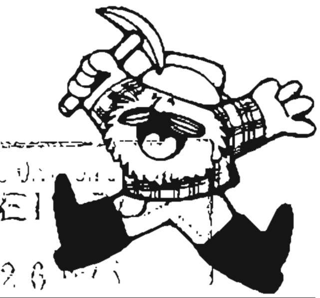
STATE OF ALASKA

Department of Natural Resources

Division of Geological & Geophysical Surveys



# MINES & GEOLOGY BULLETIN



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IN THIS ISSUE



**Mining information office.*

## Samples from Healy Coal Field Analyzed

*by Cleland N. Conwell, DGGS Mining Engineer*

Coal is the most abundant fossil fuel—and the most controversial. On one side is the federal energy administration, ERDA, who encourages the use of coal in power generation, and the other side is the Environmental Protection Agency, which opposes the use of coal because it pollutes the air.

In an area such as Interior Alaska, which has a major coal field, economics alone should dictate the use of coal. Unfortunately, politics dictate the fuel and type of electrical generation plant planned for Fairbanks. According to Mr. A.W. Baker, Jr., of the Golden Valley Electric Association, it would take more than 2 years to obtain EPA approval for a coal-burning power plant. As most Fairbanksans learned last month, when several power alerts and power outages occurred, Interior Alaska needs additional electrical power now, not years from now.

GVEA is going to install oil-burning gas turbines this year to increase capacity (by 72 megawatts). Baker stated at the recent UA coal symposium: "On a Btu basis, the oil for the gas turbines will cost four times as much as coal." What he did not add was that, because a coal-fired steam plant has greater thermal efficiency than the gas turbine engines, the real cost for oil will not be fourfold, but will be five to six times the cost of coal. The consumer will pay a higher electrical bill.

This situation is not unique to Alaska. All coal-producing states and major industrial areas are enmeshed in the conflict. Forty-six percent of electrical energy produced by public utilities in the U.S. is generated from coal (versus 18% for gas, 17% for oil, 15% for water power, and 4% for nuclear energy).

Part of the conflict can be solved by increasing the knowledge of the physical and chemical properties of the coal to be used before new power plants are built. For example, if sulfur in coal is found to be in the form of pyrite, the pyritic sulfur can be removed by mechanical treatment. From this standpoint, Alaskan coals have little sulfur and meet standards established by EPA; however, other than the calorific value and the ash and moisture contents, very little is known about the physical and chemical properties of Alaskan coals.

DGGS, in cooperation with the U.S. Bureau of Mines and U.S. Geological Survey, is sampling and analyzing Alaskan coals. The project started in 1973, when the heating value and the moisture and ash contents were monitored from Usibelli Coal Mine shipments (fig. 1). In 1975, samples were taken of the coal beds being mined on *Lignite Creek* (table 1).

The samples were analyzed for forms of sulfur, for heating value, for proximate and ultimate analyses by the U.S. Bureau of Mines, and for major oxides and trace elements by the USGS. Tables 2 and 3 show the characteristics of the coal. The major-oxide analyses provide information that is useful in determining the properties of coal slag (clinkers) or fly ash; the trace elements provide a key to the presence of undesirable pollutants.

A review of the analyses shows that the heating value, moisture, and ash are about the same in the samples as in the monitored coal shipments. The sulfur content is low, between 0.17 and 0.24%. The undesirable volatiles (As, F, Hg, Sb, and Se) are very low. One way of comparing the major oxides and trace elements in coal is to compare them with the same elements in a shale or in the Earth's crust (table 4). Although coals are usually very low in uranium and thorium, the Parting bed has a higher U and Th content than the other beds and than the average for the shale and the Earth's crust.

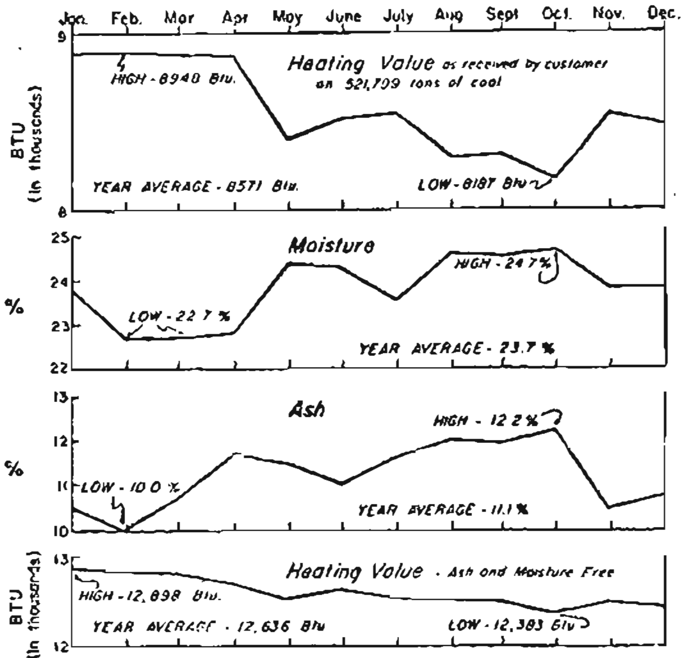


Figure 1. Average values of coal shipped from Healy coal field in 1973.

Table 2. U.S. Bureau of Mines Analyses

Proximate Analyses (%)

| | Moisture | Volatile | Fixed Carbon | Ash |
|---|---|---|---|---|
| 75-cc-15 | 24.0 | 35.9 | 33.4 | 6.7 |
| 75-cc-16 | 22.6 | 35.3 | 31.9 | 10.2 |
| 75-cc-17 | 23.5 | 36.4 | 33.2 | 6.9 |
| 75-cc-18 | 14.8 | 27.3 | 23.4 | 34.5 |
| 75-cc-19 | 26.8 | 36.4 | 31.6 | 5.2 |
| 75-cc-20 | 24.8 | 36.9 | 29.3 | 9.0 |
| 75-cc-21 | 24.9 | 35.5 | 31.4 | 8.2 |
| 75-cc-22 | 23.0 | 38.1 | 32.2 | 6.7 |

