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Jay S. Hammond—Governor | *Robert E. LeResche — Commissioner* | *Ross G. Schaff—State Geologist*

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IN THIS ISSUE

**Mining information office.*

Pioneer Peak Debris Slide

By Don L. McGee, DGGS Petroleum Geologist

Last November 30, a debris slide from the north flank of Pioneer Peak 0.7 mile east of the old Knik River bridge shattered one house, killing the occupant, displaced a nearby trailer house, blocked Knik River Road for a short time, and temporarily disrupted communications. Although this slide (fig. 1) is the most recent that has resulted in death, the circumstances under which it occurred are not unusual in the mountains of south-central Alaska.

The funnel-shaped scar of the slide starts at a point at an elevation of 455 feet and extends about 900 feet down a 26° slope to Knik River Road (fig. 2). At its greatest width the scar is 170 feet across; the total scar area is 85,500 square feet. Most of the slide body stopped against the south bank of the road fill. Three months after the tragic event 80 percent of the displaced material consisted of fine sand and silt, about 15 percent was organic debris, and less than 5 percent was rock fragments or glacial erratics. About 4,570 cubic yards of material was involved. Water content is estimated to be about 50 percent during movement.

In the source area of the debris slide the bedrock is indurated fine- to medium-grained sandstones and pebble conglomerates containing thin interbeds of green-gray metavolcanic rocks. These rocks strike northeast and dip 50° to 55° NW. A small fault trending diagonally across the middle of the slide scar exhibits little displacement (fig. 2). The bedrock surface is slightly irregular, consisting of low smoothly rounded steps or grooves trending across the slope. Glacial polish and striations parallel to the grooves demonstrate scouring of the bedrock surface by previous glaciers. The surficial deposits consist of 1 to 2 feet of eolian and fluvial fine sand and silt overlain by 6 inches of organic material and clay.

Flanking the fatal slide are two smaller slides. About 380 feet east and at the same elevation is a slide measuring about 200 by 300 feet. The failure flowed as a tongue of mud and rock fragments into a V-shaped snow chute and overrode surface sediments at the mouth of the chute but did not reach the road. A few hundred feet west of the large slide is another small slide. The presence of a hummocky terrain with mature trees between the three slide areas is evidence of previous slides on the steep slope.

Several factors may have contributed to the release of the debris slides.

1. At least 6 of the 7 days prior to the slide episode were rainy. Heavy rains saturated the thin cover of surface sediments, decreased their shear strength, lubricated the bedrock surface, and added weight to the soils. Saturation was promoted by the impermeability of the shallow bedrock.

2. The smoothness of the bedrock surface offered little hindrance to the slope failure. The 45° to 68° slope allowed the initial failure to gain enough momentum to carry it to the slope base.

Figure 1. Slide scar, looking north.

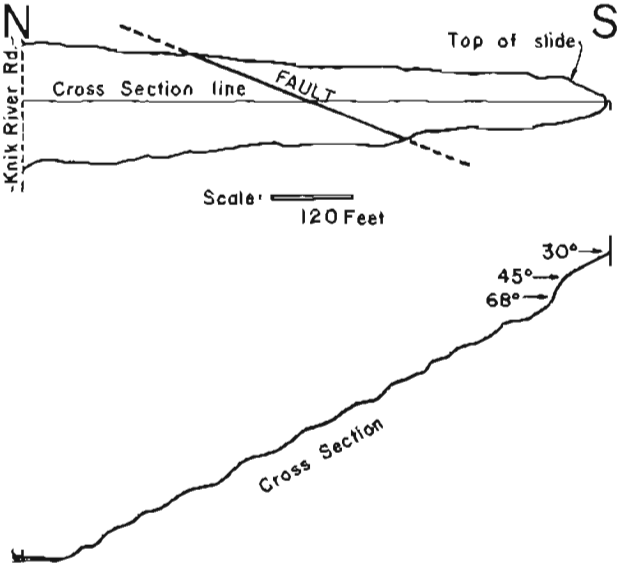

Figure 2. Map view and topographic profile through slide scar.

3. An unusually warm winter prevented freezing of the thin cover of surface sediments that made up the bulk of the slide body, even though there was no snow cover.

The event that triggered the failure may have been the uprooting of a large spruce growing on the steep slope by strong winds in the area. Numerous "blow-downs" triggered other slides in the vicinity under similar circumstances.

A thin layer of surficial sediments or the presence of large trees do not prevent dangerous slides. Debris slides can occur on any steep slope that supports a cover of vegetation. The winter of 1976-1977 was especially conducive to debris slides in the Chugach Range because the warm wet weather promoted saturation and weakening of the surficial deposits on the steep bedrock slopes of Pioneer Peak and prevented freezing, which would have strengthened the soils. Slides are not uncommon in this area. They have occurred in the past and will probably occur in the future.

LeResche Named DNR Commissioner

Dr. Robert E. LeResche was nominated Commissioner of Natural Resources by Gov. Jay Hammond in March, replacing Guy Martin, who was named an assistant Secretary of the Interior. LeResche, 35, was director of the governor's Office of Policy Development and Planning where, as policy director, he was responsible for drafting state policy on a wide range of issues, including land ownership and use and OCS oil development. Before assuming the policy position last year, he was chief on the habitat protection section of the Alaska Department of Fish and Game. LeResche, who holds a Ph.D. in ecology from Johns Hopkins University, formerly served as a research biologist for the state and was director of the Kenai Moose Research Center for 3 years. He said his chief goals as DNR Commissioner will be to speed state selection of its land from the federal government, settle the d-2 lands question, develop a consistent mining policy, establish a timetable for oil and gas leasing, and increase the role of agriculture.

With regard to mining, LeResche said the state needs to establish an explicit policy that will let miners know where the state stands. "There have been charges that we're slowing down mining by not being explicit in our policy," he said in an interview with the Anchorage Daily News March 29. "I think we need to let people know what the state is doing to encourage or regulate mining."

To charges that he is antidevelopment, the new commissioner said he realizes natural resources "are going to be the basis of life in this state for a long time to come—at least through the end of the century. We need the extractive industries in Alaska.

"But I plead guilty to thinking about these things in the long term. I see myself as a professional resource manager.....It's a question of all the people of the state profiting by (resources use). If it is a good business deal for the state, we should do it."

Green to Head DNR Minerals and Energy Management

Former Commissioner of Natural Resources Guy Martin announced March 3 that Mr. Joseph P. Green, 43, has been named Deputy Director of the Division of Minerals and Energy Management in the Department of Natural Resources. Mr. Martin made the following statement in connection with the appointment.

"The Department has engaged in a statewide and nationwide search to bring new qualified professionals to its oil and gas programs. Mr. Green is an excellent example of the professional with varied experience necessary to improve the State's mineral and energy administration. For the past 4 years, Mr. Green has been the Petroleum Administrator for Santa Barbara County, where he had wide-ranging powers to supervise the county's regulatory program for the extensive offshore operations in that area. Prior to that time, he served as a senior petroleum geologist and production engineer for the State of California. He holds a Bachelor of Science degree in petroleum geology and engineering from the University of Missouri, and is both a registered professional engineer and geologist. He has also taken postgraduate work in law and in oil and gas technology."

Questions and Answers About Mining Claims

(from BLM'S The Land, Mar. 1977)

Q. Who has to record a mining claim with BLM?

A. All owners of unpatented claims, mill or tunnel sites.

Q. Does it make a difference on which Federal lands a claim is located?

A. Yes. If your unpatented lode or placer claim or mill or tunnel site is located on any Federal lands, including lands where Federal Government owns only the minerals, then you must record it with BLM. However, if it's located on National Park Lands, you record it with the National Park Service one year from the date of their Act of September 28, 1976. The Park Service will forward copies of their filings to BLM.

Q. Do I still record my mining claim with the State, too?

A. Yes. BLM's regulations do not change that procedure.

Q. Where do I record my claim?

A. With the BLM State Office having jurisdiction over the Federal Lands where your claim is located.

Q. How much time do I have to record these claims?

A. You have until October 21, 1979, to record your mining claim if it was located on or before October 21, 1976. If your claim or site was located after October 21, 1976, you must record your claim within 90 days after locating it.

Q. What documents have to be filed to properly record a claim?

A. Either a copy of the notice or certificate of location and any accompanying maps, papers, or other documents that were required to be filed initially under your particular State's law. This includes any amendments that alter the location of the claim or site.

Q. Are owners of unpatented mining claims, mill or tunnel sites located both before and after October 21, 1976 required to file a notice or certificate of location.

A. Yes.

Q. Is there any specific information which must be included with either the notice or certificate of location?

A. Yes, unless it's already included in either document, the information listed at the end of these Questions and Answers.

Q. What do I do if my State does not require a recordation notice or certificate of location?

A. Then you must submit, in writing, all the information listed at the end of the Questions and Answers.

Q. Is there a fee for filing either of these documents?

A. A $5 service fee should accompany each claim or site filed.

Q. What other information must be filed to keep a mining claim?

A. Either written evidence that assessment work, which may be a detailed report describing geological, geochemical, and geophysical surveys conducted on the claim, or a written notice of a claimholder's intention to hold a mining claim.

