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College, Alaska 99708

Jay S. Hammond—Governor

Robert E. LeResche — Commissioner

Ross G. Schaff—State Geologist

Pouch M
Juneau, AK 99811*

3327 Fairbanks St.
Anchorage, AK 99503*

3001 Porcupine Drive
Anchorage, Alaska 99501

P.O. Box 80007
College, Alaska 99708*

P.O. Box 7438
Kelchikan, Alaska 99901*

IN THIS ISSUE

Significant deposits above Arctic Circle
Alaska-Juneau mine to be sealed
Still gold in "Them Thar Hills"
Minerals junkie
How much more oil?
Quartz Hill access road okayed
DNR selects lands for state
"We're being regulated out of business"
Lake grows as glacier retreats

Energy map, 'Short notes' released
Regional confrontation in energy war
Mining claims double again
Miners stampede to file claims
Miner feast seen in uranium area
MIRL qualifies for lab funds
DGGs solicits aeromagnetic bids
UA lists geology students
Our gangue

*Mining information office.

DGGS Details Four Study Areas

The last issue of the Bulletin summarized the many DGGS projects undertaken during the summer field season. This issue, the project leaders detail four of those projects: coal studies, coastal analysis, hydrological studies, and the Brooks Range mineral appraisal.

ALASKA'S COALS

Alaska's coals occur in eight prime areas, the North Slope, the interior, Matanuska Valley, the Beluga basin, the Kenai Peninsula, the Bering River, Herendeen Bay, and Chignik Bay.

North Slope Fields

The largest coal resources in Alaska are located in a belt roughly extending from the northern front of the Brooks Range from Cape Sabine eastward to the Canning River. The belt roughly parallels the Arctic Ocean coastline from the Canning to southwest of Point Barrow. These coals, which occur predominantly in Cretaceous sediments, have been estimated to be about 120 billion tons,¹ two-fifths of which is bituminous and the rest subbituminous. Reserves of stripping coal have not been clearly defined and recent estimates of 80 million tons of bituminous and 86 million tons of subbituminous coal may be only one-tenth of the actual reserves.

The bituminous coal is low in moisture content (2% to 7%), has an ash content generally from 2% to 25% (but generally on the lower end of the scale), a low sulfur content (0.3 to 0.7%), and a thermal value of

9,300 to 13,500 Btu. The subbituminous coals contain 5% to 27% moisture, 3% to 20% ash, 0.2% to 0.7% sulfur, and a 7,700- to 11,000-Btu thermal value.

Summary: Large-scale extraction of North Slope coals, by both strip and underground mining, will probably occur in the far future; a road or railroad will transport the coal to a partially or wholly ice-free port.

Nenana Coal Field

A discontinuous belt of Tertiary sediments ranging from less than 1 mile to more than 30 miles wide extends for about 80 miles along the north flank of the Alaska Range between the headwaters of the Wood River on the east and the Kantishna River on the west. This area includes the state's only full-time operational mine, the Usibelli. Reserves include an estimated 95 million tons of potential stripping coal; resources of coal for the entire trend are probably over 2 billion tons.

The coal is nearly all subbituminous, with 17% to 27% moisture, 3% to 13% ash, 0.1% to 0.3% sulfur, and a Btu range of 7,500 to 9,400.

Summary: Production in this, the only major currently productive area in Alaska, could be increased if additional markets were available.

Matanuska Coal Fields

Mining has occurred in three districts in the Matanuska Valley: Chickaloon, Wishbone Hill, and the Little Susitna districts; a fourth area, Anthracite Ridge, has not been mined. Most of the coal extracted was from Wishbone Hill, by both stripping and underground

working. Reserves are estimated at about 50 million tons, with additional resource values of about the same. However, relatively steep dips and increasingly thick overburden limit stripping in the Wishbone and Chickaloon districts.

The coal is ranked as bituminous at Wishbone and Chickaloon and semianthracite to anthracite at Anthracite Ridge. The moisture content ranges from 2% to 9%, ash content from 4% to 21%, sulfur content from 0.2% to 1.0%, with a thermal coefficient of 10,300 to 13,100 Btu for the bituminous and a 10,800 to 14,000 Btu for the anthracite. The anthracite resource base is very minor. Some of the coals in the Chickaloon district are of metallurgical-grade coals.

Summary: Although small mines supply coal for local use, a large-scale mine with an annual production of 1 million short tons is not likely in the near future. Possible future users might include a mine-mouth power plant or a Portland cement facility that would use limestone and argillite from the nearby Kings River marble deposits.

Beluga Coal Field

The Beluga field is part of the larger Susitna district, which is the coal-bearing part of the lowland north of Cook Inlet between the Talkeetna Mountains on the east and the Alaska Range on the north and west. The major coal reserves are centered near Capps Glacier and along the Chuitna and Beluga Rivers. These three areas contain about 2.4 billion tons of coal—0.5 in the Capps Glacier area, 1.52 in the Chuitna River area, and 0.2 in the Beluga River area. More than 400 million tons can be commercially stripped. A small area along Coal Creek was drilled by the Bureau of Mines and contains about 29 million short tons of coal.

The coal is predominantly subbituminous, with some ranked as lignite. Moisture content ranges from 12% to 33%, ash from 13% to 25%, sulfur content about 0.2%, with a thermal potential of 7,200 to 8,900 Btu.

Summary: Major extraction—by stripping, pitting, or possibly hydraulic minilog—will probably begin within the next decade. Underground mining appears to be far in the future. Transportation would probably be via a slurry system to a dock facility on the west side of the Cook Inlet.

Kenai Coal Field

Kenai Peninsula coals occur in the Tertiary Kenal Formation, including the lowland south of Tustumena Lake. The resources are estimated at about 300 million tons; there is 200,000 tons of stripping coal along Deep Creek. The coals are predominantly lignites with 21% to 30% moisture, 3% to 22% ash, and 0.1% to 0.4% sulfur, and yield 6,500 to 8,500 Btu.

Summary: These coals are thin and widely separated vertically, making any kind of mining extremely difficult. Some stripping coals along parts of the Deep Creek drainage and in the Homer area may be developed.

Bering River Coal Field

This is a fairly continuous belt of coal-bearing

Tertiary sediments that extends northeastward from the east shore of Bering Lake about 20 miles to where the coal-bearing rocks disappear under the ice fields of the Chugach Range. In this field, which has complex folding and faulting, the coal seams tend to thicken radically in the apex of the folds. The resource base for this coal field might be calculated from a ratio of coal to country rock.

The coals range from low-volatile bituminous to anthracite, most of it bituminous with 1% to 3% moisture, 2% to 25% ash, and predominantly low sulfur (0.3%); the thermal content is 9,000 to 15,000 Btu.

Summary: Although the Bering River field is near tidewater, the extremely complex structure of the sediments containing the coal will prevent large-scale mining, either stripping or underground, in the foreseeable future. If developed, transportation would be via road, rail, or a slurry pipeline to a water facility.

Herendeen Bay Coal Field

This field is on the Alaska Peninsula, between Herendeen Bay and Port Moller, about 350 miles southwest of Kodiak Island. Most of the coal is concentrated in the Cretaceous Chignik Formation, where a typical section of siltstone and sandstone is 200 feet thick and contains 26 feet of coal in seams up to 4 feet thick. Most of the Cretaceous coal is in an 8-mile-long by 2-mile-wide area, where resources are estimated at 200 million to 400 million short tons.

The coal is bituminous with 7% to 8% moisture content, 5% to 12% ash, 0.3% to 0.6% sulfur, and an 11,000- to 12,500-Btu heat content.

Summary: The Herendeen Bay field has considerable potential for development of small mines for local use. A large mine will not be developed in the area in the near future; if developed, mining would be by both stripping and underground, with transportation by road, rail, or slurry pipeline to a port facility.

Chignik Bay Coal Field

In the Chignik Bay field, located northeast of the Herendeen Bay field and about 250 miles southwest of Kodiak Island, the coals occur mostly in the Chignik Formation of Cretaceous age. Several small underground mines were opened for local use around the turn of the century. Recent field work (1977) suggests that there are three relatively small areas of coal accumulation in the area: at Chignik River-Whaler Creek, at Thompson Valley, and at Hook Bay. The thickest coal measured is a 4-foot seam in Thompson Valley. Resources are from 200 million to 400 million tons. Tertiary coals in the same area are thin and contain large amounts of silt and sand.

Summary: These coals will be developed for local use as the price of oil and gas increases, despite seams that thin and thicken markedly. There is little opportunity to develop large mines.—*D.L. McGee.*

¹Barnes, F.F., Coal resources of the Cape Lisburne—Colville River region, Alaska: U.S. Geol. Survey Bull. 1242-E, p. E1-E37.

A SUMMARY OF DGGs ACTIVITIES UNDER THE COASTAL ANALYSIS PROGRAM

Coastal-zone analyses were initiated to provide background information on geologic conditions and geologic hazards for land-use planners and others interested in coastal land use. The need for such information arises, in part, from the Alaska Coastal Management Act (June 4, 1977), which provides for the protection and development of coastal resources and the development of a management program for those resources. The documentation listed below is part of the DGGs program to evaluate geologic hazards throughout the state, as mandated by statute.

Site Investigations

The Division has produced several open-file and inter-departmental reports in a comprehensive program to determine the geology and identify geologic hazards in the coastal areas of the state. The objective of the reports is to provide planners and the public with earth-science information for making land-use decisions.

Two site-specific reports were prepared during the summer of 1976. The first, a geologic reconnaissance of the Icy Bay area, was a preliminary investigation into the geologic constraints on the development of potential onshore facilities in Icy Bay. Because Icy Bay provides the best sheltered anchorage between Yakutat and Cordova, the possibility of offshore petroleum development in the Gulf of Alaska made it a candidate site for major facility development. Among the geologic constraints and processes considered were glacier surges, glacier-burst floods, drift ice, buried ice blocks, land instability, and coastal erosion and deposition.