Ultimate Analyses (%)

| | Hydrogen | Carbon | Nitrogen | Oxygen | Sulfur | Ash |
|---|---|---|---|---|---|---|
| 75-cc-15 | 6.4 | 49.1 | 0.9 | 36.8 | 0.2 | 6.7 |
| 75-cc-16 | 6.1 | 47.7 | 0.8 | 35.0 | 10.2 | 10.2 |
| 75-cc-17 | 6.4 | 50.4 | 0.8 | 35.3 | 6.9 | 6.9 |
| 75-cc-18 | 4.6 | 35.6 | 0.5 | 24.5 | 34.5 | 34.5 |
| 75-cc-19 | 6.9 | 49.3 | 0.8 | 37.6 | 5.2 | 5.2 |
| 75-cc-20 | 6.5 | 47.6 | 0.7 | 36.0 | 9.0 | 9.0 |
| 75-cc-21 | 6.6 | 48.2 | 0.7 | 36.1 | 8.2 | 8.2 |
| 75-cc-22 | 6.4 | 52.2 | 0.8 | 33.7 | 6.7 | 6.7 |

| Btu Content | | | Forms of Sulfur (%) Sulfate | Pyritic | Organic |
|---|---|---|---|---|---|
| 75-cc-15 | 8,460 | 75-cc-15 | 0.01 | 0.07 | 0.13 |
| 75-cc-16 | 8,240 | 75-cc-16 | 0.01 | 0.09 | 0.07 |
| 75-cc-17 | 8,760 | 75-cc-17 | 0.01 | 0.07 | 0.12 |
| 75-cc-18 | 6,130 | 75-cc-18 | 0.01 | 0.07 | 0.17 |
| 75-cc-19 | 8,680 | 75-cc-19 | 0.01 | 0.10 | 0.09 |
| 75-cc-20 | 8,310 | 75-cc-20 | 0.01 | 0.08 | 0.14 |
| 75-cc-21 | 8,460 | 75-cc-21 | 0.01 | 0.07 | 0.11 |
| 75-cc-22 | 9,210 | 75-cc-22 | 0.01 | 0.11 | 0.12 |

Table 1. Coal analyses, Healy coal field-Sanderson Creek (Healy D-4 quadrangle, NE 1/4 of SE 1/4 of sec. 34, T. 11 S., R. 6 W., lat. N. 63.9158°, long. W. 148.6878°).

| Date Field | Lab. | Geology Age | Group | Formation | Bed | Column | Sample DGGS | USGS |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Sandstone | | |
| | | | | | Caribou | 6' | 75-cc-15 | D172389 |
| | | | | | | Coal 6' | 75-22-16 | D172390 |
| | | | | | | 5.6' | 75-22-17 | D172391 |
| | | | | | Parting | Light gray shale 6' | | |
| | | | | | | Coal(?) 3' | 75-cc-18 | D172392 |
| 4-1-75 | 5-21-75 | Tertiary Miocene | Coal-bearing | Suntrana | | 7' Light-gray clay, some black shale | | |
| | | | | | Moose | 5' | 75-cc-19 | D172393 |
| | | | | | | Coal 5' | 75-cc-20 | D172394 |
| | | | | | | 5' | 75-cc-21 | D172395 |
| | | | | | | 5' | 75-cc-22 | D172396 |
| | | | | | | Clay | | |

Ref: Wahrhaftig and others, 1969, The coal-bearing group in the Nenana coal field, Alaska: U.S. Geol. Survey Bull. 1274-D, 30 p.

Table 3. USGS analyses

| | On coal as received (ppm) | | | | | |
|---|---|---|---|---|---|---|
| | Ash (%) | As[1] | F[2] | Hg[3] | Sb[4] | Se[5] |
| 75-cc-15 | 8.74 | 2 | 90 | 0.03 | 2.0 | 0.4 |
| 76-cc-16 | 11.4 | 2 | 105 | 0.03 | 2.2 | 0.6 |
| 75-cc-17 | 9.3 | 3 | 95 | 0.06 | 2.5 | 0.3 |
| 75-cc-18 | 37.5 | 5 | 335 | 0.30 | 8.1 | 11.0 |
| 75-cc-19 | 6.83 | 2 | 95 | 0.04 | 1.8 | 3.2 |
| 75-cc-20 | 11.6 | 2 | 115 | 0.04 | 3.1 | 4.3 |
| 75-cc-21 | 11.2 | 2 | 110 | 0.05 | 1.8 | 3.5 |
| 75-cc-22 | 8.5 | 2 | 130 | 0.06 | 2.0 | 0.1 |

| | Delayed neutron determinations on coal as received | | |
|---|---|---|---|
| | Th (ppm) | U (ppm) | Th:U (to 1) |
| 75-cc-15 | 4.2273 | 1.3038 | 3.24 |
| 75-cc-16 | 6.3308 | 1.5114 | 4.19 |
| 75-cc-17 | 3.0593 | 1.8910 | 1.61 |
| 75-cc-18 | 17.5245 | 5.1602 | 3.40 |
| 75-cc-19 | 2.9800 | 1.32 | 2.27 |
| 75-cc-20 | 9.5127 | 1.9741 | 4.82 |
| 75-cc-21 | 7.0165 | 1.4205 | 4.94 |
| 75-cc-22 | 4.1957 | 1.4291 | 2.94 |

On ash (%)

| | $Al_2O_3$[6] | $SO_3$[6] | Cl[6] | CaO[6] | $SiO_2$[6] | $P_2O_5$[6] | $TiO_2$[6] | MnO[6] | $K_2O$[6] | MgO[7] | $Na_2O$[7] | Fe[7] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 75-cc-15 | 18 | 1.6 | .10 | 14 | 32 | 0.52 | 0.70 | .020 | .73 | 4.69 | 0.53 | 1.0 |
| 75-cc-16 | 19 | 1.2 | .10 | 10 | 48 | 0.27 | 0.78 | .020 | 1.2 | 5.65 | 0.36 | 1.0 |
| 75-cc-17 | 19 | 1.7 | .10 | 11 | 37 | 0.14 | 0.82 | .034 | 1.8 | 4.13 | 0.42 | 2.0 |
| 75-cc-18 | 23 | 0.32 | .10 | 2.0 | 51 | 0.10 | 1.0 | .020 | 2.8 | 1.90 | 0.28 | 1.0 |
| 75-cc-19 | 19 | 2.3 | .14 | 17 | 22 | 0.79 | 0.75 | .020 | .72 | 7.35 | 0.15 | 3.0 |
| 75-cc-20 | 22 | 1.2 | .15 | 9.3 | 38 | 0.34 | 1.1 | .020 | 1.4 | 3.95 | 0.14 | 1.5 |
| 75-cc-21 | 20 | 1.2 | .10 | 9.9 | 31 | 0.71 | 0.85 | .068 | 1.3 | 3.53 | 0.13 | 5.0 |
| 75-cc-22 | 23 | 1.4 | .12 | 11.0 | 32 | 1.2 | 1.1 | .024 | 1.0 | 2.60 | 0.12 | 2.0 |