Q. Are unpatented mining claim and mill and tunnel site owners all required to file the same documents?

A. No. Unpatented mining claim owners file annual assessment work or a notice to hold their claim. Owners of mill or tunnel sites located on Federal lands file only a notice of intent.

Q. When do I file a notice of intent?

A. When physical or legal impediment beyond the control of the owner prevents the filing of evidence of assessment work.

Q. How often do mining claim owners file this assessment work or notice of intent?

A. All claimants must file either evidence of assessment work or a notice of intent by December 31 of the calendar year following the date of recordation with BLM. All claims or sites located on or before October 21, 1976, have three years from October 21, 1976 to be recorded with BLM. For claims located after October 21, 1976, you have 90 days from the date of location to record with BLM.

Q. Does BLM require a special form for location notices and evidence of assessment work?

A. No, because documents filed will be copies of notices, certificates of affidavits filed in the jurisdiction where the claim or site is located, and they should contain the information listed at the end of the Questions and Answers.

Q. By filing this location notice or evidence of assessment, does that make my claim a valid one?

A. No, because the validity of a recorded claim is still subject to challenge.

Q. If I have applied to BLM for a mineral patent for my mining claim or mill site, do I still need to file a notice or certificate of location?

A. No.

Q. Does BLM want to be notified if my claim, mill or tunnel site has already been recorded and I decide to sell or transfer it?

A. Yes. File with us within 60 days after you have completed your transaction the following: serial number of the claim, and name and address of the person you sold or transferred the claim to.

Q. Suppose I inherited a claim or site. Do I still file this information?

A. Yes.

Q. Is there a filing fee for this?

A. No.

Natural Gas from Unconventional Geologic Sources

(Following are excerpts of two reviews of Natural Gas from Unconventional Geologic Sources, Proceedings of a Forum by the Board on Mineral Resources, Commission on Natural Resources, National Academy of Sciences, 1976, National Technical Information Service, Springfield, VA.—Ed. note.)

By Richard L. Jodry
Richardson, Texas 75080

The energy produced from wells in the United States in the form of natural gas (largely methane) is greater in quantity than that obtained from domestic crude oil. It supplies the heat for more than half of the residences and more than half the energy for industry. Like petroleum, reserves and production of natural gas are dropping. If present trends continue, there will be severe shortages in the next few years. The shortage of natural gas and the cost and uncertainty of finding more through conventional drilling has led to increased interest in four types of occurrences of large amounts of methane that have not been exploited to any significant degree in the past. These are (1) in the deep geopressured zone of the Gulf Coast; (2) in association with the brown shales of the Appalachian and other eastern Devonian-Mississippian basins; (3) in tight sands of the Uinta, Piceance, Green River, San Juan, Denver-Julesberg, and other western basins; and (4) in association with coals.

This growing interest, along with published reports attributing extremely large estimates of gas reserves to these sources, prompted the Board on Mineral Resources, National Research Council to hold a forum to examine the natural gas potential from these unconventional geologic sources. This book is a transcript of the proceedings of this forum.

The book concludes that total resource figures are highly speculative and much work must be done to produce even marginally acceptable estimates, that methane from the sources will not be cheap nor easy to produce, that the level of funding devoted to investigating new sources of methane has been minuscule, and that knowledge of the geology, possible production technology, and extent of the resource is fragmentary.

By William Thurston
Washington, D.C.

Production of natural gas from conventional sources has been declining for several years and additions to natural gas reserves have been less than the amounts produced. Reserves at the end of 1974 stood at 237 trillion cubic feet (Tcf), and at the end of 1975 at 228 Tcf.

The possibility of obtaining gas from methane-saturated geopressured zones, "tight sands," carbonaceous shales, and coal seams has long been recognized, and some exploitation has already been successful. In the face of the shortage of gas from conventional gas fields, the unconventional sources have received much attention, and some public statements postulated resource figures that were exponentially higher than total resource estimates for conventional gas fields. The Board on Mineral Resources of the National Research Council was concerned that such large estimates, if not carefully documented and interpreted, would hamper serious efforts to relieve the present gas shortages.

Gas dissolved in hot water and contained in geopressured deep sands of the Gulf Coast may constitute the largest quantity of methane in place in the United States. Estimates range from 3,000 to 50,000 Tcf, based on different assumptions regarding thickness of sand beds, their porosity, and degree of saturation with methane. An additional 50,000 Tcf may be present in the surrounding shale. The critical question is whether gas in the geopressured zones can be produced economically.

Mississippian-Devonian shales of the Appalachian Basin have yielded about 3 Tcf of methane since development began over a century ago. The most productive shales have been in eastern Kentucky and western West Virginia. The shale area covers 250,000 square miles from New York to Alabama, and through the Michigan and Illinois Basins to the Rocky Mountains; the gas resource may amount to hundreds of trillion cubic feet. The challenge is to find areas of unusual methane concentration and to develop the technology to produce the gas in paying quantities.

In three Rocky Mountain basins, the deeply buried Fort Union and Mesa Verde formations are estimated to contain 600 Tcf of natural gas. But the gas is held in sandstones of low permeability. Nuclear explosive fracturing and massive hydraulic fracturing have been used to open up the "tight" sands but the engineering costs have been high, and the improvement of flow rates has been disappointing in several cases because geologic

conditions from one "tight" stratigraphic section to another differ considerably. Techniques of massive hydraulic fracturing are being refined and extended, and may result in more production from Rocky Mountain basins and be applicable elsewhere in tight formations.

Methane is present in all coal seams and has been a lethal nuisance. Small amounts of methane have been drained from coal beds and sold for local use, but most of it (perhaps 80 billion cubic feet a year) has been blown out of mines by costly ventilating systems. The flow rate of methane through coal is low; a drill hole only gathers 100 to 200 cubic feet of gas per linear foot of hole per day so a drill hole perpendicular to the seam does not yield much gas but a long hole lying within the seam can yield paying quantities. If really substantial amounts of methane are to be obtained from coal, however, they must be drained from vast volumes of seams far in advance of mining. Optimum techniques have not been established but consideration has been given to directional drilling, hydraulic fracturing to increase flow rates, and long-hole drilling from shafts sunk on a mining plan with ten or more years lead time.

There is a lot of methane in these four unconventional geologic sources but the total resource figures are highly speculative; the geology is not sufficiently well known to do better. This methane will not be cheap or easy to produce, and the possible production technology has not been established. Most of the funds and motivation for working on these potential sources of natural gas have come from the private sector. The potential production of natural gas from unconventional geologic sources is high enough to justify greater support and more long-range planning.

Mining Law to be Updated?

(from Anchorage Times, Apr. 24, 1977)

Arizona Congressman Morris Udall is promoting a House bill (H.R. 5806) that would update the Mining Law of 1872.

The legislation "is designed to encourage a healthy and strong American mining industry while giving environmental considerations their rightful place in mining law," Udall said.

"The old mining law was enacted in a period when western expansion was a national goal, when we believed our resources were unlimited, and when the long-term impacts of environmental disruptions were little understood.

"For many decades the 1872 mining law served us all, but this is 1977 and we need a new law."

The bill would provide for leasing procedures, environmental controls and competitive bidding for publicly owned minerals.

"Based on common practices in the mining camps of the Old West, the mining law simply provides that anyone may go onto the public domain open to the operation of mining law, stake a claim and if he finds minerals of marketable value, he is free to dig them up."

Publicly owned coal, oil and gas are subject to leasing procedures already; the Udall bill would impose a similar system on hard-rock minerals.

Udall Seeks to Protect Huge Alaskan Area

(from Metals Week, May 2, 1977)

A House Interior subcommittee began hearings last week on a bill introduced by Rep. Morris K. Udall (D-Ariz.) to designate 115-million acres of potentially mineral-rich Alaska land as wilderness. The proposal (HR-39) goes considerably beyond a Ford administration plan to preserve 83 million acres from mining and logging exploration.

There is opposition to Udall's bill, particularly from an Alaskan coalition of business and labor interests which considers the amount of land to be excessive. The group, Citizens for Management of Alaskan Lands (CMAL), supports an alternate plan hammered out by the state's Republican delegation—Gov. Jay S. Hammond, Sen. Ted Stevens, and Rep. Don Young—under which 25-million acres would be designated for limited exploration and development, plus another 55 million acres that would constitute a so-called "buffer zone," where more intensive development would be permitted. The buffer zone would revert to wilderness status in the year 2000.

Supporting Udall is a broad coalition of environmental groups that have banded together as the Alaska Coalition. They are confident Udall's bill will pass substantially intact. If so, exploration would be barred in an area believed to contain the world's second-largest deposits of nickel.

Under the 1971 Alaska Native Claims Act, Congress must decide the issue by Dec. 1978.

Alaska d-2 Plan Studied

(from Northwest Mining Association Bulletin, May 1977)

The CMAL (Citizens for Management of Alaska Lands) (d)(2) Lands proposal moved another step closer to Congress with the production of a draft bill in outline form and a pamphlet with a map describing the proposal for wide distribution.

