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**Mining information office.*

Hard-Rock Mining in Alaska: Some Operations Since 1938

By Cleland N. Conwell, DGGS Mining Engineer
(Reprinted from Western Miner, July 1976)

In a report on the 1975 meeting of the Northwest Mining Association, a statement made at the meeting was quoted: 'Since the closure of the Kennecott Copper operations in 1938 there have been no hard rock mines working in Alaska....' Evidently this statement was not correct, and the Alaska Department of Natural Resources has provided us with some interesting data on activity in the State.

Top operations of note are the Ross-Adams uranium mine and the Kenai Chrome Company chromite mine. The property explored by Don Ross and Kelly Adams in 1955 is on Bokan Mountain, near Kendrick Bay, Prince of Wales Island, and some 40 miles southwest of Ketchikan, Alaska. The Kendrick Bay Mining Company (under Climax Molybdenum Co.) operated for a few months in 1957; the property was worked under Standard Metals-Alaska Operations in 1963-64; and under Newmont Mining Co. in 1970-71. The Kendrick Bay project was the subject of an extensive report in Western Miner.

On the Kenai Peninsula, south of Anchorage, two chromite deposits have been mined. One closed after World War I, but the Red Mountain deposits were mined during 1942-44 and 1954-57. In 1958 the last operating mine in the area closed down, the Kenai Chrome Company reportedly being left with a considerable amount of ore and concentrates (on expiry of a government purchase program) despite having paid back a substantial government loan in record time.

The major hard-rock gold mining effort was in the Alaska-Juneau mine, which was mining at a rate exceeding 10,000 tons a day and was operated until shut down by federal order L208, which shut down most of the major gold mines in the United States in 1942. Another major gold mine was the West Chichagof Gold Mine on West Chichagof Island, southeast Alaska. Other hard-rock mines included several in the Willow district in south-central Alaska, the Nabesna Mine in central Alaska, and several operating hard-rock gold mines in the Fairbanks district.

After World War II several underground gold mines did continue to operate in the Fairbanks area; these included the Hi Yu, the Keystone Mines, and a mine operated by the Vetter Brothers. Frank Birch operated the Chandalar Mine until his death in an airplane crash near the mine in 1972. His heirs operated the mine in the following year; this property has since been acquired by the Noranda Mining Company, which has been completing both surface and underground exploration during the past two years.

In the Fairbanks area, the Four Bear Mining Company has acquired the old Bartholemue property. At the present time they are constructing a mill. The principals report that they intend this as an open-pit operation and expect to be milling at the rate of 600 tons per day by the end of the season. Presumably this would mean by October. A mill is under construction at the present time and some test runs have been made.

There have been several periods of production of tungsten ore in the Fairbanks district and this in general has been related to the price of tungsten. In periods when the price is high some of the mines can operate.

Alaska has been an important producer of antimony. Again, the production has fluctuated with the price. The major antimony mine has been the Stampede Mine at Stampede; production has come from the Kantishna district (Stampede), the Fairbanks district, and an area near Tok, Alaska.

Silver ores have been periodically mined from the Kantishna district. The Kantishna district is one that would appear to have a bright future for the mining of gold, silver, lead, zinc, and copper ores, except it is near Mount McKinley Park. The National Park Service has maintained a steady effort to include the Kantishna in the park area to stop all mining. This has been a major deterrent to the development of a mine in the particular area. A mine and mill was constructed on the Banjo property and operated for a short period after 1938.

Alaska has been a producer of mercury. In 1970 there were four full-scale mercury mines operating in Alaska and possibly four additional prospects that produced some mercury that year. A major producer has been the Red Devil Mine at Red Devil. Although production has fluctuated with the price, the Bob Lyman family at White Mountain has continued a steady production of mercury for several years now.

A lead-silver ore has been produced by Bob Buzby in his prospect on the north flank of the Alaska range, almost immediately south of his home at 56 Mile Richardson Highway, which is between Fairbanks and Delta Junction, Alaska.

Johnny Wilson of Glennallen has made shipments of the high-grade chalcocite ore from his property, which is only about 15 air miles from the old Kennecott Mine.

Developments

There are some very interesting developments in Alaska. Again one may mention the work going on at Chandalar which could be a high-grade gold mine in the near future. An interesting new development is the U.S. Borax molybdenum ore body east of Ketchikan. An excellent description of this prospect is given in the May 1976 issue of Mining Engineering. Less well known but rapidly developing is the copper-nickel prospect of the Inspiration Consolidated Copper Company on Yakobi Island. Inspiration Consolidated Copper will have a crew in the area again this year to increase their reserves and obtain additional samples for metallurgical testing. This copper-nickel development will be by open pit and it was understood that the environmental impact statement was due by mid-June 1976.

In mining circles, the efforts of the Kennecott Copper Corporation, Anaconda, and Sunshine Mining Companies in the Arctic near Kobuk are fairly well known. The drilling has resulted in a very large reserve copper, zinc, and lead ores. In fact, the major exploration effort in Alaska for the past two summers has been centered in this area.