The site-second specific report was on geologic constraints on development in the Seward and Upper Resurrection Bay area. Among the major problems considered was the susceptibility of various sites to tsunami damage and subaqueous landsliding, both of which caused death and extensive damage to the town of Seward during the Great Alaska Earthquake of 1964. Because of the paucity of stable and level ground, some of the sites considered were alluvial fans located along the sides of Resurrection Bay; thus, ease of access to the site was another important consideration.

RSA Project

The Division was awarded a \$40,000 reimbursable services agreement (RSA) in the summer of 1977 by the State Coastal Management Office to research coastal geology and geologic hazards. The first product under the RSA was a report for the DNR Planning and Research section, entitled "Areas of particular concern for geologic reasons in the Alaskan coastal zone." The report lists 20 coastline areas with a significant geologic hazard to life or property. The hazards considered include seismicity and potentially active faults, regional and local tsunamis, volcanism, glacier-dammed lakes and outburst floods, and ground stability.

The second RSA report, "The geology and the geologic hazards of the western coast of the Kenai Peninsula from Kenai to English Bay, Alaska," summarizes the present knowledge of the geology and geologic hazards along the eastern shore of this part of Cook Inlet. It was based on two summers of field work and is supplemented by a review of the published literature. The report discusses geologic hazards in regional perspective, including seismicity faults, ground failures, land-level changes, earthquake tsunamis and selches, and volcanism. Four plates are included with the report, all of which have been released as open-file reports (AOFs 110, 111A-C).

Another RSA project, "The geology and geologic hazards of the coastline from Valdez Arm to Yakutat," was conducted in cooperation with a U.S. Geological Survey research program involving the research vessel *Growler*. Field checking of photointerpretation maps of surficial geology was carried out in eastern Prince William Sound and between Icy Bay and Cape Suckling with helicopter and fixed-wing support to provide surficial geologic maps at a scale of 1:63,360. A report, which will include a review of the available geologic literature and the results of the reconnaissance field investigations, will be released shortly.

Future Efforts

A comprehensive cooperative effort is being planned with the Pacific-Arctic Branch of the USGS, an organization that has extensively researched geologic hazards of the coastal zone and has evaluated the resource potential of offshore areas near Alaska. The state's objectives will be to concentrate on the state-owned submerged lands in preparation for future joint federal-state oil and gas lease sales. As a part of this program, DGGs has requested funding for a small research vessel for plying near-shore waters to determine the nature and extent of geologic hazards and the resource potential of the 3-mile limit.—*J.R. Riehle*

DGGs HYDROLOGICAL ACTIVITIES

Alaska's rapid growth rate necessitates a study of the state's water resources and increased hydrologic information. To this end, the 1977 State Legislature passed an act (SB 58) to expand the DGGs charter to "collect, record, evaluate and distribute data on quantity, quality, and location of underground, surface and coastal water of the state."

Duties

The new water resources program has two main goals: the systematic collection and recording of hydrologic data, and conducting hydrologic projects in areas of commercial and residential development.

In the past, the DGGs contracted the Water Resources Division of the USGS to carry out certain water-resource activities in the state, including the collection and recording of hydrologic data in the state,

processing hydrologic data for the Cook Inlet region, and continuing to develop a computer storage and retrieval system for ground-water data. Some of these functions will now be absorbed by DGGs (although certain independent and cooperative studies with the USGS will continue to be made). DGGs will also continue to provide information to aid the DNR Division of Land and Water Management in issuing water-use permits; in addition, these agencies plan to integrate technical ground-water data with water-use permit information in a computer system.

Permits

DGGs is preparing hydrologic folios on a 1:63,360 scale. These publications will present data on ground water, surface water, water quality, and aquifers. Other projects include issuing open-file reports on the North Kenai area water-table aquifers (in cooperation with the USGS), publishing hydrologic data on the Prudhoe Bay area, and preparing a predictive ground-water model for the North Kenai industrial area (also with the USGS)—*W.E. Long, M.D. Howland*

BROOKS RANGE MINERAL RESOURCE STUDIES

Purpose

Land-selection processes put into motion by the passage of the Alaska Statehood and Native Claims Settlement Acts require an accurate mineral resource data base for Alaskan lands from both state and federal geological surveys. The DGGs and USGS cooperate on logistics and share data to reduce the cost and project duration while maximizing area coverage and the accuracy of resulting interpretations. The resulting data are made public as quickly as they can be processed and are useful not only to planners but also to the mining industry, Native corporations, academic geologists, and others. The state and the Native corporations can use geologic information to select the lands with highest mineral potential. The mineral industry can use maps to design more effective exploration programs, and the DGGs has, in turn, benefited from data released from industry. In addition, University researchers are often stimulated by published information to undertake cooperative studies that are useful to DGGs.

History

DGGs investigations of mineral resources in the southwestern Brooks Range were initiated a decade ago by the late C.E. Fritts, who worked mainly on foot from 1968-1970 in the Cosmos Hills and Angayucham Mountains. From 1970 until his untimely death in 1972 he directed a helicopter-supported mapping and geochemical sampling project in the southwest Survey Pass and southeastern Ambler River quadrangles. In 1973 and 1974, mapping, sampling, and gravity and aeromagnetic surveys were conducted in the Ambler River and Survey Pass quadrangles by G.H. Pessel (DGGs) and I.L. Tailleux, W.P. Brosgé, and C.E. Mayfield (USGS). Studies in the Ambler River quadrangle continued from 1973 through 1975, when W.G. Gilbert

and M.A. Wiltse (DGGs) and R.B. Forbes (UA) studied the structure and petrography of the Ruby Ridge area and Wiltse mapped the geology of the stratabound Arctic Camp copper deposits.

DGGs began the mineral resource survey of the southwestern Wiseman quadrangle in 1977, and both DGGs and USGS studied state-selected lands there: the USGS (T.D. Hamilton) mapped the Quaternary surficial geology and DGGs began detailed bedrock geologic maps of nine 15' quadrangles. The latter data will be combined with USGS open-file maps, airphoto interpretation, petrography, geochemistry, radiometric dates, small-structure analyses and paleontology to produce a 1:125,000 open-file map by spring of 1978. Regional gravity and ground magnetic data and physical rock-property determination should define structures at depth. Maps of statistical geochemical anomalies are being made from 500 stream-sediment samples, 100 pan concentrates, and 200 rock samples that have been analyzed for trace elements by the USGS.

Resource Evaluation

Since 1970 economic mineral exploration in the southern Brooks Range has been primarily focused on stratabound volcanogenic copper-zinc massive-sulfide deposits in the southern 'schist belt'—the richest ore deposits known in Alaska—and on a parallel group of syngenetic(?) lead-zinc deposits farther north. The syngenetic deposits are associated with a group of lithologies that define a former depositional environment. To predict the distribution of these lithologies and related mineral deposits of the southern Brooks Range region, the complex structure must be unraveled in detail in at least one area so that stratigraphic relationships between lithologic units throughout the region can be determined. This stratigraphy is the key to predicting both the distribution of mineral deposits and the depositional and subsequent geologic history of the entire region.

Geology

Five major lithologic belts are present in the study area. From south to north they are: 1) the greenstone, chert, carbonate, and flysch of the Angayucham belt; 2) the metaclastic, metavolcanic, and minor carbonate rocks of the schist belt; 3) the marble, dolomite, and subordinate metavolcanic and metaclastic rocks of the Skajit belt; 4) the metaclastic and metavolcanic rocks of the Hunt Fork belt; and 5) the belt of metamorphosed granitic plutons that intruded the protoliths of the last two belts. All but the fifth belt were previously believed to be separated by fault zones.

Angayucham-belt greenstones that contain abundant disseminated pyrite and chalcopyrite are being assayed. Their major-oxide geochemistry should determine if they have oceanic or continental affinities. Spatially associated gabbroic and diabasic rocks of this belt are being examined for high-pressure minerals. Chert containing radiolaria is being studied to provide additional age data for this belt, which has one Permian locality. Locally, melanges or broken formations were found in

metamorphosed flyschlike deposits of this belt west of the John River. East of Wild River an apparently gradational contact occurs between the metasedimentary rocks of the Angayucham belt and those of the schist belt.

The schist belt is composed of metaclastic and volcanic rocks with local carbonate interlayers that thicken and become more abundant northward. Basic to intermediate metaigneous rocks occur throughout the belt and to the north. Felsic volcanic rocks are most abundant in the southwestern part of the belt. Petrographic analyses of relict phenocrysts and major-oxide analyses of basic and felsic metavolcanic rocks will be compared with metavolcanic rocks associated with stratabound massive-sulphide deposits in the Ambler River quadrangle. Fine-grained metapelites and quartzite layers with disseminated copper sulfides that occur near the Wiseman quadrangle metavolcanic horizons are being assayed. Recumbent anticlines and synclines with south-dipping axial surfaces and overturned anticlines occur in this belt and in those to the north. Fold axes are being studied to determine the direction of tectonic transport.

The Walker Lake lineament, which divides the schist belt from the Skajit carbonate belt to the north, has been interpreted both as a fault and an unconformity. However, there is enough lithologic continuity northward across the lineament in the Wiseman quadrangle to suggest that the transition is not a fault and is probably a folded unconformity or a facies change. If this interpretation is correct, schist-belt rocks and stratabound sulfide deposits may occur north of the Walker Lake lineament.