The influence of this existing multiple-use approach is seen in the increased emphasis on multiple-use by the Alaska Congressional delegation and the state. Although their proposal actually calls for less acreage in Park and Refuges which are closed to mining, the

New Job—Remember William D. Ruckelshaus Jr., the Environmental Protection Agency head at the time of the EPA's assault on Fairbanks five years ago, and later a victim of the Watergate "Saturday Night Massacre"? After a few years as a Washington, D.C. lawyer, he's joined industry as senior vice president of Weyerhaeuser Co., the gigantic northwest timber concern.—*Fairbanks News-Miner*

other lands are "buffer zones" open to multiple-use only to the year 2000 at which time they must be "classified."

The CMAL proposal is the clearest. It establishes withdrawn Parks (13 million acres), open Refuges, and multiple use lands under existing law and BLM or USFS management. It is the one proposal which will be manageable from the start.

The House Interior Subcommittee on General Oversight and Alaska Lands will hold hearings on the Alaska Land bills (including Udall's HR 39 which sets aside some 148 million acres) in the following places: Washington (April 21, 22, 25, and 28), Chicago (May 7), Atlanta (May 14), Denver (June 4), San Francisco (June 18), Seattle (June 20), Sitka (July 5), Juneau (July 7), and Ketchikan (July 9). Your testimony would be of value to these hearings. Notify the subcommittee at least one week in advance of the hearing at which you wish to appear: Subcommittee on General Oversight and Alaska Lands, 1327 Longworth House Office Building, Washington, D.C. 20515.

Miners Chief Cites D2 Issue

(from Anchorage Times, May 7, 1977)

The fundamental issue behind U.S. House Interior Committee Chairman Morris Udall's D2 land bill is control of the economy, Chuck Hawley told Anchorage Republicans Thursday.

And the executive director of the Alaska Miners Association said, when one is talking about control of the economy Alaska is the best place to start because it has most of the nation's oil and gas, half of the nation's coal supply and only three congressional delegates.

Hawley testified on Udall's D2 bill before an Interior subcommittee last week in Washington, D.C. He called the hearing "really stacked" against Alaskan interests, since subcommittee chairman Rep. John Seiberling of Ohio did not permit the National Chamber of Commerce nor the Teamsters union representatives to speak on the second day.

However, Hawley noted, Seiberling allowed a Dartmouth college environmental studies group nearly two hours.

Udall is calling for 116 million acres of federal land in the 49th state to be set aside as wilderness under Section 17 (D2) of the 1971 Alaska Native Claims Settlement Act.

Another 40 million acres of existing national forests, parks and wildlife refuges also would go into the national wilderness system.

Hawley said Udall's bill would have far-reaching effects upon Alaska:

—No pipeline access to Naval Petroleum Reserve 4 because a pipeline carrying oil to market would have to cross five rivers designated as wild and scenic.

—No surface access to Nome, Kotzebue or Bethel.

—No Copper River Highway.

—No Susitna River dam because the Susitna River would become a wild and scenic river.

—No more oil and gas development because wilderness areas couldn't be crossed when taking the resources to market.

—All 146 million acres would be closed to mining.

Hawley also said subsistence hunting could be shut off at 10-year intervals at the discretion of the secretary of the interior.

Mining Interests Advocate Co-op Management d-2 Plan

(from Fairbanks Daily News-Miner, Apr. 28, 1977)

A spokesman for the American Mining Congress today told the U.S. Congress that most of Alaska's land should remain open under "multiple use" for mining, but a Southeast lawyer and a Southeast Native spokeswoman argued instead for greater protection for land.

The three testified at an abbreviated session of hearings before the House interior subcommittee on Alaska lands. The subcommittee will draft legislation to determine the future of lands withdrawn under section 17d(2) of the Native Claims Settlement Act and other lands in the state as well.

Howard L. Edwards, vice president for public affairs of the Anaconda Co., appearing for the mining congress, said the major issue for his groups is access to land for continued exploration.

The cooperative management proposal advanced by Gov. Jay Hammond, Rep. Don Young, and Sen. Ted Stevens, he said, "is the only proposition on the table that is attractive to us. All the others bar access to land and that is a travesty and a crime."

Edwards said Anaconda has extensive exploration activities in the Brooks Range where it has "discovered very high mineralization." The quality of the ore there is much higher than ore being mined in other states, he said. But he cited "logistics" as preventing mining so far.

Verna Johnson, head of the Angoon Chapter of the Alaska Native Sisterhood, however, called for less development in Southeast. She said the Forest Service may be acting in bad faith when its representatives talk only about logging on half of Admiralty Island.

Warren Christianson, a Sitka lawyer, spoke in favor of wilderness designation for West Chichagof Island, saying "it is...one of the crown jewels of all wilderness areas of the world."

What's green and contains iron, manganese, strontium, zinc, uranium, and europium? Well, it's spinach. Scientists from the U.S. Commerce Department used more than 9 metric tons of spinach to develop a "standard spinach" standard for the U.S.

The U.S. has more energy produced from natural gas than from any other source.

Former DNR Head Named Top UA Alumnus

Former Natural Resources Commissioner Charles F. ("Chuck") Herbert has been named 1977 Distinguished Alumnus by the University of Alaska Alumni Association. Herbert, a 1934 graduate of what was then the Alaska Agricultural College and School of Mines, was cited for his "outstanding performance and contributions to his profession, the public, and the state." He holds a B.S. in mining engineering.

The Distinguished Alumnus Award was presented to Herbert May 6 at a banquet in Fairbanks. Now manager of the minerals section of British Petroleum in Alaska, Herbert's long career runs the gamut from placer miner to politician to executive. A miner both before and after his college days, Herbert served in the Territorial Legislature in the early 1940s, was later with the U.S. Navy Seabees during the war, and returned to mining as a partner in the Yukon Placer Mining Company and as president of the Alaska Copper Corporation. He was named Commissioner of Natural Resources by former Gov. William Egan in 1970 and served in that position 4 years. A former chairman of the Alaska Public Service Commission and executive secretary of the state's Water Resources Board, Herbert is currently based in Anchorage.

Andrus Said to be Busy on d-2 Plan

(from Fairbanks Daily News-Miner, May 23, 1977)

Under the leadership of Secretary Cecil Andrus, the Interior Department has "the opportunities of a lifetime" to add to the nation's wilderness system, an Interior official says.

Western field representative John Hough, Seattle, spoke to the Idaho chapter of the Nature Conservancy over the weekend in Boise. He was Andrus' administrative assistant when Andrus was Idaho governor.

He said the proposal to create a wilderness area in Alaska was a once-in-a-lifetime opportunity, "an opportunity to protect an entire ecosystem and do it right the first time."

DGGS Staff Presents Three Papers

Two Division staff members delivered papers at geological conferences. In Vancouver, B.C., both Wyatt Gilbert, mining geologist, and Cleland Conwell, DGGS mining engineer, gave talks at the annual meeting of the Geological Association of Canada. Gilbert's paper, which was coauthored with Milton Wiltse, former staff geologist, was entitled "Regional Setting of Southern Brooks Range Copper Deposits." The abstract follows.

The southern Brooks Range metamorphic belt trends east-west for at least 600 km and consists of Proterozoic-early Paleozoic pelitic schist and minor metabasite and marble intercalated with metafelsite of probable mid-Paleozoic age. Rock sequences of similar age and lithology are represented by the Birch Creek Schist, Keevy Peak Formation, and Totatlanika Schist of Interior Alaska and by the Yukon Crystalline Terrane in the southwestern Yukon Territory. These rocks probably represent once continuous Proterozoic-early Paleozoic miogeoclinal rocks that may have been metamorphosed, in part, in pre-Devonian time and were overlain in Devonian-Mississippian time by volcanic rocks ranging in composition from basalt to rhyolite. This belt has favorable potential for further discoveries of volcanogenic massive sulphide deposits. The present distribution of these rocks may be due to 1) the early Paleozoic configuration of the North American continental margin, 2) southward movement of the Brooks Range from the area of the Canada Basin in Mesozoic time, and 3) lateral offsets along the Tintina-Kaltag fault systems. The authors favor a combination of the latter two possibilities.

Conwell's paper, "The Cook Inlet-Susitna Coal Basin," was delivered in Vancouver the same day as Gilbert's—April 26.

The Cook Inlet-Susitna coal basin contains a thickness of over 26,000 feet of nonmarine sediments with more than 100 individual coal beds in the Tyonek Formation, 37 or more beds in the Sterling Formation, and about 30 different beds in the Chickaloon Formation. The coal beds vary in thickness from a few inches to over 50 feet. Several beds in the Tyonek Formation exceed 25 feet. The beds in the Beluga area, about 75 miles west of Anchorage, are nearly flat lying and would have a low stripping ratio.

The coals vary in rank from lignite to anthracite. Most of the coals in the Kenai Formation are ranked as subbituminous C; those in the older Chickaloon Formation are classified as a high-volatile bituminous to anthracite. The geologic structure on the Kenai Peninsula is uncomplicated, and the beds dip very gently but are thin (3 to 7 feet thick). In the Beluga area, the better coal locations correspond to upthrown blocks, where the thicker Tyonek coals are near the surface; the proved reserves there (several billions tons) are available for strip mining. In the Matanuska Valley, the reserves have been estimated at 100 million tons, but at a high stripping ratio—over 10 to 1; additional reserves should be available for underground mining in the synclinal area south of Wishbone Hill.