Mention should be made of the work by the Lost River Mining Company on the Lost River Mines, Seward Peninsula, Alaska. This is an area in which hard-rock tin mining did occur after 1938—in fact, after World War II. The Lost River Mining Company took over the claims in about 1970 and started an extensive drilling program; a tin-fluorite reserve in excess of 40-million tons of ore has been developed. The grade and tonnage of the combined tin-fluorite resource appears to be quite adequate to support a mining operation. In addition to the reserves that have already been developed, there are several other areas with good showings of both tin and fluorite that are yet to be explored.

Undersea Open Pit

The barite mine on Castle Island deserves special recognition. The barite deposit originally outcropped on Castle Island. All of the reserves above low tide have been depleted. In this unique situation, hard-rock mining is conducted under water. The ore body has been explored and limits are known, although exploration has not completely outlined the full extent of the ore bodies.

In this operation, from controls on shore, holes are drilled and blasted. The ore is removed by a clam-shell mounted on a barge and transferred to a bottom-dump barge. Ore is transported near the shore, dumped, picked up with a dragline, and deposited on a feeder for crushing. The barite is upgraded in a heavy media plant, then ground and bagged as a finished product for shipment. Wallace W. Dolph, the plant manager, deserves special recognition for the ingenuity that he has shown in bringing this particular ore body into production. To my knowledge this is the only hard-rock open-pit mine under the ocean.

Geochemistry as a Prospecting Tool
By Alfred F. Trites

(This is the ninth of a series from The Mining Record [Feb. 5, 1975]. The author is a consulting geologist in Denver—Ed. note.)

Geochemical Sampling of Molybdenum Ore Deposits

Molybdenum is one of the major chemical elements being analyzed geochemically in rocks and soils in today's laboratories. One reason for this attention is the vastness of such deposits in which molybdenum can occur, indeed the large sizes necessary for their exploitation. These "elephants" of the metallic ore deposits are measured in hundreds of millions to billions of tons. The stakes run high for their discovery but the pay-off is equally high for the successful locator of one of them.

Exposed at the surface, such large-scale deposits may occupy an area of a square mile or more. Visible molybdenum mineralization and rock and soil sampling may be sufficient to delineate target areas for exploratory drilling in such areas.

Where they are buried beneath great thicknesses of rock, molybdenum ore bodies may only be inferred through the use of such tools as geochemistry and geophysics. Other possible tip-offs may be such features as large zones of rock alteration, widespread disseminated pyrite, or the presence of unusually large amounts of mercury or fluorine along large-scale faults or fractures.

Occurrence of Molybdenum

It is impossible within the scope of these articles to discuss to any extent the facts and theories of molybdenum mineralization. An array of information is stored in the minds of a number of geologists and geochemists who have spent years in exploring, sampling and mapping in detail, and interpreting the ore occurrence and alteration in some of the world's largest molybdenum deposits. Some of this information has been published and is available in the literature, much of it is no doubt company confidential data or is locked in the minds of some very capable and discreet men and women.

However, in order to consider the application of geochemical methods in a search for molybdenum deposits some salient facts of molybdenum ore emplacement should be set forth, so here goes:

1. Molybdenum deposits are similar in overall aspects to many of the large porphyry-copper deposits of the world.

2. The molybdenum mineralization is nearly always related to stocks or other large masses of intrusive igneous rocks.

3. Very often a major part of the igneous rock is quartz monzonite, although other types of intrusive rocks such as rhyolite porphyry, quartz porphyry, and aplite very commonly are present.

4. Igneous stocks appear to be most favorable for molybdenum emplacement if they are of a complex type, having been formed by several pulses of injection.

5. The tops and flanks of the igneous intrusive mass, often domal in shape, are surrounded by zones of fractured rock.

6. Primary molybdenum invariably consists of molybdenite (MoS_2) which occurs disseminated in the stock as well as in cross-cutting dike swarms that have been formed in the fractured rock above and marginal to the main igneous mass.

7. Some molybdenum ore bodies are in the form of cylindrical pipes, more than a half mile in diameter and extending downward for nearly a mile in vertical distance. Other ore bodies may be irregular in shape, especially if their emplacement has been controlled by complex faulting.

8. Widespread pyrite mineralization is common in the stocks and veins. Chalcopyrite, sphalerite, galena, and silver and tungsten minerals may occur in veins outward beyond the main mass of molybdenum mineralization. Quartz, calcite, fluorite and rhodocrosite may occur as gangue minerals in these veins.

9. Molybdenum ore bodies are associated with large zones of rock alteration, notably silicification, sericitization and potash feldspar alteration from plagioclase feldspar.

10. Widespread molybdenum may occur as "paint" along joint or fracture surfaces for hundreds or thousands of feet from the ore bodies.

11. Above the water table much of the molybdenite may have been destroyed by oxidation, the molybdenum here forming concentrations of the hydrated iron-molybdenum oxide, ferrimolybdite, which is usually intimately associated with iron oxides.

