

STATE OF ALASKA

Department of Natural Resources

Division of Geological & Geophysical Surveys

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ALASKA MINES & GEOLOGY

Vol. XXXI

October 1982

No. 4

Published Quarterly

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DGGS winds up FY-82

Last June 30, in the midst of the field season, Fiscal Year 1982 quietly came to a close. Many of the DGGS projects, described below, continue into FY-83.

WATER RESOURCES

During FY-82 the Water Resources section operated programs in the three classic subdisciplines of hydrology: surface water, ground water, and water quality. The section also operated a special navigability unit to aid the state in its claims on the land beneath navigable waters.

DGGS and the USGS coordinated their water-resource investigations under the Alaska Water Resources Evaluation (AWARE) program; a 5-year plan to guide water resources activities has been developed.

Surface water

In FY-82 DGGS, in cooperation with the USGS, the UA Institute of

Water Resources, the U.S. Soil Conservation Service, and the UA Geophysical Institute, monitored 19 stream-gaging stations, monitored peak flow and low flow of streams and lakes in the Matanuska-Susitna and the Kenai areas; conducted studies of flood hazards near Mt. Spurr, on the Nushagak and Wood Rivers, and at Lake George; investigated the Knik Glacier movement, conducted a hydrological study in the Chilkat River - Klehini River system; completed an afeis mapping project; examined upper Kuskokwim River tributaries; maintained wind-monitoring stations in the agricultural areas of Point MacKenzie, Nenana, and Delta; and conducted snow surveys in the Beluga region.

Ground water

Ground-water projects included a study of the Eagle River aquifer system, a geophysical investigation of ground-water potential at the new McGrath city site, and geophysical logging of exploratory boreholes in the Beluga coal area. Drilling was

contracted out both in the Eagle River area and the Chilkat bald-eagle study area near Haines. Other direct support was provided for a UA Institute of Water Resources evaluation of the Ester Dome (Fairbanks) area and a fracture-trace aquifer study of the Fairbanks upland area. Cooperative programs with the USGS included a ground-water inventory and compilation of data from water-well logs. In a February interagency planning session in Anchorage, guest speakers from the National Water Well Association addressed ways of improving the relationship between Alaskan well drillers and governmental agencies, primarily DGGs.

Water quality

Primary production and eutrophication of large and small lakes in the Matanuska-Susitna area and the monitoring of water quality of streams and lakes in the Beluga coal area were the prime FY-82 projects. A placer-mining conference with the USGS and the Alaska Departments of Environmental Conservation and Fish and Game was also held.

Navigability

Hydrologists provided support data for defense of the state's submerged-lands selections by investigating the Nushagak, Tanana, and Gulkana Rivers and lakes near Northway, Bettles, and Iliamna. (W.E. Long, section chief).

ARCHAEOLOGY

The Archaeology section, recently transferred to DGGs from the DNR Division of Parks, has responsibility for locating and assessing the significance of archaeological sites. DGGs also investigates areas of imminent road and building construction to glean all possible information available on our links with the past.

Fieldwork in FY-82 focused on the Matanuska Valley, the Kenai Peninsula, and northern Bristol Bay. (R.D. Shaw, section chief.)

COAL INVESTIGATIONS

In June, DGGs examined coal deposits in the Kobuk River region near Kiana and at several sites on the Seward Peninsula.

Under contract with Denali Drilling, the coal deposit at Chicago Creek on northern Seward Peninsula was core drilled; coal reserves and mineability are being estimated from the results. Further drilling and geophysical exploration of deposits near the Sinuk River west of Nome, at Grouse Creek, Koyuk, and Elim in eastern Seward Peninsula, and at Unalakleet are planned for late fall and early winter.

Under contract with Dan Renshaw, auger drilling on Saint Lawrence Island indicated the area west of Niyrakpak Lagoon lacks the extensive deposit of coal suggested by the coal exposures in the bluff along the lagoon's west shore. Exploration will continue next summer on the eastern half of the island.

Jim Callahan and his staff at U.S. Minerals Management Service---on loan to DGGs to conduct the coal study in the Cape Beaufort area---located 21 drill sites for next summer between the coast and the Kukpowruk River. The program will verify and trace the island coals westward to the coast.

DGGs completed fieldwork in the Nenana Field. The end product will be the second in a series of coal atlases on the major coal fields of the state; the first, on the Susitna Lowland, is in preparation. (G.R. Eakins, section chief.)

OIL & GAS

The DNR held two lease sales in FY-82. Sale 32, held August 25, 1981 in Anchorage, offered acreage on the

Kenai Peninsula and in Cook Inlet. The terms of this sale were fixed cash bonus and variable royalty. The total fixed cash bonus for sale 32 was \$1,524,282. The sale consisted of 78 tracts totaling 202,000 acres.

Sale 36, held May 26th in Fairbanks, offered 56,862 acres on the North Slope. About 18,500 acres of submerged lands and uplands were offered in the Flaxman Island-Canning River areas, and 41,500 acres were offered in the vicinity of the Midway Islands. The leasing system included a fixed royalty of 12.5 percent and a fixed net-profit share percentage of 40 percent, with cash-bonus bidding to determine ownership. Total cash bonus was \$32,583,451.

The section also completed the geological and geophysical tract analysis for FY-83 sales 37, the middle Tanana and Copper River basins, and 37A, Chakok River Exempt.

Analysis for sale 34, Prudhoe Bay Uplands, scheduled for September 1982, has been completed and presented to DNR Commissioner John Katz for selection of bid items. Sale 38, Norton Basin, was canceled.

Evaluation for sale 39, Beaufort Sea, is in the preliminary stages. This major sale consists of submerged upland acreage in the Colville Delta-eastern Harrison Bay area.