Three weeks earlier, Gilbert gave a paper prepared with Tom Bundtzen, staff mining geologist, at the Alaska Geological Society annual symposium in Anchorage. Their paper, entitled "Tectonics, Mid-Paleozoic Volcanism, and Sulfide Mineralization in the North-Central Alaska Range," was given April 5. The abstract of the talk, delivered before AGS members gathered to hear the latest findings on the relationship of plate tectonics to Alaskan geology and resources, follows.

The Totatlanika Schist and correlative rocks are a metamorphosed volcanic sequence that once covered at least 5,000 square kilometers in the north-central Alaska Range. These rocks include metabasalt, meta-

rhyolite, felsic schist, metatuff, and volcaniclastic metasedimentary units, and nearly always overlie black phyllite, black quartzite, and stretched conglomerate of the Keevy Peak Formation. The Keevy Peak Formation and Totatlanika Schist probably represent a continental-margin ocean floor and andesitic volcanic arc which existed during Devonian-Mississippian time and which were later strongly affected by Mesozoic and early Tertiary orogenic events.

The results of 2,000 stream-sediment and bedrock geochemical samples from the north-central Alaska Range indicate several areas of high lead, zinc, and copper concentrations. This geochemical signature and the presence of sulphide-bearing units within the Totatlanika Schist and Keevy Peak Formation suggest that these units contain significant massive sulfide mineral deposits.

Governor's Office Replies to Proposed BLM Regulations

The following is a letter to Curtis Berklund, Director of BLM, from John Halterman, State-Federal Coordinator in Gov. Hammond's State Policy Development and Planning Division—Ed. note.

Dear Mr. Berklund:

The State of Alaska has reviewed the proposed procedures to minimize adverse environmental impacts on lands managed by the Bureau of Land Management; our comments are offered below:

3809.0-5 Definitions.

1. "Significant disturbance" of the land surface is poorly defined; determination of what constitutes "significant" is left to the authorized officer. Although the definition of "casual use" helps clarify what is significant disturbance, wide discretionary power is left to the authorized officer, who in turn may be anyone "delegated the authority." There should be a more specific definition of what constitutes "significant disturbance." In addition "authorized officers" should have mineral production familiarity as part to their personal requirements.

3809.1 Notice of Intent.

1. The Document has a large number of ambiguous statements which make if difficult for the individual to understand his responsibilities under the regulations. One example is that by definition, use of any motorized vehicle (helicopter, boat) is considered significant disturbance, and consequently, under 3909.1-1 a notice of intent must be filed. Will BLM require exploration programs which use helicopters or boats to file a notice of intent which then must be judged by the authorized officer to determine if a plan of operation is needed? Helicopters and boats are all commonly used in Alaska for exploration purposes, and hardly cause significant disturbance.
2. The regulations do not appear to take into consideration the Alaskan situation. Thus paragraph 3809.1-2 part 3 states that maps must be submitted under the notice of intent on a scale of one inch to a mile. Base maps at that scale are not always available in Alaska. The words "if available" should be inserted with reference to maps.
3. It is unlikely that careful evaluation of the impact of proposed mining operations on such aspects as archeological sites, permafrost and other sensitive environments can be adequately accomplished within the "15 working day" notification period. A 30 working day period is suggested, especially in Alaska where some areas may be open to mining for the first time and careful evaluation is a necessity.

3809.2 Plan of Operations.

1. The general bonding requirements set forth in these regulations are at least ambiguous if not extremely confusing. It is hard to determine from the regulations which miners would be subject to the requirements that they place a $100,000 bond for activities. A possible interpretation of these regulations could require such a bond from every miner in the State.
2. Section 3809.2-7 Bond Requirements. Under this section the miner is required to place in bonds monies from reclamation purposes. The regulations require this may remain bonded over a long period of time to guarantee compliance which places an extremely difficult hardship on the small miner. Although some type of regulation is necessary, there may be alternative ways to assure completion of reclamation efforts without tying up the money for an inordinate amount of time. Such alternatives should be investigated before the regulations are finalized.
3. Though these regulations do include several guidelines and definitions on what reclamation means they do not specify whether or not it will be necessary to return the terrain to its original configuration. The existence or non-existence of such a requirement is of great importance as to whether or not the regulations are acceptable and reasonable. Specific guidelines should be spelled out to limit the arbitrary judgements of the authorized officer.

   Flexibility should also be given here for revegetation with specially adapted species, since quite often in arctic and subarctic environments many species cannot be effectively used.
4. Extension of the review period for sixty days following the time when the area becomes accessible for inspection (3089.2-4 4) can absorb the whole working season for most Alaska locations.

3809.3 Environmental Protection.

1. Section 3809.3-2 Section F, Cultural Resources, has an unworkable definition of the types of archaeological, cultural, or paleontologic objects which must

not be disturbed by mining activities. Some definition needs to be added to this section, or qualifying phrase to assure that only archaeological, cultural, or paleontologic areas of scientific significance are protected. Ore bodies themselves commonly contain fossils.

3809.4 General Provisions.

1. The inspection process (Sec. 3809.4-7) can become a constructive management tool, beneficial to both the prospector and the management agency if performed by knowledgeable personnel.
2. Throughout these regulations, reference is made to an authorized officer who makes most of the decisions concerning mining activities and whether or not they abide by the regulations. He also approves the notice of intent to determine whether or not a plan of operation is needed and approves the plan of operations. In carrying out these duties, the authorizing officer is given a wide latitude of discretion which could lead to arbitrary and unreasonable actions. The miner has essentially no recourse or protection except through a time-consuming appeals process. Some type of consideration should be given to minimizing the possibility of arbitrary action by such an officer. At minimum, the word "qualified" should be inserted before authorized officer, and perhaps this can also lead to a definition of qualified authorized officer to include some type of land management and/or geological background.

Thank you for the opportunity to comment.

Sincerely,
John Halterman

State to Certify Coal Mine Employees

The Department of Natural Resources has proposed to amend and repeal the Alaska Administrative Code (AAC) to require certification of certain employees in surface and underground coal mines. If the measure is adopted—as expected—the state will issue permanent certificates of competence of coal-mine foremen and fire bosses. In the past, they had to have a temporary certificate, issued every 6 months by the federal Mine Enforcement Safety Administration.

In the same measure, the state will update the reference to the Code of Federal Regulations concerning coal-mining safety provisions and extend reciprocity of state personnel certification to holders of temporary federal certificates. These actions amended 11 AAC 44 and repealed 11 AAC 44.007 and 44.008. Further information may be obtained from C.N. Conwell, DGGS-College (p. 1).

Two signs seen (and admired) on the desk of a state official in Anchorage: "I don't have an answer, but I admire the problem" and "I said 'Maybe' and that's final."

USGS-DGGS Release First Detailed Geologic Map of Alaska

(from USGS news release, Mar. 8, 1977)

The most detailed statewide geologic map of Alaska yet prepared is now available in preliminary uncolored form from the U.S. Geological Survey.

By detailing areas of stratified rock that are the source of fuels, areas of volcanic and related rocks that contain important mineral resources, and trends of major faults, as well as the location of active volcanoes, the map should become an important tool in resource prospecting and environmental planning.

Published at a scale of 1:1,000,000 (16 miles or 25 kilometers to the inch), the preliminary map is printed in five separate sheets that can be combined to form a single 9-foot-square map. By comparison, a map of Arizona on the same scale measures about 2 feet by 2.5 feet.

The map was compiled by Helen M. Beikman, geologist with the Alaskan Branch of the USGS, headquartered in Menlo Park, Calif., and represents research done by more than 100 geologists that have worked in Alaska since 1890. Although most of them were members of the staff of the U.S. Geological Survey, the map also includes work done by the State of Alaska's Division of Geological and Geophysical Surveys, and was prepared cooperatively with that organization.

Each of the five sheets of the map is accompanied by a second sheet on which map units are correlated and briefly described. The second sheet also includes an index map showing the principal sources of geologic data and a list of references. For those interested in more detailed geology of a particular area, the index map and references provide a visual and easily accessible source of information to larger scale maps of smaller areas.

These uncolored preliminary maps are interim products from which a single multicolored geologic wall map of Alaska, on a smaller scale, is being prepared.

The five map sheets may be purchased separately. Those in the set are: MF 611 (southwestern Alaska), $1.00; MF 612 (south-central Alaska), $1.00; MF 673 (southeastern panhandle), $1.00; MF 674 (Alaska Peninsula and Aleutian Islands), $1.00; MF 789 (northern Alaska), $1.50. The entire package of five maps and supporting sheets is priced at $5.50.

All maps are available for purchase by mail from the USGS Branch of Distribution, Box 25286, Federal Center, Denver, CO, 80225 and from the Alaskan Distribution Section, 310 First Avenue, Fairbanks, AK, 99701. (Prepayment is required and remittances should be sent by check or money order payable to U.S. Geological Survey.) Copies may also be purchased over the counter from the USGS, Water Resources Division, 441 Federal Building, 710 West Ninth Street, Juneau, AK, and the USGS Public Inquiries Office, 108 Skyline Building, 508 Second Avenue, Anchorage, AK.

Seismic Notes....