Geochemical Prospecting Hints

The behavior of molybdenum is different in an arid region than in a very moist region during the weathering process. The formation of the tell-tale ferrimolybdite depends upon the acidity and this secondary molybdenum mineral probably is not formed whenever the pH exceeds 7 (neutral). Quantities of pyrite are necessary for sufficient sulphuric acid to be formed to attack the molybdenite and take the molybdenum into solution during the weathering of a primary deposit. Under these conditions the acidity usually is correct and sufficient iron is available for the reprecipitation of the ferrimolybdite. Smaller quantities of molybdenum usually are also trapped in the hydrous iron oxide, limonite. Where the pH is too high the molybdenum tends to be removed from the area and this condition could result in a geochemical low for the element immediately above or adjacent to the deposit, so the highest molybdenum anomalies do not everywhere coincide with the ore bodies themselves. A good tip for geochemical prospecting for molybdenum is to sample the iron oxides along joint and fracture surfaces. You may have to use a pen knife to scrape off sufficient quantity for your lab to analyze, but if unusually large amounts of molybdenum are to be found at the surface, here is a good place to find them.

Look for a zonal pattern of lead-silver veins surrounding your suspected "hot" molybdenum area. You will probably want to have your soil or rock chip samples run for lead, zinc, and silver along with molybdenum. Some molybdenum deposits can also carry small but significant quantities of copper, so it is wise to check a sufficient number of samples to determine whether or not this element can be used as an indicator.

Remember, large faults exposed for great lengths at the surface may extend to great depths, possibly from a molybdenum deposit thousands of feet below the surface. Such conduits may have served as channelways for quantities of mercury or fluorine originating from hydrothermal solutions which have formed the deposit. Where you suspect a buried molybdenum deposit, check for the presence of unusually large amounts of these easily transported elements along any large faults that may be present.

The normal background value for molybdenum is low in both rocks and soils. H.E. Hawkes and J.S. Webb in "Geochemistry in Mineral Exploration" report a range of from .2 to 5 ppm. in soils with an average of 2 ppm.

DGGS Aeromagnetic Maps of Brooks Range to go on Sale September 30

The 15-minute aeromagnetic maps compiled from the 1975 flight season will go on sale at all four DGGS Mining Information offices on Thursday, September 30. Sale of the maps, scaled 1:63,360, will begin at 11 a.m. in Juneau (11th floor, State Office Bldg., Pouch M, 99811) and Ketchikan (205 State Office Bldg.; P.O. Box 2438, 99901). The sale will start at 9 a.m. in the Anchorage office (MacKay Annex, 323 E. 4th Ave.; 99501) and at the College office (Physical Plant Bldg. of U. of A.; P.O. Box 80007, 99708).

The maps, of the Ambler River and Shungnak 1:250,000 quadrangles, may be purchased or examined at any of these offices. They cost $1.10 postpaid or $1.00 in person. Those maps to be offered for sale are:

Ambler River	Shungnak
A-1, A-2, A-3	D-1, D-2, D-3
B-1, B-2, B-3	
C-1, C-2, C-3	
D-1, D-2, D-3	

DGGS to Seek Annual Mine Information

Mine operators are urged to comply with the State Mine Regulations, as published in the Alaska Administrative Code, and provide DGGS with two sets of information—one now and one at the end of the year. For the former requirement, the operator shall notify DGGS (either the Anchorage-Porcupine or College offices; see p. 1) of his name and address, name of mine, and the probable number of men to be employed during the year (see paragraph 11AAC 44.028, below). No forms will be sent out to operators for this information; a short, hand-written note will suffice.

At the end of the mining season, DGGS or the U.S. Bureau of Mines will send out forms requesting statistics of accidents, labor, and production. (There is a penalty for failure to comply with this request.) Information received will be held confidential for the individual operator.

The applicable sections of the Alaska Administrative Code are reprinted below.

11 AAC 44.026. INSPECTION AUTHORITY. The director *(i.e., State Geologist)* or his authorized agent shall have the right to enter, inspect and examine any operation, and to inspect and examine the workings and the machinery belonging thereto, at all reasonable times, either day or night, but not so as to impede or obstruct the workings of the operation. He shall also have the right to make inquiry into the condition of such operation, workings, machinery, ventilation, drainage, method of lighting or using lights, and into all methods, things and appliances connected with and relating to the health and safety of persons employed in or about the same, and especially to make inquiry whether or not the provisions of these regulations have been complied with. The manager of each operation is hereby required to furnish the means necessary for such entry, inspection, examination, inquiry and exit. When upon such examination any operation or portion thereof is found to be in an unsafe or insecure condition, or if proper first aid measures have not been adopted, the director shall at once serve a notice in writing upon the owner, lessees, agent, operator, manager, or superintendent thereof, setting forth the nature of the defects which render such operation unsafe or insecure and the point or place where such defects exist, and requiring the repairs necessary to remedy such defects to be made within a specified time; and, if in his judgment the circumstances so require, he shall forbid the working of such operation or any portion thereof that has been declared unsafe or insecure, save and except for the purpose of making the repairs necessary to remedy such defects, and for the purpose of permitting inspection and investigation of the conditions described in the notice. Information pertaining to metallurgical processes, ore-bodies, ore-shoots, or the location or course of underground workings, that is obtained during an inspection under authority of this part, shall be kept confidential, unless permission to release such information is obtained from the operator. (Eff. 8/1/63, Reg. 12) Authority: AS 27.20.