FY-82 field projects associated with future oil and gas lease sales are:

.Depositional faces, petrography, and hydrocarbon potential of the Colville group, Sagavanirktok Quadrangle. Upper Cretaceous rocks of the Colville Group crop out along an east-west belt within the Sagavanirktok Quadrangle. DNR has proposed a number of oil and gas lease sales in the area, which has hydrocarbon potential. This project will help the state evaluate future North Slope lease areas.

.Killik River-Chandler Lake AMRAP joint state-federal (USGS) project. The major objective is to appraise the hydrocarbon potential of a large tract of Arctic Slope lands east of the National Petroleum Reserve and west of the Arctic National Wildlife Range.

.Alaska Peninsula Cretaceous and Tertiary field studies (joint project with U.S. Minerals Management Service). The deposition, source rocks, and reservoir potential of selected formations of the Alaska Peninsula will be examined for sale 41, Bristol Bay Uplands. Fieldwork was completed this summer and results will be published in 1983.

.Surface materials of the Susitna River valley. Surficial studies were conducted in areas where oil and gas production may occur. A series of 1:250,000-scale maps will show distribution and type of construction materials available in the Susitna River valley.

.Gravity-base-station network. This project is designed to update and maintain a network of gravity base stations in south-central Alaska.

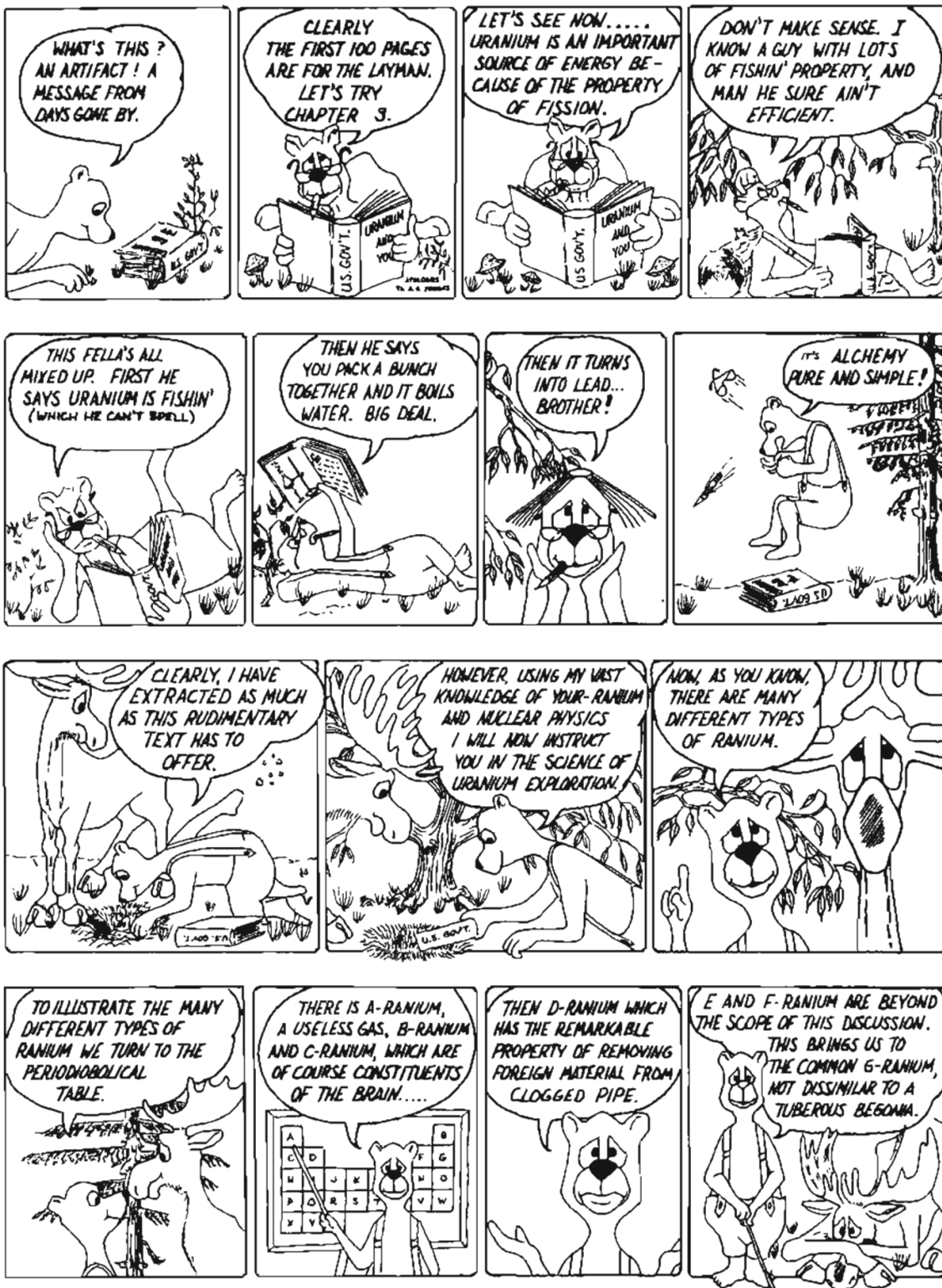
.Minchumina gravity project. Fieldwork was completed in FY-81. A report will be published prior to the Minchumina lease sale.

.Regional study, Kuparuk oil field, North Slope. Because this is a new oil field, continuous updating is required as new wells are drilled. Maps will be produced that will allow DNR to better understand the lateral and vertical distribution of the sand bodies.

.Data analysis. Programming for oil and gas-related projects will

BOGS

*An Artifact From The Past, or
You Three Owe Eight*



continue. New equipment---a second digitizing table, additional tape drives and terminals---will be added in FY-83. (D.L. McGee, section chief.)