The Skajit carbonate belt consists predominantly of mid-Paleozoic marble and dolomite with some metaclastic rocks and greenschist both in layers and as metamorphosed dikes. The metaclastic rocks, which locally contain disseminated copper sulfides and may be infolds of overlying or underlying units, probably include felsic metavolcanic rocks. Isoclinal folds of all scales are highly visible in the Skajit carbonate belt. Some folds have shallow-dipping axial surfaces and overturned limbs covering tens of square miles. The largest recognized recumbent isoclinal fold occurs along the northern boundary of the Skajit belt where the carbonate overlies younger metaclastic rocks of the Hunt Fork belt.

Quartzitic metaconglomerate occurs in the Hunt Fork belt beneath the carbonate and grades northward into finer grained metaclastic rocks with greenschist interlayers. The metaconglomerate and the southernmost fine-grained units contain local deposits of galena, bornite, malachite, and azurite in both veins and layers; samples are being assayed. Greenschist is common near the southern contact of the Hunt Fork belt. Metaclastic rocks consist mainly of euxinic metapelite and metagraywacke with lesser amounts of quartzite. Westward along strike there is an increasing abundance of siliceous (volcaniclastic?) grit, and felsic metavolcanic

rocks are interlayered with the metaclastic rocks near Ernie Lake.

A metaplutonic belt that intrudes the protoliths of the Skajit and Hunt Fork belts trends east-southeast from Ernie Lake. These granitic rocks had previously been assigned a mid-Cretaceous age because of lithologic similarity to the Igikpak and Arrigeth plutons, which yield mid-Cretaceous K-Ar ages. However, the dated minerals define a lineation and a foliation and probably were formed during a metamorphic event. D.L. Turner (UA) confirmed that most of the southern Brooks Range underwent metamorphism at that time. In the Wiseman quadrangle gneissose structures in the metaplutonic rocks parallel metamorphic structures in the intruded Late Devonian country rocks. If the metamorphism there is also mid-Cretaceous, the plutons were intruded during or after the Devonian but before the mid-Cretaceous. Metaplutonic rocks from the schist belt in the Chandalar quadrangle yield mid-Paleozoic K-Ar ages, and fossil and model lead ages recently released by Atlantic Richfield indicate that mid-Paleozoic is the approximate age of extrusion of the felsic metavolcanic rocks found in the schist belt in the Ambler River quadrangle. Radiometric primary crystallization ages (U-Pb, zircon) on four of the plutons and on several of the volcanic centers will be obtained as part of a joint research agreement between the University of California, the USGS, and DGGS.

Future Programs

During 1978 the DGGS will extend the southwestern Wiseman project to adjoining (d)(2) lands currently being studied by the USGS. Several critical lithologic units will be measured and described. This work will complete the cooperative reconnaissance mapping of a large east-trending swath of the southern Brooks Range, including portions of the Ambler River, Survey Pass, and Wiseman quadrangles, which began in 1968. To understand the apparent transition from the thrust belt of the northern Brooks Range to the isoclinally folded belts of the southern Brooks Range, several north-south strip-mapping projects, including cross sections, are planned. Cooperative DGGS-USGS funding is now assured for an aeromagnetic survey of the south-central Brooks Range during 1978. Detailed ground gravity and magnetic profiles along four north-south traverses in the southern Wiseman quadrangle will also be completed, and widely spaced electromagnetic profiles may be taken near several new mineral finds. In 1979 a similar DGGS mineral resource study will probably focus on the Chandalar quadrangle.—*J.T. Dillon, G.H. Pessel*

A snowpack 29.8 feet deep at Wolverine Glacier on Prince William Sound set an Alaska record for depth. The snow, measured at an elevation of 4,430 feet June 7, is reportedly the deepest ever recorded at an established long-term measurement site. The equivalent water level would be 13.8 feet.

Significant Mineral Deposits Reported Above Arctic Circle

(from *The Mining Record*, Sept. 24, 1977)

Houston Oil & Minerals Corp. said that it and its joint venture partner, General Crude Oil Co., found "significant" mineral deposits in Alaska.

The company said "data are incomplete and no reliable estimate" of the reserves of the minerals involved can be made pending further exploration. It added: "Data thus far developed permit the inference that the find is a major discovery."

Houston Oil said the minerals it found are above the Arctic Circle, about 80 miles north of Kotzebue, Alaska, and 50 miles from the Chukchi Sea. Because winter is starting there further substantial exploration probably won't be done until next year, it added. The area's location, plus environmental reporting requirements, ensure that "production won't begin for a number of years," the company said.

The company said that four of seven core holes it has drilled have resulted in mineral finds. It cautioned that it hasn't determined whether the core holes penetrated the mineral layers precisely at right angles. Thus, it said, it doesn't know for sure how thick the mineral deposits might be.

Alaska-Juneau Gold Mine will be Sealed

(from *The Mining Record*, Sept. 7, 1977)

Old-timers in Alaska's capital city resigned themselves years ago to the realization that the Alaska-Juneau Mine, once the largest underground gold mine in the world, would never reopen.

But the former miners say they couldn't help but feel a tinge of nostalgia when city officials gave the go-ahead for a public works project to seal up one of the A-J's main tunnels for use as a municipal water reservoir.

"I wouldn't say I feel really sad, but I still consider it an honor to have worked for the outfit," says Felix Toner, a former engineer at the famed mine. "It's a shame, but hell, that's been 30 years ago and you just kind of start forgetting."

Work is scheduled to begin on a \$423,300 contract to plug both ends of a 2,200-foot-long tunnel which connects the mine on one side of Mount Juneau with the mill on the other side. When the plugs are in place, the tunnel will be flooded with 4.5 million gallons of water.

Although any realistic hopes for reopening the old A-J died in a fire which destroyed the mine's mill in the early 1960's many old timers continued to harbor fantasies that the spiraling price of gold could make the operation economical once again. The reservoir project however, marks the acceptance of an end to those dreams.

"Sure, some people talked about reopening it, but those feelings weren't held by anybody familiar with the

operation or value of the ore," says Toner. "It was a low-grade mine that made money with a high volume of production."

From its discovery in 1886 to its shutdown in 1943 as a non-essential wartime activity, the A-J produced \$80 million in gold and turned Juneau into one of Alaska's biggest gold rush boom towns.

"It was world renowned," says Toner, who worked at the mine from 1939 until it closed. "It produced 12,000 tons of ore a day for 365 days a year. From a production standpoint, it was the largest underground gold mine in the world."

"When the mine closed, the average value of the ore was between \$1.15 and \$1.20 a ton," Toner says. "Today, the ore would be worth between \$4.75 and \$5 a ton, but that's not even enough to cover the cost of labor these days."

Toner says there's no question that the mine still contains a lot of gold, but adds that "It's simply not in the books to show a profit."

There's Still Gold in "Them Thar Hills" of Alaska

(from *The Mining Record*, Sept. 7, 1977)

There's still gold in "them thar hills" of Alaska if you have a good planning technique, persistence, endurance and physical strength.

And it also doesn't hurt to have a "love of rain and being wet and a tolerance for bugs," says prospector Doug Toland.

Toland's description of life as an Alaska prospector may not quite match your fantasy of living off the land, but then that's part of his message, too.

"I know all about dreaming and dissatisfaction," Toland says. "I've been there. But it takes more than dreaming. It takes hard work, back-breaking work. It's your back that goes first, you know."

A native of Wilmington, Del., Toland, 35, began his dream odyssey in 1967, but it wasn't until last year that he gave up the last remnants of a 9-to-5 career for the life of a prospector in the misty mountains of southeastern Alaska's Alexander Archipelago.

Toland contracted prospecting fever when he first came to Alaska on a geology field trip as an undergraduate at the University of Delaware in 1967. But the call of career was too great. He buried his dream under the workload of a master's degree program at the University of Montana.

The dream bloomed again in Montana when he picked up his panning technique from an "old man who made more money sluicing gold than his retirement check." But the fantasy was sidetracked again when Toland completed his degree and took a high-paying job as an environmental research analyst for the state of Alaska.

"I was doing what I thought I wanted, but things started going wrong," Toland, a father of two, recalls.

"I was up tight all the time. I'd come home with headaches every day, and I couldn't sleep. The only time I felt good was when I'd take time off and go out prospecting."

After purchasing a block of mining claims on nearby Prince of Wales Island 18 months ago, Toland quit his job and began supporting his family with a mail-order business for mineral collectors and gold prospecting.

Toland says he can make between \$100 and \$150 a week panning for gold "with persistence."

"Anyone can find gold," says Toland. "All you have to have is an understanding of the basic principles of panning, a practiced technique, a good working knowledge of geology and stream dynamics, a grub-stake to last until you know the lay of the land, persistence, endurance and physical strength."

But he warns that anybody with similar dreams had better not plan on getting rich: "Gold is totally unforgiving. It doesn't care how many hours you have spent working a sluice box or stooped over panning.

"If you make any mistake, do anything wrong at all, you'll lose it and the worst thing is that you'll never know how much you could have had."

The Minerals Junkie

by James D. Santini, U.S. House of Representatives
(from *Journal of Metals*, July 1977)

It is common, indeed fashionable, these days to speak of our endangered species. But along with all the friendly (or otherwise) little creatures that command so much space on the printed page, there is a potential shortage of something equally significant for national well-being: our mineral resources. I would like to speak to you for a few minutes about how this problem evolved, how important it is, and what we can do about it.

America is today a crisis-prone society. In the recent past we have had to face an oil and gasoline crisis brought about by the growing activism of the OPEC cartel. We are currently facing a water supply crisis—particularly in the West; and there is a nationwide crisis over supplies of natural gas. We may look forward to a food shortage in the not-too-distant future, as well as continued energy problems, and—as some of us are acutely aware—a shortage of minerals.