11 AAC 44.028. ANNUAL REGISTRATION. The operator of each producing mine, at the beginning of the calendar year or as soon thereafter as practicable, shall register with the director, giving the name and mailing address of the operator, name of the manager, name of the mine and the probable number of men to be employed during the year. (Eff. 8/1/63, Reg. 12). Authority: AS 27.20.

11 AAC 44.030. STATISTICAL REPORTS. The director shall distribute blank forms requiring statistics of accidents, labor, production and such other information as he deems advisable. The person in charge of

each operation shall complete the forms for each calendar year or working season and return them to the Anchorage office of the division as soon as possible after the year or working season to which they pertain. The completed and filed forms are to be used by the division under the same conditions and restrictions as required by the U.S. Geological Survey and the U.S. Bureau of Mines. (Eff. 8/1/63, Reg. 12). Authority AS 27.20.

11 AAC 44.944. PENALTIES. Any person who willfully fails to comply with any of the provisions of these regulations, upon conviction, is punishable by a fine of not more than $1,000, or by imprisonment for not more than one year, or both. (Eff. 8/1/63, Reg. 12). Authority AS 27.20.

Contract Signed for Study of Possible Coal Strip Mining on Alaska's North Slope

(from Dept. of Interior News Release, July 22, 1976)

Technical and economic feasibility of strip mining coal in the arctic climate and permafrost of Alaska's North Slope, and reclaiming the land afterwards, will be studied under a $276,735 research contract awarded by the Interior Department's Bureau of Mines.

Contractor on the 12-month project is Kaiser Engineers Co., of Oakland, Calif. The work will include an effort to define potential markets for North Slope coal, plus an evaluation of ways the coal could be transported with minimal environmental impact on the Alaskan tundra. Alaska's North Slope is the area between the Arctic Ocean and the northern side of the Brooks Range mountains.

The work will begin with a survey of worldwide technical literature related to mining in the arctic, followed by an evaluation of mining and land reclamation operations at existing surface coal mines in other parts of Alaska. Fitness of present-day mining equipment and machinery for operation in the arctic will be assessed, to see if it could be successfully modified for North Slope operations, or whether all-new designs would be needed instead.

Based on findings from early stages of the work, Kaiser Engineers will formulate ideas for complete mining and reclamation systems that could be developed into practical systems for commercial coal production on the North Slope at some time in the future. For each minihg concept developed, the contractor will assess the probable environmental effects on vegetation, animal life, surface and underground water resources, and people living in the North Slope region. North Slope areas that would make suitable sites for field demonstration of the most promising mining system, under carefully controlled conditions, will be recommended as part of the project. Results of the feasibility study will be made public when the project is complete.

Investigations of Alaska's Uranium Potential Continue

Efforts of both industry and government (especially the Energy Research & Development Administration) to evaluate the uranium resources of Alaska are increasing. The price of this commodity also continues to escalate: U_3O_8 for future delivery is now generally quoted at $40 per lb.

Alaska is believed to hold much promise for future discoveries of uranium (for which a critical shortage is forecast within the next few years). The following excerpts are from National Uranium Resource Evaluation Report, published last June by ERDA.

The only production from Alaska was derived from a mine located on Bokan Mountain on Prince of Wales Island. Available information is inadequate to permit assessment of uranium resources in most of Alaska; however, numerous investigations underway and planned will provide the information base required for future assessment.

Regional Geologic Setting

The tectonic framework of Alaska is controlled by Precambrian and Paleozoic structures. South and central Alaska is part of the circum-Pacific belt of seismicity and volcanism. Large thicknesses of subaerial and submarine eugeosynclinal rocks and two stable blocks comprise the tectonic framework of northern and central Alaska.

During Cretaceous time several subparallel broad, elongated basins were filled with sediments shed from the Brooks Range, the Seward Peninsula, and the Tanana and Ruby geanticlines. In Cenozoic time, subaerial basins were formed along the Tintina, Denali, and Kaltag lateral faults.

Alkalic-silicic plutons were intruded in the Alaska Range and southeastern Alaska from Jurassic through Oligocene time. The Cook Inlet-Matanuska graben south of the Alaska Range was a major tectonic feature during the Mesozoic and Tertiary. During five major episodes of deposition, the character of the strata changed from marine eugeosynclinal sediments in the Triassic Period to nonmarine and estuarine clastics in the Pleistocene Epoch.

Overview of Uranium Resources

The one uranium mine in Alaska is in a sodic peralkalic granite stock of Jurassic age at Bokan Mountain, Prince of Wales Island. Uranium-thorium minerals form veinlets and replacement pods and also are disseminated in granite, pegmatites, aplite dikes, and adjacent albitized rocks. Ore containing 0.5 to 3.0 percent U_3O_8 *is enveloped by lower grade rock. All uranium and thorium ore within the Bokan Mountain area is probably related genetically to the granite.*

Albitization is the principal type of rock alteration associated with the Bokan Mountain uranium deposits. Fluorite and hematite contents of adjacent *rocks vary directly with the uranium content in the veins and segregations. The thorium-uranium ratio at Bokan Mountain ranges from 1:1 to 7:1. The ore contains less potassium and more iron, lead, aluminum, yttrium, and fluorine than the unmineralized granite.*

The ore body was mined to a depth of 400 feet, where it terminated against a fault.