ASSAY LAB

During the past 3 years, DGGs analytical facilities have undergone a marked expansion. This evolution, due largely to the purchase of modern analytical equipment, enables DGGs to use a wider variety of instrumentation to complete mineral analyses in a shorter period of time.

For example, during the 5 years prior to 1979 the average submitted sample was analyzed for copper, lead, zinc, molybdenum, antimony, gold, and silver, but it took an average of 4 months to do it and return it to the miner. Now, the average sample is analyzed for those elements plus calcium, cobalt, nickel, chromium, iron, manganese, and arsenic---normally within 10 working days of submittal.

Several other economically important elements---tin, tungsten, mercury, and platinum---are not yet analyzed routinely; they take considerably longer to complete. The Assay Laboratory can also identify unknown minerals by X-ray diffraction.

The lab ran 30,000 analyses during the fiscal year. (M.A. Wiltse, section chief.)

GEOHERMAL INVESTIGATIONS

In FY-82, the Geothermal section published an open-file report (no. 144) on the geothermal assessment of over 20 thermal-spring sites on the Alaska Peninsula and Aleutian Islands. The section completed reconnaissance field investigations and geochemical and isotopic analyses of thermal-spring waters and gases in both interior and southeastern Alaska (more than 35 sites). Site-specific work concentrated on the Makushin Volcano geothermal area (Unalaska Island) and on

Akutan hot springs (Akutan Island); reports on the geothermal potential of these areas are in preparation. Articles on the fluid geochemistry of the Akutan and Makushin geothermal areas will appear in vol. 6 of Geothermal Resources Council's 'Transactions,' 1982.

Geologic mapping and a gravity survey of Makushin Volcano were completed during the 1981 field season. A preliminary geologic map is scheduled for release in November.

In cooperation with the UA Geophysical Institute, the section completed a detailed geophysical and geochemical field study of mineral springs and mud volcanoes of the Copper River valley west of Mt. Drum. The DGGs Geothermal section has also established a geothermal-fluids laboratory for investigating and analyzing thermal waters, gases, and hydrothermal alteration.

Under the volcanic-atlas program, the section has now sampled fumaroles and thermal springs from over 15 volcanic centers. DGGs has so far identified at least 13 sites in the Aleutian arc that have potentially developable high-temperature (>150°C) resources. The Geothermal section is also involved in geothermal drilling programs on Makushin Volcano and at Pilgrim Springs on the Seward Peninsula; DGGs is conducting detailed geochemical and isotopic investigations of thermal fluids in both areas and is acting in an advisory capacity for the drilling projects. (C.R. Nichols, section chief.)

SOUTHERN BROOKS RANGE PROJECT

Geologic mapping of the Wiseman A-1, A-2, and A-3 Quadrangles began near Coldfoot and was completed early in the 1982 field season under a USGS-DGGs cooperative program. Geologic and geochemical surveys of the Chandalar C-5 and C-6 Quadrangles, started in late FY-82, were completed while working out of Dietrich Camp in early

August. A preliminary report on gold deposits of the Wiseman and Chandalar districts, reconnoitered during FY-82, was published (AOF-158).

SURFACE MATERIALS AND ENGINEERING GEOLOGY

Geologists Dick Reger, Randy Updike, and Rod Combellick continued work on the late Quaternary deposits and history of the upper Cook Inlet region. Progress was made toward correlating key sections, and several critical samples were collected for radiocarbon dating. A large sample of compressed Goose Bay peat was sent to the University of Washington for dating by radiocarbon enrichment; the peat represents a nonglacial interval between the Naptowne and Knik Glaciations and has previously been dated---at least five times---beyond 38,000 to 45,000 years B.P. The areal extent of the Bootlegger Cove Formation (formerly called the Bootlegger Cove Clay) was broadened considerably by surveys up Turnagain Arm and the Yentna River. A summary outlining the current status of the late Quaternary history of the upper Cook Inlet region is being prepared for inclusion in DGGs Guidebook No. 1, on the Richardson and Glenn Highways between Fairbanks and Anchorage.

Five weeks were spent in Prudhoe Bay. From Deadhorse, daily helicopter-supported traverses were made in western coastal and riverine areas of the Beechey Point Quadrangle to map surficial deposits. Over 100 stratigraphic sections in varied geologic units were measured, described, and sampled.

Peat resources in part of the Susitna valley and in a small area near Dillingham were assessed in early FY-82. DGGs also completed a literature-derived map of statewide peat resources. Two USGS open-file reports (81-1301 and 81-1302) and 16 DGGs open-file reports (AOF-150, -150A-M, -151, and -152) were published.

In addition, Reger and Kristin Kline began compiling data for a guidebook on permafrost in the Fairbanks area. (The guidebook will be one of a series of six on permafrost that will be published by DGGs next June.)

The flood-plain units, material resources, and hazards between Sleetmute and Kalskag on the Kuskokwim River were mapped at a 1:31,680 scale by airphotos and field checking. The project was initiated in response to local concern that apparent haphazard excavation of sand and gravel from the Kuskokwim River channel by the Alaska Department of Transportation and the U.S. Army Corps of Engineers was accelerating bank erosion. (Thousands of cubic yards of gravel are barged yearly to Bethel from a site between Kalskag and Aniak.) The field party found a) no evidence of accelerated erosion near the excavation site, b) a potential rock quarry across the river from the site, and c) an alluvial fan several miles upriver that has potential as an upland source for sand and gravel; the fan is adjacent to the river channel and contains coarser sand and gravel than the site now used.

DGGs continued its inventory of surficial materials, geomorphic processes, and Quaternary chronologies of the upper Kuskokwim River area. In the project, operated in cooperation with the nearby McGrath-Lime Hills project, key parts of the central McGrath Quadrangle were field checked by helicopter-supported traverses. Samples from several bluffs along major headward tributaries of the Kuskokwim River were collected for radiocarbon dating. Two open-file reports were published.