•The President's new science adviser is Frank Press, former head of the Department of Earth & Planetary Science at MIT. President Carter is reported to have said that the first six names suggested to him for the post were all physicists—and that took care of *that.* Press is a *geo*physicist. More precisely, Press is a seismologist and has long been concerned with earthquake prediction, a factor that may well have influenced his choice. (Alaska, by the way, has the highest seismicity of the 50 states.)

•The Seismological Office of Tientsin, China, in a six-page pictorial book explaining how to monitor animals for earthquake prediction, gave the following verse:

"Animals are aware of precursors before earthquakes;
Let us summarize their anomalous behavior for prediction.
Cattle, sheep, mules, and horses do not enter corrals,
Rats move their homes and flee.
Hibernating snakes leave their burrows early,
Frightened pigeons continuously fly and do not return to nests.
Rabbits raise their ears, jump aimlessly and bump things,
Fish are frightened, jump above water surface.
Every family and every household joins in observation,
The People's war against earthquakes must be won."

•According to the March issue of *Geotimes* "The Earthquake Hazards Reduction Act of 1977 has been introduced in both the House and the Senate, with the express intent of accelerating the effort to predict earthquakes. In connection with that Representative Brown of California inserted in the Congressional Record for Feb. 8 a speech by Robert M. Hamilton, chief of the U.S. Geological Survey's Office of Earthquake Studies. In that speech Hamilton listed these challenges:

'For the geologists and seismologists they lie in learning how to recognize earthquake precursors, translating those observations into a prediction, and responsibly communicating that information to the public with a clear assessment of the uncertainties involved.

'For the engineer: To develop techniques for identifying the vulnerable structures in an earthquake-targeted area and providing a way to remedy hazardous conditions.

'For the sociologist and economist: To anticipate public reaction to predictions and suggest actions that could maximize the benefits and minimize the costs.

'For the political leaders and government officials: To develop adequate plans for disaster preparedness and relief and to warn the public of the appropriate actions to take based on a prediction.

'And for the news media: To communicate prediction and warning information to the public in a responsible way so that a rational response to an earthquake threat is encouraged.'"

A Geologic Rarity on the Horizon?

(from Fairbanks Daily News-Miner, Apr. 29, 1977)

A University of Alaska scientist says two new volcanic vents on the Alaska Peninsula may represent geologic features whose formation has been witnessed only once before in the written history of man.

Dr. Jurgen Kienle of the university's Geophysical Institute said Wednesday he believes the now-quiet pits are maars, but that only an absence of further eruptive activity will offer positive proof.

Maars are low-relief, volcanic craters created by a single explosive eruption. They are usually associated with great amounts of ground water, which fills the crater after the eruption subsides. No volcanic cone is formed.

Kienle, a volcanologist of international reputation, said maars dating from prehistoric times have been found in a number of areas, particularly on Alaska's Seward Peninsula and in the Eifel region of Germany.

But he said geologists know of only one time in the past that written observations were made of a maar in formation, in Chile in 1955. That eruption lasted four days.

Kienle, who was called in as a consultant by France when Le Soufriere Volcano on Guadeloupe in the French West Indies threatened a catastrophic eruption last year, said he was not absolutely sure whether the Alaska Peninsula vents are maars.

"One of the conditions in the formation of a maar is one set of phreatic-magmatic (steamlava) explosions," and that is what we have had here, one set," Kienle said.

"Still, I'm not prepared at this point to call them maars. I'm not 100 per cent sure."

Roman Motyka, a doctoral candidate at the institute who accompanied Kienle and other scientists from the University of Alaska and Dartmouth College to the area, said the vents "have exhibited all of the characteristics thus far of maars.

"The one thing that will determine whether they are maars is if they show further activity, if they are quiescent from now on."

The smallest of the two pits exploded into creation on March 30 some 10 miles from Mt. Peulik, a 6,000-foot active volcano near Lake Becharof, 330 miles southwest of Anchorage.

A Native from Ugashik, 40 miles to the southwest of Lake Becharof, witnessed the eruption at 4 a.m. that day.

A cloud of ash and steam billowed 25,000 feet into the sky, and a fine ash fell at Larsen Bay, 90 miles to the east of the lake on Kodiak Island.

The largest of the two vents exploded open on April 2, an event witnessed by Red Brooks, a Federal Aviation

Administration pilot from King Salmon.

Brooks said the eruption was accompanied by lightning and that there was a fountain of lava 75 feet high.

A cloud of ash from the second explosion drifted over King Salmon 60 miles to the northwest, on April 5, and fine ash sifted down on the village for seven hours.

When activity at the smaller vent ceased on April 2, the pit was 75 to 100 feet deep, and the oblong crater was 75 to 150 yards across at the top. A lake has already formed in it.

Steam and gases were still rising on April 16 from a lava dome which formed at the bottom of the larger vent.

The nearly circular big vent is about 300 yards wide at ground level and is about 220 feet deep, Kienle said.

The two eruptions left a layer of fine ash and a field of splattered lava and boulders, some as large as a desk, around the two vents.

Douglas Lalla, another doctoral candidate who was on the UA-Dartmouth expedition, said probes around the small vent taken two weeks after the eruption showed a temperature of 1,500 degrees Fahrenheit at three feet.

Kienle said a lake of molten rock which formed in the large vent was observed fluctuating rapidly during one flight he and Motyka made over the pit.

"Once we saw the whole lake (of lava) suck into the pipe at the bottom of the vent, then surge back out again," Motyka said.

Kienle added: "The way it ended there was just sort of a final pulse, after many of these fluctuations. What is sitting there now is a lava dome."

Possible Staging Area in Alaska Has Natural Hazards

(from Dept. of Interior news release, May 4, 1977)

Icy Bay, a potential staging area for offshore oil and gas development in the Gulf of Alaska, may experience a short life for that purpose because onshore facilities could be vulnerable to the area's naturally rapid erosion and siltation rate, a U.S. Geological Survey scientist said Wednesday.

"The most significant hazards from the point of view of locating onshore facilities and pipeline corridors," he said, "are the high rates of shoreline erosion and sediment deposition," the latter of which threatens to fill in the bay adjacent to where the proposed dock, shiphandling and other onshore facilities would be constructed.

Dr. Bruce F. Molnia, geologist, USGS Branch of Pacific-Arctic Marine Geology, Menlo Park, Calif., outlined results of a USGS study of the Icy Bay area in a paper prepared for delivery Wednesday to the Ninth Annual Offshore Technology Conference in the Astrodome in Houston, Texas.

Molnia said Icy Bay has shown relatively rapid natural changes during its recorded history dating back to 1794 when the explorer Vancouver surveyed the Gulf of Alaska coast. Icy Bay is at the northern end of the narrow strip of Alaska that extends along a portion of the western border of Canada.

"As recently as 1904," Molnia said, "today's Icy Bay did not exist. The glacier that once filled Icy Bay has receded more than 40 kilometers (25 miles) since 1904, when the bay was completely ice covered. A large hooked spit, Point Riou Spit, has developed on the eastern shore of the bay mouth and has grown to a length of 6.6 kilometers (4.1 miles), with an average growth rate of 92 meters (300 feet) a year.

"The Gulf of Alaska shoreline on the east side of Icy Bay, which includes the Malaspina Foreland and Point Riou Spit complex, has been steadily eroded northward by waves and longshore currents," the USGS geologist added. "Analysis of ten sets of aerial photographs taken since 1941 indicates that the eastern shoreline has receded as much as 1.3 kilometers (0.8 miles) in this period, an average rate of retreat of 37 meters (121 feet) a year. The western shoreline has also changed similarly, with more than 8.2 square kilometers (3.1 square miles) having disappeared, including all of Guyot Bay.

"Field observations during 1976 revealed that the eastern section of Point Riou Spit is frequently washed over by storm waves and is filling in the Riou Bay portion of Icy Bay with sediment," Molnia said. At the point where the spit attaches to the Malaspina Foreland, a forest with trees at least 90 years old is being undercut by wave erosion.

"If pipelines or any onshore staging facilities are to be placed in the areas of Point Riou, Riou Bay or the Malaspina Foreland," he said, "then the dynamic changes in shoreline position must be considered so that man-made structures will not be eroded away or silted in before the completion of development or otherwise limit the useful lifetime of the structures."

Icy Bay is from 12 to 50 miles (20 to 80 kilometers) from the majority of potentially rich offshore tracts leased in the April 1976 Northern Gulf of Alaska Lease Sale for oil and gas development. Molnia said Icy Bay also offers the only shelter from storms for marine traffic between Yakutat Bay, 55 miles (90 kilometers) to the east, and Prince William Sound, 185 miles (295 kilometers) to the west.

"Its location and the protection it can offer have made it a logical candidate for consideration as an onshore staging area for the development of Gulf of Alaska oil and gas," he said.

Molnia said the Chugach Natives, Inc., have applied to the Army Corps of Engineers for a permit to dredge and fill and to construct dock and shiphandling facilities in the Moraine Island area north of Point Riou Spit and Riou Bay. Other plans include housing, fuel storage areas, warehouses, water storage and supply, power generation facilities, a sewage treatment site, and a

6,000-foot (1,800-meter) airstrip capable of handling jet aircraft. Molnia said Cecil Barnes, president of Chugach Natives, Inc., has been quoted as "envisioning a new town at Icy Bay that could have a population of 2,500 in 7 to 10 years."