Potential Uranium Resources

Potential resources were estimated for Alaska only in the Bokan Mountain granite in extreme southeastern Alaska. Elsewhere in Alaska, alkalic silicic plutons of Mesozoic and Tertiary age and their aureoles, veins, and dikes may be favorable. The late silicic differentiates of alkalic magmas may contain deposits similar to those in the Bokan Mountain granite. Primary uranium-bearing minerals in igneous rocks of the region contain appreciable thorium, which could be a co-product.

Many of the sedimentary basins in Alaska have characteristics similar to the uranium-bearing basins in the conterminous United States. The probability of uranium deposits in these basins is enhanced because the sources of the basin sediments include uraniferous rocks such as alkalic and silicic plutons and volcanics. The nonmarine Mesozoic and Tertiary clastic strata in these basins have stratigraphic and lithologic characteristics similar to rocks in ore-bearing areas of the western United States. The Upper Cretaceous and Eocene formations are probably the most favorable. However depths to mineralized zones may be excessive because many of the favorable beds dip more steeply than their counterparts in the conterminous United States. Redistribution of uranium by ground water may have been impeded by permafrost and shallow water tables, thereby reducing the likelihood of ore formation.

In a related issue, DGGS still has a few copies of Special Report 12 left. Entitled "Alaska's Uranium Potential," the report, which costs $10, is 372 pages long and has five large blueline maps. Extra sets of maps are $4.

ERDA to Conduct Copper River Basin Uranium Study

(from ERDA News Release, July 22, 1976)

The Grand Junction (Colorado) Office, Energy Research and Development Administration (ERDA) has executed an $89,700 contract with the University of Alaska Geophysical Institute at Fairbanks, to conduct a follow-up pilot investigation of airborne radiometric survey work previously completed in the Alaska Copper River Basin.

The contract was signed with Bendix Field Engineering Corporation, ERDA operating contractor at the Grand Junction facility. The contract is for a study to provide information useful in establishing procedures for field evaluation of data from the airborne reconnaissance radiometric surveys made in Alaska. The information generated from this study will be useful in planning the methods of assessment of uranium favorability in similar arctic and sub-arctic areas. The study will include rock unit identification, rock sampling and analysis, and the evaluation of the significance of the distribution of radioactivity in various rock units.

The University of Alaska contract is part of the ERDA Grand Junction Office ongoing National Uranium Resource Evaluation (NURE) program, which includes the development and compilation of geologic and other information to assess the magnitude and distribution of uranium resources and determine areas favorable for the occurrence of uranium in the United States.

Long-Sitting Alaska Chrome Ore Going to Japan

(from Alaska Business News Letter, June 25, 1976)

Englehard Minerals and Chemicals Corp. is planning to move nearly 8,000 tons of stockpiled chrome ore from a beach site near Seldovia to Japan this summer. Englehard's Philipp Bros. division is arranging movement of the chromic oxide-rich ore in Jakolof Bay to be moved in July by Inlet Marine tug and barge off the beach to a waiting ore vessel in Kasitsna Bay. The loading operation is being handled by North Star Terminal and Stevedore Co. of Anchorage.

The chrome ore has been sitting on the beach for some years. Englehard bought the ore about five years ago from the federal government, that had stockpiled it as a strategic metal in World War II and the Korean War. It was mined at Red Mountain just a few miles up into the Chugach Mountains from Jakolof Bay near the mouth of Cook Inlet. Union Carbide and Carbon Corp. conducted the mining operation in World War II, and Kenai Chrome Co. operated by Anchorage resident Karl Bachner mined more than 20,000 tons of ore during the Korean War.

Chrome has more than doubled in value in the last two and a half years, which makes the current project economically feasible. The skyrocketing market value is due in large part to doubts about the political future of the non-Communist world's largest supplier of ore, Rhodesia.

Mountain Named for Hale Boggs

(from the Fairbanks Daily News-Miner, July 22, 1976)

A 4,440-foot mountain peak in Alaska has been named Boggs Peak in memory of the late Rep. Hale Boggs, D-La., his widow and successor said Wednesday.

Boggs, majority leader of the House, and Rep. Nicholas Begich, D-Alaska, were on a plane which disappeared during a flight over Alaska Oct. 16, 1972 and has never been found.

Rep. Lindy Boggs, elected to the seat after Boggs was officially presumed to have died, said she was notified that the U.S. Board of Geographic Names has approved the naming of the peak in the Chugach Mountains, six miles northwest of Whittier, Alaska.

A nearby peak, she said, is being named in memory of Begich. Ceremonies are tentatively planned for October 1977. Mrs. Boggs said the move to name the peaks was initiated by Sen. Ted Stevens, R-Alaska and that she is deeply grateful to him.

"These landmarks will form a lasting tribute to their many contributions to our nation and the Congress," she said.