Part of the season was spent with a Washington State University team of archaeologists that is trying to correlate extinct or prehistoric physiographic settings and environments with the prehistoric activities of man in the region.

The avalanche paths of Thompson Pass, near Valdez, were mapped, as was the surficial geology in the Haines-Skagway area. (R.D. Reger, section chief.)



Ambler-district map highlights DGGGS publishing effort

DGGGS printed three geologic reports---including one on the highly mineralized Ambler district in the Brooks Range---a bibliography, and seven open-file reports during the quarter.

Geologic reports

Geologic Report 75, 'Bedrock geology of the Ambler district, southwestern Brooks Range, Alaska,' was prepared by M.W. Hitzman, T.E. Smith, and J.M. Proffett. "This report," said State Geologist Ross G. Schaff, "is a sterling example of the cooperation that is possible between government and industry." Schaff said that Anaconda Minerals Company gave its data to the state with the sole stipulation that DGGGS provide the cartography and the printing funds.

"The data that Anaconda gave us represents millions of dollars in fieldwork, logistics, and personnel," Schaff said. "We should grasp every such opportunity to increase the geologic knowledge of our state," he added.

Dave Heatwole, Alaska Exploration Manager for Anaconda Minerals, said, "Anaconda is pleased to be able to make this contribution to the geology of the state of Alaska. We hope the information will be useful to both government and industry geologists working in the Brooks Range."

Geologic Report 75 consists of two plates. The primary one is a multicolored 1:125,000-scale plate that delineates the bedrock geology in the southwestern Brooks Range. The various rock units shown on the map host world-class copper-lead-zinc-

silver deposits. The second plate is a compilation of supplemental data and includes tables, figures, geochemical information, and references. The report costs \$4.

Geologic Report 72, 'Geology of the Iditarod D-2 and eastern D-3 Quadrangles,' by T.K. Bundtzen and G.M. Laird, is the first in a series of maps on the central Kuskokwim Mountains, which includes the Ophir mining district. The report, which consists of a multicolored plate, scale 1:63,360, is the result of 2 years of fieldwork by the authors. Geologic Report 72 sells for \$2.

Geologic Report 74, 'Mineral preparation, Grant Gold Mine, Alaska,' is a short (15-page) treatise on laboratory tests in liberating gold from quartz veins in the Grant Mine, located about 15 miles northwest of Fairbanks. The report, written by former DGGGS mining engineer Cleland Conwell, has 10 figures (two in color) and 30 short tables. It costs \$2.

Bibliography

Special Report 30, 'Geological literature on the Copper River and middle Tanana River basins,' is a 21-page listing of selected documentation written on the general geology and petroleum potential of that part of Alaska. The booklet, compiled by K.S. Emmel and P.L. Coonrod, sells for \$1.

Open files

Three of the open-file reports published focus on the Fairbanks mining district. AOF-156, 'Photointerpretive map of the surficial geology of the northern Fairbanks D-1 and southern Livengood A-1 Quadrangles, Alaska,' by D.E. Lee, includes five plates. Four 1:24,000-scale maps show the extent and type of unconsolidated deposits in the two quadrangles; the fifth plate is an explanation. The report sells for \$5.

Destined to be one of the more

popular open-file reports published this quarter is AOF-170, 'Bedrock geologic map of the Fairbanks mining district,' by R.B. Forbes and F.R. Weber. This work, one of the initial parts of the DGGs study of the Fairbanks district, is a compilation of work done by Forbes, Weber, and other geologists over the past 20 years or so. Included on the two 1:63,360-scale maps are previously unpublished material and data from several theses. The report sells for \$2.

AOF-171, 'Evaluation of geophysical methods in the Fairbanks mining district,' is just that---a survey run across five mineral deposits during the 1980 field season to test the effectiveness of various geophysical exploration techniques. Author Gene Wescott ran classical geophysical profiles with gravimeters, electromagnetic systems, seismicity, magnetometers, and time-induced polarization methods. The results of his findings are included in the 24-page AOF-171, which sells for \$1.

The other open-files pertain to the southern Brooks Range, the Skagway area, and the Aleutian chain. AOF-158, 'Source of lode- and placer-gold deposits of the Chandalar and upper Koyukuk districts, Alaska,' by J.T. Dillon, discusses the spatial and geochemical relationship between the lodes and placers and introduces hypotheses regarding the ultimate source of the gold present. The 22-page report includes a 1:250,000-scale plate that shows the distribution and characteristics of the gold deposits. AOF-158 sells for \$2.

Two open-file reports are available on the Skagway area. AOF-159, 'Photointerpretive map of the surficial geology of the Skagway B-1 Quadrangle,' by G.D. March, is a 1:63,360-scale blackline plate that sells for \$1. AOF-161, which also costs \$1, covers the Skagway B-2 Quadrangle.

AOF-163, 'Hydrothermal resources of the northern part of Unalaska Island, Alaska,' by J.W. Reeder, is a

17-page report discussing, among other things, the hydrothermal resource potential of previously unreported active fumaroles and hot springs located in the Makushin Volcano region. It also sells for \$1.



DGGs adds Los Alamos data to its geochemical 'library'

DGGs has added about 2.5 million chemical analyses from 60,000 sample sites to its data base. The data, distributed over 103 of Alaska's 153 quadrangles, were obtained from the Los Alamos National Laboratories in New Mexico as a result of a bill introduced during the 1981 Legislative Session by Sen. Bettye Fahrenkamp.

Sample density averages 600 samples per 1:250,000-scale quadrangle. "The data set is unique," said State Geologist Ross G. Schaff, "because sample distribution is truly random. This offers great potential for significant geochemical statistical modeling despite the open sample spacing."

