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COVER - Energy Fuels Nuclear, Inc. Arizona Strip Mine. Photograph was submitted by Donn M. Pillmore, CPG-4887 - article on page 8.

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MINING GEOLOGY

PART 2

La Colpa Mine, Compañía Minera Mantos de Oro (50% Placer Dome Inc., & 50% Cons. TVX Mining); 15,000 ton per day gold/silver recovery plant nearing completion of construction; April 1991, Maricunga Gold Belt, Atacama District, Northern Chile. The La Colpa epithermal silver-gold deposit is hosted in Triassic sedimentary rocks and Miocene dacitic volcanic rocks.

Photo Credit: James B. Lincoln, CPG-7958
Current Trends in Mineral Exploration and Mine Development in Latin America

James B. Lincoln, CPG-7958

Over the past several years, there has been a significant increase in mineral exploration and mine development expenditures in Latin America. The increase is largely from foreign sources, lead mainly by North American-based companies with notable participation from European, Australian, and South African mining companies as well. This trend of foreign investment in the mineral sector in selected countries of Latin America is the result of a number of contributing factors, including business and political developments in both North and South America. Exploration and mine development have been conducted by foreign companies in Latin America at various levels in the past, however, the current trend will likely exceed all previous levels.

For many decades, exploration and mining development activities for metals have made an important contribution to the total resource development of North America. In 1990, the United States minerals industry (excluding energy fuels) accounted for $33 billion in revenue and the minerals processing industry accounted for $310 billion[1]. Historically, the mining industry provided the economic base for many localities and the basic resource industries played a vital role in U.S. and Canadian economies. Mining operations in remote and developing regions (such as the Red Dog Mine, a joint venture between Cominco and Nana Regional Corp., in the high Arctic of Alaska) have also contributed considerably to the economy and quality of life for remote populations while maintaining harmony with the existing cultures.

The United States and Canada are both experiencing difficulties maintaining minimal levels of mineral exploration and mining development. This is a result of maturity of exploration arenas, permitting delays and constraints, ever-increasing environmental regulations by a multitude of agencies, a reduction in available lands open for mineral entry, and a general negative public opinion toward development of resources, particularly mining. The United States is rapidly developing a service-oriented and information economy at the expense of basic industries such as manufacturing and resource development. As a result of this trend, it is apparent to many North American mining companies relying on production in the United States and Canada, that geographic diversity will be a necessity of business in the 1990s and into the next decade.

The current scenario in exploration for metallic deposits in the United States and Canada is one of shrinking areas for exploration, lower quality properties, intense competition, and ever-increasing restrictions on developing and operating metal mines. Also, there is a strong movement in the United States Congress to repeal or significantly amend the historic Mining Law of 1872. Any change in this law will likely add further financial burdens on exploration as well as additional fees and royalties on mineral production.

Canada and U.S. mining companies, faced with these dim prospects for mine development at home, have looked to other parts of the world to carry on exploration and development activities. The studies

Volcan Copiapó in background Tertiary age Strato-volcano, (8052 meters); Salar de Marungua in foreground; Marungua Gold Belt, Atacama District, Northern Chile
have targeted Latin America as one of the most attractive areas for mineral development in the world. The factors influencing this selection include the attractive geologic environments for hosting base- and precious-metal deposits and the recent changes in political attitudes towards foreign investment and resource development.

Central America and the western portion of South America are dominated geologically by the Andean Cordillera, the result of compressional tectonics caused by subduction of the oceanic plate under the continental plate. The Cordillera has experienced extensive volcanic activity, principally in Mesozoic and Cenozoic time. This process has resulted in the formation of classic metamorphic environments hosting epithermal gold, porphyry copper, and other base metal deposits. Such terrains have produced sizable deposits such as the well known Chilean and Peruvian porphyry copper and numerous epithermal gold occurrences scattered throughout the Cordillera.

In attitude and policy towards foreign investment and resource development Chile has maintained an economic policy for many years that encourages foreign investment in the mining sector. This policy, and other economic reforms introduced in the mid '70s, have allowed Chile to develop the strongest economy in South America with considerable gains in managing inflation and debt reduction. Chile is often pointed to as a model for the recent new laws and regulations being drafted by other countries in Latin America.

Several Latin American countries are adopting new mining and foreign investment laws and policies that encourage foreign investment in exploration and mineral resource development. In 1991, Bolivia adopted a new mining code and Columbia adopted new foreign investment policies and other laws relating to privatization. Ecuador is in the process of improving mining laws and will have new legislation in 1992. Guyana introduced a new foreign investment code in 1988 and Mexico adopted a new mechanism for foreign ownership in December 1990. This year, Nicaragua developed a new foreign investment law and Venezuela adopted a new tax law. Panama developed a new mining code a year ago. In addition, there are several other countries in the process of enacting new legislation and policies designed to attract foreign investment and mineral development.

Exceptions to this trend are Brazil, whose new constitution, adopted in 1988, was heavily influenced by nationalistic interests, and Argentina, where no major change in foreign investment has occurred in the recent past. As a result, neither of these countries has experienced much success in attracting new foreign investment money in the last two to three years.

In general, the new laws and regulations in Latin America are designed to provide the foreign investor with a guarantee of ownership of mineral rights; reasonable and consistent taxes; and appropriate repatriation of capital and profits. Governments are recognizing both the need for privatization of resource industries and for foreign capital to assist in resource development. The historic notion of natural resources being reserved for development and use only by nationals is disappearing in most Latin American countries.

Many countries are also reforming incoming tax rates to be competitive with the United States. For example, income tax rates due to new laws and regulations are 35 percent or less in Bolivia, Chile, Costa Rica, Ecuador, Mexico, and Panama.

In many of the Latin American countries, bank financing can be secured for resource development in a manner similar to North American financing. Public financing, through stock markets, is not universally established, although there are active stock markets, such as Mexico's, where the market is currently involved in major privatization financing. Debt/equity finance schemes are
available in many Latin American countries; however, in some situations such as Chile, the difference in the price of the purchasable debt and the realized revenue is not large enough to be an advantage in small- to medium-sized financing situations. This is further indication of stability in selected countries where economic and political risks are quite acceptable for foreign mining companies.

In conjunction with the new trends in resource development in Latin America, many of these countries are also becoming more environmentally conscientious; particularly in those countries with long mining histories. Good environmental practices and policies are not being ignored in Latin America. Mining companies considering development should be prepared to build and operate mines according to North American environmental and safety standards, which will help maintain reasonable government policies well into the future.

The risks involved in developing and extracting mineral resources historically have been inherently greater offshore than in Canada and the United States. As indicated above, these risks are lessening in Latin America, where new business practices; positive foreign investment laws and regulations; and improved political and economic stability are apparent. The risks involved with offshore development are further offset by the higher quality opportunities and reduced production time frame which results in a higher return on investment.

The current economy problems in North America have hit resource companies hard, as evidenced by the decline in earnings of nearly every major mining company in North America since 1988. Despite the tight cash situation of mining companies, it remains very timely to begin exploration and resource development activities in selected areas of Latin America, and indeed most major mining companies are already established in various locations in Latin America. This should not be viewed as a detriment to late-comers, as there are numerous favorable geologic terrains where exploration has been minimal to non-existent.

In summary, there is no doubt that Latin America will be a significant location for development of mineral resources in the 1990s and an important contributor of mineral resources to the world for many decades.

Development of mineral resources will greatly assist these countries in their economic development and world status well into the next century.


James B. Lincoln is the Chief Geologist for the Pegasus Gold Corporation of Spokane, Washington.

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Arizona Strip Uranium Mining District Northern Arizona

Donn M. Pillmore, CPG-4887

In 1979, Energy Fuels Nuclear, Inc. (EFNI), a Denver, Colorado based mining company, began exploring an area in northern Arizona, known as the "Arizona Strip", for high grade uranium deposits. EFNI considers the Arizona Strip an area bounded on the north by the Arizona/Utah state line; on the east by the Colorado River and Marble Canyon; on the west by the Grand Wash Cliffs; and on the south by a mid-point between the city of Flagstaff and the Grand Canyon (see Figure 1). Previous discoveries of high grade uranium occurrences on the Arizona Strip and a declining uranium industry dictated the need to locate high grade deposits and prompted an extensive EFNI exploration effort. The effort paid off and high grade uranium deposits were located by early 1980.

High grade uranium mineralization found on the Arizona Strip is located in breccia pipes. Breccia pipes are collapse structures which consist of roughly cylindrical, nearly vertical, columns of brecciated rock. These collapse structures are formed by the progressive collapse and subsequent upward caving or stoping of unstable portions of large caverns originating in the underlying Redwall Limestone Formation. Limestone dissolution from circulating ground water resulted in cavitation. Evidence suggests initial cavitation occurred at the intersection of basement faults. Collapse of these large cavities is believed to have begun soon after the deposition of the Redwall Limestone, approximately 230 million years ago, and continued intermittently up to the Triassic Period.