DGGS Issues New Documents

A spate of documents has arrived from the printer. Now available are two new geologic reports, four new special reports, and two new open-file reports. They are:

Geologic report 47, "The Teklanika Formation - A new Paleocene volcanic formation in the central Alaska Range," by Wyatt G. Gilbert, Virginia M. Ferrell, and Donald L. Turner (16 p.). $1.00. The abstract follows.

A series of andesite, rhyolite, and basalt flows, felsic pyroclastic rocks, and related intrusive rocks covers about 165 square kilometers in the eastern part of Mount McKinley National Park. These rocks, once considered part of the Cantwell Formation, are now defined as the Teklanika Formation. The formation, which locally reaches a minimum thickness of 3,750 meters overlies the Cantwell Formation both conformably and unconformably. The type section of the Teklanika Formation forms the ridge east of the upper Teklanika River drainage and is composed of six conformable units.

Felsic volcanic flows are generally amygdaloidal porphyritic rhyolites with sanidine phenocrysts. Pyroclastic rocks are dominantly a combination of andesitic to rhyolitic vitric, lithic, and crystal welded tuffs. Mafic flows range from olivine basalt to andesite.

Chemically, the Teklanika Formation is part of a calc-alkali series and may be cogenetic with early Tertiary plutonic rocks in south-central Alaska.

Minimum radiometric ages of 60.6 and 41.8 m.y., together with an age of 57.2 $\pm$ 4. m.y. from a related plug, suggest that eruption of the Teklanika Formation and orogeny occurred during Paleocene time.

Geologic report 52, "Clay mineralogy and petrology of the coal-bearing group near Healy, Alaska," by Don M. Triplehorn (14 p.). $1.00.

Within the coal-bearing group near Healy, Alaska, three different clay mineral associations are recognized: a lower interval with little or no montmorillonite, an upper interval with abundant montmorillonite, and a relatively thin intermediate interval with predominant kaolinite. The montmorillonite and at least some of the kaolinite are interpreted to be of postdepositional origin—the montmorillonite by the weathering of volcanic feldspar.

Greatest potential for stratigraphic correlation is found in certain clay partings that may have originated as volcanic ash falls. Because of their lack of methods for sediment distribution, coal swamps are ideal environments for the preservation of ash falls. The clay partings, if proved to be of volcanic origin, have value as widespread, distinctive isochronous units. Perhaps of more importance is the possibility of obtaining absolute age dates on them, thereby permitting correlation with both marine and nonmarine Tertiary rocks throughout the state.

Special report 9, "Mordenite deposits and zeolite zonation in the Horn Mountains area, south-central Alaska," by D.B. Hawkins (9 p., 2 pl.). $1.00.

Extensive mordenite-rich tuffs occurring with the Talkeetna formation in the Horn Mountains area of south-central Alaska are of commercial grade. The properties of the mordenite with regard to commercial requirements need further study.

The zeolites in the area were formed by burial diagenesis and regional metamorphism of lava and volcanic detritus deposited in a eugeosynclinal trough. Heulandite and laumontite zones suggest that the sediments were subjected to a maximum temperature near 200°C at water pressures from 0.5 to 3 kilobars, which corresponds to burial depths of 1 to 10 kilometers.

The occurrence of mordenite within the heulandite zone is probably due to the fine-grained nature of the parent tuffs, which caused a higher silica activity than elsewhere in this zone, thereby producing mordenite.

Analcime, which occurs locally within the mordenite zone, may have been formed from mordenite or heulandite tuffs by the action of solutions that were more alkaline locally than elsewhere in the zone.

The field test by Culfaz and others (1973) gives reliable results and should find use in zeolite prospecting.

Special report 11, "Commercial-grade mordenite deposits of the Horn Mountains, south-central Alaska," by D.B. Hawkins (11 p., 1 pl.). $1.00.

The Horn Mountains, in south-central Alaska, have zeolitized tuff beds 14 kilometers long and at least 30 meters thick and that consist of 50 percent mordenite. This mordenite tuff is of commercial grade and shows promise as a sulfur-dioxide sorbent.

Both the individual tuff beds and the entire tuff unit are graded. The double grading implies that the tuff was formed by a large undersea volcanic (dacitic?) explosion.

Mordenite and other zeolites such as heulandite, laumontite, and analcime, which occur in other rock units of the area, were formed by chemical reactions controlled by the composition and permeability of the parent material and the composition of pore water. During zeolite formation the volcanic pile was subjected to fluid pressures of 0.5 to 3 kilobars and temperatures *less than 200^{o}C.*

Special report 13, "Mineral occurrences near Cantwell, Alaska," by R.G. Hickman and Campbell Craddock (7 p.). $1.00.

Regional geologic mapping, conducted as part of a continuing investigation of the Denali Fault system, has revealed several small areas of mineralization in the central Alaska Range near Cantwell, Alaska. These occurrences are not known to have been previously reported.