He said continued growth of Point Riou Spit at the present rate would connect it with Moraine Island in less than 20 years, thus closing off Riou Bay. Then new sediment could continue along the face of Moraine Island and enter Moraine Harbor, the major site for proposed development. Moraine Harbor could fill in within 15 years, Molnia said.

In addition to the onshore hazards, he said Icy Bay has many other environmental hazards, including an underwater moraine (ridge caused by a glacier) at the mouth of the bay, and active "calving" by glaciers at the bay's head that produce many icebergs.

Molnia said records indicate that extensive changes have occurred in the Icy Bay area since Vancouver surveyed the region in 1794. Another bay, located east of the Icy Bay, was open at that time. But this bay, now called Vancouver's Icy Bay, had disappeared by about 1850.

New Claims Continue to Drop

The number of new claims dropped for the second straight quarter, according to DGGS mining-information specialist Mildred Brown. A total of 1,646 claims were filed in the past 3 months, a decrease from the 2,268 filed in last period and the 8,107 the quarter before that. Barrow (24 claims last quarter), Talkeetna, and Fairbanks were the busiest recording districts. Totals are:

Haines	4	Fairbanks	349
Petersburg	16	Bethel	32
Ketchikan	21	Manley Hot Springs	4
Juneau	2	Nulato	6
Kotzebue	20	Rampart	17
Anchorage	3	Nenana	16
Seward	20	Fort Gibbon	99
Palmer	8	Barrow	636
Talkeetna	393		

MINFILE System Now Offered on Subscription Basis

DGGS has set up a subscription service for the MINFILE system, a computerized version of the old Kardex mining-claim file. Both microfiche card sets and computer output listings are available under the new service.

Microfiche Cards

For $60, a set of microfiche cards, representing the latest changes in the MINFILE system, will be sent to you monthly. These cards are reproductions of the MINFILE computer listing, cross referenced according to quad/serial, X-Y coordinates, owner name, and claim name. Monthly microfiche reports may be purchased for $5. An annual report, to be available each February, will also cost $5.

The microfiche cards are reduced to 1/48th of their original size and a 42- to 48-power viewer will be needed to discern the data. To purchase the microfiche card sets, make checks payable to State of Alaska and send to DGGS, 323 E. 4th Ave., Anchorage, AK 99501.

Computer Listing

Arrangements have been made with two computer service bureaus to allow the public access to the computer files of the MINFILE system. Special extracts or copies of the computer files can be made by the following two firms:

Boeing Computer Services	Alaskan Data Systems
3230 C St.	3500 Eide St.
Anchorage, AK 99503	Anchorage, AK 99503
Ph. 278-1511	Ph. 279-6578

The firms will gladly give cost estimates for their services.

Volcano Watcher Relates Rocks to Resources

(from Anchorage Times, Apr. 5, 1977)

A little unnamed volcano-let with a cone less than 150 feet high belched and muttered and steamed and dusted Kodiak Island with fine particles of ash last week.

Geologist Thomas P. Miller, the main volcano watcher for the Alaskan Geology Branch of the United States Geological Survey office, wanted to watch it.

Miller, who monitors such eruptions whenever possible, was office-bound in Anchorage Friday due to blizzard conditions that blocked visibility in the area, which is about 50 miles south of King Salmon and half that far from the boundary of Katmai National Monument.

The theory or process now called plate tectonics began to be expressed 10 or 12 years ago, according to Miller, as earth scientists began to formulate a very encompassing theory that tied together a lot of geologic phenomena such as earthquakes, volcanoes, and mountains.

"The surface (crust) of the earth consists of perhaps seven large plates and maybe a dozen smaller ones that extend to a depth of perhaps 50 miles and these plates move relative to each other. They are in contact with each other and along their boundaries they are in movement.

"Some places they are grinding past each other as in California along the San Andreas fault." Miller said. Along the Aleutian Trench, one plate is being forced under another one. Earthquakes and volcanoes are associated with the movement of the plates, he added.

The theory of plate tectonics explains a lot of other previously puzzling facts and phenomena and leads to important consequences in mineral and fossil fuel searches and in geological hazards such as volcanoes and

earthquakes, according to Miller.

"Relations between plates have affected all of Alaska, some millions of years ago, and even now are affecting Alaska along faults," he said. Engineering geologists study fault lines to determine where earthquakes or volcanoes caused by crustal movements may present hazards to structures such as buildings or dams or pipelines, Miller said.

"In Alaska we have a very interesting situation in that along much of the Alaska Peninsula and Aleutian Islands we have the large Pacific Ocean Plate (which is moving northwest) being shoved under the North American Plate" along the Aleutian Trench, he said.

Melting occurs in the subduction zone beneath a trench and heat forms a locus for concentrated metal deposits. Magma (molten rock) has certain composition and those metals with economic value tend to be concentrated in the last molten stages and form valuable mineral deposits, he said.

Plate movement "wrinkles crust up along the edges so you get mountains and basins and in many of these oil is formed as organic material decays." High temperatures in nearby subduction zones "aid in the process of forming oil and localizing it," he said.

In contrast, "coal deposits tend to occur in confined continental areas and weight and pressure produce most of the heat to start formation of coal," he said. Oil is usually formed in a marine environment while coal is generally a product of decayed land vegetation, he added.

"Knowledge of plate tectonics helps (geologists) find economic mineral deposits," he said. "The easy ones were found a long time ago." Now they are "looking for favorable environments where deposits might be found," he added.

Geologists look for places that have similar conditions to those with known valuable deposits. They "interpret the rocks to find these areas." Though the deposits may not be exposed at the surface, there may be some indication at the top, Miller said.

"We think we can look back perhaps one to two billion years," he said, "and in places we can decipher contacts between plates, but we don't have the full picture from then as compared to now.

"As molten material comes out of volcanoes and forms rock as in lava flows, there is magnetite (magnetic iron) which gets oriented in a north-south direction." With magnetometers, geologists can trace the magnetic patterns that result from periodic switches between the north and south magnetic poles, he noted.

While the edge of the Pacific Plate is disappearing into the Aleutian Trench, far out in the Pacific Ocean along the Mid-Pacific Ridge (or rise) new material in the form of volcanic rock is coming up between plates and pushing them apart, he said.

They Said It....

"Your March 1977 issue of the Mines & Geology Bulletin was full of interesting reading that most real Alaskans appreciate. They will be looking forward to other interesting issues that keep us posted on the good news—and some not so good." –Herman Kloss, of Tenakee Springs, AK.

(According to the boss, Ross Schaff, it is due solely "to good supervision"—Ed. note.)

"The land we do work (dredge) is improved. For example, considerable building was done on our tailings at our Fairbanks site near Ester. The dredge areas have good value as it makes an excellent foundation on which to build."—Bob Baldwin, acting manager, Alaska Gold Company.

"These lands *(the Udall-proposed 115 million acres)* belong to all Americans....Congress should act in the allotted time....since the alternatives would leave the outcome to the unpredictable.....Alaska legislature." —*New York Times* editorial.

"The extensive protection of the land afforded by HR 39 (the Alaska National Interest Lands Conservation Act) balances the intensive national demand for Alaskan resources. Without this balance, Alaska would likely become another example of the environmental devastation of industrialization."—George Matz, executive director of the Fairbanks Environmental Center.

"The BLM is simply a dead-letter office. And worse, you don't even know where your letter is in the maze."—Robert B. Barcus, vice president, Cominco American.

"The increasing use of oil, domestic and foreign, has been brought about in part by the actions of environmentalists. Their pressure has resulted in the banning of coal as a source of fuel for electric-generating plants in many parts of the country."—Norman Sklarewitz, in *Skeptic* magazine.

"We're trying to say that the mining industry will pay extra taxes and in turn we expect the state to assist with some of the costs of getting mining started, such as roads."—C.C. Hawley, executive director, Alaska Miners Association.

"Mining operations undoubtedly will require less than 0.16 percent of the d-2 land or any other part of Alaska and will provide no danger of destroying the beauty of this great state. They will help to supply Alaskan self sufficiency and will provide the jobs and opportunities necessary for the pride and self respect of all Alaskans. Mining will be good for Alaska, given a chance."—R.C. Babcock, exploration district manager, Bear Creek Mining Co.

"It's just a job. Grass grows, birds fly, waves pound the sand. I beat people up."—Muhammad Ali, heavyweight boxer.

Petroleum Development in Alaska Studied

(from UA Institute of Social and Economic Research, Mar. 1977)

Following is the conclusion of an ISER 15-page report that examines "the past, present, and future potentials" of Alaska's petroleum development—Ed. note.

Alaska has large oil and gas resources, the nation needs them, and the aim of the federal government and of industry is to find and produce them. The state of Alaska and the Native corporations also have interests in the development of Alaska's petroleum resources. The probability is great, therefore, that Alaska's petroleum resources will be developed on a grand scale within a relatively short period of time.

Production of the proved oil reserves at Prudhoe Bay alone is expected to result in up to $1 billion in new revenues annually to the State of Alaska by the early 1980s. This contrasts with total state revenues from state sources of about $300 million in 1975. The new Prudhoe Bay revenues will be based on production of 1.2 to 1.75 million barrels of oil a day. This production rate compares with about 200,000 barrels a day from Cook Inlet in 1975, which is only 11 percent of estimated Prudhoe Bay production at peak. Thus, bringing Prudhoe on stream may result in a four-fold increase in total state revenues and a nine-fold increase in Alaska oil production within the next 5 years.