Schaff added, "These data contain information about the Alaska distribution of not only the many strategic elements that are projected to be in great demand in the near future, but of several rare-earth elements of increasing importance in the electronics industry."

Software

The data base has several forms:

a) Hard-copy listing of the data for each sample point arranged by numerical order of sample site and grouped by quadrangle. Sample sites are identified on mylar overlays matching standard 1:250,000-scale sheets.

b) Copies of the original computer data tapes will be made available at the cost of the tape and reproduction in either the above printout, or in 'string' format, which is better configured for automated data processing.

c) Computer models of the data in map format showing areas of anomalously high concentrations of specific elements.

The hard-copy listing is available for inspection at the DGGs Assay Lab in Room 205 of the O'Neill Building on the Fairbanks UA campus. The other two data forms will be arriving soon, according to Assay Lab chief Milton Wiltse.

Because of the many elements included in the newly acquired data, widespread interest in the analyses is expected. Information on more than 40 elements, including precious metals, base metals, and strategic minerals, are represented. They are: Ag, Bi, Cd, Cu, Nb, Ni, Pb, Sn, W, Be, Li, Mg, Mn, Na, Rb, Sb, Sc, Sm, Sr, Ta, Tb, Th, Ti, V, Yb, Zn, Al, Au, Ba, Ca, Ce, Cl, Co, Cr, Cs, Dy, Eu, Fe, Hf, K, La, Lu, and U.

Hardware

DGGs will also install a data-processing system designed to integrate the Los Alamos data with existing geologic and geophysical information to delineate broad regions with anomalously high concentrations of specific elements. The hardware was also funded by Sen. Fahrenkamp's bill.



New claims drop sharply from last year

The number of new mining claims filed in the third quarter of 1982 dropped slightly compared to last quarter, from 4,679 to 3,672, but showed a marked decrease compared to figures for the same period just a year ago. Last year at this time 8,484 claims were recorded.

The continued decrease in mining activity reflects the depressed world minerals market and in general the low level of the economy, according to mining-information specialist Dan Wietchy.

Mining activities this past quarter centered in the Fairbanks, Nulato,

and Mt. McKinley mining districts.

The claims by recording district follow:

	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>
Fairbanks	288	262	316
Manley Hot Spr.	35	10	12
Nulato	458	189	14
Mt. McKinley	360	13	2
Ft. Gibbon	1	0	0
Talkeetna	10	26	169
Palmer	52	31	72
Nome	0	157	111
Seward	56	13	44
Juneau	30	8	101
Ketchikan	0	1	8
Sitka	6	0	0
Anchorage	37	0	89
Cordova	108	4	4
Chitina	23	0	6
Valdez	1	0	0
Kuskokwim	95	168	91
Glennallen	0	0	42
Barrow	55	0	0
Nenana	19	17	25
Petersburg	0	1	0
Skagway	0	0	10
Rampart	0	0	15
Haines	0	0	13
	<u>1634</u>	<u>900</u>	<u>1138</u>



Four new faces at DGGs

DGGs has four new employees, one in Fairbanks and three in Anchorage.

Joining the mining-information section in Fairbanks is drafting technician Fred Sturmann, a newcomer to the U.S. Sturmann immigrated to Alaska in March 1981 from Austria, where he worked for the Division of Mining History at the University Museum of Graz; his job was to find, explore, and map old mines, many of which are in natural caves. Fred, who enjoys mountain climbing, is researching and plotting mining-claim locations on 1:250,000-scale overlays.

Recently hired in Anchorage is M. Scott Christy, special assistant to the state geologist. Christy has a B.S. degree in field biology and earth science from Central Michigan Univer-

sity, an M.A. from the University of Missouri, and a Ph.D. in geomorphology from the University of Maryland. Scott, whose hobbies include photography and gardening, first came to Alaska in 1976.

Also new to the Anchorage office are Norman Crosby and Tom N. Smith. Crosby works for the computer section as a data processing manager. He is a graduate of Colorado University and has lived in Alaska since 1977. Norm is building a wilderness retreat near Talkeetna.

Smith, formerly with Union Oil and the Minerals Management Service, works in the petroleum-resources section. A native of Oregon, Smith received his B.A. and M.A. degrees in geology from Oregon State University. Tom has lived in Alaska since 1974. He is not to be confused with another DGGs geologist named Tom Smith (middle initial E), who works in the Fairbanks office.

Gail March, DGGs Fairbanks geologist, gave birth to an 8-lb, 13-oz girl on the 53rd anniversary of Black Tuesday. Jennifer is the March's first child.

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DGGs participates in conferences

DGGs staffers took part in two recent conferences, the 29th Pacific Northwest Meeting of the American Geophysical Union and the 33rd Alaska Science Conference.

Six DGGs staff members and two former employees participated in the two events, which were held in conjunction Sept. 15-18 at Alaskaland in Fairbanks. In addition, DGGs's John Davies chaired the AGU Seismology session.

Cyclic fluctuations in heat flow from the North Crater, Mt. Wrangell
(By R.J. Motyka and C.S. Benson)

Beginning in 1966 thermal activity increased dramatically in the North Crater, one of three craters

situated on the rim of Mt. Wrangell's summit caldera. Since 1966 heat flow in ice-covered areas of the crater has followed a cyclic pattern of activity with peaks occurring in 1968, 1974, and 1980. These peaks have been followed by a four-year decline in heat flow, but the energy released during the peak periods has successively increased. Thus, there seems to be a long-term trend of increasing heat flow. Since 1980 heat flow in the North Crater has continued increasing rather than declining.

An island-arc gabbroic complex in southern Alaska

(By L.E. Burns, G.H. Pessel, and N. Sleep)

Geologic mapping and geophysical anomalies indicate the presence of a narrow, elongate (1,000-km) belt of gabbroic and ultramafic rocks in southern Alaska. Although the rocks are bounded by a major suture zone, the Border Ranges fault, and superficially appear to resemble an ophiolite, petrologic and compositional data clearly indicate that these rocks were not formed as a mid-ocean ridge or back-arc basin.