The breccia pipes range in size from 100 feet (30 m) to 400 feet (122 m) in diameter and have a vertical dimension of more than 3,000 feet (915 m). Stratigraphically, they extend upward from the Redwall Limestone to the Chinle Formation (Figure 2). Since 1980, when EFNI first began mine development at the Hack Canyon No. 2 mine, the

Formations. Pitchblende, the principal uranium mineral, occurs mainly in the matrix portion of the breccia, where it fills voids between sand grains and, to a lesser extent, replaces portions of rock fragments. Selected samples of uranium ore contain up to 68.0% U-238, while the average grade of ore mined from the breccia pipes has been 0.65% U-238. Uranium mineralization of the breccia pipes, based on uranium-lead age dating of ore which has been mined, suggests uranium mineralization occurred 180 to 220 million years ago. The principle gangue mineral found in the ore is pyrite. Calcite and gypsum are also common as cementing minerals in the breccia, while minor amounts of copper, lead, and zinc minerals are also present.

The base of operations which support the Arizona Strip is located in Fredonia, Arizona. The ore is hauled, via 30-ton highway trucks, approximately 300 miles to the White Mesa Uranium Mill, located south of Blanding, Utah. The White Mesa Uranium Mill is a 2,000 ton per day, state-of-the-art, acid leach mill.

Donn M. Pillmore is the Chief Geologist at Energy Fuels Nuclear, Inc., Fredonia, Arizona.
The Sleeping Giant Wakes

Richard C. Swainbank, CPG-6106, Mark S. Robinson, CPG-6414

Alaska is a land of superlatives. Stretching 1,350 miles from Ketchikan in the southeast, to Barrow at the northern tip, and the same distance west to Attu Island, the State has a land area of 566,412 square miles, or one million acres for each day of the year. It is larger than the next three largest states combined, has more than three million lakes larger than 20 acres, and the coastline is longer than that of the contiguous 48 states.

Almost 60% of Alaska is owned by the federal government, and over 75% of that land is closed to mining in National Parks, Forests, and Wildlife Refuges. Fortunately the remaining 50 million acres of Federal land, the 104 million acres of State land, and the 44 million acres of native-owned land remain open for mineral entry. These scattered parcels, in aggregate somewhat larger than Texas, contain sufficient mineral resources to nourish a growing industry.

In 1990, the gross value of base metal production in Alaska ($285 million) surpassed that of gold and silver ($140 million) for the first time since 1927. In the few years before 1927, the value of copper from the very rich Kennecott Mine in the Wrangell Mountains exceeded the value of precious metals from the Alaska-Juneau Mine (A-J) in the town of Juneau. In its day, the A-J was the largest and lowest grade gold deposit in the world and produced both the economic and, to a large extent, the physical foundation for the present capital city of Alaska.

Mining activity near Juneau was invigorated in 1898, after a 40-year hiatus, when the Kennecott Greens Creek Mining Company began mining the volcanogenic lead-zinc-silver-gold deposit at Greens Creek, about 18 miles southwest of the town. Reserves at start-up were 3.5 million tons grading 9.7% zinc, 3.9% lead, 24 ounces per ton silver, and 0.18 ounces per ton gold, but work since 1989 has added an additional 14 million tons of reserves at similar grades. In both 1989 and 1990, the Greens Creek Mine was the largest silver producer in the United States.

In extreme northwest Alaska, the huge Red Dog zinc-lead-silver deposit, owned by the NANA Native Regional Corporation and operated by Cominco Alaska, Inc., had the first full year of operations in 1990 and shipped about 320,000 tons of concentrates. The value of these shipments, added to those from Greens Creek, accounted for the total value of base metals produced in Alaska in 1990, exceeding the value of precious metals.

Reserves at Red Dog are stated to be 85 million tons with a grade of 17% zinc, 5% lead, and 2.4 ounces per ton silver. The deposit is one of the largest of its kind in the world. The favorable geometry suggests that there will be a very low stripping ratio over the projected 55 year mine-life. In 1991, about 539,400 tons of concentrate were shipped as the mine was tuned up to the projected full annual production of 730,000 tons of concentrate. There are indications that the Red Dog Mine is only one of several similar deposits in the region, albeit maybe the largest. The Lik deposit, 12 miles to the northwest of Red Dog, contains at least 24 million tons of 9% zinc, 3.1% lead, and 1.4 oz/ton silver.
If more base metal mines like RED DOG or LIK are developed in the area, it may also be possible to develop the enormous low-sulfur bituminous coal resources of northwest Alaska for mine-mouth power. The State Division of Geological and Geophysical Surveys has estimated identified resources of over 1 billion tons of high-rank coal and hypothetical resources of about 8 billion tons in just three small parts of the known coal areas. The whole area of the North Slope may hold as much as 4 trillion tons of coal - about 40 percent of the total United States resources.

![Mill at Greens Creek, 1991](Image)

Photo Credit: Richard Swainbank

In the Ambler Copper Belt along the south flank of the Brooks Range, several deposits of copper, lead, zinc, silver, gold, and cobalt have been drill-tested and shown to contain a cumulative total well in excess of 100 million tons. Individual deposits include BORNITE (100 million tons of 1-2% copper, including 36.2 million tons of about 2% copper, 4.6 million tons 0.0% copper plus accessory zinc and cobalt); ARCTIC (40 million tons 4% copper, 5.5% zinc, 0.8% lead, 1.6 oz/ton silver, and 0.02 oz/ton gold); SUN (6-12% zinc, 1-4% lead, 0.5-7% copper, and 3-11 oz/ton silver, with a 1976 gross in-place metal value of over $1 billion); and SMUCKER ('significant tonnage' in 3,000 ft x 190 ft area with grades 5-10% zinc, 1.5% lead, 3-10 oz/ton silver, and some gold and copper). Other deposits, such as OMAR and FROST, are known to the west, but extensions of the belt to the east are compromised by strategic salients of the huge Gates of the Arctic National Park. These resources will probably require road or rail access to be economically viable unless some innovative transportation such as large Hovercraft can be utilized.

Tin reserves at the LOST RIVER MINE, west of Nome on the Seward Peninsula, are the largest in the nation, with measured reserves of 24.6 million tons grading 0.15% tin, 16.3% fluorite, and some tungsten. There are several other properties in the same Seward Peninsula Tin Belt such as CAPE MOUNTAIN, EAR MOUNTAIN, and POTATO MOUNTAIN, each of which could host substantial tin deposits. The KOUGAROK deposit, further to the east, has a high-grade core of about 150,000 tons in excess of 1% tin, and lower grade reserves are much greater. The tin deposit at COAL CREEK, about 150 miles north of Anchorage in the 'railbelt', contains 5 million tons of 0.28% tin, 0.3% copper; and some tungsten, zinc, and silver. SLEITAT MOUNTAIN, in southwest Alaska, eighty miles northeast of Dillingham, was discovered recently and has a resource estimated by the U.S. Bureau of Mines at 28.6 million tons with an average grade of 0.37% tin, 0.49 oz/ton silver, and 0.04% tungsten. If these resources can be confirmed as reserves, SLEITAT would contain more than twice as much tin as LOST RIVER.

Alaska contains one of the largest resources of molybdenum in the world in the QUARTZ HILL deposit, about 40 miles east of Ketchikan in the extreme south of the panhandle. Proven reserves are 1.5 billion tons grading 0.14% molybdenum disulphide and include a high grade core of almost 500 million tons grading about 0.22% MoS2, which is of itself a very major deposit. This vast resource has been severely compromised by its inclusion in the Misty Fjords National Monument, created by Congress in 1980. Another occurrence of molybdenum at BEAR MOUNTAIN, in the extreme northeast corner of the state, is also "off-limits" for evaluation due to its location within the huge Arctic National Wildlife Refuge, but rock samples containing up to 0.8% molybdenum and 0.6% tungsten occur within a 35-acre area where soil samples average more than 0.2% molybdenum. Soil samples in an adjacent 25-acre area average 0.12% tungsten.

None of the copper, molybdenum and gold deposits of the porphyry
persuasion in Alaska are world class, but many, in the Nabsena Porphyry Belt, were only in the evaluation stage when the surrounding Wrangell-St. Elias National Park was created by Congress in 1980. BOND CREEK, ORANGE HILL, CARL CREEK, BAULTOFF, AND HORSFELD, near Nabsena, contain inferred reserves well in excess of 1 billion tons at grades of about 0.3 - 0.5% copper with about 0.03% molybdenum. Porphyry copper deposits on the Alaska Peninsula have recently been investigated, and the PYRAMID deposit has inferred reserves of 125 million tons of 0.4% copper and 0.03% molybdenum, while the resources at Cominco Alaska's PEBBLE BEACH deposit are reported to be 200+ million tons of 0.4% copper, 0.012 oz/ton gold, and 0.02% molybdenum, with a 50 million ton core of 0.5% copper and 0.015 oz/ton gold.