There is likely much more beyond Prudhoe Bay. The state government probably owns additional petroleum resources that can be developed. Native corporations are likely to own commercially significant resources of their own. Most importantly, the federal government continues toward development of its own resources on Alaska's Outer Continental Shelf, and it may open federal lands to development elsewhere in the state.

The energy crisis of 1973-74, the price explosion, and the national drive toward energy "self sufficiency" added a powerful new stimulus to U.S. domestic petroleum development, with special emphasis on Alaska resources. Alaska (including OCS) oil and gas may constitute a third of total U.S. undiscovered oil and gas resources. Accordingly, the federal government looks to Alaska and its outer continental shelf for the single largest increment of new oil and gas supplies to meet national energy demands in the 1980's and 1990's. Federally inspired petroleum development in Alaska, in turn, will probably trigger greater production from state and Native lands as well.

Large-scale petroleum development in Alaska will bring more jobs, more money, and more people. It will mean more pipelines, more roads, and more processing and port facilities. It will result in greater pressures on housing and community services; on land, water, and wildlife; and on other renewable and non-renewable natural resources. It will also support a bigger state government having at least the financial capacity to influence the rate and quality of Alaska's future growth. But the extent of this influence may be limited. First, a process of development that generates its own requirements and pressures for further development is apparently already in motion. Second, federal government and Native corporation activities are largely beyond the control of state government for legal and political reasons, and the key petroleum development policy decisions will be made primarily by federal, not state, policymakers. It remains to be seen whether recent indications of more moderate and cooperative policies by the Carter Administration will result in any substantial redirection of federal leasing programs.

In any case, the state of Alaska may have a greater capacity to speed growth (by what it does with its own resources and wealth) than to slow growth generated by federal and Native corporate actions as well as by past state government actions. This means that the government may have to rely primarily on policies other than the direct control of petroleum resources—on environmental regulations, tax policies, expenditure programs, and other policy actions that can both mitigate undesirable effects of petroleum development and distribute its benefits more equitably.

DGGS Issues Annual, Other Reports

An annual report, a bibliography, and several geologic and open-file reports are among the new DGGS reports. Also in the making is a reprint of a field guide to central and south-central Alaska. New publications include the following:

- Geologic report 45, "Geology of the Rainbow Mountain—Gulkana Glacier area," by G.C. Bond. This report, which emphasizes the upper Paleozoic strata of the area and has 47 pages of text and three plates, costs $3.00. The abstract follows.

The upper Paleozoic strata have been divided into two lithologic successions. The older is named the *Tetelna Complex*, and it ranges in age from middle Pennsylvanian to early Permian. The Tetelna Complex is overlain by the younger Mankomen Group, which is early to middle Permian and possibly late Permian.

The Tetelna Complex consists of approximately 35 percent andesitic-basaltic lava flows, 12 percent andesitic pyroclastics, 50 percent dacitic pyroclastics, and about 3 percent rhyodacitic pyroclastics (compositions based on mineralogy). These volcanic rocks are interbedded with feldspathic and lithic sandstones and conglomerates, all of which were derived from volcanic sources. Silicified siltstones, claystones, and fossiliferous limestones also are present.

The Mankomen Group consists of well-bedded calcarenites and calcirudites, black argillite, highly fossiliferous argillaceous calcilutites, and bryozoan bioherms. Most of the strata in the Group were deposited in shallow water at or above wave base. Volcanism in the arc had ended by the time de-

position of the Mankomen Group began, and volcanic source areas were not present.

•Geologic report 49, "Gravity survey of Beluga basin and adjacent area, Cook Inlet region, south-central Alaska," by S.W. Hackett. The abstract for this report ($2.00), which contains 10 pages and 3 plates, follows.

Two hundred gravity stations were occupied in a previously unsurveyed area between latitudes 60° and 62° N. and longitudes 151° and 153° W. Interpretation of a simple Bouguer gravity map, compiled from this survey and from previously acquired U.S. Geological Survey reconnaissance data, indicates that the tectonic framework of the region differs in many respects from that previously published.

Several gravity lows identify sedimentary basins within the Cook Inlet petroleum province. Geologic interpretation of the geophysical data provides a better estimate of the structural configuration and thickness of Tertiary sedimentary deposits in the Cook Inlet, Beluga, Susitna, and Yentna basins. Steep gravity gradients indicate these subprovinces were down dropped along deep-seated basement faults. The gravity gradients, which are offset from the fault traces, suggest a high-angle reverse nature for the Castle Mountain, Bruin Bay, and Beluga Mountain fault zones. The Beluga Mountain fault, a newly recognized structural feature, is inferred to have a vertical displacement in excess of 10,000 feet (3,000 m).

•Geologic report 50, "Metamorphic rocks of Toklat-Teklanika Rivers area, Alaska," by W.G. Gilbert and Earl Redman. The report on the Mount McKinley National Park area terranes has 13 pages and 1 plate. The abstract for this document, which costs $3.00, follows.

Two contrasting metamorphic terranes are juxtaposed along the western extension of the Hines Creek fault. The northern terrane is polymetamorphic and includes Precambrian-early Paleozoic(?) metasedimentary rocks of the Birch Creek Schist in fault contact with a Middle or Late Devonian series of metasedimentary rocks and metafelsites. Metavolcanic rocks in the northern terrane suggest that mid-Paleozoic andesitic volcanism affected at least 5,000 square kilometers in central Alaska.

The northern part of the southern terrane is composed of weakly metamorphosed Triassic(?) siliceous marble in fault contact with Cretaceous(?) slate to the south. Both the siliceous marble and slate are extensively intruded by gabbro.

The northern terrane was affected by an early period of deformation and recrystallization in the lower greenschist facies; this deformation may have affected the southern terrane. A second, weaker deformational event also affected the northern terrane.

•Geologic report 56, "Aeromagnetic map of southwestern Brooks Range, Alaska," by S.W. Hackett. This report consists of two 1:250,000-scale plates in a map envelope. The plates show total-intensity magnetic anomalies of the earth's field in gammas relative to common datum. The areas covered are the entire Ambler River and Survey Pass quadrangles, the northern tier of the Selawik, Shungnak, and Hughes quadrangles, and most of the Baird Mountains quadrangle. The report costs $2.00.

Two DGGS open-file reports were recently released, a little one and a monster. The reports, which are available from any DGGS mining-information office (p. 1), are:

•AOF-108, "Reconnaissance geochemistry of parts of the Fairbanks A-4 and Healy D-2, D-3, and D-4 quadrangles, Alaska," by T.K. Bundtzen and W.G. Gilbert. The report has 10 pages of text and 1 plate (scale 1:250,000) and costs $1.50.

•AOF-109, "Investigation of Alaska's uranium potential," by G.R. Eakins, B.K. Jones, and R.B. Forbes. This report, originally written for the U.S. Energy Research and Development Administration, is the result of a 6-week reconnaissance program in west-central Alaska and in the Copper River Basin—Chitina River Valley area to aid in determining the uranium potential of the state. The work was conducted as part of the National Uranium Resource Evaluation, an ongoing ERDA program to assess the magnitude and distribution of uranium resources in the U.S. The 209-page report is made up of two sections—"Reconnaissance program, west-central Alaska and Copper River Basin," by Eakins; and "Uranium and thorium in granitic and alkaline rocks in western Alaska," by Jones and Forbes—and 10 blueline plates. During the reconnaissance, 916 stream-sediment samples and 427 bedrock samples were collected for uranium, thorium, and potassium determinations, and 565 water samples were gathered for uranium analysis. The report, which will be available near the end of this month, costs $9.00.

Also available is "Bibliography of the Cook Inlet region, Alaska—1969-76." This 40-page report lists the most recent bibliographic entries for this south-central Alaska area. It costs $2.00.

There are several new complimentary publications, too.

•The Department of Natural Resources 1976 annual report. This document lists the events and progress of each of the six divisions in DNR. This is a departure from the old format, wherein each division published its own annual progress report. Included in the DGGS portion are the figures for Alaskan mineral exploration and production for last year. The report is free.

•Information circular 16, "Alaska map information," revised Apr. 30, 1977 (2 p.).

•Information circular 20, "Aeromagnetic maps of quadrangles," revised June 1, 1977 (4 p.). A

complete list of DGGS publications may be obtained by requesting IC-11, a 16-page pamphlet.

Finally, to be available next month will be a reprint of the "1965 INQUA Conference Guidebook to central and south-central Alaska." This 141-page document, originally printed by the Nebraska Academy of Sciences, was a field guide for the VII Congress of the International Association for Quaternary Research (INQUA). The handy digest-size booklet summarizes the Quaternary geology of central and south-central Alaska and contains numerous descriptions of locations between Anchorage and Fairbanks. Because its considerable popularity among both scientists and nonscientists led to a rapid exhaustion of the limited number of first-edition copies, DGGS has reprinted it. It sells for $4.00.