Comparison with data from the Marianas and Aleutian arcs suggest that the Nelchina gabbroic complex, the largest exposure in the belt, represents part of the basal accumulation of an island arc. The existence of this nonophiolitic belt of rocks has important implications for the formation of southern Alaska.

The petrology, geochemistry and isotope geochronology of the Gilmore Dome and Petro Dome plutons, Fairbanks district
(By J.D. Blum)

Intrusive rocks in the Fairbanks district occur mainly as northeast-trending bodies that range from granodiorite to quartz monzonite. The rocks appear to be primarily derived

from remelted Precambrian crustal rocks. Petrologic considerations limit models for the origin of tungsten and gold mineralization located near the intrusive contacts.

Igneous petrology and geochemistry
of northern Akutan Island
(By J.D. Romick)

Lavas on Akutan Island, located in the eastern Aleutian Arc, are tholeiitic. Two petrologic grounds are recognized: olivine-clinopyroxene basalts from western Akutan Island and clinopyroxene-orthopyroxene andesites exposed elsewhere on the island. K-Ar whole-rock dates indicate that lava flows from both groups erupted between 1.4 and 1.1 million years ago. The two lava types may be the result of shallow-level fractionation and subsequent eruption from different levels of a zoned magma chamber.

Upper Cretaceous-Lower Tertiary
volcanic rocks near Farewell
(By D.N. Solie, T.K. Bundtzen,
and W.G. Gilbert)

Upper Cretaceous to Lower Tertiary volcanic rocks occur on the north side of the southern Alaska Range near Farewell, in interior Alaska. Recent DGGs mapping reveals igneous complexes at Veleska Lake, Sheep Creek, and Windy Fork. They are composed predominantly of intermediate flows and dikes, tuffs of intermediate to felsic composition, and subordinate basaltic flows and dikes that collectively cover an area of 50 km. The volcanic and hypabyssal rocks intrude and overlie a thick section of highly folded Paleozoic sedimentary and low-grade metamorphic rocks.

Numerous structurally controlled dikes that cut the Paleozoic section trend northeast near Windy Fork and northwest near Veleska Lake. The magnesium-iron-alkali plot (AFM diagram) and the wide range in chemical composition demonstrate a calc-alkaline trend for the volcanic suites.

1981 gold production increases 80% in state
(from Fairbanks Daily News-Miner, Sept. 7, 1982)

Gold production in Alaska grew by 80 percent last year and the state produced 12 percent of the nation's gold, the state Office of Mineral Development reports.

An annual report made public by the state office also said mining companies continue to spend large amounts of money on mineral exploration in Alaska, with the Fairbanks area and the eastern Interior receiving most of the attention.

DGGs input

The report on last year's season, 'Review of Alaska's Mineral Resources,' was written by T.K. Bundtzen, G.R. Eakins, and C.N. Conwell of the state Division of Geological and Geophysical Surveys. The report was assembled from questionnaires sent to mining companies last year.

Charles Green, at the Office of Minerals Development, said a similar questionnaire will be sent out at the end of the mining and exploration season this year.

He said the exploration activity this summer is expected to be comparable to 1981. Some companies have pulled out of Alaska, Green explained, but others are "still going with some big programs."

Production up 19 percent

The total value of 1981 mineral production in Alaska was more than \$180 million, an increase of about 19 percent from 1980, the report said.

"The dramatic growth in gold production was responsible for most of this increase," the report states. "At least 134,000 ounces of gold were recovered from several hundred small and a few medium-size placer and lode gold operations throughout the state."

Fairbanks and the eastern Interior accounted for half the major gold

mining operations and half the gold production in Alaska, according to the report.

"Exploration and development expenditures during 1981 remained at the high levels established during the last 6 years, amounting to over \$75 million," the report added.

Gold buyers and refiners who deal with placer miners report activity this year in the Interior is about the same as last summer, with miners beginning to bring in gold for sale now that prices have jumped.

Without breaking down the confidential information of individual companies, the authors said 31 exploration companies spent more than a half-million dollars each, four spent more than \$5 million each, and two spent more than \$10 million each.

Exploration also up

The heaviest exploration activity was in the eastern Interior, where \$21,662,868 was spent and 552 people were employed.

The eastern Interior took over first spot last year in exploration efforts because of increased gold and silver prospecting, important mineral discoveries and the region's proximity to transportation, labor, and supply sources, the authors said.

Union Carbide, Phillips Minerals, Resource Associates of Alaska, Anaconda Minerals, Patino, WGM Inc., and Northern Lights Exploration spent an estimated \$5.4 million exploring for base metals (copper, lead, and zinc) in the eastern Interior, the report said. Most of this effort was on the north side of the Alaska Range and in the Yukon-Tanana uplands of the Forty-mile River country.

"Although Delta is a very promising district, no formal announcements have been made," the report said. "One consultant suggested that several prospects could commence development by 1986."

Several companies also are look-

ing at recent discoveries of copper, lead, zinc, tin, and tungsten in the Healy area, east of the Usibelli coal mine.

Gold is drawing hard-rock exploration efforts by Resource Associates of Alaska, St. Joe Minerals, Placid Oil, Houston International Minerals, and Getty Oil in the Fairbanks and Tanana River areas, the report said.

"Since 1979, St. Joe American has completed trenching, sampling, and 10,000 ft of diamond drilling on the Ryan Lode on Ester Dome," the report said. "Past reserve estimates suggest that about 2 million tons of gold ore may exist on site, and St. Joe's efforts have confirmed the presence of a large reserve of undisclosed grade."

"Poor ground hampered underground bulk sampling efforts in 1981, and a 500-ft decline (tunnel) was abandoned," the report added.