On ash (ppm)

| | Cd[7] | Cu[7] | Li[7] | Pb[7] | Zn[7] | Mn[8] | Ag[8] | As[8] | Au[8] | B[8] | Ba[8] | Be[8] | Bi[8] | Cd[8] | Co[8] | Cr[8] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 75-cc-15 | 1.0 | 158 | 35 | 50 | 26 | 70 | 1 | - | - | 1,000 | 7,000 | 5 | - | - | 70 | 150 |
| 75-cc-16 | 1.0 | 86 | 36 | 55 | 30 | 70 | 1 | - | - | 500 | 3,000 | - | - | - | 70 | 150 |
| 75-cc-17 | 1.5 | 266 | 40 | 50 | 46 | 200 | 1.5 | - | - | 1,000 | 5,000 | 7 | - | - | 70 | 150 |
| 75-cc-18 | 1.5 | 130 | 85 | 40 | 99 | 70 | - | - | - | 200 | 1,500 | 7 | - | - | 30 | 200 |
| 75-cc-19 | 1.0 | 202 | 43 | 50 | 37 | 150 | 1 | - | - | 1,500 | 10,000 | 3 | - | - | 100 | 150 |
| 75-cc-20 | 1.0 | 180 | 68 | 50 | 35 | 70 | 1 | - | - | 700 | 7,000 | 3 | - | - | 20 | 150 |
| 75-cc-21 | 1.0 | 148 | 51 | 40 | 70 | 500 | - | - | - | 700 | 10,000 | 3 | - | - | 15 | 150 |
| 75-cc-22 | 1.5 | 210 | 56 | 55 | 76 | 150 | 1.5 | - | - | 700 | 15,000 | 3 | - | - | 50 | 150 |

| | Cu[8] | La[8] | Mo[8] | Nb[8] | Ni[8] | Pb[8] | Pd[8] | Pt[8] | Sb[8] | Sc[8] | Sn[8] | Sr[8] | Te[8] | U[8] | V[8] | W[8] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 75-cc-15 | 100 | - | 15 | 20 | 150 | 70 | - | - | - | 30 | - | 1,500 | - | - | 200 | - |
| 75-cc-16 | 100 | 100 | 15 | 20 | 100 | 70 | - | - | - | 20 | - | 700 | - | - | 200 | - |
| 75-cc-17 | 200 | 100 | 15 | 20 | 150 | 70 | - | - | - | 30 | - | 700 | - | - | 300 | - |
| 75-cc-18 | 100 | 100 | - | 20 | 70 | 70 | - | - | - | 30 | - | 200 | - | - | 300 | - |
| 75-cc-19 | 300 | 150 | 15 | 20 | 150 | 70 | - | - | - | 30 | - | 3,000 | - | - | 300 | - |
| 75-cc-20 | 300 | 100 | 10 | 20 | 100 | 70 | - | - | - | 30 | - | 1,000 | - | - | 300 | - |
| 75-cc-21 | 200 | 100 | 10 | 20 | 150 | 70 | - | - | - | 30 | - | 2,000 | - | - | 200 | - |
| 75-cc-22 | 300 | 100 | 15 | 20 | 150 | 70 | - | - | - | 30 | - | 3,000 | - | - | 300 | - |

| | Y[8] | Zr[8] | Ce[8] | Ga[8] | Ge[8] | Hf[8] | In[8] | Li[8] | Re[8] | Ta[8] | Th[8] | Tl[8] | Yb[8] | Nd[8] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 75-cc-15 | 30 | 200 | - | 30 | - | - | - | - | - | - | - | - | 5 | - |
| 75-cc-16 | 30 | 150 | <500 | 30 | - | - | - | - | - | - | - | - | 3 | - |
| 75-cc-17 | 70 | 150 | <500 | 30 | - | - | - | - | - | - | - | - | 7 | <150 |
| 75-cc-18 | 50 | 150 | <500 | 30 | - | - | - | - | - | - | - | - | 7 | <150 |
| 75-cc-19 | 70 | 150 | <500 | 30 | - | - | - | - | - | - | - | - | 7 | <150 |
| 75-cc-20 | 30 | 150 | <500 | 30 | - | - | - | - | - | - | - | - | 7 | <150 |
| 75-cc-21 | 30 | 150 | <500 | 30 | - | - | - | - | - | - | - | - | 7 | - |
| 75-cc-22 | 50 | 150 | <500 | 30 | - | - | - | - | - | - | - | - | 7 | - |

[1] Determined by spectrophotometry.
[2] Determined by specific ion electrode method.
[3] Determined by wet oxidation and atomic absorption.
[4] Determined by Rhodamine-B method.
[5] Determined by X-ray fluorescence.
[6] Determined by X-ray fluorescence.
[7] Determined by atomic absorption.
[8] Determined by semiquantitative 6-step spectrographic analysis.


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Table 4. Comparison of 34 elements in the Caribou, Parting and Moose seams, Healy, Alaska with the average value of the same elements in shale and the Earth's crust.