Drilling at Fort Knox Gold Deposit, 1990. Photo Credit: Richard Swainbank

Fort Knox Gold Deposit N.E. of Fairbanks, Summer 1990. Photo Credit: Richard Swainbank

Other 'elephants' include the Cambior, Alaska, VALDEZ CREEK MINE, in central Alaska, which is probably the largest dry land gold placer operation in North America, with production scheduled to be about 80,000 ounces per year. The BRADY GLACIER property, which is compromised by the surrounding Glacier Bay National Park, contains proven reserves of 100 million tons of 0.5% nickel and 0.3% copper, in addition to cobalt and platinum, and is one of the largest nickel deposits in the United States. At BOKAN MOUNTAIN in southeast Alaska, nine deposits are estimated by the U.S. Bureau of Mines to contain 240 million pounds of rare-earth oxides within 37.8 million tons of rock. About half of this is composed of the heavy yttrium subgroup, making this area one of the best prospective sources in the USA. Uranium, thorium, columbium, and zircon are commonly associated in significant quantities with the rare-earths. GOODNEWS BAY, in extreme western Alaska, is probably the largest reserve of placer platinum in the country, with deep reserves in excess of 60 million cubic yards. RED MOUNTAIN, about 120 miles southwest of Anchorage, contains a huge quantity of low grade chromite, but new technology under test may make this deposit economically viable with a ferrochrome product. The SLATE CREEK asbestos deposit, west of Eagle, in east central Alaska, contains 55+ million tons of 6.3%, high quality chrysotile asbestos, and is one of the largest deposits in the nation.

What of the future? Very significant proven and probable gold reserves have been outlined in the igneous-hosted FORT KNOX deposit near Fairbanks, in central Alaska. The global resource of 7 million ounces of gold to a depth of 600 feet will almost certainly increase with continued evaluation, but already compares favorably with the 8 million ounces estimated to have been produced from the whole mining district during the last 90 years. More targets of the same type can be anticipated in this area.

In the Juneau area, recent exploration at the A-J MINE has outlined over 100 million tons of proven/probable and possible gold ore grading about 0.05 ounces per ton and Echo Bay is in the process of trying to obtain permits for mining at a rate of about 22,000 tons per day. Echo Bay is also involved in the KENSINGTON project about 40 miles north of Juneau. Stated reserves here are 11.5 million tons grading 0.143 ounces per ton of gold, but numerous host structures remain to be tested. This mine is also in the permitting stage, so Juneau could have a major underground primary gold producer before Fairbanks.

Gold production from these three properties is projected to be about 900,000 ounces per year. If and when all are producing, and assuming metal prices don’t vary greatly, the value of precious metal production in Alaska will again be in a horse race with the value of base metals.

[Sources for the information in this review are the property owners, credited agencies, and Alaska's Mineral Industry 199, (State of Alaska, Division of Geological and Geophysical Surveys Special Report 45).]
Mine Planning to Marketing by Computer

William F. Rapier, CPG-6759

If your computerized mine and reclamation plans have expanded to new horizons to include: geographic mapping of competitors; market growth based upon population trends from TIGER file data; delivering cost analysis to numerous geographic locations from multiple mine sites; or integrating parcel tax maps with proprietary surveys, aerial photos, or digital USGS maps, then welcome to the world of Geographic Information Systems (GIS/LIS).

As a member of the Urban and Regional Information Systems Association (URISA), I attended a URISA workshop entitled "GIS in Real Estate" at the 1991 Annual Conference in San Francisco, California. The professional workshop was both appropriate and worthwhile since I have been developing and implementing a GIS/LIS system for my employer's specific needs for several years. My employer's current approach is a PC DOS based AutoCAD, FMS/AC, Paradox software system which is being developed slowly in order to maintain a low cost functionality with new technological advances and proprietary database development. Luckily, that approach fits well with what I learned in the workshop. I recall Mr. Gil Castle, Regional Director of the Roulac Group of Deloitte & Touche for the San Francisco, California office, commenting that no one software supplier has provided all of the solutions and databases required to satisfy his client's needs. As amazing as it may sound, even the software and database suppliers have realized the need for easy compatibility between software systems and database information. Overview versions of existing software programs are being developed so that even various raster and vector based databases can be viewed on top of each other in order to eliminate or greatly reduce the cost of database and/or software data conversions.

Consequently, in the near future, mine and land use planning and permitting will be able to merge with real estate and market competition analysis, so that the mining geologist can be involved with the entrepreneurial or empowered employee approach to mining and supplying tomorrow's mineral needs.

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Mining Geology in the Forest Service

F. B. "Ted" Mullin, CPG-1716

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Prior to the establishment of the U.S. Forest Service, lands which are now National Forests were first created as Forest Reserves by the Geological Survey. The administration of the Forest Reserves was transferred to what is now the U.S. Forest Service in 1905, with Gifford Pinchot as the Chief. It was his concern for management excellence that led to the hiring of geologists and mining engineers to oversee mining operations on the National Forests as early as 1911. By 1960, there were 34 mining engineers and geologists in the Forest Service.

The Forest Service now employs approximately 350 people nationwide in the Minerals and Geology program. Included in this group of managers are about 165 geologists and mining engineers; and, of this group, there are 60 or so whose job deals primarily with mining geology and/or mining engineering. The remainder work with environmental standards for exploration, development, and production of oil and gas and other leasable minerals; land reclamation; land management planning assessments; and engineering. The engineering geologists investigate geologic conditions affecting safety, efficiency, and economy of engineering projects such as roads, dams, bridges, and geotechnical activities dealing with landslide stability studies, seismic surveys, and other subsurface investigations of soil and rock.

The mining geologists work primarily with hardrock operations. In addition to a detailed knowledge of metallic and non-metallic mineral deposits, the mining geologist for the Forest Service is required to have a working knowledge of underground, surface, and placer mining operations. He or she must be familiar with the practical side of mineral economics; mine cost estimation; milling and marketing; mill chemistry; reclamation practices and procedures; mineral land appraisal and valuation; and the laws pertaining to mineral extraction and reclamation. Mastery of these skills may lead directly to the witness stand as an expert witness on behalf of the government.

The events that end up in court or before an Administrative Law Judge in an administrative hearing almost always involve some misuse of the mining laws. Exceptional cases involve differences in opinion regarding the requirements of a discovery under the mining law. Some of these cases will last hours and others can stretch out for weeks. It is often years before a final decision is reached.

The wide range of mining activities is the most interesting part of the job. Those of us who have been involved with the mining activity in the forests have, at one time or another, had to deal with major mining operations one day and prospectors or "Mom and Pop" operations the next. Operations involving large underground block caving; major large low-grade bulk mineable deposits; small placer operations; limestone quarries; dimension and decorative stone quarries; sand-and-gravel operations; and small underground mining operations are but a few examples of the variety a mining geologist in the Forest Service are confronted with sooner or later.

Involvement ranges from full-blown economic analysis of the operation for mineral patent cases to providing technical advice to the local District Forest Ranger who may never have dealt with a mine before.

If one can "put up" with the bureaucracy, it's steady work with a lot of variety and, best of all, the scenery is the most outstanding in the country.

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The Mining Environment

William F. Rapier, CPG-6759

When flying from one part of the United States to another, I am always amazed at the diversity of land forms that even an untrained eye would be able to recognize from various altitudes. Needless to say, I perceive a large mine site as merely another land form that I will recognize easily due to my experience, especially in the early mining stages. Yet to me, a mine site does not stand out any differently from its otherwise natural surroundings, than do other man-made variations, such as farms, highways, or cities. Even natural variations such as rivers, deserts, mountains, and volcanoes, have pronounced visual and physical impacts on the otherwise humanly perceived natural surroundings.

The cycle of weathering, uplift, and tectonic disturbance that has been reshaping the Earth's surface day-to-day for more centuries than man has been recording them, is in many instances quite similar to the land alteration cycles involved in the mining industry's pursuit of mineral extraction. The general public's negative sentiment toward mining seems to be a result of the loss of time perspective in dealing with nature and the mining industry. Consequently, the loss of this perspective has helped to spur the many stringent mining and reclamation requirements placed upon the mining industry's extraction of minerals today.

Having grown up swimming, fishing, and boating in man-made lakes and ponds, some of which were due to prior dredging or quarrying activities, I view what is natural in a different light than those who have never had the experience. The public hearing process that has become intertwined with the increased regulation of mining and reclamation activities does not, in most instances, take into account the fact that the mining, processing, and use of minerals and construction materials is as basic to our civilization's every day activities as is food, clothing, and shelter. In Texas, the so-called soil materials under and around our homes and in our gardens were often mined, processed, transported, and placed there by the mining industry when the home was constructed, in order to improve our natural environment. Furthermore, the concrete sidewalks we walk on, the bricks and mortar that front our homes, the gypsum wallboard upon which we hang our pictures, the electrical wiring that delivers power to our fingertips, and the silverware, glass, and stoneware that we cook, eat, and drink with, were mined and processed at some point in time and space from the surface of the Earth.