DGGS Anchorage office to move, but gets new mailing address first

The DGGS Anchorage office obtained a mail pouch a couple of months ago in anticipation of its pending office move.

"Although we are still located at 3001 Porcupine Drive, we anticipate moving to a new office sometime toward the end of November," said State Geologist Ross G. Schaff. He continued, "To ease the transition, we thought it would be advantageous to begin having mail sent to a post-office pouch."

The Anchorage staff will begin moving to its new quarters in the Frontier Building, located at 3601 C Street, around December 1.



One exploration-company president to another: "Let them eat yellowcake."

"Howard Cosell wrote in his autobiography that his father 'never recovered from his disappointment at my decision to abandon the law'---a sentiment widely shared by his viewers." --Inside Sports, Jan. 1982.

Mineral-deposit runoff said harmful to fish
(from Fairbanks Daily News-Miner, Sept. 17, 1982)

Even if the geologists didn't know there was a giant mineral deposit on Red Dog Creek, the fish certainly know.

Jonathan Houghton of Dames and Moore told the Alaska Science Conference Thursday that natural runoff of minerals from the deposit is killing Arctic char and grayling in Red Dog Creek and another tributary of the Wulik River in northwest Alaska, about 100 miles north of Kotzebue.

Metals show up in tissue of the fish, Houghton said, and in the water itself.

The result, he said, is a very interesting dilemma for how the effects of mining are assessed and regulated. There was some joking after Houghton's talk that the mining would be the key to reducing water pollution.

The study revolved around the area in which a large deposit of lead, zinc, and silver has been discovered on land owned by NANA Regional Corp., the Kotzebue-based Native regional corporation.

NANA and its principal operator, Cominco American, recently announced that they have located in-place reserves of 85 million tons of ore, which would be worth \$11 billion to \$15 billion.

The research by Houghton's firm and Lawrence Peterson of Fairbanks shows that Red Dog Creek is generally free of minerals upstream from the ore deposit, but shows concentrations of metals at toxic levels at and below the deposit.

Referring to one tributary creek, Houghton said, "It has a pH of 2.9 and it tingles when you drink it."

The pH scale is a 14-point measure of acidity or alkalinity of water, with 7 being a neutral solution and acid solutions being stronger as the pH goes toward zero.

Houghton stressed that no mining

has been done at Red Dog. The ore body has been defined by drilling only, and the runoff is a natural feature.

The Arctic char in the area is "of major importance as a subsistence fishery" for residents of Naotak and Kivalina, Houghton said, and the part of the Wulik River affected by the runoff is an important fishing site.

The fish show no indication to avoid the area, he said. "Natural fish kills of grayling and Arctic char are fairly common in the Red Dog area."

Some fish show that they have developed a tolerance, however. "We found grayling in areas where the water had what we consider toxic levels," he said.

The finding poses some interesting questions about how the government will monitor any future mining operation, Houghton said.

"How do you establish water quality standards for a development when you have natural fish kills existing?" he asked. "What water quality standards do you establish for this creek?"

"There are lots of interesting regulatory problems remaining in this area," he said.



Water still muddy in settling ponds
(from Fairbanks Daily News-Miner, Aug. 14, 1982)

Settling ponds help in reducing water pollution from placer mines, a state study shows, but they don't always work well enough to meet all state and federal water quality standards.

Only one of 16 mines sampled last year met all of the state water-quality standards in every sample.

In nine mines that had settling ponds, an average of 79 percent of the suspended solids were removed by the ponds. However, the standards for turbidity and arsenic were still not met in eight of them.

The study was conducted by R&M Consultants last summer under a con-

tract to the state Department of Environmental Conservation.

It was intended to evaluate the effectiveness of settling ponds in helping miners meet state and federal water-quality regulations and to find out what factors affected the quality of water discharge.

The study is intended to point out which direction DEC officials should go in evaluating their own regulations and finding ways miners can reduce water pollution.

The contractor built a test settling pond downstream from a mine on Porcupine Creek, and took water samples from 15 other mines.

"The effluent from placer mine sites typically does not meet all state and federal water-quality standards," the study said.

Tests were made on the state standards for temperature, dissolved oxygen, acidity, and the various tests for solid materials clouding the water. In addition, laboratory tests were conducted with material from a mine to show what is possible under the best conditions.

"The settling pond had little apparent effect on the concentration of dissolved oxygen, temperature or the pH (acidity) of the process water of the mine," the report said. "While arsenic standards were not met by the pond effluent, it appears that if the suspended sediment could be removed from the mining wastewater the major portion of arsenic introduced by the mining operation would be removed also."

The state had three standards for testing the muddy water from placer mines that commonly generate complaints from recreational users of rivers.

'Settleable solids' are tested by letting a certain volume of water stand for 1 hour and measuring the amount of sediment that accumulates at the bottom of the vessel during that time. "The pond was generally effective in limiting settleable solids to state standards of 0.2 milliliters per

liter above natural conditions, with 56 of 89 measurements meeting this standard," the report said.

State standards for settleable solids were met 63 percent of the time in the test. None of the mines without settling ponds met this standard, however.

Another test for total suspended solids weighs the amount of material collected on a filter after a mine sample is passed through it.

The state turbidity standards were hardest to meet. That test measures the light reflected at a 90-degree angle when it is shined through a sample, and the regulations allow a certain increase above natural conditions measured at the time. All but one mine failed the turbidity test.

A few tests were also taken for arsenic, which is found in association with gold and released into water by mining operations.

"The standards for turbidity and arsenic were almost never met and the standard for settleable solids was only met about half the time," the study said. ". . . It was shown that mining operations having settling ponds released higher quality water than operations without ponds," the study concluded.



Our Gangue....

