 Eugene E. "But" Davis, Associate Librarian at Idaho State University, has been appointed to the Alumni Association. He will be in attendance at the Alumni Day College, and has returned to the office of his former position.

36 Carl M. Morris, E.M., has been elected Chairman of the Board of Directors. He holds a degree in Geology from the University of Colorado. He is a member of the Board of Directors for the Idaho Geophysical Society, and has served on the Board of Directors of the Idaho Chapter of the American Institute of Mining and Metallurgical Engineers.

40 Herbert D. Thornton, P.E., is an Associate Professor of Geology at the University of Idaho. He has been named the Idaho Geologist of the Year. He is a member of the Idaho Geological Society, and has been active in the Idaho Chapter of the American Institute of Mining and Metallurgical Engineers. He is a member of the Board of Directors of the Idaho Association of Geologists.

43 Robert Greider, Geol. E., is now President of Geo-Data International. He was formerly associated with the Geodynamics Research Corporation, and has been active in the Idaho Geological Society. He is a member of the Board of Directors of the Idaho Association of Geologists.

52 George A. Carpenter, M.E., is attending Western State University College of Law. In Colorado, he is working on the trial of a major lawsuit.

53 A new Staff Director, Petroleum Engineering for the Natural Resources Group of Phillips Petroleum Company is James E. Oates, M.E., who is now serving as an Assistant Director and is in charge of the operations of the Natural Resources Group.

59 Harold T. Nodland, M.E., is back in the U.S. after a project in Saudi Arabia. He is now Senior Research Engineer with Phillips Petroleum Company.

64 Ed Cottrell, M.E., is now working in the Tucson, Arizona office of Dorr-Oliver.

68 John T. Hoffman, M.E., has been elected to the Board of Directors of Geo-Data International. He is a member of the Board of Directors of the Idaho Geological Society.

72 Nathan J. Hoffman, M.E., has been appointed to the Board of Directors of Geo-Data International. He is a member of the Board of Directors of the Idaho Geological Society.

76 William A. Colburn, M.E., Met. E., and David M. Colburn, M.E., have been appointed to the Board of Directors of Geo-Data International. They are members of the Board of Directors of the Idaho Geological Society.

80 William G. Oglesby BSc. Pet., is now President, Texas Vanguard Oil Co., based in Houston. He is a member of the Board of Directors of the Texas Oil and Gas Association.

88 George C. W. Clark, M.E., is now associated with the University of Texas at Austin. He is working on the trial of a major lawsuit.

92 Terence P. McNulty BSc. Pet., has joined McNeil Oil Corporation in Austin. He is working on the trial of a major lawsuit.

96 Brian P. Balsen, M.E., vice President of Technical Services, is teaching a course, utilizing his expertise in engineering, to the Navy Department. The course is titled "Undersea Construction of Submerged Geotechnical Structures." His former position was as an Engineering Consultant for the U.S. Navy.

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112 mountain states

116 mineral exploration

120 environmental studies

124 feasibility studies

128 metal processing development

132 mine crushing/conveying systems

136 plant design engineering

140 Turnkey Construction

144 mountain states engineers

25 the mines magazine • April 1980
China After Mao—Death of a Revolution

by Ralph Buultjens, with a foreword by Indira Gandhi

International Study and Research Insti­tute, New York, 1979, 240 pp., including indices, comparative tables, and selected readings.

Dr. Buultjens terms this small volume an essay, in her forward, Mrs. Gandhi characterizes it as a monograph. By whatever term one chooses for it, it is a surprisingly enlightening collection of information, which, as the author says he intends, presents a balance between general information and specialized interpretation. Again, according to its author, it derives from several lectures given to both academic and civic groups. Its origins are clearly concealed, for there is a unity to the presentation that does not reflect in any way that it represents several different discussions held at various times.

The central theme of the discussion is that China is still, for all the apparent difficulties of this are great, considering the huge numbers of people involved, reasonably united, but consideration of the tremendous influence this one man had on the development of the present structure of the nation. He points out that Mao was responsible for at least a dozen happenings of major importance in the nation, over a period of almost 60 years. Beginning with the establishment of the Chinese Communist Party in 1921, the Long March, collectivization, the Sino-Soviet links and the like, and last, and probably the most important development in the history of China, according to the present government, to bring the ideals and force of Mao into a manageable entity in the world, is expressed by the great love and the more than 50 years of labor the peasant class spent on the land. Mao’s philosophy, Dr. Buultjens questions whether the current leadership of the nation will continue to influence the development of his country. It is important to remember, the author says, that Mao never held absolute power—he governed only with the consent and cooperation of others—a fact which enhances his stature. It is easier to be a despot, such as Stalin, than to gain the confidence of a sufficiently large number of people who will accede to a single policy.