The mining industry has enhanced and utilized natural processes in order to manufacture the products that people now take for granted in their day-to-day lives. In the Central United States, sand and gravel materials were brought into the area by glaciers, and subsequently reworked by geologic processes over thousands of years into specific deposit areas. Hydrological transport by rivers (being one of those geologic processes), scours, removes, segregates, clarifies, and redeposits the sand, gravel, and sediment load to create sand bars, deltas, highbanks, and abandoned water-filled channels and pits, among many other features that man calls natural. The mining geologist, through his understanding of the various geologic processes that affect a given geographic area, can locate and define the limited economically suitable deposits of sand-and-gravel materials that occur in that regional area. After the exploration and definition of a sand and gravel deposit has been completed by the mining geologist, the mining company can often employ hydraulic underwater dredging operations mimicking, to a major extent, the transport of sediments by rivers within their banks, so that sand, gravel, and sediment can be segregated into saleable products.
The politician's desire that some sort of reclamation, or even full restitution of the land to its original condition prior to mining, should occur in order to represent to his constituents that no change has occurred to the potential use of the property, is an untruth. Even when property has been mined with all of the economically recoverable minerals or construction materials having been removed, the property still exists. Yet, useable products, along with the creation of new wealth, have been provided to the public for its use. Mining of a property does change its potential use, since the property can no longer yield the minerals or construction materials that have already been removed. Consequently, the property has a lower income value to man until some other use is made of the property or wealth is reinvested into the property in order to put it to some other use. However, nature will use and affect the property whether man does so or not. The prospect of nature's use of mined but un-reclaimed land leads to a series of other questions when exploring the issue.

Will an oxbow abandoned by the river be filled to its prior original grade in one year, five years, or even fifty years? Who is responsible for determining the future use of that abandoned oxbow? Who puts up the reclamation bond until the oxbow reseeds itself? An un-reclaimed floodplain sand-and-gravel mine site will undergo the same natural processes at work with an abandoned oxbow, within about the same five to fifty-year time span. The cycle of deposition, mining, and reclamation by natural means, and the subsequent reuse of the mined area by nature or by man, will occur over time without the need for major and costly regulations geared to recreate original conditions, or to eliminate or prevent mining in the first place.

Consequently, it is a misconception on the part of some individuals to view the alterations by mining of small portions of the Earth's surface as being detrimental, whether reclaimed or un-reclaimed. Nevertheless, just as in any other type of business or industry, the mining industry recognizes the necessity for proper safety and environmental hazard prevention to eliminate any immediate threat to the health or physical safety of the general public. The change of land forms is part of the natural cycle, whether it is accomplished by nature or mining; whereas, what is natural is a perception of what people are accustomed to and what they understand. It is up to the mining industry and the geologic professional to educate the public as to what is acceptable in the cycle of land forms and uses to which the Earth's surface will be employed.

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**Earth Science Software**


This handbook is a comprehensive summary of PC software programs available from government agencies in the United States and Canada, universities and individuals, as well as the most popular and inexpensive commercial programs. The book is divided into more than 30 categories, including economic evaluation, geology, mapping, geochemistry, coal, geophysics, statistics, mining, surveying, hydrology, earth science bulletin boards, and GIS.

Available from Gibbs Associates, Energy and Minerals Information Specialists, P.O. Box 706, Boulder, CO 80306-0706, Phone (303) 444-6032.
LIST OF REGISTRATION/CERTIFICATION
BOARDS FOR GEOLOGISTS

ALASKA*
Dept. of Commerce and Economic Development
Division of Occupational Licensing,
9th Floor, P.O. Box 110806
Juneau, AK 99811-0806
(907)465-2534
(907)465-2540
(Reciprocal with AIPG)

ARIZONA
AZ State Board of Technical Registration
of Architects, Assayers, Engineers, Geologists,
Landscape Architects, and Land Surveyors
1951 West Camelback Road, Suite 250
Phoenix, AZ 85015
(602)255-4053

ARKANSAS
AR State Board of Registration for Professional Geologists
c/o Arkansas Geological Commission
3815 West Roosevelt Road
Little Rock, AR 72204
(501)324-9165

CALIFORNIA
State Board of Registration for Geologists
and Geophysicists
400 "R" Street, Suite 4060
Sacramento, CA 95814-6200
(916)445-1920

DELAWARE
DE State Board of Registration
Margaret O’Neill Building
P.O. Box 1401
Dover, DE 19903
(302)739-4522

FLORIDA
Dept. of Professional Regulation
Board of Professional Geologists
1940 North Monroe Street
Tallahassee, FL 32399-0751
(904)487-7992

GEORGIA
GA State Board of Registration for Geologists
Secretary of State, Examining Boards Division
166 Pryor Street, S.W.
Atlanta, GA 30303
(404)656-2281

IDAHO
ID State Board of Registration for
Professional Geologists
650 W. State B-83
Boise, ID 83720
(208)334-2268

INDIANA*
IN Geological Survey
Department of Natural Resources
611 North Walnut Grove
Bloomington, IN 47405
(812)855-5067
(812)855-9350
(Reciprocal with AIPG)

MAINE*
ME State Board of Certification for Geologists
and Soil Scientists
Dept. of Prof. and Financial Regulation
State House Station #35
Augusta, ME 04333
(207)582-8723

NORTH CAROLINA
NC Board for Licensing of Geologists
P.O. Box 27402
Raleigh, NC 27611
(919)781-7297
(919)733-3833

OREGON
OR State Board of Geologist Examiners
750 Front Street, N.E., #240
Salem, OR 97310
(503)378-4180

SOUTH CAROLINA
SC State Board of Registration for Geologists
P.O. Box 11904
Columbia, SC 29211-1904
(803)253-4127
(803)252-3432 FAX

TENNESSEE
Dept. of Commerce and Insurance
Division of Regulatory Boards
500 James Robertson Parkway
Nashville, TN 37243-1139
(615)741-3449

VIRGINIA*
VA Board of Geology
Virginia Department of Commerce
3600 West Broad Street
Richmond, VA 23230-4917
(804)367-8595

WYOMING
WY Board of Registration for Professional Geologists
Box 3008
University Station
Laramie, WY 82071
(307)766-2490
* = Certification
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- Business meetings scattered from Monday - Wednesday
- Five field trips, tied to theme sessions
- Three workshops, one tied to field trip
- Keynote Speaker: T S Ary, Director, U.S. Bureau of Mines

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facilitate the use of natural gas as an alternative fuel.

STATUS: 3/3/92 INTRODUCED.

CT S 362
AUTHOR: Comm. on Transportation
TOPIC: TRANSPORTATION
SUBTOPIC: TRANSPORTATION - MISC.
SUMMARY: Requires the Dept of Transportation to purchase motor buses or multi-passenger vehicles powered by natural gas.

STATUS: 3/4/92 INTRODUCED.

FL S 2176
AUTHOR: Dantzie
TOPIC: POLITICS & GOVI.
SUBTOPIC: GOVT. PROPERTY - STATE & FEDERAL
SUMMARY: Belongs to the removal of organic & detrimental matter from soils; prohibits the Board of Trustees of the Internal Improvement Trust Fund & all other state agencies from imposing a charge of lien on any such matter removed from state lands; prohibits the Dept. of Environmental Regulation from requiring a deposit & fill permit for removing such matter from the surface of natural mineral soil materi. provides for effective date.

STATUS: 1/23/92 INTRODUCED.

FL 10095
AGENCY: Dept of Prof. Regulation
TOPIC: BUSINESS AND CORPORATIONS
SUMMARY: Allows successful licensure candidates up to 6 mos. from the time they are eligible to become licensed, without having to recally under new laws & rules which are possibly more stringent than the old.

AGENCY CONTACT: Angel Gonzalez, Exec. Director, Board of Architecture & Interior Design, Northwood Centre, 1942 N. Monroe St., Tallahassee, FL 32309-0750.

CITATION: FAC218-17.002
PROPOSAL DATE: 2/14/92
COMMENT DEADLINE: 3/9/92
HEARING DATE: 3/16/92

HI H 217 & 227
AUTHOR: Ige & Stagner
TOPIC: EDUCATION
SUBTOPIC: POSTSECONDARY EDUCATION
SUMMARY: Requests that the Univ of Hawaii establish a strategic plan to make the School of Ocean & Earth Science & Technology a premier school of its type in the nation.

STATUS: 3/12/92 INTRODUCED.