(As, F, Hg, Sb, Se, Th, and U values used to calculate the means were determined directly on whole coal. All other values used were calculated from determinations made on coal ash.)

| | Healy, Alaska | | | | |
|---|---|---|---|---|---|
| Element | Caribou | Parting | Moose | Shale average[9] | Crustal average[10] |
| Si (%) | 18.7 | 51.0 | 39.0 | 7.3 | 28.15 |
| Al (%) | 18.7 | 23.0 | 21.0 | 8.0 | 8.23 |
| Ca (%) | 11.7 | 2.0 | 21.5 | 2.21 | 4.15 |
| Mg (%) | 4.8 | 1.9 | 4.4 | 1.5 | 2.33 |
| Na (%) | 0.4 | 0.3 | 0.13 | 0.96 | 2.36 |
| K (%) | 1.1 | 2.8 | 1.1 | 2.66 | 2.09 |
| Fe (%) | 1.5 | 1.0 | 2.9 | 4.72 | 5.03 |
| Ti (%) | 0.8 | 1.0 | 0.95 | 0.46 | 0.57 |
| As (ppm) | 2.3 | 6.0 | 2.0 | 13.0 | 1.8 |
| Cd (ppm) | 1.3 | 1.5 | 1.0 | 0.3 | 0.2 |
| Cu (ppm) | 170.0 | 130.0 | 185.0 | 45.0 | 55.0 |
| F (ppm) | 97.0 | 335.0 | 112.0 | 740.0 | 625.0 |
| Hg (ppm) | 0.04 | 0.3 | 0.04 | 0.4 | 0.08 |
| Li (ppm) | 0.0 | 0.0 | 0.0 | 66.0 | 20.0 |
| Pb (ppm) | 52.0 | 40.0 | 46.0 | 20.0 | 12.5 |
| Sb (ppm) | 2.2 | 8.1 | 2.2 | 1.5 | 0.2 |
| Se (ppm) | 0.4 | 11.0 | 2.75 | 0.6 | 0.05 |
| Th (ppm) | 4.5 | 17.5 | 6.9 | 12.0 | 9.6 |
| U (ppm) | 1.6 | 5.2 | 1.5 | 3.7 | 2.7 |
| Zn (ppm) | 34.0 | 99.0 | 64.5 | 95.0 | 70.0 |
| B (ppm) | 833.0 | 200.0 | 900.0 | 100.0 | 10.0 |
| Ba (ppm) | 5000.0 | 1500.0 | 10,500.0 | 580.0 | 425.0 |
| Be (ppm) | 4.0 | 7.0 | 3.0 | 3.0 | 2.8 |
| Co (ppm) | 70.0 | 70.0 | 70.0 | 10.0 | 25.0 |
| Cr (ppm) | 150.0 | 200.0 | 150.0 | 90.0 | 100.0 |
| Ga (ppm) | 30.0 | 30.0 | 30.0 | 19.0 | 15.0 |
| Mo (ppm) | 15.0 | · | 15.0 | 2.6 | 1.5 |
| Ni (ppm) | 133.0 | 70.0 | 137.0 | 68.0 | 75.0 |
| Sc (ppm) | 27.0 | 30.0 | 30.0 | 13.0 | 22.0 |
| Sr (ppm) | 967.0 | 200.0 | 2,250.0 | 300.0 | 375.0 |
| V (ppm) | 233.0 | 300.0 | 300.0 | 130.0 | 135.0 |
| Y (ppm) | 43.0 | 50.0 | 45.0 | 26.0 | 33.0 |
| Yb (ppm) | 5.0 | 7.0 | 7.0 | 2.6 | 3.[illegible] |
| Zr (ppm) | 167.0 | 150.0 | 150.0 | 160.0 | 165.0 |

[9] Turekian, K.K., and Wedepohl, K.H., 1961, Distribution of the elements in some major units of the Earth's crust: Geol. Soc. Amer. Bull., v. 72, no. 2, p. 175-191.

[10] Taylor, S.R., 1964, Abundance of chemical elements in the continental crust - A new table: Geochem. et Cosmochim. Acta, v. 28, no. 8, p. 1273-1285.

## Geochemistry as a Prospecting Tool by Alfred F. Trites

*(This is the sixth of a series from The Mining Record [Jan. 15, 1975]. The author is a consulting geologist in Denver—Ed. note.)*

### Determining Background Values

Before describing the methods of visualizing the results of the geochemical analysis of your soil sampling I should discuss what is known as "background" values. Your first impression as you examine the report from your lab listing the content of the elements which you have requested will probably be the spread in parts per million for each element. This is as it should be unless the buried deposit is extremely large and uniform in metal content so that your sampling did not extend beyond its limits or that you have sampled only a very small area. If the geochem results are indicating significant mineralization, you should be able to recognize it by the presence of a number of values from a few times to perhaps hundreds or even thousands of times the low values reported.

Each element on the periodic table has a certain background or normal value within a given area, be it a mining district or otherwise. Usually this background is found to be within a small range of values for which an average can be expressed. As the knowledge of geochemistry has increased in the world a certain average or range has come to be recognized for certain elements in normal soils. These backgrounds in both soils and various rock types are listed in publications on geochemistry which probably can be obtained through your local library. For instance, H.E. Hawkes and J.S. Webb in "Geochemistry in Mineral Exploration," Harper and Row Publishers, New York and Evanston, published in 1962, give the normal soil content of various elements, a number of which I have listed as follows:

Arsenic: Average 5, Range 1-50 ppm
Barium: Average 500, Range 100-3,000 ppm
Chromium: Average 200, Range 5-1,000 ppm
Cobalt: Average 8, Range 1-40 ppm
Fluorine: Average 200 ppm
Lead: Average 10, Range 2-200 ppm
Mercury: Range 0.03-0.3 ppm
Molybdenum: Average 2, Range 0.2-5 ppm
Nickel: Average 40, Range 5-500 ppm
Silver: Average 0.1 ppm
Tin: Average 10 ppm
Vanadium: Average 100, Range 20-500 ppm
Zinc: Average 50, Range 10-300 ppm

Such background figures can be used as general guides as long as you recognize the fact that they are world averages and that each metalliferous district will have its own unique background, although generally within the ranges indicated. It will be up to you to determine the background values for each element determined in your area.

A number of techniques have been used to determine background values and those that are sufficiently high above the background to be considered anomalous. One rule-of-thumb method simplifies it by taking the upper 5 percent of the values as anomalous and letting it go at that. There must be at least a few significantly high values for this to work.

Another method is the statistical approach. In this the cumulative percentage of the parts per million are plotted on log probability graphs. Abrupt breaks in the slopes of the probability curves indicate significant breaks in the population groupings of the values. The values should fall into at least two different populations and may occur in three or more population groupings. The lowest grouping, of course, usually is the background range.