Mao took the view of Lorn, whom he admired, and he believed in a narrow revolutionary line of Lenin into a broad, encompassing movement. He emphasized Lenin’s theme that competent men must be isolated to rule the masses, but took it far beyond the meaning expressed by Lenin. He managed to find thousands of men who were both dedicated to his philosophy and capable and competent to administer them, thus insured that his control would be the most powerful force in the country.

Dr. Buultjens, in tracing the evolution of modern China, brings together the history of Mao Tse-Tung, and the tremendous influence this one man had on the development of the present structure of the nation. He points out that Mao was responsible for at least a dozen happenings of major importance in the nation, over a period of almost 60 years. Beginning with the establishment of the Chinese Communist Party in 1921, the Long March, collectivization, the Sino-Soviet links and the like, and last, and probably the most important development in the history of China, according to the present government, to bring the ideals and force of Mao into a manageable entity in the world, is expressed by the great love and the more than 50 years of labor the peasant class spent on the land. Mao’s philosophy, Dr. Buultjens questions whether the current leadership of the nation will continue to influence the development of his country. It is important to remember, the author says, that Mao never held absolute power—he governed only with the consent and cooperation of others—a fact which enhances his stature. It is easier to be a despot, such as Stalin, than to gain the confidence of a sufficiently large number of people who will accede to a single policy.

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Buultjens reaches back into the incremental evolution of the nation. He points out that Mao was responsible for at least a dozen happenings of major importance in the nation, over a period of almost 60 years. Beginning with the establishment of the Chinese Communist Party in 1921, the Long March, collectivization, the Sino-Soviet links and the like, and last, and probably the most important development in the history of China, according to the present government, to bring the ideals and force of Mao into a manageable entity in the world, is expressed by the great love and the more than 50 years of labor the peasant class spent on the land. Mao’s philosophy, Dr. Buultjens questions whether the current leadership of the nation will continue to influence the development of his country. It is important to remember, the author says, that Mao never held absolute power—he governed only with the consent and cooperation of others—a fact which enhances his stature. It is easier to be a despot, such as Stalin, than to gain the confidence of a sufficiently large number of people who will accede to a single policy.

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JOHN D. STRASSER

John D. (Jack) Strasser P. E., 1941, died in Montebello, California January 23, 1980, after a lengthy struggle with cancer. Strasser was born and reared in Denver, and attended Regis High School before entering Mines. While completing his college education he was a member of ATO, on the tennis team, participated in intramural sports and sang in the Glee Club.

Immediately following his graduation, he was commissioned as a 2nd Lt. in the Corps of Engineers, he served in Queensland and New Guinea. He was wounded and later hospitalized in Melbourne, then spent a tour of duty in Sydney. After a period of time in Washington, D.C., he returned to Chicago with a captain's rank.

Most of Rod Strasser's life was spent as a process engineer and manager in the petroleum and chemical industries. He worked for Shell Oil, Bechtel, C. F. Braun, Ralph M. Parson and Best Fertilizer Company. The last 13 years of his career were with Fluor Corporation, and he was a project manager for that firm until his death.

John is survived by his wife, the former Yvonne Moloney, whom he met and married while stationed in Australia, and an aunt, Rebecca Strasser of Denver. Mrs. Yvonne Strasser makes her home at 16361 Colegio Drive, Hacienda Heights, CA. She has two children.

JOHN V. SELVIDGE

John Vivian Selvidge E.M. 1921, died in late 1978 in Kansas City, Missouri. Mr. Selvidge had been out of touch with CSM for many years, and there is no knowledge of his work, family or survivors.

DORSEY E. MAYHUGH

Dorsey E. Mayhugh E.M. 1921, died in early 1977, according to information recently received in the Alumni Office affiliation.

It is believed that he is survived by a daughter, Mrs. Mary Ann Bantle, of Colorado Springs, Colorado.