HI H 275 & 285
AUTHOR: Santiago
TOPIC: ENV. PROT. & POLLUTION CONTROL
SUBTOPIC: ENVIRONMENTAL ISSUES
SUMMARY: Requests the Legislative Reference Bureau to study the possibility of establishing a system which would ensure the preparation of environmental impact statements by private consultants.

STATUS: 3/12/92 INTRODUCED.

ID H 778
AUTHOR: Comm. on Ways & Means
TOPIC: ENV. PROT. & POLLUTION CONTROL
SUBTOPIC: SOLID WASTE
SUMMARY: Requires the siting & design of solid waste facilities; provides legislative findings & purposes; defines consistency with Federal Land law regarding solid waste; provides for the rules of units of govt.; locates restrictions & site certification procedures for site certification standards for design; provides for a design & development review procedure, standards of operation, review of operation plans, ground water monitoring, standards for closure standards for post closure care.

STATUS: 3/4/92 INTRODUCED.

IL 4667
AGENCY: Dept of Mines & Minerals
TOPIC: ENERGY
SUMMARY: Requires the Illinois Oil & Gas Act; specifies requirements for drilling & completing wells including the handling, storage & disposal of wastes generated during drilling & completion activities; specifies alternative ways & means of completing & completing wells respectively, defines plugging fluid wastes & sets forth requirements for their handling, storage & disposal during plugging & well site restoration operations; clarifies that transfers include all wells on a lease, & provides for notice & hearing if an interested person contests a permit transfer action by the Dept.


CITATION: 62 IAC 240-10, 500-550, 610, 630, 640, 710, 740, 900, 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1300, 1400, 1400, 1410, 1440, 1460
PROPOSAL DATE: 3/6/92
COMMENT DEADLINE: 4/20/92

LA 2877
AGENCY: Env. Protection Comm.
TOPIC: ENV. PROT. & POLLUTION CONTROL
SUMMARY: Regards soil boring samples at sanitary landfill sites; adds reference to the submittal schedule for subsequent solid waste comprehensive plans; removes the direct tie to the 3 yr. permit renewal schedule for comprehensive plans, and implies, submitted by cities, counties, interstate agencies managing solid waste, to encourage planning activities for multi-county areas where feasible.

AGENCY CONTACT: Julie Kijokriasio, Waste Management Div., Dept. of Natural Resources, Wallace State Office Bldg., 100 E. Grand Ave., Des Moines, IA 50319-0034, (515)281-8946, FAX (515)281-8895.

CITATION: 567 IAC 101.5
PROPOSAL DATE: 3/18/92
COMMENT DEANLINE & HEARING DATE: 4/8/92

KS S 761
AUTHOR: Comm on Ways & Means
TOPIC: RES. MGMNT. & PRESERVATION
SUBTOPIC: MINING
SUMMARY: Requires to be listed on the state's natural resources for protection against land use activities that cause damage to the environment.

STATUS: 2/27/92 INTRODUCED.

KY H 817
AUTHOR: Smith, R.
TOPIC: ENERGY
SUBTOPIC: OIL, GAS, PETROLEUM
SUMMARY: Requires to be listed on the state's natural resources for protection against land use activities that cause damage to the environment.

STATUS: 3/3/92 INTRODUCED.

KY S 361
AUTHOR: Naison
TOPIC: RES. MGMNT. & PRESERVATION
SUBTOPIC: MINERALS & MINING
SUMMARY: Requires to be listed on the state's natural resources for protection against land use activities that cause damage to the environment.

STATUS: 3/4/92 INTRODUCED.

ME 2825
AGENCY: Board of Certification for Geologist & Soil Scientists
TOPIC: BUSINESS & CORPORATIONS
SUMMARY: Increases the exam fees in order to provide sufficient funds for testing administration for geologists & soil scientists.

AGENCY CONTACT: Sandra Leach, State House Station #53, Augusta, ME 04333, (207)582-8723.

CITATION: UNCODIFIED - Chap. 2 Review of Applications for Certification.

PROPOSAL DATE: 1/29/92
COMMENT DEADLINE: 2/21/92

MN H 3562
AGENCY: Board of Fire Prev. Reg.
TOPIC: UTILITIES & APPLIANCES
SUMMARY: Requires certification of oil storage tanks, tank installation, & permits & licenses in their connection.

AGENCY CONTACT: Lisa Attili, Admin. Secy., Board of Fire Prevention Regs., McCormick Bldg., Rm. 1310, 1 Ashburn Place, Boston, MA 02101.

CITATION: 527 CMR 4.00
PROPOSAL DATE: 1/31/92
EFFECTIVE DATE: 1/31/92

MI H 5004, 5605 & 5606
AUTHOR: Dolan, Mursell, & Goss
TOPIC: ENERGY
SUBTOPIC: OIL, GAS, PETROLEUM
SUMMARY: Requires & provides protection for surface owners under gas & oil drilling requirements; returns to counties control over gas & oil drilling; provides for control over gas & oil drilling in charter townships.

STATUS: 3/4/92 INTRODUCED.

MN H 3170 & S 2185
AUTHOR: Farrell
TOPIC: ENV. PROT. & POLLUTION CONTROL
SUBTOPIC: HAZ. & TOXIC WASTE - NON-NUCLEAR
SUMMARY: Requests that persons bidding on a corrective action or other hazardous waste contracts to perform investigations under the petroleum tank cleanup fund must file a bond (in blank amount) naming the state as obligated; requires contractors to have workers' compensation, comprehensive auto, commercial general liability, & professional liability & environmental insurance coverages in specified minimum amount; written by insurers rated A or better by A.M. Best.

STATUS: 2/27/92 INTRODUCED.

MS H 1005
AUTHOR: Pery
TOPIC: ENERGY
SUBTOPIC: OIL, GAS, PETROLEUM
SUMMARY: Requires that owners of co2 gas wells begin production from such wells within a certain period of time or surrender their lease to the owners of the mineral rights.

STATUS: 2/24/92 INTRODUCED.

MS H 1056
AUTHOR: Mathison
TOPIC: RES. MGMNT. & PRESERVATION
SUBTOPIC: LAND
SUMMARY: Creates the Board of Registration of Geographic Information Systems Professionals; authorizes the Board to adopt rules & regulations; provides for registration fees; sets forth the qualifications of an applicant; provides for certificates of registration; defines unlawful acts; provides for disciplinary actions; authorizes the Board to perform inves-
AGENCY CONTACT: Oil Conservation Commission, Santa Fe, NM.
CITATION: 24 Tex. R.S.C. § 301.010-010.030
PROPOSAL DATED: 10/10/91
EFFECTIVE DATE: 12/31/91

NY A 10047
AUTHOR: DiNapoli
TOPIC: LABOR & EMPLOYMENT
SUMMARY: Relates to the practice of environmental consultation and establishes licensing requirements for professional environmental consultants.
STATUS: 3/3/92 INTRODUCED.

NC 2021
AGENCY: Dept. of Env. Mgmt.
TOPIC: ENV, PROT., & POLLUTION CONTROL
SUMMARY: Relates to underground storage tanks; provides for corrective action in the event of leaking of petroleum or hazardous substances.
AGENCY CONTACT: Tracy Davis, Chief of Div. of Land Resources, Land Quality Section, P.O. Box 27677, Raleigh, NC 27611-7078, (919)733-4574.
CITATION: 5 NCAC 0.0005, Mining Resource Regulations.
PROPOSAL DATED: 2/14/92
COMMITTEE DEADLINE: 3/5/92

OR 3837
AGENCY: Appraiser Certification & Licensure Board
TOPIC: BUSINESS & CORPORATIONS
SUMMARY: Sets out the organization, administration, and procedures for the Appraiser Certification & Licensure Board; sets requirements for Appraisers & Appraiser Assistants in Oregon; provides for the application & examination procedures, educational courses & providers, scope & procedure & practice for appraisers, temporary registration, grandfathering, & discrimination.
AGENCY CONTACT: Calvin O. L. Henry, Administrator, Appraiser Certification & Licensure Board, Office of Secretary of State, 325-13th St., S.E., Ste. 301, Salem, OR 97310, (503)337-1300.
PROPOSAL DATED: 2/11/92
EFFECTIVE DATE: 12/31/91
EXPIRATION DATE: 6/30/92

PA S 1598
AUTHOR: Stapleton
TOPIC: ENERGY
SUBTOPIC: OIL, GAS, PETROLEUM
SUMMARY: Amends the Oil & Gas Act; provides for definitions, well permits, well registration, inactive status, plugging requirements, well reporting requirements, bonding, the Oil & Gas Technical Advisory Board, public nuisances, civil penalties, determination of compliance, unlawful conduct, & surcharges for new wells; exempts certain bonds from bonding requirements; provides for local ordinances.
STATUS: 3/16/92 INTRODUCED.