Without log probability paper on hand you can simplify the procedure by the following method: List the parts per million of the element, say zinc, from the lowest value at either the top or bottom of your paper to the highest at the other end. It helps to list each unit in the series, such as 5, 10, 15, 20, 25, 30 etc., ppm even if no samples were reported to have that particular value of zinc. Use ticks for each value in parts per million. As you progress you will note a preponderance of the ticks falling within a certain range, for instance 20 to 50 ppm zinc. This would represent your background range for zinc and any values significantly above it would be anomalous. You might find another grouping, smaller but significant, of say 250 to 350 ppm zinc with only a sprinkling of samples falling between the 50 ppm (upper background value) and the 250 ppm (lower value of anomalous samples). Still another grouping, even smaller in number of samples, might be found between 1,000 and 2,500 ppm zinc with at best a sprinkling of values between 350 ppm and 1,000 ppm zinc. You have hereby crudely identified the background, a lower anomaly, and a higher anomaly for zinc. Some geochemists would use the terms "possibly anomalous" and "probably anomalous" for these two higher groupings.

Of course, the significance of any groupings increases with the number of samples. I hesitate placing a minimum number required but perhaps a minimum of 50, and better still 100, samples should be analyzed before you can place much confidence on any statistical method.

## Roderick Named Deputy Commissioner

*(from the Fairbanks Daily News Miner, Dec. 12, 1975)*

Jack Roderick, former Mayor of Anchorage, has been appointed deputy commissioner of the state Department of Natural Resources.

Commissioner Guy Martin announced the appointment Monday. Roderick is expected to assume his new post at the first of next year.

Martin also announced present deputy commissioner Bill Fackler will become executive director of the Alaska Royalty and Gas Development Board.

At the same time, Martin announced the selection of Hope resident David G. Hanson as chief of the newly formed Natural Resources Planning and Research Section.

Roderick, contacted at home Monday said, "I feel the orderly development of our natural resources is really essential to the state's survival. I feel that is most important to the state, and that I have something to offer."

Roderick has lived in Alaska 20 years and has varied experience involving Alaska natural resource issues.

He was founder in 1955 of Alaska Petroleum Publications, and three years later founded Alaska Title Guaranty Co. He also founded and directed firms devoted to gas and oil exploration and investment.

He was co-publisher of Alaska Industry magazine from 1969 to 1972.

## DGGS Releases Open-File Report Pertinent to OCS Lease Sale

DGGS is about to release its most extensive (and expensive) open-file report. Sometime in mid-January (pending USGS approval), AOF-93 "Stratigraphic study of the Gulf of Alaska Tertiary Province, northern Gulf of Alaska area," will be available at Petroleum Publications, 409 W. Northern Lights Blvd., Anchorage, 99503. It was written by W.M. Lyle of DGGS and I.F. Palmer of the USGS Conservation Division. For $88 plus postage, you get 23 blueline plates, 9 appendixes (including 53 photos), and about 30 pages of text. The report describes the porosities, permeabilities, and depositional environments of the northern Gulf of Alaska, with emphasis on the Yakataga Formation. It also contains microfossil and macrofossil information (including environment and water depth), paleocurrent data, and source-rock analyses. AOF-93 may be examined at any DGGS mining information office (p. 1). It is about 160 pages long, is printed on 60-lb coated paper and enclosed in a sturdy three-ring binder; the bluelines will be rolled, not folded, and inserted into a high-quality map tube.

DGGS also released revisions to two information circulars. IC 7, "Alaskan companies and prospectors," is 27 pages long, and lists the names, addresses, general locations, and major type of endeavor of most of the licensed prospectors and mining companies. IC 20, "Aeromagnetic maps of Alaska quadrangles," has also been updated. This is a list of all maps available as of January 30 (p. 7). Both publications are free at any DGGS mining-information office (addresses on p. 1).

A third information circular, No. 21, is available for the first time. Entitled "Open-file reports," this free nine-page pamphlet gives the titles, authors, and prices of more than 80 DGGS open-file reports.

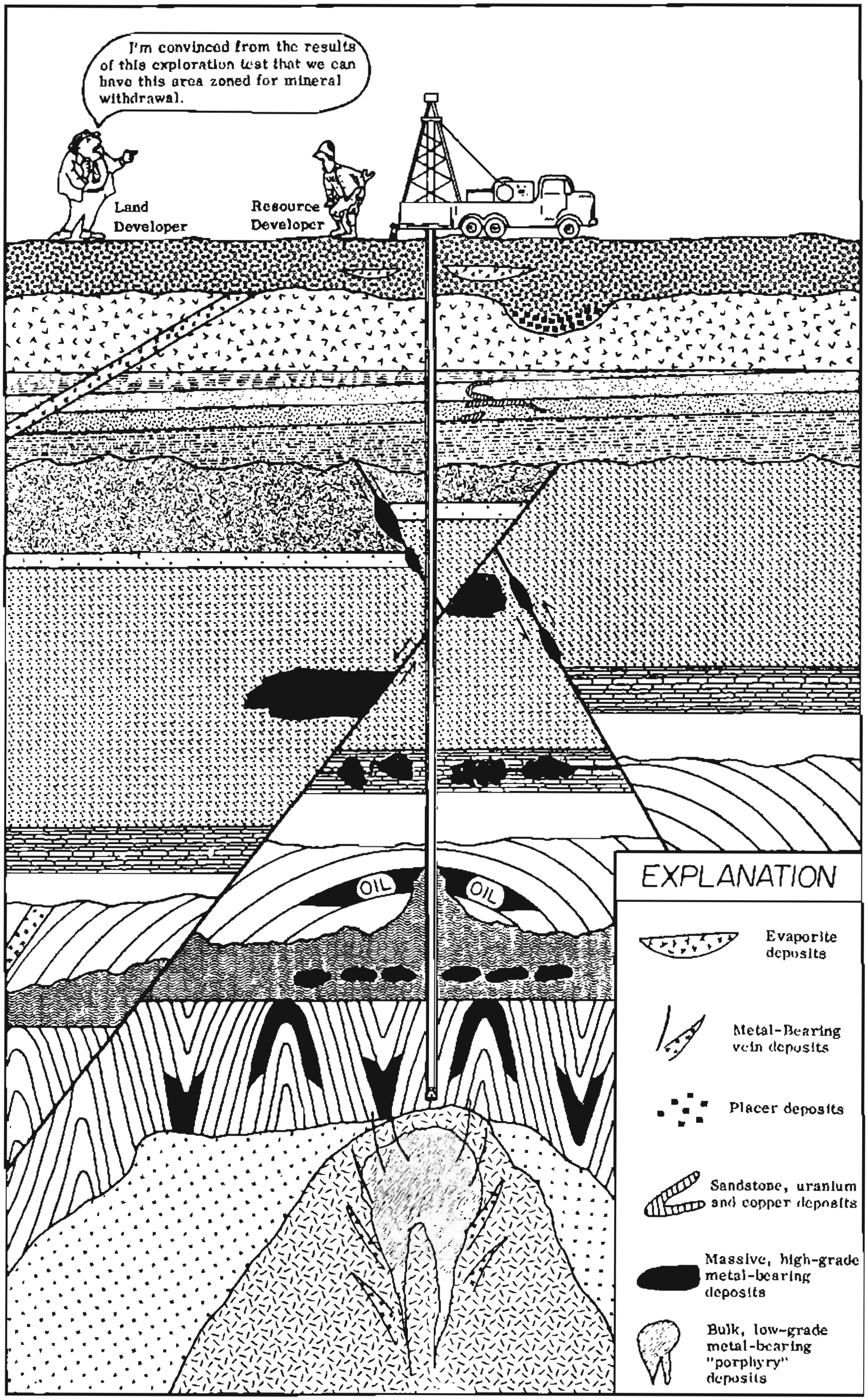
## Three Huge Offshore Drilling Rigs to Head North