Special report 14, "Mineral occurrences in the upper Wood River, Edgar Creek, and West Fork Glacier area, central Alaska Range," by K.W. Sherwood, Campbell Craddock, and T.E. Smith (13 p.). $1.00

Geologic mapping and geochemical sampling in the central Alaska Range have identified several mineralized areas near the headwaters of the Wood River, Edgar Creek, and at the head of the West Fork Glacier. Geochemical samples collected from these sites contain significant concentrations of copper, silver, and gold. Metalliferous zones include: (1) all rocks adjacent to gabbro sills and granodiorite plutons, (2) the interior of gabbro sills, and (3) subsidiary fracture zones related to the Hines Creek Fault. This report provides locations and a general description of these mineral occurrences as well as elemental analyses of selected samples.

Also available to the reader is a reprint from Transactions of the Society of Mining Engineers, "Reclaiming mined lands in Alaska," by Cleland N. Conwell, DGGS mining engineer. It is free.

The following open-file reports may be inspected at any DGGS office and purchased at Petroleum Publications, Inc., 409 W. Northern Lights Blvd., Anchorage, AK 99503.

AOF-98, "Progress report: Geology and mineral deposits of the Kantishna Hills, Alaska," by T.K. Bundtzen and T.E. Smith (80 p., 2 pl.). $30.90 postpaid, $29.45 over the counter.

AOF-100, "Regional gravity survey of Beluga and adjacent area, Cook Inlet region, south-central Alaska," by S.W. Hackett (38 p.). $12.50 postpaid, $12.00 over the counter.

AOF-102, "Contributions to clay mineralogy and petrology, Cook Inlet basin, Alaska," by D.M. Triplehorn (19 p.). $6.70 postpaid, $6.30 over the counter.

Rare Earth

(from Playboy, June 1976)

While a great deal of emphasis has been placed on conserving fossil fuels, our supplies of other essential materials have been diminishing. The U.S. Geological Survey released a 1975 report predicting that by the year 2000, the U.S. will be 100 percent dependent on foreign sources for 12 essential materials, most of them occurring in minerals. We now import 90 percent of our manganese, cobalt, chromium, titanium, niobium, strontium and sheet mica. Ninety-six percent of our aluminum ore comes from foreign sources and 100 percent of our tin has to be imported. Without tin there would be no "tin" cans (actually, tin-plate metal), solders, bearing alloys, bronze or brass. Ultimately, total "energy" independence appears to be impossible without the outlay of staggering (and unavailable) sums of money for mining and refining.

—FORUM—

The Bulletin occasionally prints viewpoints found in editorials and letters to the editor of various publications. Readers with differing opinions are urged to send their rebuttals to us. However, we ask that you keep them brief.—Ed. note.

The Impact Statement Boondoggle

(Editorial from Science magazine, May 7, 1976)

The demand for "impact statements" evaluating the environmental consequences of human activities in natural ecosystems seemed a natural outgrowth of the rise in ecological awareness of the 1960's. This idea, designed to protect our natural resources, has to some extent pacified the demands of ecologically concerned citizens. These citizens should have another look. Having seen the results of many of these impact studies, and evaluated proposals for second-generation studies, I believe that the idea has backfired.

Many politicians have been quick to grasp that the quickest way to silence critical "ecofreaks" is to allocate a small proportion of funds for any engineering project for ecological studies. Someone is inevitably available to receive these funds, conduct the studies regardless of how quickly results are demanded, write large, diffuse reports containing reams of uninterpreted and incomplete descriptive data, and in some cases, construct "predictive" models, irrespective of the quality of the data base. These reports have formed a "gray literature" so diffuse, so voluminous, and so limited in distribution that its conclusions and recommendations are never scrutinized by the scientific community at large. Often the author's only scientific credentials are an impressive title in a government agency, university, or consulting firm. This title, the mass of the report, the author's salary, and his dress and bearing often carry more weight with the commission or study board to whom the statement is presented than either his scientific competence or the validity of his scientific investigation. Indeed, many agencies have found it in their best interests to employ a "traveling circus" of "scientists" with credentials matching these requirements. As a result, impact statements seldom receive the hard scrutiny that follows the publication of scientific findings in a reputable scientific journal.

The advancement of the scientific method is also in jeopardy. First-rate natural scientists are finally learning to set and test hypotheses and to study mechanisms and processes that are important in natural systems, rather than simply to survey and catalog the systems. They are, however, usually not attracted to the undefined scientific problems, complex committee hierarchy, and unrealistic time constraints that are usually attached to impact studies. Instead, such studies are often done by scientists who cannot successfully compete for funding from traditional scientific sources. In general, their methods are ancient, descriptive "textbook" techniques, which do not reflect either the many scientific advances of the past decade or the problems unique to the study undertaken. The same tired old bag of tricks is applied to studies of every type, regardless of the type of impact anticipated. The type of data generated cannot usually be extrapolated from one ecosystem to another, because studies were not planned with that as a major objective. As a result, each new study begins with little or no logical background, and no master plan for studying environmental processes is emerging. How well a particular study is funded is a direct function of the value of the resource to be affected, with no consideration given to the amenability of the system to study or to the quality of science which might result. Enormous sums are therefore spent with little or no scientific return.