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MORGAN J. DAVIS

Morgan J. Davis Honorary Doctor of Engi- neering, 1964, died December 31, 1979. Mr. Davis, a petroleum geologist of world wide fame, graduated from the University of Texas in 1930 and moved to Denver in 1936. He left Harvard Business School, Advanced Manage ment Program in 1966. He distinguished career in the petroleum industry culminated with his appointment, in 1956, as President of Exxon Company, USA. He later became Chairman of the Board and C.E.O. of that company, and held that title until his retirement in 1963. At the time of his death, he was still active in the industry, heading his own consulting firm, Morgan J. Davis Associates. He was a member of a number of professional societies, had received numerous awards for his contributions to the petroleum industry, and was in recognition for his work entitled "The"...
Safety Institute

Mine Health and Safety Institute

The Colorado School of Mines has announced the permanent establishment of the Institute of Mine Health and Safety on its campus.

Asking mine operators in complying with Mine Safety and Health Administration (MSHA) regulations and providing academic expertise to government regulatory agencies are the two primary objectives of the Institute, according to Prof. Robert T. Read, Reader, a veteran member of the school's Mining Engineering Department, has been appointed director of the newly-created entity.

Making affordable consultation available directly to the mining industry is to be the thrust of the organization.

The non-profit Institute will be engaged in research projects in mine health and safety. Technical support will be given to the school and to state agencies whose functions relate to the mining industry.

The Institute is the outgrowth of five field and safety conferences held annually at the Colorado School of Mines. An annual conference will remain the focal point for the Institute with the Sixth Institute on Mine Health and Safety slated for November 12, 13, and 14, 1980.

Reeder and his staff are presently identifying specific services that can be immediately provided to industry. A list of research projects will be compiled. Funding is actively being sought with immediate provision to industry. A list identifying specific services that can be provided to industry is available.

As part of the Distinguished Lecture Series at the Colorado School of Mines, funded by the AMAX Foundation, Inc., Dr. Rosalyn S. Yalow, Nobel Prize Winner in Medicine, lectured February 26 at Geen Center. The title was "Science in the Service of Man." The lecture was attended by students, professors and several political figures, including Lt. Governor Nancy Dick of Colorado.

While much of her talk focused on the history of her own research, it was interspersed with witty comments on feminism, multi-disciplinary research, peer review and scientific breakthroughs.

"On feminism: "I've been asked to change the title of my talk to "Science in the Service of People." I won't do that. The issue of feminism is equally important to the study of cancer as that of cancer is to the study of feminism."" To change the title of her talk to 'Science in the Service of People', I won't do that. Playing games with a dictionary is divisive. Doing real research gives women the power of the professional world."

"On research: "Multi-disciplinary research works when you really care about the other fellow's field -- that's why Sol Berson (her partner for many years) and I had a great partnership. You've got to realize that college or graduate school is only the beginning, then you will be moving from field to field.""

"On peer review: "It is very easy to publish a new paper. Great discoveries take longer. That's why peer review, or research grants, combined with cut-throat competition, is hurting scientific enterprise. Very few people create science... but many are there to develop it. Oddly enough, breakthroughs are often made not by the most knowledgeable -- sometimes, if you know everything, you don't work so hard anymore."

"The developer of the radioimmunoassay, Dr. Yalow called it "a powerful tool for measurement. Radioimmunoassay is a uniquely sensitive and specific technique now widely used for measuring the concentrations of thousands of biologically active substances."

With this tool, Yalow noted that physicians have a clearer understanding of diabetes: eliminated the threat of hepatitis in blood transfusions; detected hormonal and thyroid imbalances that cause stunted growth or mental retardation -- and prevented same.

"On nuclear waste disposal: "I strongly suspect that the federal government is still on determining which of many solutions they'll adopt. Why? Simply because there is a good chance that many wastes can be reused, and the federal government wants access to those wastes a little longer," said Yalow.

"She was severely critical of federal radioactivity standards, stating that the level of hospital radioactivity is not a significant threat to the public. The federal regulators are making no distinction between the natural background radioactivity and the man-made radioactivity," stated the doctor.

"She went on to note that many people outside the nuclear industry are constantly exposed to background radioactivity that often exceeds federal safety guidelines, yet suffer no ill effects."