*(from Alaska Business Newsletter, Dec. 12, 1975)*

Three large semi-submersible drilling rigs are scheduled to be towed to the Gulf of Alaska within the next 15 months.

Sedco, a large offshore drilling company, is under contract to the SAM group (Shell-Arco-Mobil) to deliver a $43 million rectangular platform by next June. It is currently under construction by Kaiser Steel in the San Francisco Bay area. Exxon contracted with Mitsubishi Heavy Industries to construct a platform in Japan some 5/7th the size of the SAM Sedco 706 rig and for delivery in the first quarter of 1977. Sun Oil is to take delivery of the next platform manufactured by Kaiser (at an estimated cost of $50 million) in February, 1977. It is the Sedco 708.

Arco has already contracted with Evergreen Helicopters to provide support for the SAM platform.




"To reason without data" (or with inconclusive data) "is nothing but delusion."—with apologies to Arthur Holmes. *(From Arizona Bureau of Mines, Sept. 1975.)*

Exxon is expected to contract with Era Helicopters although no contract has been signed yet. Evergreen will use its twin-engine Sikorsky S62 with Era using twin-engine Bell 212s. (All of the offshore helicopters used will be two-engined so they will be able to stay airborne even if they lose an engine in flight. Even so, all passengers will be required to wear cumbersome survival suits in flight against the possibility of a helicopter going down in the cold Gulf waters.)

## DGGS Aeromagnetic Maps of Brooks Range to go on Sale January 30

The last of the 15-minute aeromagnetic maps compiled from the 1974 flight season will go on sale at all four DGGS Mining Information offices on Friday, January 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, 99701).

The maps, of the Ambler River and Baird Mountains 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:

| Baird Mts. | Ambler River |
|---|---|
| B-1, -2 | B-4, -5, -6 |
| C-1, -2 | C-4, -5, -6 |
| D-1, -2 | D-4, -5, -6 |

A complete list of available maps has recently been recently been released as Information Circular 20 (p. 5).

## "New" Volcanoes in the Aleutian Volcanic Arc

*(The following article is from an informal U.S. Geological Survey publication and may contain preliminary or incomplete data. Nevertheless, we think you may find it interesting—Ed. note.)*

Two previously unreported volcanoes in the Aleutian volcanic arc were encountered during geothermal reconnaissance investigations. The first volcano, Mount Kialagvik, is located on the Alaska Peninsula about 80 miles ENE of Port Heiden and was found by Tom Miller, Bob Smith, and Brent Dalrymple. Although the investigation was brief, the volcano appears to consist of a dacitic dome with associated dacitic ash flows. The relative lack of erosion of the unconsolidated ash flows suggests a very young age, perhaps a few thousand to a few tens of thousands of years, similar to other nearby dacitic volcanoes with associated ash flows.

The other volcano, as yet unnamed, is 95 miles west of Anchorage in the Tordrillo Mountains of the Alaska Range and is about 25 miles north of Mt. Spurr which had previously been thought to be the last, or easternmost, volcano in the 1600-mile-long Aleutian volcanic arc. It occurs near the head of the Hayes Glacier about 3 miles NNW of Mt. Gerdine and was investigated by Tom Miller, Bob Smith, and Pat Buffler. Most of the original vent appears to have been covered by the Hayes Glacier and only a remnant of ash fall and avalanche deposits remains. Compositionally the volcano consists of hornblende-biotite dacite. This volcano is the probable source of the air fall ash that immediately underlies the surface vegetation in the upper Susitna River drainage and may be the source of some of the air fall ash found in the general Anchorage area. Its age is likewise thought to be very young as judged by the occurrence of the air fall ash so close to the surface and the unconsolidated avalance deposits that have survived in an environment that is subjected to a considerable amount of erosion.

## DGGS Hires New Geologist, Promotes Old One

Richard D. Reger, 36, has been hired as a geologist in the Fairbanks office and Gilbert R. Eakins has been appointed chief mining geologist. Eakins, a veteran of 9 years with DGGS, succeeds Dr. Thomas E. Smith, who left the division in September to teach at the University of Alaska.

Reger, who will specialize in mapping surficial deposits and determining geological hazards, earned his bachelor and master degrees at the University of Alaska, Fairbanks, and his doctorate from Arizona State University at Tempe. He taught geology at the Tempe campus for 3 years and has been employed the last 3 years in Fairbanks as senior geologist with R & M Engineering Consultants.

Reger and his wife, Valerie, reside in College with their two sons, Larry, 4, and Tom, 3.