SC H 4607
AUTHOR: Rhoad
TOPIC: RES. MGMT., & PRESERVATION
SUMMARY: Establishes the State Board of Registration for Hydrologists, defines its powers and duties, regulates the practice of hydrology, & provides penalties.
STATUS: 3/4/92 INTRODUCED.

TX 9533
AGENCY: Texas Water Commission
TOPIC: ENV, PROT., & POLLUTION CONTROL
SUMMARY: Relates to underground & aboveground storage tanks; relates to the Interim Reimbursement Program; repeals a rule establishing a groundwater protection program, implementing a reimbursement program to responsible parties who clean-up sites on their own initiative.
AGENCY CONTACT: Ethel Birch, Staff Atty., Legal Division, Texas Water Commission, 100 N. Congress Ave., P.O. Box 13087, Austin, TX 78761-13087, (512)463-8569.
PROPOSAL DATED: 1/3/92
EFFECTIVE DATE: 3/4/92

VA H 1146
AUTHOR: Stump
TOPIC: ENV, PROT., & POLLUTION CONTROL
SUBTOPIC: WATER QUALITY
SUMMARY: Relates to the injection well interference with groundwater supplies.
STATUS: 1/23/92 INTRODUCED.

VA H 1146
AUTHOR: Stump
TOPIC: ENV, PROT., & POLLUTION CONTROL
SUBTOPIC: WATER QUALITY
SUMMARY: Relates to the injection well interference with groundwater supplies.
STATUS: 1/23/92 INTRODUCED.

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the United States, but only on a very modest scale. Much profitable improvement is possible. Geological investigations prior to siting, design and construction can be exceedingly cost-effective.

The significance of the bedrock, placer and other unconsolidated materials is potentially enormous. Most soil is derived from underlying or nearby bedrock. Thus, nearly all minerals which occur in the bedrock also are found in the soils derived from them. Placer deposits are mechanically concentrated minerals which often have been transported from some other place, though not always very far. While they indicate the presence of a source, that source is not always immediately underlying or adjacent to the deposit. Yet, its approximate location can be inferred.

Over the past two decades, it has been amply demonstrated that much information of potential importance to pipeline owners and designers is gathered in the process of conducting environmental investigations. Unfortunately, this has too often been viewed as presenting a nuisance or obstacle instead of an opportunity. To seize these opportunities, the owners and designers must think more in terms of how this information can be used to design and construct more efficiently and cost-effectively.

For example, review and synthesis of existing geological information, including existing commercially and publicly available maps, reports, aerial photography, LANDSAT, etc., is an essential first step in properly establishing baseline data for environmental studies (ALL environments occur in a geologic setting). Such information gathered in corridors proposed for two major pipelines (in the northern and in the southwestern United States) yielded maps: showing areas likely to have unfavorable conditions, owing to possible landslides, subsidence, archeological sites, shallow rock and ground water, and other problems likely to result in delays and high construction and maintenance costs; as well as areas likely to have particularly favorable construction conditions and areas appearing to offer high potential for the occurrence of exploitable resources. For quality control, these maps were spot-checked in the field, with nearly 100% verification. All of this was accomplished prior to incurring expensive field reconnaissance. The result was selection of a number of areas to minimize or avoid the "problem" areas, and to maximize the use of "favorable" areas, with a substantial savings over conventional methods in both time and money.

In another example, an existing gas line in the eastern United States, built without geological input, had been plagued by interruptions caused by frequent landslides. The line was partially redesigned and relocated on the basis of three days of geological investigations. It remained free of such problems until its abandonment with the demise of its market some years later.

A consideration that has been almost universally overlooked is the opportunity for profitable by-products. During the environmental investigations prior to construction, resources may be identified that offer the potential for development of profitable enterprises. Here again, knowledge of the ways in which soils and plants are related to the local geology is extremely important in providing clues. For example, environmental geological investigations in a proposed gas pipeline corridor in the midwest tentatively identified previously unreported extensive closed anticline, with subtle surface expression, on the basis of an observed affinity of a particular species of plant for a particular geological formation. On the further basis of known regional stratigraphy, the structure was identified as having excellent potential for shallow gas storage which would enhance the value of the proposed gas line.

Moreover, during construction of a pipeline, excavations for both the facilities and the pipeline itself offer unique opportunities to explore for, and identify, mineral resources for possible future exploitation. Myriad examples exist of deposits which could have been found by properly qualified geologists on "spreads", logging, sampling, and photographing all of the excavations. Two in Wyoming and one in Oklahoma are cited: (1) The large Green Mountain-Shirley Basin open pit uranium development; (2) The extensive magnetic iron deposits in the South Pass area of Wyoming; and (3) A high-quality clay deposit, now supplying a major ceramic manufacturer in the mid-continent. Instead of being found by "spread" geologists, these were located in the conventional method of expensive exploration programs. The potential is not limited to uranium, iron and clay. It extends to all minerals, but metals are the most obvious. An outstanding example of a lost opportunity in one of the most highly mineralized areas of the world is the Kern River gas pipeline recently constructed from southwestern Wyoming to central California. While a large number of biologists, archeologists and paleontologists were employed on the "spreads", there was reported to have been no geological input of the type described in this paper in either the design or the construction of the line.

It should be obvious that geologists, both before and during construction, are a very profitable investment.

"Design" geologists, involved from the inception of the project, can provide information which can be invaluable in the routing and design of the pipeline and in the preliminary identification of exploitable resources. They perform an inexpensive service with the potential to yield a highly significant return.

"Spread" geologists also are inexpensive, while offering potential for high return. The information they gather builds on, and supplements, that provided by the "design" geologists, frequently identifying pre-
viously unknown geological conditions.
Together, the "design" and the "spread" geologists (who may actually be the same persons) perform several important services. They
* Identify construction conditions and constraints;
* Identify potential threats, or contributions, to the future integrity of the pipeline;
* Identify anomalous materials and conditions which may suggest the existence of an archeological site to be investigated and, perhaps, avoided; and
* Identify potentially exploitable resources.
Thus, each geologist serves multiple functions with multiple potential economic significance. These are in terms of both minimizing costs of time and money and adding to income, both immediate and long-term.*

Senator Nickles Addresses Oklahoma Section

Will Investigate Charges of Canadian Discrimination Against U.S. Geologists

Tulsa, OK - U. S. Senator, Don Nickles (R-OK), addressed the Oklahoma Section, AIPG, on the subjects of "U. S. Energy Policy" and "Proposed EPA Regulatory Changes" at its annual meeting, February 22.

After his formal presentation, Senator Nickles answered many questions on these and other subjects. Two issues were raised which are of particular interest to Members in other Sections as well as Oklahoma. They are: (1) anti-U.S. discrimination by Canadian provinces in their geological registration/chartering acts, and (2) retraining for displaced petroleum and mining geologists.

Senator Nickles has asked AIPG Headquarters to gather information for him on recent acts in Canadian provinces which appear to violate the Free Trade Agreement. Members and others are encouraged to send documentation on this issue to AIPG Headquarters, Attention: Government Affairs - Canadian Registration, 7828 Vance Dr., Arvada, CO 80003, or FAX (303) 431-1392.

As to the second issue, the Senator will look into reports of recent cuts in funding of programs to assist in retraining displaced petroleum and mining geologists.

Senator Nickles is the Ranking Minority Member of the Energy Regulation and Conservation Subcommittee of the Committee on Energy and Natural Resources, and a member of the Interior and Related Agencies Subcommittee of the Committee on Appropriations, in addition to other committee assignments of interest to geologists. He also is Chairman of the Senate Republican Policy Committee. Senator Nickles is regarded as a friend of the geological profession.*

Executive Director's Itinerary
(subject to change)

The Executive Director is visiting various Sections, agencies, campuses, and other organizations. He is talking, listening, and exchanging information and ideas. Members are encouraged to attend these meetings wherever and whenever possible. His itinerary for the next six months, as presently scheduled, is:

Apr. 11: AIPG Executive Comm., Arvada, CO
Apr. 20: Univ. of Colorado, Boulder, CO
Apr. 23: Colorado School of Mines, Golden, CO
Jul. 11: AIPG Executive Committee, Arvada, CO
Jul. 28-31: (Tentative) Council of Eng. and Scientific Society Executives, Detroit, MI
Sept. 11: Univ. of Northern Colorado, Greeley, CO
Sept. 27-30: AIPG Annual Meeting, Lake Tahoe, NV

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CONSULTANTS' COLUMN

Fred L. Fox, CPG-1273

Executive Director William V. Knight's column (February '92 TPG) makes an excellent point that I hope was not lost on the consultants among us: "All of this [others doing work that rightfully should be done by geologists] results from default by the geologic profession." While the statement is not totally true, the point is completely valid.