Dr. Yalow closed her talk by emphasizing the need to develop more nuclear energy, or face the threat of nuclear war, in defense of Middle East oil.

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The Colorado School of Mines wrestling season over

The Colorado School of Mines grapplers finished their 1979-80 wrestling season at the 18th NCAA II Tournament, held this past weekend in Omaha, Nebraska.

While the Orediggers' performance was strong, senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first place in Senior Dan Scrivner took first 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**Siphon Pipeline at the Granite Creek Bureau of Reclamation Project, Near Basalt, Colorado**

**Project Details**
- **Pipe line**: 4000 ft. long, 30" diameter
- **Pipe trench excavated on slopes greater than 100% grade**
- **Pipe laid on slopes greater than 100% grade**
- **Judo located at 10,000 ft. elevation**
- **Construction cable way—single span of 3200 feet**
- **Diversion structure of concrete placed by helicopter**
- **Limited right-of-way width—15 ft.**
- **Pipe line 4000 ft. long, 30" diameter**

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Librarian Named

Joanne Y. Ayers has been appointed as a librarian at the Boulder Reading and Reference Center of Energy, Environment, and Public Policy of the Arthur Lakes Library. A graduate of North Carolina State University, she holds a master's in library science from the State University of New York at Albany. Prior to joining the library staff at CSAM, she was catalog librarian at the American University Law Library in Washington, D.C. She has also served on the library staffs at the University of Connecticut and Rensselaer Polytechnic Institute.

Chinese on Rocks

Colorado School of Mines Press has just published "The Principles of Rock Drilling," by George Clark, an expert in this field from Harvard University. The book is a result of extensive work done in Hunan Province, People's Republic of China. Professor Clark's paper was published this summer in the CSM Quarterly, Vol. 74, No. 2. It is recommended for students interested in drilling and blasting of rocks.

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Miners also listened to an informative lecture on income tax procedures. Fred Fox '54

**Bill Thorne '48 Ex.**

**Rick Weber '65**

**Regan Heath '74**

**Don Taylor '77**

**Hydrogeology**

**Engineering Geology**

**Soil and Rock Mechanics**

**Construction Quality Control**

**Construction Materials Testing and Engineering**

Wilson's comments evoked a number of questions and led to some lively discussion about the School and its future. Other guests attending the meeting were Bill Dinmore, Tennisill, and Bud Leeds, CSAM Foundation.

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Cruce Oil Trading & Transportation

**The mines magazine • April 1980**
Charles Kittrell, a dynamic showman with very persuasive ways, discussed the role of the engineer in working with the public.

It is his contention, and that of some few other prominent industry advocates, that engineers, on whatever level, must be prepared to meet the media without qualms, to answer questions, to pose questions, and to tell the story of their own company and the industry as a whole. His firm, Phillips Petroleum, has chosen to place top-level management in the somewhat threatening (to many) position of responding directly to hostile media, and even to actively seek an interchange of information with such media.

In principle, I agree with this concept—with one important reservation. Last spring, recruiters for the petroleum companies would have hired almost 300 graduates—and there were less than 200 available from the three top petroleum departments of three engineering schools. Can we afford to use these engineers in pursuing technical solutions to the difficult problems confronting the mining industry by training them in answering off part of their time for public communication?

My reservation addresses this problem—and also the fact that the petroleum industry, the mining industry, the energy development industry must indeed limit the effectiveness of public relations people? The answer, sadly, is that we must indeed limit the effectiveness of public relations people. Even for those that are obviously necessary, yes, but also, let's use our other employees and friends.

Communication—once considered an art—has now become a science, with schools and practitioners everywhere. Its use becomes a means of survival in an increasingly verbal and vocal world. We grapple with it incessantly every day in inter-office memos as well as in company pronouncements. One-to-one or one-to-many, we all engineers as well as others, must communicate.

Charles Rogers E.M. 1915, sent me a list of 21 titles from which to choose a caption for this back-page column. I chuckled at some of them, are considering others. Many other people have been supplying suggestions, also, and I thank you all for your participation—even for those that are obviously tongue-in-check ideas!

Titles of columns and magazine sections in MINEs were supplied by Mr. Kittrell, a dynamic showman with very persuasive ways, discussed the role of the engineer in working with the public.

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