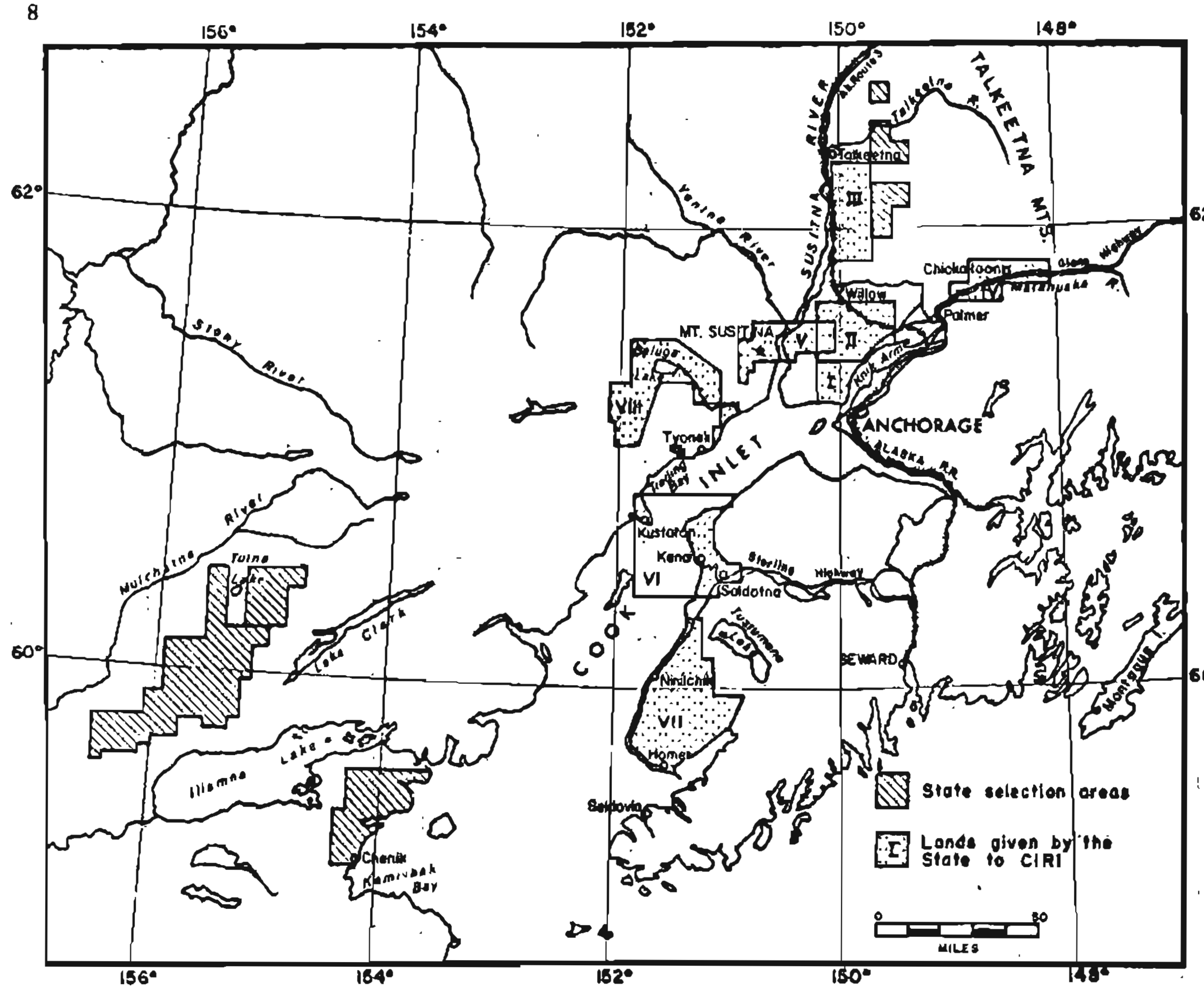
## ERDA Issues DGGS Report on Alaska's Uranium Potential

A report entitled "Investigation of Alaska's Uranium Potential" has been placed on open file for public inspection by the Grand Junction (Colorado) Office of the U.S. Energy Research and Development Administration. The 481-page report, GJO-1627, was prepared in two parts.

Part 1 of the report, by Gilbert R. Eakins, summarizes published data and unpublished information on uranium prospects and areas that may be favorable for the occurrence of uranium deposits in Alaska.

Part 2 of the report, by Robert B. Forbes of the UA

*—Cont. on p. 8—*




## Cook Inlet Land Trade Proposed

As a result of a three-way agreement between the federal government, the state government, and the Cook Inlet Region, Incorporated (CIRI) Native association, a land swap is brewing. The proposed land areas to be exchanged, which include a good part of the Beluga coal field, are indicated on the above map. *(Because the negotiations were still going on at Bulletin press time, the map is not to be regarded as final—Ed. note.)*

## ERDA Issues DGGS Report . . . . . .

Geophysical Institute, describes the regional distribution and tectonic setting of alkaline intrusive igneous rocks in Alaska and includes a map of granitic rocks in the state.

The report describes several geographic regions in Alaska that may be favorable for uranium occurrences. They are the Copper River Basin, the alkaline intrusive belt of the Seward-Selawik area in west-central Alaska, The Susitna Lowland, the coal-bearing basins of the north flank of the Alaska Range (Healy Basin), the Precambrian gneisses of the Goodnews quadrangle, and southeastern Alaska. Other areas that also may be favorable for uranium include the Yukon Flats area, the Cook Inlet Basin, and the Galena Basin.

The report, prepared under Contract No. AT(05-1)-1627 with the Grand Junction Office of U.S. Energy Research and Development Administration, has been placed on open file at various locations, including the DGGS College and Anchorage (Porcupine Dr.) offices. *(The report is being reproduced as Special Report 12 by DGGS. Inquiries regarding availability and cost may be made at the College office; details will be announced in the next Bulletin—Ed. note.)*

## Placer is Leader in Beluga Coal Field

*(from The Northern Miner, Oct. 16, 1975)*

Since the worldwide energy crisis in 1973, the United States government, in an expanding program to find new deposits of energy fuels, has intensified its interest in the Beluga Coal Field of Alaska. In concert with a number of major companies, it is conducting extensive research to develop the most economic method to bring the coal field into substantial production.

A leader in this area is Placer Amex, a wholly owned U.S. subsidiary of Placer Development, which, as a former coal producer, is most familiar with this energy producing product. In 1957-68 Placer Amex operated in Alaska the Evan Jones Coal Co., which sold coal for steam mainly to the military bases in the Anchorage area. About the same time, the company was a major coal producer in Australia.