The four common steps which lead up to a national crisis might be looked upon as stages in the development of a sickness that we may call "junkie syndrome." These are:

1. The development of a dependency on a particular commodity, which produces
2. Increasing demand for that commodity—until demand outstrips domestic productive capacity causing
3. Development of a dependency upon unreliable foreign sources, until
4. The foreign sources "pull the needle" on our habit—which may produce a great public outcry

as we go through our national withdrawal pains. This may be accompanied by a Government suddenly sympathetic but equipped only with 20/20 hindsight.

Let us examine our current minerals situation in light of the above scenario. Perhaps we can spot a new case of junkie syndrome while it is still in the early stages of development.

Dependency

How important are minerals to our society and to what extent are we dependent on them? The answer is obvious: our minerals are critical to agriculture, energy, construction, transportation, communications, defense... in short, everything. We have but five percent of the world's population and seven percent of the world's land area, yet we consume one quarter of the entire world's mineral production. We consume 40,000 pounds of minerals per person per year. There are 15 different minerals in an automobile, 35 in color TV set, and 40 in a telephone.

Domestic Production

While our dependency on minerals continues to grow, our domestic production of these important commodities is simultaneously being restricted. Nearly 75% of our public lands have been placed off limits to minerals development. The mood of the times is such that recreational or environmental land uses loom larger in the public mind than the needed minerals lying below the land's surface. While we all recognize the need to preserve wilderness areas for our wildlife and for our own enjoyment the fact (of which few are aware) is that mineral development actually consumes very little land. Alaska, for example, is currently the subject of much wilderness-protection rhetoric. But when we speak of minerals development in Alaska, we are talking of only two percent of the total geography. Unfortunately, the ugly image of unreclaimed Appalachian strip mines persists, so wilderness bills (H.R. 3454, for example) keep appearing. It is particularly unfortunate that those areas most suitable for outdoor recreation are, for geologic reasons, the very places where additional minerals are most likely to be found.

Domestic production is further hampered by government regulations dealing with surface management and environmental factors. Any beyond this there are other legislative threats: elimination of the tax depletion allowance threatens the financial stimulus for new ventures; revisions to the mining law threaten basic mining charters. One can only guess the extent to which the Clean Air Act will hinder production; certainly it will not stimulate it. And, of course, our known supplies of high-grade domestic ores are dwindling. Where the U.V.X. Mine in 1914 yielded ore averaging 23% copper, the Bingham Mine today typically runs 0.6 percent. Add to this the fact that the U.S. Bureau of Mines has not grown at a rate commensurate with the pressing need for minerals research and development and you have a national picture that is anything but bright and shining.

Foreign Dependency

Right now, there are 30 critical minerals for which we must rely on foreign sources to supply at least 25% of our needs. We require that foreign sources supply the ore or raw materials for 87% of the domestically produced aluminum; the figure is 85% for tin, 71% for nickel, 70% for gold, 60% for tungsten and zinc, and 27% for iron. We are almost totally dependent on the outside world for mica, manganese, cobalt and, of course, chromium. Worse, the list of foreign suppliers includes such potentially unreliable sources as Brazil, Nigeria, Zaire, Russia, Algeria and South Africa.

Cartel Actions

Will there come a time when our foreign suppliers actually pull the needle as the OPEC cartel did a few years ago? It's hard to say in all cases, but we have seen the growth of at least one new and important cartel—in aluminum—and others may form as world economics and international politics change. The point is that we must be prepared beforehand for any large-scale changes in our minerals and raw materials supplies. Now is the time to exercise 20/20 foresight.

What Can Be Done

The President and national leaders must be made aware of the seriousness of our minerals situation. We must examine the implications of actions already taken; for example, the Mining and Minerals Policy Act of 1970 should be re-evaluated now. And to give minerals the voice in government they need, I propose specifically the appointment of a minerals advisor with access to the highest levels of government.

Further, and equally important, our public must be educated to the seriousness of the situation and must be given some of the basic facts that those in the minerals industries have known for years. The public must come to appreciate the enormous value of our non-renewable natural resources. They must learn that the time lag between discovery of a new deposit and actual production is between six and fifteen years, that 10,000 acres must be explored to locate one producing acre, that the actual land disturbed by minerals development is only 3/10 of one percent (whereas highways cover 14 times that amount), that over 40% of lands developed for mineral extraction have already been restored. For those concerned about future international politics the fact that *Mining Journal* late last year called Russia "the most self-sufficient in minerals among the world's industrial nations" should be made known.

Within the minerals industry itself there is much to be done: it must substantially improve its public image; it must improve its lobbying effort (though the difficulty of this will be greatly reduced by an improved public image); it must improve its technology to satisfy legitimate public concern and to conserve energy; and it must increase its own internal organization and communication so that it can address public and government with a unified and effective voice.

Role of Government

It is of primary importance that the Administration

recognize the gravity of the minerals situation. The administration must control its executive rule-making to conform to Congressional intent. (The recent decision to identify the authors of specific regulations by name will do much, I hope, to dispel the image of a faceless bureaucracy.) The administration must provide an opportunity for a balanced input; and it must conform to Congressional dictates stipulating the establishment of a national minerals policy and the encouragement of mineral exploration and development. Lastly, the Administration must evaluate our stockpile situation for each of the minerals likely to be affected by international cartel actions.

For its part, Congress must give closer attention to the effects of changes in mining laws. Specifically, with regard to the 1872 Mining Law revision, Congress must retain the concept of the location patent, it must retain security of tenure and freedom of access. Congress must also recognize the unique role of the small miner and prospector and the important role of smaller mining operations. Finally, Congress must provide the U.S. Bureau of Mines and the U.S. Geologic Survey with increased budgets for research and technological advancement, and it must furnish the necessary incentives to promote a healthy mineral posture.

It is not too late to prevent the "junkie syndrome" from bringing us to a minerals crisis. Certain important steps have already been taken, and our leaders are becoming aware of the seriousness of the situation. It is still important, however, that organizations such as the AIME use all their resources to bring to both the public and the government the knowledge that is uniquely theirs.

How Much More Oil?

(from *Science*, Nov. 4, 1977)

One of the major battles fought on Capitol Hill this year has been over pricing and taxing of crude oil. Part of the petroleum industry has taken the position that given sufficient incentives, they could find and produce much more oil. Conversations with veteran oil geologists and exploration managers reveal a sharp division of opinion. Some are sincerely and deeply optimistic about finding much more oil, but another group with equal conviction holds the opposite view. The optimists cite the fact that most of the area of the continental shelves and part of Alaska remain undrilled. They also believe that they will find much more oil within the contiguous 48 states. They assert that improved methods of recovery will bring out more oil from formations where it is currently unproducible.

The pessimists point to the poor results obtained during the past 5 years in drilling in the contiguous 48 states. They concede that more oil will probably be found in the frontier areas, but they point to disappointments in drilling on the continental shelves. Major oil companies spent nearly \$1 billion to obtain the right to drill dry holes in the Destin Anticline located in the Gulf of Mexico west of Florida. Results of drilling the

first hole off the mid-Atlantic Coast were also not encouraging.

The National Energy Plan projected that domestic petroleum production (including condensate) will total about 11 million barrels per day in 1985, or about 1 million more than current levels of production. This estimate is optimistic. Under present leasing policies and federal regulations, there is no possibility of substantial additional oil from the outer continental shelves by 1985. A useful contribution will come from Alaska, but if the Plan's target is to be met, most of the production must come from the contiguous 48 states. Moreover, to sustain the production rate, a large amount of oil must be discovered—about 3 billion barrels per year. During the past 4 years, discoveries averaged only 1.2 billion barrels and little of that was in new fields.

A recent release by the Federal Energy Administration, now part of the Federal Energy Organization, provides a historical perspective. In 1976 there were 30,000 oil fields, but half of the total production came from only 100 fields. Among these large fields, 76 were found before 1955. Only eight large fields came into production in the period 1966 to 1975 and they yielded only 3.9 percent of the total oil. Thus domestic production in 1976 was largely obtained from discoveries made decades ago. An example is the great East Texas field discovered in 1930. It still ranks high with respect to both reserves and production, but only 20 percent of its original reserves remain.

There is another reason for the view that large new reserves will not be found in the contiguous 48 states. Nearly 2.5 million holes have already been drilled, many of them spotted by a combination of expert judgment, experience, and geological, geophysical, and geochemical information.

By far the best prospects for major discoveries are in frontier regions. In one frontier field alone at Prudhoe Bay, Alaska, reserves match the total found in 29,900 fields in the contiguous 48 states. But some 40,000 additional holes a year are being drilled in the unpromising territory. At the same time, vast areas of the outer continental shelves go untouched. The total area that has not been drilled is about equal to that of the well-explored sedimentary basins on shore. As Hollis Hedberg and others have pointed out, we will have no basis for an estimate of oil potential until we have drilled. With luck, an amount equal to five times our present reserves might be found. However, on a bitterly cold day in winter, one cannot heat a house by burning hopes. Prudence dictates that this country should have a better basis for estimating how much more U.S. Oil.

Quartz Hill Access Road Okayed

(from *Ketchikan Daily News*, Nov. 4, 1977)

Forest Supervisor Jim Watson today issued a decision approving an environmental impact statement on access to the U.S. Borax and Chemical Corp. molyb-

denum deposit at Quartz Hill.

Ketchikan environmentalists say they "will be studying the possibility of an appeal" to that decision. The decision approved the impact statement which has been scrutinized for a year and a half.

They have 30 days to appeal the decision to Regional Forester John Sandor in Juneau, the beginning of an extended appeal process which could end in the courts.

The impact statement has been attacked by various quarters since it was issued in draft form in March, 1976. The statement covers impacts of a proposed 13-mile access road to the U.S. Borax molybdenum prospect at Quartz Hill, about 45 miles east of Ketchikan, and an ore sampling process which will determine whether mining will take place.