The continued application of such studies can have several effects, including increased prices for natural resources; a declining credibility for environmental science and scientists; a reduction in the overall quality of scientific personnel; and the degradation of our natural resources, not as the result of the direct activities of industry and government, but because of the ineffectual groping of environmental scientists.

If we are to protect both our resources and scientific integrity, environmental scientists must seek to put their studies on a scientifically credible basis—to see that problems, terms of reference, funding, time constraints, reports, and conclusions are all within a bona fide scientific framework.—*D. W. Schindler, Leader, Experimental Limnology Project, Freshwater Institute, 501 University Crescent, Winnipeg, Manitoba, Canada*

Our Gangue.....

By Frank Larson, DGGS editor

Notice anything missing out of your summer (besides the fact that Budweiser went on strike, that is)?....Have you by chance espied the slack look on your postman's jaw when he delivers mail nowadays? It is our fault. We deprived him of reading your Bulletin by taking the summer off. In fact, we decided to publish the Bulletin quarterly instead of bimonthly, as we used to. The mailman's current weltschmerz aside, we did this for several reasons: 1) To give you a larger repertoire of selections in the "DGGS New Documents Available" section; 2) to generate more money (through the sale of reports) for the state coffers; 3) to save state taxes in postage money; and 4) to save you tax money by using the U.S. Post Office 33 percent less....Now to the news: Lost River Mining is seeking a joint-venture partner or other financing to develop their fluorite-tin-tungsten property on the Seward Peninsula. Ore reserves at the site are estimated at 28.6 million tons grading 18 percent fluorite, plus tin and tungsten values. Estimated development of the project is more than $80 million....Union Oil of California has spudded the No. 1 Redoubt Bay in Cook Inlet. The well is being drilled by the Glomar Grand Isle drillship in 18-17N-13W. If successful, the well may lead to development of the Redoubt Bay field, discovered 6 years ago....Dresser Minerals is considering building a barite plant at Seward, 140 miles south of Anchorage. The facility would process raw barite shipped from Peru three or four times a year....Northgate Exploration is participating in a joint venture with Westfield Minerals and Anglo United to develop 195 claims in the Candle area of the Seward Peninsula. Some of the claims contain radiometric anomalies indicative of possible uranium occurrences....There could be another significant oil discovery on the North Slope. BP Alaska is widely rumored to have hit it big with a drilling east of Prudhoe Bay in the Lisburne Formation underneath the main Sadlerochit Formation....H.S. Dempsey, an attorney for AMAX, testified before the U.S. Senate Committee on Interior and Insular Affairs on the subject of land withdrawals for national park and refuge systems. He said the economy of this nation is based on minerals, that we must now import a substantial percentage of our minerals, and that we will need to import larger and larger percentages of minerals as time passes. He went on to ask the committee, "Will import mineral resources be unwittingly be locked up, with the possible result of forcing this country to rely more heavily upon foreign sources of supply, or will the objectives of the Mining and Mineral Policy Act be left attainable by employing, to the maximum extent practible, the multiple-use concept of administration?"....Doyon Ltd., the Fairbanks-based Native corporation who will become the world's largest holder of private land when the Native Claims Settlement Act is implemented, is not locking up any of its possible minerals. It is engaged in exploratory work with Asarco on an asbestos deposit near Eagle, about 60 miles west of the big Cassiar asbestos mine in the Yukon Territory. Doyon is also looking for uranium and fissionable materials on a half-million-acre tract in western Alaska, and is drilling an exploratory oil well in the Kandik basin....In closing, I ask your opinion: Don't you really think that, instead of choosing "Great Land, Great Beer," as their slogan, the new Anchorage brewery would have chosen something with a little more color, a little more body to it?—Like my entry, for instance "The Brew That's Worth Your Family Nuggets")?..Cheers.

Metals Market

	Aug. 23, 1976	Three Months Ago	Year Ago
Antimony ore, stu equivalent			
European ore	$ 22.75-24.25	$ 21.50-23.00	$ 33.5-34.5
Barite (drilling mud grade			
per ton)	$ 17-28	$ 17-28	$ 17.00-21.00
Beryllium ore, stu	$ 40-42	$ 40-42	$ 30.00
Chrome ore per long ton (Transvaal)	$ 38-46	$ 36-42	$ 47.00
Copper per lb. (MW-prod.)	$ 0.75	$ 0.70	$ 0.866
Gold per oz.	$109.35	$128.40	$156.30
Lead per lb.	$ 0.25	$ 0.22	$ 0.245
Mercury per 76-lb. flask	$108-112	$132.00	$285.00
Molybdenum conc. per lb.	$ 2.90	$ 2.90	$ 2.05
Nickel per lb. (cathode)	$ 2.20	$ 2.20	$ 1.85
Platinum per oz.	$170-190	$161.00	$180.00-185.00
Silver, New York, per oz.	$ 4.31	$ 4.46	$ 4.10
Tin per lb.	$ 4.05	$ 3.61	$ 4.32
Titanium ore per ton (Ilmenite)	$ 55.00	$ 55.00	$ 55.00
Tungsten per unit (GSA domestic)	$100.98	$ 86.00	$ 98.77
Zinc per lb.	$ 0.39	$ 0.37	$ 0.378

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