According to a 1966 report by the U.S. Geological Survey on the geology and coal resources in the Beluga and Yentna region, almost all of the minable coal is contained in a 400 sq. mi. area south of Beluga Lake. The structure is uncomplicated, occurring in Tertiary sediments, and there is probably in excess of two billion tons of coal. The area features very large and extensive outcrops. In the Capp Glacier and Chuitna areas, several coal seams outcrop with thickness ranging from 20-55 ft. In the latter area, one outcrop is traceable for seven miles and in the Capp area an outcrop runs continuously for four miles.

Tests show that the coal is subbituminous with a high moisture content of 28%. Ash averages 10%; volatile matter, 30%; fixed carbon, 30%, and sulphur is low at 0.15%. Heat quality is 7,550 British Thermal Units (BTU) per lb.

Alan G. Horton, president, Placer Amex, told The Northern Miner that Placer first applied for a coal prospecting permit in Beluga in 1966 and has been acquiring additional blocks since then. The interest was taken with a long-range view to develop a solvent refining process to produce a type of "super coal" with perfect moisture content, no ash and no sulphur and, of course, high BTU's to meet virtually any requirement.

The company has formed Beluga Coal Co., which holds the leases and prospecting permits from the state, covering a total of 40,000 acres. The Placer coal land is 60 miles due west of Anchorage and within about 25 miles of Cook Inlet, which engineering studies of the past two years indicate is navigable virtually year round.

Drilling by Placer indicated a potential of 700 million tons of coal to a depth of 300 ft. Up to 1975, the company expended a total of about $500,000 on work in this coal field.

This year the company launched a more aggressive program, spending $500,000, or as much as has been spent in all of the previous years. It moved into an area where there is near-surface coal of a low grade and set out to prove up this area in order to obtain some idea of mine planning and costs with a view to starting an operation in the not-too-distant future.

In the 1975 program 45 holes were drilled in this area covering about two sq. mi. The drilling indicated in the order of 100 million tons of coal, which is continuous, shallow and minable at low costs.

## Our Gangue......

**By Frank Larson**

Speaking of Christmas, 'Twas the night before said event, and all throughout the office, everybody was stirring—even me, who labored far into the night getting out the Mines and Geology Bulletin....a veritable Bob Cratchitt....(Oh you little Dickens)....did the same thing last year, too...(no schist)......and what good did it do me?....all I received for my efforts was a lump of nonagglomerating meta-anthracite with shimmering anthraxylone......Despite the fact that many state offices are breaking away early today, DGGS labors on faithfully, diligently, happily........(?)..........Why are we different? Well, mainly because we (select one): A) are up to our eyebrows in overdue deadlines, B) have the reincarnated Ebenezer Scrooge for a boss, C) are mentally unbalanced, D) have nowhere to go tonight anyway. The answer, of course, is C. (You will receive some credit for answer B, however)....For New Years, I have several resolutions to make: To exercise daily. To find an honest job....I also drew up a little schedule for my wife to follow for the new year. She is somewhat disorganized, so the least I can do is give her a copy of W.C. Fields' regimen for model wives, right? 7 to 8 AM: Arise quietly, shake down furnace, stoke it, prepare breakfast—eggs exactly 4 minutes, two lumps in the java. 8 to 9: Awake husband, gently singing *sotto voce*. His preferences are "Narcissus" and "Silent Night." 9 to 10: Drive husband to work, do marketing for dinner, and be sure not to order anything husband might decide to have for lunch. 10 to 12: Mow lawn, wash clothes, iron husband's shirts, press his suits, starch his shorts, paint screens, weed garden, swat flies. 12 to 2: Clean cellar, wash windows, tidy house, beat rugs. 2 to 2:15 PM: Eat simple lunch. 2:15 to 5:30 PM: Spade garden, darn socks, wash Rover, put up jelly, polish car, burn rubbish, wash woodwork, paint garage, clean sidewalls of tires. 5:30 to 7: Pick up husband, shake cocktails, cook dinner, serve dinner, wash dishes. 7 to 12: Keep busy—keep smiling, for, as every man knows, the husband is tired....Speaking of which, our mining information girls are feeling just that...They've processed many many claims lately—1816 new claims in November (filed in October), and 1119 more the next month. They report the heaviest claim staking to be in the De Long Mountains and Mt. Hayes, Ketchikan, Tanana, Healy, Anchorage, Eagle, Chandalar, and Talkeetna quadrangles. And, in view of the claims that are coming in for December, they appear to be bringing in their New Years with a bang...(although they steadfastly deny any improprieties)..........................Cheers.

## Metals Market

| | Dec. 19, 1975 | Two Months Ago | Year Ago |
|---|---|---|---|
| Antimony ore, stu equivalent European ore | $ 17.00-18.50 | $ 18.74-20.39 | $ 31-32 |
| Barite (drilling mud grade per ton) | $ 17-28 | $ 17-28 | $ 17.00-21.00 |
| Beryllium ore, stu. | $ 30.00 | $ 30.00 | $ 30.00 |
| Chrome ore per long ton (Transvaal) | $ 37-52 | $ 37-52 | $ 47.00 |
| Copper per lb. (MW-prod.) | $ 0.63 | $ 0.63 | $ 0.73 |
| Gold per oz. | $139.60 | $145.05 | $186.70 |
| Lead per lb. | $ 0.19 | $ 0.20 | $ 0.245 |
| Mercury per 76-lb. flask | $117.00 | $128.00 | $150.00 |
| Molybdenum conc. per lb. | $ 2.62 | $ 2.62 | $ 2.30 |
| Nickel per lb. (cathode) | $ 2.20 | $ 2.20 | $ 1.85 |
| Platinum per oz. | $148.00 | $147.20 | $170.50 |
| Silver, New York, per oz. | $ 4.10 | $ 4.35 | $ 4.47 |
| Tin per lb. | $ 3.02 | $ 3.24 | $ 3.42 |
| Titanium ore per ton (Ilmenite) | $ 55.00 | $ 55.00 | $ 55.00 |
| Tungsten per unit (GSA domestic) | $ 77.96 | $ 78.26 | $ 82.26 |
| Zinc per lb. | $ 0.39 | $ 0.39 | $ 0.39 |

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