"We will be studying the possibility of appeals and a lawsuit," said Sharon Newsome, president of Tongass Conservation Society. She said the decision would be based largely on material which may have backed up environmentalists' claims during a federal meeting Oct. 27.

Environmentalists have attacked the impact statement as much for what it doesn't say as for what it covers. Tongass Conservation Society and Southeast Alaska Conservation Council have maintained that the impact statement should cover the entire proposed mining operation, while the company and the U.S. Forest Service say it is too early to do that. They say the mining operation will be covered by a second impact statement if U.S. Borax decides to continue with its project.

Conservationists say more emphasis should have been placed on alternative access methods such as helicopter transportation, and on protection of salmon streams in the area.

However, U.S. Borax and the Forest Service have maintained that helicopter access is dangerous and prohibitively expensive. And the Forest Service says the Mining Law of 1872 requires them to give "reasonable access" to mining claims on federal land.

Another concern of conservationists is that the mining claim sits within the boundaries of the coveted Misty Fjords Wilderness Area, which they would like to see established by Congress.

However, in preliminary committee action in the U.S. House of Representatives, an enclave of 25,000 acres has been proposed in the wilderness area in question to allow the U.S. Borax project to continue if the company decides to do so.

Watson's decision announced today came following a year and a half of debate which climaxed in high-level meetings last week in Washington, D.C., with several federal agencies. The president's Council on Environmental Quality explored questions which had been raised by environmentalists and met with the Forest Service on the impact statement on Oct. 27. Other agencies represented included the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the Environmental Protection Agency, the Bureau of Mines

and the State of Alaska.

Watson said his decision was made "after careful review of all information provided me by individuals, groups, organizations and agencies" including the CEQ.

"I have decided to permit U.S. Borax to construct an access road to their Quartz Hill molybdenum claim via the Keta River and Hill Creek Valleys," Watson's announcement stated. "I find this means of access will provide the greatest net public benefit considering total cost, energy use, worker safety and residual value."

Watson said that following the meeting with CEQ, which he and planner Charles Gass of the Ketchikan office attended, several factors were studied in detail, including worker safety in SE weather when workers depend on helicopter access compared to a road, the effect of the road on fisheries, operating plans and operations time schedule and the need for additional permits, licenses and environmental statements.

Watson's announcement gives U.S. Borax a special use permit to construct the road for their bulk sampling and other exploration.

U.S. Borax officials have stated that, pending approval of the permit, they hope to start road construction next spring and complete the first seven miles by the end of the construction season. The road would be completed the following year, which would allow bulk sampling to start.

Department of Natural Resources Selects Lands for State

In order that the State's land entitlement is ensured and strengthened through current discussions of D-2 legislation, DNR has prepared a preliminary selection of lands. Criteria for selection include the mineral and energy potential of the region under consideration. Nominations of townships by the mining industry are solicited. Information shared may remain confidential. Suggestions should be directed toward Ross G. Schaff, State Geologist, 3001 Porcupine Dr., Anchorage. Public review of the State's land selections will be considered through March 1.

New Interior Rules Open Mineral Rights (from *Fairbanks Daily News-Miner*, Nov. 18, 1976)

The department of Interior has proposed procedures that would allow some private landowners to purchase the mineral interests to their lands.

Copies of the proposed rules are available at Bureau of Land Management offices in Anchorage, Fairbanks, Tok, Glennallen, Kotzebue and Bethel. Public comment will be accepted until Jan. 3.

State BLM Director Curt McVee says the rules would affect lands "where mineral interests were reserved by the federal government when the surface was transferred into private ownership."

He said the Interior secretary has very limited authority under the Federal Land Policy and Management Act, and many applications to purchase those interests will be denied.

The rules would allow sale of mineral interests where there are no known mineral values or where federal ownership of the interests interferes with more beneficial use of the land.

BLM officials say the rules and those conditions would apply to settlement claims, small tracts, lands sold under the Alaska Public Sale Act of 1940 and lands acquired under the Recreation and Public Purposes Act.

The proposal requires that the BLM work closely with the U.S. Geological Survey to determine the value of mineral interests.

McVee said, "We don't feel these procedures will have a widespread impact on Alaska. Most of the land with mineral interests reserved by the federal government are in the Fairbanks and Anchorage areas, the Mat-Su Valley and the Kenai Peninsula."

The proposed rules specify which owners and prospective owners may apply, set standards for mineral exploration, and set standards for determining fair market value of the mineral interests.

They also call for a \$50 nonrefundable application fee.

'We're Being Regulated Out of Business,' Miners Agree (from *Fairbanks Daily News-Miner*, Oct. 31, 1977)

Despite a growing national need for and dependence on many minerals that could be mined in Alaska, the mining industry here is "not in good shape."

With that comment, Alaska Miners Assn. President James Hamilton opened a convention of the organization in Anchorage Friday, and other speakers during the two-day session concurred with his assessment.

"The mining industry and exploration industry in Alaska is not in good shape," Hamilton said as he gavelled the convention to order. "We are being regulated out of business."

Convention keynoter J. Allen Overton, president of the American Mining Congress, was asked to speak on the convention theme, "Mining at the Crossroads," but he told the group, "I don't know that we're at the crossroads. I think we're under seige."

Hamilton and Overton were two of more than 20 speakers to address the miners during their convention. Held at Anchorage's Captain Cook Hotel, it drew more than 300 persons, many of them miners and others state and federal officials whose duties touch on the mining industry.

Topics discussed ranged from the impact of d-2 land decisions on the mining industry to the status of federal efforts to inventory the state's mineral potential to problems caused by state and federal taxation and transportation policies.

Speaking at the Saturday night banquet, Overton passed briefly over a half-dozen examples of proposed federal policies or regulations that he said could have an adverse impact on the mining industry. But the thrust of his remarks was on the d-2 land decisions now before Congress.

He said miners should be careful not to be drawn into the battle over the amount of acreage to be included in new national parks, forests, wildlife refuges and wild and scenic rivers. Rather, he said, they should consider the basic philosophy behind the action.

"One way to obfuscate the issues when your case is wrong is to shift to the numbers game," he said. "To avoid at all costs and examination of any facts that expose the deep-freeze legislation."

A miner's pick has touched less than one per cent of the land mass of the United States, Overton said, but still have provided a basis for development of one of the world's highest standards of living.

"Without mining and agriculture we have no freedom, nothing with which to live," he said, commenting that legislation proposed by environmental groups would "be without a doubt the greatest legislative rape in the United States."

The Mining Congress has worked closely with Citizens for the Management of Alaska's Lands to push for a development-oriented settlement of the d-2 issue.

CMAL Executive Vice President Tony Motley, speaking at the convention luncheon Friday, said CMAL now is working for time, hoping to delay House action on the issue until more congressmen can be contacted and briefed.

Land use issues were not the only ones discussed at the convention, however.

State and federal taxation policies came under attack as several speakers said there was a net benefit to the economy to allow mining to operate under minimal taxes, thus maximizing activity and resulting in a multiplier effect through increasing employment in mining and related industries.

Commissioner of Revenue Sterling Gallagher told the group that miners would have to "police themselves" if they hoped to see net-type taxes rather than gross taxes, which the industry claims cut down exploration and production.

For example, he said, only three of some 20 alien corporations operating in Alaska pay any state taxes, but if American companies were in partnership with them, many loopholes would not be available.

Gallagher also said the Legislature has mixed social policy with tax policy, resulting in complex tax policies aimed at doing more than simply raising money.

"I'm not sure that's the best way," he said, but offered no suggestions on how taxation might be divorced from social issues.

On the transportation question, miners urged state Commissioner of Transportation Don Harris to open the haul road north, plus providing miners and others access to land for mineral exploration.

Progress

(Excerpted from "Slim's Column,"
Fairbanks Daily News-Miner, Nov. 29, 1977)

Back in the olden days, like about five years ago, all a man had to do to become owner of a gold mine was to find a likely creek, then go and file on it in an office.

Life has gotten a bit more complex today, however. It now requires a likely creek, two lawyers, the backing of a mining organization, and a Supreme Court decision. Now that's just to locate. To file requires a bit more paperwork.

At least, that was the impression we got when we set out to go prospecting on a semi-secret creek high in the Alaska Range. My partner, Deep River Jim, had made some inquiries on the creek with a routine stop at the two land agencies in Anchorage—the state folks in the pink building, and the feds in the yellow building.

The feds told him there was no gold mining in Alaska, but if there were:

1. He couldn't have one because all the gold was on state land.
2. All the federal land was either d-2 or claimed by Native corporations.
3. The bears would eat him if he left the road.

The state folks said:

1. He couldn't have one because all the gold was on federal land.
2. They couldn't find their maps to see if the creek was already staked.
3. They weren't accepting any claims, but if you don't file before 1979, you'll never get one.
4. All mining stopped in October of 1976.
5. Where is the Alaskan Range?
6. The bears would get him if he left the road.

It turns out: the creek you are interested in was a state selection but the state withdrew it and now it has been set aside for McKinley National Park but it wasn't a park yet and we're not sure about state claims but we're almost positive its d-2 which means you can't do anything to it except camp I think but you might check with park service and see what they say but personally I don't care what you do and you might just go in and take what gold you need and leave a clean camp and don't tell anyone I said so but it's those @%\$&! environmentalists....

Park service was more helpful. They said: if BLM doesn't care neither do I because until it's in the park I can't do a thing but be sure your fire is dead out, leave a clean camp, don't pet the grizzlies and remember fool's names and fool's faces are always found.....