The fault in the statement is a telling one. Historically, some of the work that should be done by geologists has been done by engineers. The reason that it was not done by geologists is not that we defaulted so much as that the work was perceived as affecting the public welfare, and PROFESSIONAL(?) ENGINEERS took the responsibility. You don't see appraisers doing engineering. You don't see soil scientists doing engineering. You don't see geologists doing engineering either, but you do see appraisers, engineers, soil scientists, and podiatrists doing geology, don't you? Especially engineers. PEs do virtually everything, under the law. Is it because geology is so simple that it can be done by anyone? It's obvious, from countless inferior reports by engineers, geographers, and whomever, that the answer is NO.

It is because engineers are protected by their registration and empowered by it to move, almost at will, beyond their profession into any other profession not protected by registration. It's only a short step to the realization that, if geologists were registered, we'd be empowered to do geologic work, and you wouldn't see others doing it. This is a sad state of affairs, having to be permitted by others to do the work that we must. This is a perfect example of the difference between ethics and the law. PEs are protected by the law which, in this case, clearly underwrites unethical conduct.

I agree with Director Knight that geologists have given away whole professions and I believe that they (we) did so from a scientific point of view that has come to haunt us. Much of the discord between geologists and engineers springs from our origins. Geologists are basically scientists, while engineers are not. Scientists tend (or at least tended) to stick to their specialty and expect others to stick to theirs. Engineers in public practice do not. They soon learned to appreciate the power that had been bestowed on them, using it to permeate adjacent professions in the name of public welfare. Geologists have only recently figured that out (and too many of us fail yet to see that seamy side of the registration issue).

I've been an environmental geologist since it came to be (with the birth of NEPA, 1969), and one of the things I haven't like about it is the fact that it is "statute-driven" (in Director Knight's words). A lot of our work is done because it is written that it must be done, rather than because it should be done. This, in turn, means that we aren't hired to do something creative so much as to keep our clients' wounds to a minimum. This isn't very satisfying (in my book, at least), but I believe that at least if geologists do geological work, it protects the client from the incompetents who will gladly do it if we don't.

Fortunately, the dislikes of my profession are outweighed by the positive aspects, the main one being that environmental geology is applied geology; public geology; useful geology; yes, even fun geology, and people can see the results. I am able to affect society directly and hopefully make a living at it. In most cases, I can make clients happy and make their spending money on my services somewhat satisfying. In some cases, I can only help them cut their losses, but usually the net result of their hiring me is a benefit rather than a liability.

What I'd really like to do is get to top management and help set policy. Identifying/solving environmental problems is one thing. Preventing them is quite another. I'd be interested in hearing from any of you who might know how to penetrate this firmament. A network, perhaps?

There is no doubt in my mind that we geologists have it within our power to "save the environment" - we certainly understand it better than most - and make the world a better place. There aren't many professions that have that potential or that obligation. It's unethical on our part to let the world down by not using our talents and/or by defaulting to others the work that we can do better than anyone else. There's a dilemma here - we can't expect "them" to ask, or even to know. We have to tell them. And we can't expect the PEs to relinquish control of our profession. We will have to take it back. We have to take back those responsibilities that we have let slip away. We must do this. It's our duty. But, just trying to "get registered" won't do it. We have to go at it from the point of view of ethics. Do you have any ideas? Case histories? Let's hear them. It's time.

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In this space in the last two months we have addressed the questions, "What Do Employers Want?" and "What Is Needed For Advancement?" This month we will begin to talk about career planning and management. This subject is important and there is a lot to be said, so we will divide it into sections.

Career Planning And Management: Filling In The Holes

Now that we have mastered the fundamentals of our profession and learned what employers expect of us, we need to give a little thought to where we want our career to go and what we are going to do to try to get it there.

First, you need to have some idea of where you want to be five years from now - ten years - fifteen years. Very probably, you will not be exactly there, but your chances are much better if you have some career goals and some plan to follow. Next, you need to know what it is going to take to get you there.

We have identified the subject matter one needs to have as a foundation and for advancement. Now, it is up to each individual to identify the holes in his or her qualifications and try to fill them.

The first qualification is education. Several times in the previous months, we have mentioned the need for continuing education. This is one of the ways we fill those holes. We are constantly inundated with opportunities to attend short courses and seminars. Some are good and some are not. Some are blatant sales pitches disguised as continuing education courses. We have to make some choices. We need a way to get some idea of the quality and appropriateness of these courses.

Many courses carry what are called "CEUs", Continuing Education Units, granted on the basis of 1 CEU = 10 hours of contact time. This is a copyrighted term that the vendor of a course pays for the privilege of using. The standards upon which CEUs are based have nothing to do with course content. The standards apply only to the methods used to present the course and to keep the records of attendance. Thus, this term is not necessarily a reliable guide to use in determining the quality of a course and its appropriateness to your needs. To remedy this confused situation, AIPG, at the suggestion of some of the State Geological Surveys and State Boards of Registration for Geologists, has devised a system of accreditation. This is designed to evaluate the content of courses, as well as their presentation. This program is just getting under way, but is expected to grow. Watch for it. If a course is offered, ask if it has been accredited by AIPG. Courses expected to be so accredited are not limited to geology, but may include courses in related scientific or technical subjects and in non-technical management subjects, as well. Credits awarded for activities accredited by AIPG will carry the term "CECs", Continuing Education Credits, awarded on the basis of 1 CEC = 1 hour of contact time. There is a reason for the difference in arithmetic between CEU and CEC. The State Boards and other organizations which require continuing education generally base their requirement on hours of contact. Some use 8 hours per unit, others 10, and so on. To avoid the resultant confusion, AIPG has adopted the straightforward 1 = 1 so that the conversion can be made readily and easily.

The second qualification is experience. What kinds of work experience will be most useful to you? Identify and seek out job and project opportunities that not only seem to fit what you already know (this will be necessary to get the job), but will provide you with new experience that will be applicable to your career goals. Try not to waste your time, talents, and energy on some distraction or side-track if it has no application to your career goals. (A word of caution is in order here. Examine each opportunity carefully. Reject none out-of-hand. You may find that one will introduce you to a very rewarding career that you would prefer to the choice you had mapped out. You may not have previously considered it because you knew too little about it. On the other hand, you can waste a lot of time examining opportunities that will lead you aside. You must develop for yourself some method to quickly evaluate opportunities so that you do not pass up any, while not spending too much time on the ones that have no future for you.)

Experience can take several forms. The most obvious is directly work-related, i.e., the specific job you were hired for. But, there are other forms that, in some ways, are more important because they give you something extra that you would not otherwise have if you limited yourself to your specific job. These include publishing technical papers and participating in professional, technical, community, fraternal, and political activities. Not only will these give you good experience, but they will also give you opportunities to expand the network of people who know you and who know your capabilities. Remember: your life should not be limited by your chosen career, so the selection of activities should display some variety. Nevertheless, many of your selections should be influenced by your career goals and how these activities may help you to meet them. (Another word of caution is in order. Approach these opportunities with the idea that you are serving others, not just yourself. The self-serving person is quickly recognized and viewed with suspicion. Participate because you are as interested in the activities and the people who are involved in them as you are in promoting yourself. There is a 15th century house in Spoleto, Italy, that has inscribed over the entrance a Latin motto which translates, "Who Serves. Profits --- Serve when you can." That advice is as appropriate today as it was 500 years ago.)

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April 23-24, 1992. Special Institute on Coiled Gas Development, East and West Santa Fe, NM. Contact: Rocky Mountain Mineral Law Foundation, Porter Administration Building, 7039 E. 18th Avenue, Denver, CO 80220, USA, Ph.: (303) 321-8100, Fax: (303) 321-7657.


May 24-25, 1992. First International Seminar on the Environmental Problems of Large Urban Centers - ECO-URBS '92, Rio de Janeiro, Brazil. Contact: Organizing Committee of the FOREST 92 and ECO-URBS '92, P.O. Box 3591, 20001 Rio de Janeiro, RJ Brazil, Ph.: (0055) (21) 521-7896.


June 14-18, 1992. National American Society for Surface Mining and Reclamation (ASSMR) 9th Annual meeting, Duluth, MN. Contact: Daniel R. Jordan, IRIRB Mineland Reclamation Div., P.O. Box 392, Chisholm, MN 55719, Ph.: (218) 254-3369.

June 18, 1992. ASTM Symposium on Durability and Conformance Testing of Rock used for Erosion Control, Louisville, Kentucky. Contact: Charles H. McBryde, Soil Conservation Service, P.O. Box 6567, Fort Worth, TX 76115, Ph.: (817) 334-5444.


October 19-21, 1992. FOCUS Conference on Extensive Regional Ground Water Issues, Newton, MA. Contact: NGWA, P.O. Box 182039, Dept. #017, Columbus, OH 43218-2039, Ph.: (614) 761-1711.