BP Man Says Energy Demand to Triple

(from Anchorage Times, Apr. 6, 1977)

The U.S. consumes almost a quarter of the world's energy and minerals and that demand will triple in the next 25 years, says BP Alaska's vice president for exploration, Colin C.S. Davies.

Davies, keynote speaker at an Alaska Geological Society symposium, pointed out that the U.S. is importing close to 40 per cent of its oil now and more than 50 per cent—in some cases, 90 per cent—of 23 vital minerals. Those supplies from abroad could be cut off or simply dry up, he said.

Whether Alaska's full potential for many types of mineral deposits is ever realized, Alaska "undoubtedly will be called on to make a very large contribution toward satisfying demands that will arise.

"The thrust to meet this challenge has only just begun," he said, "and the ingenuity of all explorers will be taxed."

Already there is the distraction of discord, Davies warned. "It is impossible to discuss the extraction of any natural resource without challenge.

"The attack on big business, with threats of horizontal and vertical divestiture, only serve to illustrate the diversions from the real necessity for exploration and development that exist, despite that fact that those companies in the firing line have contributed so much to the establishment of known reserves."

"The rip-off theme is also taken up by those with extreme environmentalist views," Davies said.

He cited as examples "the inordinate and expensive delays" in construction of the trans-Alaska pipeline and the current dispute over the future of Alaska's D-2 land.

Those will be followed, he predicted, "by controversies over other issues, again with many expressions of extreme views that are invariably obstructionist and counterproductive."

What is needed, Davies said, is a common realization that development of resources not only contributes to man's well being, but also is compatible with ultimate environmental objectives.

"Alaska has a long history of mineral exploration," he said, "and the possibilities for further discoveries of a wide range of ore deposits appear to be enormous.

"Relatively recent copper finds in the Ambler River district of northern Alaska, along the northern flank of the Koyukuk Basin, and the molybdenum ore body discovered at Quartz Hill in Southeast Alaska are symptomatic of a potentially prosperous future."

An understanding of the structural evolution of Alaska in the light of modern tectonic theories "can only bring benefit and reward to those engaged in mineral exploration," he said.

Davies told the geologists that, "As an explorationist, I am fully aware that the development of the earth's resources is not just a technical problem." Economic, social, environmental—"and above all, political"—issues also are involved, he said.

For example, he said the geology underlying petroleum discoveries off the coast of East Trinidad may be analogous to the setting in the Gulf of Alaska, and recent finds in south-east Asia, such as the giant Minas field in central Sumatra, may have implications for the Aleutian Chain.

Referring to the "far reaching controversy that now surrounds the extraction and processing of natural resources," Davies said, "I venture to claim that man's collective right to develop and use the natural resources of the earth is not open to question."

Our Gangue...

By Frank Larson, editor

The Visitor

Imagine a garish movie set from a generation or two ago. There is a gleaming marble staircase spiraling down from a galaxy of twinkling stars. Descending the steps is a wizened, bewhistered, mackinaw-clad man. He is carrying a gold pan and a pick and scratching himself. (But not with the pick.) The Old Timer has come to visit from The Great Placer in The Sky.

"Howdy, Old Timer," I greet him. "Welcome to America in the late 1970s."

"Hi, Sonny. Anywheres' 'round here I can do a little diggin'?"

"Well, times have changed a little since you were around, Old Timer. We have some new things you'd like—like insulated clothing, bunny boots, and mechanized means of mining and transport."

"Really? Sounds wonderful."

"But there are some things you probably won't like. Like some of the rules. You see, Old Timer, times have changed on you. You can't just go out in the Bush and mine anymore. First, you have to keep the Government informed of where you are going to mine. Then maybe they'll let you go there."

"You're pulling my leg."

"Oh no. Then if they let you go into a certain area, you have to give them some of your grubstake as a bond that you won't hurt the land."

"The hell you say. I never heard of such foolishness. Besides, how can you mine without bothering a little of the Old Sod?"

"Well, the Government has people to tell us these things now. For instance, once you get a permit to mine...."

"A what?"

"Then you have to post a hundred-thousand-dollar bond, too...."

"A hundred-thous...."

"This is to ensure that your mining operation doesn't 'significantly disturb' the land. Then you have to submit a plan of operations to a Government agency called the Bureau of Land Management. They'll have one of their 'authorized officers' look...."

"Pshaww," says the grizzled Old Timer, spitting tobaccy.

"Then you have to establish the corners and lines of your claims."

"Yeah, well, I can understand that."

"But you cannot disturb the vegetation doing it."

"What?"

"Also, you cannot use any type of these new things called motor vehicles on it without the Government's permission. And another thing: you're going to need a permit to build your road."

"Road? What road? The mining season up here is for mining, not road building. If I'd wanted to build a road I'd build one to my cabin."

"Well, there's more to come. Listen. When you've built your road, you can't prevent others from using it. But you still are responsible for the land that you got the permit for. If others 'significantly disturb' your land, well, remember that hundred-thousand-dollar bond you put up?"

"Migod. You mean....?"

"Yup. Gone as fast as," snapping fingers," *that*. "Also, if you should find anything that looks like it's from another era—like old pottery, gravesites, arrowheads, tools, even fossils...."

"What are these here fossils?"

"Kind of skeletons of little bugs and critters that are imbedded in rocks."

"You don't say. Anyway, you can't disturb those, either. Instead, you have to contact your 'authorized officer' again. He'll then halt your operations to have some people come out and look at these things—they're called 'cultural resources.' Then, if they say it's all right to continue mining, you can. But you'll have to pay for their investigation and any salvaging they may do, of course."

"What? I never heered of sech foolishness."

"Oh, yes. The Government, you see, has as its duty the job of protecting us."

"*Protecting* you? Sounds like you young people got confused somewhere along the way and got the cart pulling the horse. In my time the Government worked *for* us."

"Hmm. A novel concept. Anyway, we've got another Government agency called the Environmental Protection Agency. Those boys can really shut off your water."

"What?"

"Sure. Ask your modern-day Alaska placer miners. Many of them have had cease-and-desist orders served on them. That means they can't use the water for their mining."

The Old Timer grins, "Bull. Sonny, I gotta admit. You had me going there for a little while, but I know now you just been pullin' my leg."

"No bull, sir. And that's not all. The EPA has another thing they can do to see that you don't molest the land. It's called an environmental impact statement. It's a document that you have to write, usually a long one that....You can write, can't you?"

"None of your business, young smart aleck."

"Well, you have to inform them of your plans and your schedule and how, after mining, you are going to replant the trees and replace the bushes and...."

"And put back the gold, too, I suppose."

"Oh, no. The Government will let you keep your gold—at least some of it. You see, the Government has an altogether different set of rules on how much and what type of gold you can keep."

The Old Timer shakes his head and starts up the stairs, muttering, "The world has gone mad. Jest plumb loco."

"Hey, Old Man. Where you going?"

"I just hope it's not too late. I gotta get back before your Government starts," he paused to point his pick skyward, "protecting us Up There."

.....

But before it does, the USGS has asked the Government for $333,000 to continue the geological, hydrologic, and seismic studies to monitor the Trans-Alaska Pipeline.....ERDA has an open-file report out entitled "Aerial gamma-ray and magnetic survey of the Bethel and Yukon areas" that sells for $160 (up to $585, depending on the options exercised). But don't feel you are over a barrel: DGGS has copies you can peruse for nothing at the Anchorage and College offices.....Whatever you do, don't let ERDA get you over *this* barrel: The agency has scheduled a test involving the proverbial 'speeding locomotive' of comix fame and a 25-ton cask. The test will help determine the structural integrity of a nuclear-fuel shipping container by hitting it with a rocket-propelled choo-choo traveling at 70 to 80 mph. (Talk about getting between a rock and a hard place!).... Well, Old Timer, have a nice summer. Before going into the Bush, however, I suggest you look into a couple of the newer fangled inventions—Cutters for 'skeeters and Cutty for snakebite.....Cheers.

Metals Market

	May 20, 1977	Three Months Ago	Year Ago
Antimony ore, stu equivalent European ore	$ 23.50-25.00	$ 23.50-25.00	$ 21.50-23.00
Barite (drilling mud grade per ton)	$ 19-28	$ 17-28	$ 17-28
Beryllium ore, stu	$ 40-42	$ 40-42	$ 40-42
Chrome ore per long ton (Transvaal)	$ 56-61	$ 38-46	$ 36-42
Copper per lb. (MW-prod.)	$ 0.72	$ 0.68	$ 0.70
Gold per oz.	$147.31	$136.60	$128.40
Lead per lb.	$ 0.31	$ 0.29	$ 0.22
Mercury per 76-lb flask	$130.00	$156-165	$132.00
Molybdenum conc. per lb.	$ 3.45	$ 3.45	$ 2.90
Nickel per lb. (cathode)	$ 2.41	$ 2.41	$ 2.20
Platinum per oz.	$162.00	$162.40	$161.00
Silver, New York, per oz.	$ 4.74	$ 4.53	$ 4.46
Tin per lb., MW composite	$ 4.48	$ 5.16	$ 3.61
Titanium ore per ton (ilmenite)	$ 55.00	$ 55.00	$ 55.00
Tungsten per unit (GSA domestic)	$156.26	$139.15	$ 86.00
Zinc per lb. (MW US PW)	$ 0.34	$ 0.37	$ 0.37

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