In both cases, neither had heard of the creek, but when given the township's range and bearing, they were able to whip out the big map drawers with the maps and the colored mylar overlays, and spreading them beneath the neon lights could tell you just exactly which other agency to call to learn about it.

Jim and I hoped to walk in and look the creek over, as the last we heard nobody had fenced it off, and just

see what happened. And as we stowed a week's grub in our packs, we silently gave thanks for the progress made by civilization in the past five years.

During the Dark Ages of mineral exploration back then, they would just have said, "Go ahead...and good luck."—*Slim Randles, editor, Talkeetna Alaskan.*

Alaskan Lake Grows as Glacier Retreats (from U.S. Geological Survey information release, Nov. 4, 1977)

Portage Lake, Alaska, may continue to increase in size, and Portage Glacier may retreat out of sight from the National Forest Visitor's Center within the next 50 years, if predictions by U.S. Geological Survey glaciologists are correct.

Portage Glacier is a major tourist attraction in Chugach National Forest, southeastern Alaska, 50 miles southeast of Anchorage. A U.S. Forest Service Visitor's Center presently provides a view of both the 2.5-mile (4 km)-long lake and the spectacular "calving" or collapsing front of the glacier that produces numerous icebergs. The Center is located on a paved road from Anchorage near a branch of the Alaska railroad. The Portage area has served literally as a "portage" or boat-carrying route between Prince William Sound and Turnagain Arm of Cook Inlet for centuries.

In a new map report describing the past and probable future movement of the glacier, USGS glaciologists L.R. Mayo, D.G. Trabant (Fairbanks) and Chester Zenone (Anchorage) said that for some years before 1800, Portage Glacier did not block the overland route through Portage Pass. The glacier began to advance strongly, however, from about 1800 to 1890. As a result, prospectors during the 1898 gold rush had to climb over the glacier to use Portage Pass. Since 1914 the glacier has been in retreat and the lake has become larger. Ironically, the recent retreat and breakup of the glacier have made surface and boat travel more difficult because of the many crevasses on the glacier and icebergs on the lake.

The rate of retreat from 1914 to 1939 was about 53 feet (15 meters) per year. From 1939 to 1950, the retreat quickened to about 478 feet (145 meters) per year, but has since slowed to about 106 feet (32 meters) annually.

If the glacier continues to retreat at its present rate, and if estimates of the depth of the Portage valley are accurate, Portage Glacier will gradually retreat around the bend it now takes. The glacier will then be out of sight of the present visitor's center, leaving more dry land and providing a more easily travelled transportation route. If the valley is deeper than estimated or if the rate of retreat increases, the glacier could recede even farther than presently postulated.

Alaska has more pet rocks than snakes.

Energy Map, "Short Notes" Report Released

An Energy Resource map and the annual "Short notes" volume have been released. The six-color map, which details oil and gas, coal, and uranium deposits, geothermal locations, and electricity sources, is available for inspection and purchase at any DGGs office (p. 1). People requesting maps by mail are asked to send their checks or money orders for \$2.50 to the College office. (The map will be sent in a tube.) In related news, DGGs still has copies of the ERTS satellite map of Alaska. The map, scaled 1:1,000,000, consists of five sheets and is sent in a sturdy map tube. Available at any office, the map costs \$7.

Geologic report 55, "Short notes on Alaskan geology - 1977," also costs \$2.50. This book contains about 10 articles and covers such diverse subjects as geochronology of southern Prince of Wales Island, geology of the Chulitna mining district, tectonic significance of the Knik River schist terrane, the Givetian fauna found in the Healy quadrangle, and an analysis of the Katmai caldera.

Six of a series of open-file reports on the Talkeetna-Kashwitna area are scheduled for completion at the end of January. Available by mail from the College office, they are:

- AOF-107A - "Reconnaissance geology of the Talkeetna-Kashwitna area, Susitna River basin, Alaska," by R.D. Reger (1 pl. - 1:63,360). \$1.50.
- AOF-107B - "Reconnaissance map of geologic materials of the Talkeetna-Kashwitna area, Susitna River basin, Alaska," by R.D. Reger and C.L. Carver (1 pl. - 1:63,360). \$1.50.
- AOF-107C - "Slope map of the Talkeetna-Kashwitna area, Susitna River basin, Alaska," by J.T. Kline (1 pl. - 1:63,360). \$1.50.
- AOF-107E - "Bedrock geology and coal occurrences, Talkeetna-Kashwitna area, Susitna River basin, Alaska," by D.L. McGee (1 pl. - 1:63,360). \$1.50.
- AOF-107G - "Simple Bouguer gravity map of Talkeetna-Kashwitna River area, Alaska," by S.W. Hackett (1 pl. - 1:63,360). \$1.50.
- AOF-107H - "Aeromagnetic map of Talkeetna-Kashwitna River area, Alaska," by S.W. Hackett (1 pl. - 1:63,360). \$1.50.

Also available in late January will be another open-file report:

- AOF-114 - "Reconnaissance geology of the new capital site and vicinity, Anchorage quadrangle, Alaska, by R.D. Reger (1 pl. - 1:24,000). \$1.50.

A couple of publications are free this quarter, too. A few copies remain of the September 1977 issue of *The Coal Miner*, in which DGGs mining engineer C.N. Conwell discusses reclamation of the Usibelli mine. Also free is a revised information circular, No. 18, "Amateur gold prospecting in Alaska."

Regional Confrontation in the Energy War

(By Peter T. Flawn, President,
Univ. Texas—San Antonio)

As of September, 1977, we have a White House promulgated National Energy Plan, we have a congressionally-authorized Department of Energy to be officially born in just a few days, we have an overwhelming flow of rhetoric including three hours of prime TV time by Walter Cronkite, and we have the beginnings of a congressionally-manufactured policy that as of September 27 appears grossly inadequate.

What we are facing is an energy problem, an energy crisis, or an energy war, depending on your perceptions of the gravity of the problem and the level of national effort required to solve the problem, meet the crisis, or win the war.

I agree with President Carter that the situation is in its severity analogous to a war experience both in terms of the national effort required to win and the consequences of losing the war. It worries me that in all of the rhetoric, there has been little public exposure of the real consequences for the United States of losing the energy war. The concern when expressed, is a mild and un-specific apprehension about "changes in life-style."

As in all wars, we are seriously threatened both nationally and individually. Losing the energy war will result in a profound economic depression with attendant massive unemployment, crippled industry, and an agricultural system unable to feed, at anything like its accustomed level, a population with a greatly reduced mobility. To talk about a reduced standard of living or a changed life-style is an understatement of truly magnificent proportion. Democratic institutions are not likely to survive the kind of social unrest that losing this war will produce.

The United States of America has enjoyed the fruits of relatively cheap and abundant energy since the late 18th and early 19th centuries when we first began to develop the energy of our river systems and the use of forest resources for fuel on a large scale. Of course, there were then regional differences in abundance and cost of energy—not all river systems were suitable for development. Forest resources were widespread in the then United States but they did not occur everywhere.

Throughout our 200 year history, the nation has enjoyed a most significant economic margin resulting from cheap and abundant energy. Regional shifts in economic flows occurred as coal was developed and then was supplanted as the prime energy source by oil and gas. Regional change occurred without an articulated national policy. The unarticulated policy was "hands off."

The economic margin resulting from cheap and abundant energy has been a critical national element in industrial and social development. It has produced through capital formation a powerful investment stream; it has lowered operating costs, and because energy costs were low, wages could be high. Our energy-

intensive agricultural system is second to none. The American life-style consumes enormous amounts of energy moving human bodies around at high rates of speed at their own initiative. Cheap and abundant energy has given us a strong economy, and because we have a strong economy we have been able to allocate resources to social and environmental programs. I submit that societies with weak economies can address only their most urgent priorities. These societies do not spend money on environmental restoration and maintenance. If you have to choose between operating hospitals and reclaiming mined-land—you operate hospitals.

If we as a nation do not forge a sound national energy policy through democratic processes, and if there is no political or military interdiction of foreign oil supplies, there will be a continued outflow of the wealth and substance of the United States that will leave us a poorer, more dependent, socially-unstable nation. On the other hand, if there is political or military interdiction of foreign oil supplies, we shall see the danger and fight the economic war with all of our financial, technological, and human resources—but without the critical lead time. If we win we will be a much stronger and more united nation. The democratic society of the United States has always been able to unite to meet a clearly perceived threat or enemy. For a democratic society, it is easier to fight than to prepare to fight. I would rather fight the war now while we are still strong than to fight later when we shall surely be weaker.

Losing the energy war would be so disastrous that we as a nation should not take risks. We should not gamble on nonexistent or undeveloped technologies; we should not gamble on as yet undiscovered oil, gas, or uranium resources. New technologies will be developed and new deposits will be found but not within a predictable time frame. While we vigorously pursue new technologies and new deposits of oil and gas and uranium, we must, over the near term, fight the war with what we now know and what we now have.

We should, for example, begin now an all-out effort to build synthetic fuel plants that can produce liquid fuels from coal and oil shale in the mid 1980's. Production of 2 million barrels per day of synfuel by 1985 would be an important victory. This great national effort will not in itself solve the problem. It will provide some margin against disaster. The overriding consideration is national security. National security must override the fact that such plants will not at today's product prices meet return-on-investment criteria. National security must override the strident opposition of the uninformed who do not perceive the danger.

In waging this war, the nation must buy time to develop and build the vast wind-solar networks for the future; it must buy time to pursue a viable nuclear fusion technology; it must buy time to search out the deposits of natural resources, both of oil, gas, and uranium needed for the transition period, and of the minerals and metals that will be needed for the new technologies. Consider, for example, the metal and min-

eral requirements for manufacture of 100 million storage batteries under any known battery technology. Major increases in production of certain metals and minerals will become necessary. Achieving these increases will take time. We must protect our existing energy system while we prepare to change it. The energy war—more properly the energy—environment war—may well be another 100 years war.