October 26-28, 1992. International Conference on Extractive Metallurgy of Gold and Base Metals, Kalgoorlie, WA, Australia. Call for papers. Contact: Dr. V. Nisma, Conference Chairman, Kalgoorlie Metallurgical Laboratory, P.O. Box 881, Kalgoorlie, WA 6430, Australia, Ph.: (090) 220 120, Fax: (090) 912 762.

November 4-6, 1992. Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration, Houston, TX. Contact: NGWA, P.O. Box 182039, Dept. #017, Columbus, OH 43218-2039, Ph.: (614) 761-1711.


March 30 - April 4, 1993. AusIMM Annual Conference celebrates the Centenary of The Institute of Mining and Metallurgy, South Australia. Call for papers. Contact: R. K. John, C/- Department of Mines and Energy, 191 Greenhill Road, Parkside, South Australia 5063, Ph.: (08) 274-7500, Fax: (08) 272-7597. Abstract deadline: May 1, 1992.

April 17-20, 1993. SECO Conference '93, Integrated Methods in Exploration and Discovery, Denver, CO. Call for papers and posters. Contact: SECO Conference '93, P.O. Box 571, Golden, CO 80402, USA, J. Alan Coope, Ph.: (303) 899-6534 or (303) 791-7231 or Richard L. Nielsen, Ph.: (303) 791-3118.


June 24-25, 1993. ASTM Symposium on Analysis of Soils Contaminated with Petroleum Constituents, Atlanta, GA. Contact: Symposium Chairman, Tracey O'Shay, Gordon and Lawton, P.O. Box 80072, Austin, TX 78727-0072, Ph.: (512) 475-2302. Abstract deadline: June 23, 1992.


Marcus E. Milling Appointed AGI Executive Director

Marcus E. Milling, CPG-4518, has been appointed Executive Director of the American Geological Institute. Christopher C. Mathewson, AGI's President, announced the appointment, effective February 24.

Milling, currently Associate Director of the Texas Bureau of Economic Geology at the University of Texas - Austin, has served in a number of positions at the Bureau since joining the university in 1987. He played a leading role in establishing the Geoscience Institute for Oil and Gas Recovery Research and served as the Institute's Director from 1988-91. At the Bureau, Milling was primarily responsible for development and management of the environmental and water-resources program and the oil and gas industrial associates research program.
Dear Editor:

Bull, Van de Water, and Montazer (The Professional Geologist, January 1992) note the importance of determining the uncertainty in model predictions that results from uncertainty in the values of input parameters. Although their note pertains explicitly to the use of models in estimating the fate of hazardous wastes to be placed in disposal sites, sensitivity analysis to determine uncertainty of the sort with which they are concerned should be incorporated much more generally in the analysis of the environmental impacts. However, I believe that the uncertainties that should be recognized are not limited to those associated with the evaluation of parameters input to a model but should include also those associated with the choice of the model itself. Bull, et. al., recognize that one of the principal reasons for evaluating the kind of uncertainties with which they are concerned is to indicate where additional exploration is warranted to reduce the uncertainties. Evaluation of the effects of the choice among possibly fitting models may similarly indicate where additional exploration may be warranted to narrow the choice.

Most if not all geologists of my generation were taught the importance of the consideration of multiple hypotheses, in other words multiple alternative models. Most of us have learned from experience that there may be significant differences between the model that seems to us most likely to fit a real situation and the situation itself. Bull, et. al., urge that "consultants and regulators should agree upon which models will be used" in the evaluation of hazardous-waste disposal sites. I have had no personal experience in the evaluation of hazardous-waste disposal sites, but I can testify as to the importance of errors in prediction that may result in other kinds of environmental impact analysis from the employment of models that were misfit or incomplete, even though accepted by consultants, clients, and regulatory agencies. For this reason I have been an active advocate of opening to public review, not merely the results of analyses of the environmental impacts of projects of public interest, but the whole sets of assumptions on which the results are based - the models used as well as the values of the input parameters.

Doak C. Cox, CPG 182

Dear Editor:

I wish to add a comment to your recent opinion papers concerning expert witnessing. (The Professional Geologist, August 1991)

It is unethical for a geologist to present expert testimony before any government body on a contingency basis, if he fails to disclose the contingency arrangement.

Attorneys commonly work on a contingency basis and it is an attorney’s duty to present his case in a manner most favorable to his client. He may and should seek out, exaggerate, omit, belittle, distort, or confuse any evidence in his effort to further his client’s interest. Scientists are not allowed such latitude.

It is common for geologists to represent themselves at commission hearings. This practice creates no ethical problem as long as the witness reveals his ownership interest prior to his testimony.

Presumably, a geologist testifying in order to earn an interest in a prospect - based upon a successful hearing outcome - could avoid ethical degradation by disclosing his arrangement prior to his testimony. This could be in the public interest in situations where landowners cannot afford expensive legal and scientific help. It probably should not be done in cases involving knowledgeable operators. Commission members should carefully consider any such evidence, and any scientist suspected of working on a contingency basis should be questioned about it in cross-examination.

Burton Smart, CPG-4774

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CLARIFICATION OF UZBEKISTAN OIL RESERVES

Uzbekistan is presently engaged in developing a program for additional oil prospecting in the Namangan region (northeast Uzbekistan). The program will last through the end of the year. The oil well found in the Mingbulak area at a depth of more than 5,100 meters has given an unexpectedly high yield - more than 100 tons per day.

Local specialists claim the republic has much greater oil reserves than had previously been thought. The government is planning to refurbish equipment at oil refineries in the Fergana Valley (east Uzbekistan) and construct additional storage tanks for oil and petroleum products.

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Robert Brownfield, CPG-1368, is a retired Engineering Geologist. Bob was employed by the Illinois Department of Transportation for 18 years, Jet Oil Company for 9 years, TExaco for 3 years, and the Illinois Geological Survey for 2 years. At this time, Bob is studying theology at Holy Apostles Seminary, Cromwell, Connecticut. He will be ordained to the Catholic Priesthood on April 25, 1992 and will be assigned to S.E. Iowa.

Bob Fickies, CPG-2658, has been keeping busy with a myriad of administrative tasks as Assistant Chief of the New York State Geological Survey. He is also working as Editor of the 42nd Annual Highway Geology Symposium Proceedings volume. The book, which contains 21 papers relating to geologic complexities in the Highway environment, will be published as a New York State Geological Survey Bulletin some time in mid-1992. Bob is also serving as an arbitrator for the American Arbitration Association on a case involving a major petrochemical spill in the northwest U.S. Bob is one of a small number of AIPG Members who has been appointed to serve as an arbitrator for the American Arbitration Association.

William L. Fisher, CPG-2398, was appointed to the Board of Directors of Pogo Producing Company. Bill, a native of Illinois, currently is the Director of the Bureau of Economic Geology at The University of Texas - Austin. He also serves as Director of the Geology Foundation and occupies the Leonidas T. Barrow Centennial Chair of Mineral Resources at the University of Texas.

Bob Luhrs, CPG-8071, of LBG-Nashua, has recently been following the development of the Licensed Site Professional Program (LSP). This program will allow for non-priority projects, soon to be termed Tier II, to be supervised by Licensed Site Professionals, without MDEP oversight. The professional license will be available to persons from a variety of disciplines, including geology, who have a significant amount of professional experience, including a minimum of 5-7 years experience in project management of hazardous waste sites, and who can demonstrate proficiency of the Massachusetts Contingency Plan. Although not fully defined, this program will be different from other types of certification or registration programs, and will probably offer significant legal liability or penalties to anyone who misuses his/her authority under this license.

Policy on Applicant Sponsors

Relation of Sponsors to Applicant

Relatives may be the individuals who best know an applicant on a personal basis. However, despite all efforts to be objective, such relatives may be biased in their professional judgement of the applicants. Therefore, sponsors for an applicant may not be immediately related by blood (i.e., first cousins or closer) or marriage to the applicant.

The Chairmen and Members of the Section Screening Committees may not act as sponsors for AIPG applicants. If appropriate, Members of Screening Committees may verify geological work experience of applicants.

Relation of Sponsors to Each Other

When an application is received by Headquarters on which all of the sponsors are from the same company or organization; or whose only contact with the applicant came from the same project or company experience; then Headquarters, at its own initiative or at the request of a Section Screening Committee Chairman, shall ask the applicant to furnish sponsor forms from at least one sponsor not connected with the same company or organization. If the applicant is unable to obtain such an additional sponsor, he or she may submit a letter explaining why this is so. In such cases, the Section Screening Committee may personally interview the applicant prior to approving or disapproving the application.

Individuals, while applicants of the Institute, may not serve as sponsors for another applicant.

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IN MEMORIAM

John F. Barnes, Jr., CPG-1816, Houston, Texas
Charles D. Butler, CPG-3683, Longview, Washington
George S. Galbraith, CPG-0632, Abilene, Texas
Frederick J. Kuebler, CPG-6408, Socorro, New Mexico
R. Dana Russell, CPG-0172, Santa Rosa, California
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