By Frank Larson, editor

The DGGs Anchorage office has a new mailing address (see p. 12). Around Thanksgiving, it will have a new fanny-parking address to go with it. The old building on Porcupine Drive, you see, is being reclaimed by the Oil & Gas Conservation Commission, who loaned us, in 1970 or so, an office. Welllll, DGGs grew a bit ('metastabilized' might be a more appropriate term) and we---now 50 or so strong---ended up overstaying our welcome...To make a long story short, a passel of DGGsers and other DNR types are now packing to move into a new building at 36th & C Sts....(Had we been able to move a little farther south, we could

have moved into the Shrine of Rabbit Creek, the beloved Our Lady of the Prinz Brau Brewery---but that's another story, as Jack Lemmon used to say)Anyhow, in mid-November, the move to the Frontier Bldg---that fancy, smoked-glass monolith (also known as the 'Le Spam Bldg')---begins. And with the move comes the usual office politics. There will be bickering ("But you had the desk near the window LAST decade") and jockeying for position ("Well, it should be ME who gets the office next to the boss") and reality ("Damn. Next to the restroom again."). Also, there will be the usual discoveries. ("So that's where that sardine sandwich went. Do you think we can have it age dated?")... One old friend of mine, 'Beargrease' (so named for a youthful addiction to pomade); was the recipient of such a find. Back during the Pipeline construction era (Mid-Late Alyeskan), Beargrease had this elderly gent from an old, old Tennessee family working for him. And Good Ol' Everett had this old, old family recipe---a secret one---for his Good Ol' Barbecue Sauce. Oh, Ev would give out samples, all right, but never the recipe. Well, once the Pipeline was completed, Ev and his ilk headed south with their gotten gains. But in the resultant office move, guess what Beargrease found behind Ol' Everett's filing cabinet? Why, Ah swear, Jim Bob, it was the recipe for his secret sauce....Oh, where are you now, Ev, you secretive, sly old Snopesian? Somewheres' down South, back in the Land of Br'er Fox and (barbecued) Br'er Rabbit? Or up in that Great Cookout in the Sky? Well, no matter, Babe, 'cause you're about to start spinning in little circles....The cat, you see, is about to be let out of your venerated family bag....Here's the recipe for Ol' Everett's BBQ sauce: Combine 4 oz crushed red pepper, 4 oz coarse black pepper, 1/2 c. salt, 3 c. sugar, 8 oz tomato sauce, 8 oz catsup, 3 qt white vinegar, and 1 qt water. Boil, then sim-

mer for 1/2 hr. When cool, blend to distribute the 'sludge' before decanting. Use straight for marinating, mix with commercial BBQ sauce for thickening....Now, be aware that this is some wicked stuff. Some hints: a) Buy a six-pak of Visine before you start; b) Wear rubber gloves; c) Either have a heavy-duty industrial fan in your kitchen or brew up this stuff outside on a Coleman stove, preferably on the upwind side of a raging gale; d) Use a glass gallon jug to store it in (Old Ev's nitro eats up plastic ones for breakfast); and e) Don track shoes before taking internally. In the next issue we'll deal with the effects of Ev's BBQ Sauce on human tissue.... Noranda and its four partners plan on increasing their \$10M expenditure on their Greens Creek deposit by ninefold within the next 4 yr. They plan to have their lead-zinc-silver-gold-copper-deposit on Admiralty Island in production by '86. Once mine life has expired, Noranda will restore the 400-acre site to its natural state..Alaska Apollo Gold Mines Ltd has located, on Unga Island, near the Alaska Peninsula, gold and silver mineralization in three parallel veins. The veins are 3,500 ft from the main tunnel of its Apollo Mine and extend beyond the mineralized zone that was the basis of its claims (estimated at 2M tons of ore reserves)....On the home front, DGGs hydrologists will help the Municipality of Anchorage in its search to alleviate the ground-water shortage in the Eagle River area. The hydrologists, who are headquartered in that south-central vale, are studying the area's geology to recommend where the Municipality should turn its drilling contractors loose. (Bill Long's crew is getting more involved in this sort of thing; they are also helping in similar studies for the city gummints of Juneau and Fairbanks.) Postdrilling DGGs activities will include monitoring of water levels and measuring hydrologic properties with downhole nuclear probes.....Cheers.

Metals Market

	<u>Oct. 25, 1982</u>	<u>3 Months Ago (8/2/82)</u>	<u>1 Year Ago (10/30/81)</u>
Antimony metal per lb (NY dealer)	\$ 0.98	\$ 1.05	\$ 1.26
Beryllium ore, stu*	\$110-135	\$110-135	\$130.00
Chrome ore per long ton (Transvaal)	\$ 48-52	\$ 48-52	\$ 55.00
Copper per lb (MW-prod)	\$ 0.74	\$ 0.73	\$ 0.81
Gold per oz	\$ 430.45	\$ 347.18	\$427.14
Lead per lb	\$ 0.23	\$ 0.28	\$ 0.38
Mercury per 76-lb flask	\$ 378.00	\$ 345.00	\$420.00
Molybdenum conc. per lb (Climax)	\$ 7.90	\$ 7.90	\$ 7.90
Nickel per lb (cathode)	\$ 1.90	\$ 2.42	\$ 3.45
Platinum per oz	\$ 349.90	\$ 287.84	\$415.30
Silver per oz (H&H)	\$ 10.07	\$ 6.89	\$ 9.04
Tin per lb (MW composite)	\$ 6.24	\$ 6.04	\$ 7.90
Titanium ore per ton (ilmenite)	\$ 70-75	\$ 70-75	\$ 70.00
Tungsten per unit (GSA domestic)	\$ 99.60	\$ 99.60	\$125.21
Zinc per lb (MW-US PW)	\$ 0.40	\$ 0.38	\$ 0.46

* - Standard ton unit (20 lb)

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