And, as for other wars, Congress must declare war. This one will be no more popular than the last, but this one we must win!

In a democratic system, elected representatives will always bear the responsibilities of looking out for the well-being of their constituents, their state, or their congressional district. And that is as it should be. We can expect confrontation. However, historically, regionalism in the perjorative sense does not loom large when the nation is at war and threatened by a visible enemy from without. There may be bickering about the location of a military facility or war materials contract, but regional interests are clearly secondary to the national interest—which is to win—to survive.

Short of war, or in a war that is unperceived, regionalism can be divisive to the point where it threatens the building of a national policy to meet the threat. And so it is with energy in 1977.

The fossil fuels, and uranium, being natural earth substances in a planet that is not homogenous, are not equally distributed. They occur in some regions and not in others. Earth heat is more easily tapped in some regions than in others. Running and falling water is more abundant in some regions than in others.

The producers and the citizens of the energy-producing regions of the United States want to receive a fair price for their products. When the government suppresses the price of domestic goods and pays higher prices to foreign producers for the same goods, it produces bitterness, political confrontations, a depressed domestic industry, and a threat to national economic security. Those who would protect the consumer must address the security of supply as well as the price of the commodity. The Texas oilman believes it is just as patriotic to explore for and produce oil and gas as it is to manufacture shoes. If a pipeline from Mexico brings \$3.00 or \$4.00 per MCF natural gas into McAllen, Texas, where new Texas gas is at a controlled price of \$1.75 per MCF—that is not equity.

Regionalism and political confrontation between energy producers and consumers is not new. Just 7 years ago, the President's Task Force on Oil Import Controls recommended policies to reduce the price of domestic crude oil by increasing imports of cheap foreign oil. This task force examined the national security issue and concluded that it was unlikely that exporting nations could successfully establish a cartel. The recommendations of this task force, fortunately not adopted, would have sacrificed the domestic industry to save "the consumer" 5 billion dollars in annual fuel bills. This was

regionalism at its worst.

A current major national issue that is producing regional confrontations is, of course, deregulation of the price of oil and natural gas. Whether to deregulate or to maintain, indeed to extend, price controls is a most difficult issue. Our economic system can accommodate to economic changes if there is time to accommodate to them—it is the sudden economic change that causes dislocations and individual hardship—and that brings people out in the street in protest. Government in a democratic system survives only with the consent of the governed. If changes in prices of basic commodities come gradually, adjustments can be made. If they come suddenly, there are serious political consequences.

Because of existing ill-conceived government price regulation, price increases that would have been a natural market reaction over a period of years to cost increases and declining supplies have not occurred. Conservation has been discouraged and domestic supplies have been reduced.

The mineral exploration industry is a high-risk industry. An individual or private corporation in the exploration business finds little profit in second guessing or looking backward. When, as is inevitable, large sums of money are lost on dry holes or unsuccessful mining ventures, it is considered a normal business risk and exploration goes forward. When failures, such as in the Gulf of Alaska or in the Gulf of Mexico off West Florida, result in the loss of hundreds of millions of dollars, the loss is accepted. There is no great political upheaval. It is private money that is lost—not public money.

This kind of high-risk business cannot tolerate extensive government intrusion in the decision process. Management has to be free and unrestrained to make its decisions—good or bad—and to succeed or fail. The exploration business cannot be run as a regulated utility or airline. It must be left alone or it must be nationalized—there is little in between that will work, except perhaps acquisition by the government of equity interest in private corporations. It is true that national oil and gas companies have had reasonable success in some countries—although they operate at very high costs per unit of product. However, these government-managed companies have succeeded only in oligarchies or autocracies where spectacular and costly failures do not threaten the government. In our system, I submit that a federally-operated oil and gas company, under the government of either political party, could not take the necessary exploration risks with billions of dollars in public money. Failures, inevitable failures, would be so exploited by the press and the opposition party that exploration programs would be ultra-conservative. Ultra-conservative programs do not find oil, or gas, or uranium, or base metals, or anything else.

Unless regional interests can be subordinated to the national interest, we will not win the energy war. They will not be subordinated unless there is political and economic equity. The producing regions must

accept the fact that sudden price escalations cannot be accommodated without unacceptable political consequences; consumers must accept the fact that it is not in the best interest of the United States to fatten foreign producers while starving domestic producers. This is reverse and perverse protectionism—protecting the foreign producer who is draining the wealth of the United States. Profits in Texas and Louisiana and other producing regions that are invested in new energy development do indeed support the national interest. And, a very high level of investment in energy RD & D is essential to carry us over the long term to a 21st century energy system that is compatible with a high-quality environment.

One of the factors that brought the United States to victory in past wars was an efficient and effective government—private sector partnership. The government was an innovator, a facilitator or a partner and not a regulator or adversary. Now, because of inhibiting anti-trust laws and the Federal Advisory Committee Act it is either illegal or politically unacceptable for government and private industry to sit down together to plan and carry out projects in the public interest. In trying to eliminate opportunities for abuse, undue influence, or undue advantage, we have removed the freedom to act! Legislation to remove these foolish roadblocks is essential. So frustrating is the current entanglement that the Energy Research and Development Administration has asked the National Academy of Sciences to devise through the National Research Council, a mechanism to improve private-sector participation in energy research, development and demonstration planning. We have created a problem where there should not be one. Notwithstanding legislation that charges ERDA to develop new technologies to assist the private-sector to deliver the goods and services, ERDA cannot simply invite industry representatives to sit down with them to plan RD & D projects. We need the Clean Slate Act of 1978 to make possible a government—industry partnership to wage the energy war!

In my judgment, the 1985 goals of the National Energy Plan will not be achieved without acceptance by the Congress of wartime urgency.

The critical path toward successful resolution of the conflict must include:

- (1) An honest public appraisal of the consequences for the United States and its people of the cost and dependence on foreign supplies of oil (and natural gas).
- (2) An end to the demagogery that has cast government and the private-sector as adversaries; conversely, re-establishment of working partnerships that have been successful in the past.
- (3) A recognition that (a) a strong economy is

essential to build an environmentally-acceptable energy system for the next century and (b) there can be no strong economy without an adequate supply of energy.

(4) Establishment of regional equity in national energy policy.

Mining Claims Double Again

Bridge, anyone? Double and redouble.—The number of new mining claims filed has redoubled. A total of 6,389 new claims were filed for the period September through November, according to DGGs mining-information specialist Mildred Brown. This is twice the 3,285 claims filed for the preceding 3 months, which was twice the 1,646 filed the quarter before that.

The Fairbanks quadrangle was easily the heaviest staked this quarter, with 3,591 new claims. (See following article.) Totals for the quarter, by recording office, are:

Wrangell	- 1	Palmer	- 36
Petersburg	- 32	Talkeetna	- 38
Ketchikan	- 310	Glennallen	- 6
Juneau-Haines	- 289	Fairbanks	- 3,591
Nome	- 93	Bethel	- 6
Kotzebue	- 273	Nenana	- 162
Anchorage	- 16	Ft. Gibbon	- 19
Iliamna	- 2	Barrow	- 1,464
Seward	- 35	Manley Hot Spr.	- 1
Nulato	- 12	Cordova	- 3

Yearly totals are also up. The new claims staked in the last 12 months rose slightly—from 12,439 to 13,062. The number of total active claims in the state has risen substantially, however—from 25,378 to 32,240. The largest claim blocks filed during the year were (in order) in the DeLong Mountains, Circle, Nome, Sitka, Tanacross, Mt. Hayes, Bendeleben, Candle, Chandalar, Melozitna, Talkeetna, and Ketchikan quadrangles. In other mining news, Resource Exploration Consultants of Fairbanks deeded its claims in the Circle and Livengood quads to an Outside firm, Mapco, Inc., of Tulsa, Oklahoma.

Miners Stampede to File Claims

(from Fairbanks Daily News-Miner, Dec. 2, 1977)

A massive surge in filing mining claims has piled up a mountain of work for the State Recorder's office in Fairbanks, according to Judy Brenner, recording supervisor. "We are so far behind, we have to work on weekends," she said.

She said 5,031 claims were filed for the Barrow recording district from September through November; 3,561 of them were filed last month alone.

Wrong brushers—An Alcan Pipeline survey crew was shut down by government officials in Delta recently because they were suspected of clearing brush without a permit. This confused the crew because they hadn't been clearing any brush, and subsequent investigation showed the culprits were a Bureau of Land Management crew working in the same area.

The Fairbanks recording district, which is the largest in the state, came in second with 3,052 mining claims filed.

In the Champion Creek area, about 50 miles north-east of Fairbanks, where a uranium find was announced by U.S. Bureau of Mines in September, 700 claims were filed. "It would remind you of the gold rush days," Brenner said, "I had guys standing at the door trying to decide who was going to get in first. Four different guys were trying to stake the same claim."

Mildred Brown, mining information specialist with the Alaska Division of Geological and Geophysical Surveys, said a large number of the claims are being staked by firms rather than individuals. One firm, Watts, Griffiths and McQuat of Anchorage, expects to record 4,000 claims in December, she said.

Dr. Earl Beistline, dean of the School of Mineral Industry at the University of Alaska, doesn't see the large number of claims being staked in the last three months as unusual.

"New discoveries keep coming to light all the time and people get interested," he said. "This is a natural trend. As minerals become shorter throughout the nation, more attention will be turned to Alaska." The claims being filed now are based on a considerable amount of exploration, he said. "It's a normal thing stimulated by the need for minerals."

Miner Feast Seen in Uranium Area

(from Fairbanks Daily News-Miner, Sept. 22, 1977)

A rare public disclosure by the U.S. Bureau of Mines will allow prospectors to stake claims within the boundaries of a proposed wild river area near Fairbanks before Congress has a chance to lock up the stream through passage of Alaska d-2 lands legislation, the Associated Press has learned.

The bureau announcement Wednesday that government geologists have found "significant concentrations" of uranium near the headwaters of Little Champion Creek is expected to attract a flood of prospectors to the area, about 50 miles northeast of Fairbanks.

The area in question is within the proposed boundaries of the Beaver Creek National Wild River sanctuary contained in the Carter administration's d-2 lands recommendation presented to Congress last week by Secretary of Interior Cecil Andrus.

Under the still-developing Andrus proposal, no mining would be allowed with line of sight or two miles of the banks of a wild river, but the prohibition would be "subject to prior existing rights."

Bureau of Mines officials readily acknowledged that their announcement of the discovery in a press release will allow miners to establish such prior existing rights in the area before Congress takes action on d-2 legislation which would prohibit mining.

MIRL Qualifies for Laboratory Funds

Public Law 95-87 (Surface Mining Control and Reclamation Act of 1977) provides potential funds on a matching basis for the UAF Minerals Institute Research Laboratory (MIRL) under Title VIII, Title III and Title IX. Of particular importance is Title VIII which outlines the qualifications of the applicant.

- 1) Title VIII allows for the creation of one coal research laboratory in a single state at ten institutions of higher education. In addition, the coal laboratories will be located in states with abundant coal reserves and in such a way that at least one laboratory will be established within each of the major coal provinces recognized by the Bureau of Mines including Alaska.
- 2) The institution of higher education shall have experience in coal research in several areas and must be currently active in such programs.
- 3) The institution of higher education has the capacity to establish and operate the coal laboratories to be assisted under this title.
- 4) a. No institution of higher education may receive more than \$4,000,000 for the construction of its coal research laboratory and installed fixed equipment as the Federal governments matching fund contribution.
b. No institution will receive more than \$1.5 million for initially installed movable equipment nor may it receive more than \$500,000 for new program startup expenses (matching funds).
c. No institution will receive more than \$1,500,000 per year from the Federal Government for operating expenses (50% matching funds).
d. No funds are anticipated until after fiscal year 1978.

DGGS Solicits Aeromagnetic Bids

DGGS will be issuing invitations to bid for the provision of digitally recorded and processed aeromagnetic data covering areas of the central Brooks Range. Work will take place in 1978 and will cover an area ranging from 5,288 to 12,200 square miles, depending on the funding available. Four specific areas will be flown in north-south traverse lines, spaced 3/4 mile apart, with east-west tie lines for each tier of 15' quadrangles. Elevation height will be 1,000 feet above ground level. The four areas are:

- Area A - Survey Pass A1-D1; Wiseman A4-A6, B2-B6, C2-C6, D2-D6; Bettles D4-D6.
- Area B - Shungnak C1; Hughes C1-C6; Bettles C4-C6.
- Area C - Bettles A5, A6, B4-B6.
- Area D - Shungnak A1, B1; Hughes A1-A6; B1-B6.

UA Lists Geology Students

The Solid-Earth Sciences Program of the Fairbanks campus disclosed its roster of students at both the graduate and undergraduate levels. The students are:

Graduate:

Barrett, Steve	McFarlane, Rena
Blodgett, Robert	Mitchell, John
Clough, James	Moore, Michael
Cotter, Peter	Motyka, Roman
Dean, Kenneson	Nye, Chris
Estes, Steve	Panuska, Aimee
Foley, Jeffrey	Panuska, Bruce
Fountain, Andrew	Peterson, Robert
Herzberg, Peter	Peace, Jerry
Huot, John-Paul	Rawlinson, Stuart
Haung, Paul	Rex, Hans
Lalla, Doug	Ross, Mary
Longenecker, D.	Root, Michael
Lueck, Larry	Wilson, Randy
MacKleith, Peter	Vasapoli, Jennifer
	Zdepski, Mark

Undergraduate:

Anderson, Nancy	Kleweno, Keven
Apel, Robert	Laird, Gregory
Bodnar, Dirk	Lowey, Grant
Burns, Laurel	Lybarger, Charles
Burton, Jeffrey	Mitchell, Dennis
Carver, Cheryl	Mortensen, Thomas
Fitzmaurice, James	Nelson, Diana
Gitomer, Leslie	Paris, Chester
Grabber, Eric	Rueben, June
Grace, Yvonne	Scala, Alexander
Haney, Joseph	Sherman, Gary
Hickock, Bruce	Sundt, Eric
Hughes, Lance	Wietchy, Daniel

They Said It....

"You visit Prudhoe Bay, and you'll readily realize that no matter how many congressional hearings—no matter what the environmentalists urge or the bureaucrats decree—the area is never going to compete as a place for man to live. Nobody is ever going to buy a lot and retire on Prudhoe Bay."—Paul Harvey, Commentator

"The biological capacities of man are geared to life as a hunter. Geologists and Bushmen are the surviving remnants of the world's hunting bands."—R.E. Folinsbee, University of Alberta, Canada.

Our Gangue....

By Frank Larson, editor

'Tis that time of year again...You know: Mistletoe, Crosby's 'White Christmas,' city workers humming carols as they hang boughs and strings of lights in 40-below

midday darkness, the heart-rending tale of Tiny Tim (not the one with the uke in the paper bag—the one with the bum wheel)...Although the Christmas seasons now are accompanied by football games galore, I still harken back to those happy Yules of my youth...The best part, back then, was opening the gifts, of course...The worst part was the wait. Two weeks before the blessed event, you stared at the lode under the tree, wondering what it would pay. One week later, you were *pretty* sure you knew what was under there. (But you still had to wait a week for the assay results.) Finally came the big day, Pay Day, and The Ritual began in earnest (no, not the Sacrificing of Virgins, the EPA having placed virgins on the endangered-species list and all).....You always received clothes ('Gee. Nice, but....'), but sometimes something really neat, too....Like in '47, when I got my long-awaited hockey skates (size 4). I loved those blades. (Slept with them, in fact.) By New Years Day, '48, they looked like Stanley Cup castoffs.....But values change. Nowadays I look forward to a more hedonistic ritual—the Stuffing In of the Stuffing.....Lost River Mining is still attempting to arrange financing for development of its fluorite-tungsten-tin property on the Seward Peninsula.....In other financial news, Little Squaw Gold Mining recently absorbed the interests of the Mikado Gold Mines partnership and reacquired all former holdings in the Chandalar district. Company president, Eskil Anderson, says Little Squaw owns most of the lodes in a 7-mile-long belt.....A seismic station has been installed in the village of Savoonga on St. Lawrence Island. The sensor, which uses RCA Alascom's small-earth satellite station, allows UA Geophysical Institute personnel to monitor earthquake activity in the Norton Sound area... ARCO is to drill two development oil wells in the Kuparuk River Formation west of the Prudhoe Bay field this winter. If successful, they will be the first of a planned \$217-million, 32-well program designed to deliver oil from the Kuparuk to the Trans-Alaska Pipeline....If not, they will probably emulate the Doyon Native Corp., which has abandoned its plans to drill a fourth exploratory oil and gas drill hole in the Kandik Basin. The first three came up dry.....Newconex Holdings reported that a joint venture in which they have a one-third interest has staked and optioned several uranium showings in Alaska. Drilling of an optioned showing confirmed existence of the vein, and step-out testing along strike is underway.....If Placer Amex proceeds with plans announced in September in Juneau, six million tons of coal a year could be produced from three lease tracts totaling 26,000 acres near the Beluga River on the western side of Cook Inlet (see p. 2). The company is studying the potential of a power-generating plant near their leases and a city of 3,000 to house the operation's employees.....Finally, congratulations are in order for DGGGS geological assistant Greg Laird, whose wife gave birth to a second child, a 9-lb boy, on Dec. 8. Best wishes are in order for wife Havanna and son Michael, who was delivered by his father. Good hands, Greg.....Cheers.

Metals Market

	<u>Nov. 25, 1977</u>	<u>Three Months Ago</u>	<u>Year Ago</u>
Antimony ore, stu equivalent			
European ore	\$ 16.2-18.2	\$ 16.20-18.20	\$ 17-18.50
Barite (drilling mud grade per ton)	\$ 19-28	\$ 19-28	\$ 17-28
Beryllium ore, stu	\$ 40-42	\$ 40-42	\$ 30
Chrome ore per long ton (Transvaal)	\$ 56-61	\$ 56-61	\$ 87-52
Copper per lb. (MW-prod.)	\$ 0.596	\$ 0.60	\$ 0.63
Gold per oz.	\$159.30	\$145.35	\$139.60
Lead per lb.	\$ 0.32	\$ 0.31	\$ 0.19
Mercury per 76-lb flask	\$130.00	\$115.00	\$117.00
Molybdenum conc. per lb.	\$ 4.10	\$ 4.10	\$ 2.62
Nickel per lb. (cathode)	\$ 2.13	\$ 2.41	\$ 2.20
Platinum per oz.	\$166.00	\$162.00	\$148.00
Silver, New York, per oz.	\$ 4.70	\$ 4.40	\$ 4.10
Tin per lb., MW composite	\$ 6.20	\$ 5.47	\$ 3.02
Titanium ore per ton (ilmenite)	\$ 55.00	\$ 55.00	\$ 55.00
Tungsten per unit (GSA domestic)	\$148.00	\$155.75	\$ 77.96
Uranium per lb., MW US spot oxide	\$ 41.50-42.50	\$ 41.50-42.50	\$ 41-42
Zinc per lb. (MW US PW)	\$ 0.305	\$ 0.34	\$ 0.39

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