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Alaska State Legislature



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Economic Development and Tourism Committee
Representative Gail Phillips, Chair

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Economic Development & Tourism Committee

Wednesday, Feb 23rd, 2000 – 5:00 to 6:30pm

House Resources Room 124

Meeting Notice: The Economic Development and Tourism Committee will hold a regularly scheduled meeting on Wednesday, February 23rd at 5:00pm

We will be hearing a series of updates on the mining industry in Alaska.

Presentations will include:

Frankie Pillifant - (DCED-DOT) Mining Opportunities in Alaska.

Dr. Lance Miller – (Red diamond Mining Co.) Gold in Alaska and World Comparisons.

Carl Hanneman – (Teck Resources) Pogo Mine update.

June McAtee - (Calista) Socio-economic Benefits of the Development of the Donlin Creek Deposit

This will be an excellent meeting. Please try to attend.

GP:sp

Chair: Representative Gail Phillips

Committee Members: Representatives Ramona Barnes • Fred Dyson
Norman Rokeburg • Andrew Halcro • Sharon Cissna • Beth Kertula

February 22, 2000

Mining Industry update for
House Special Committee on Tourism and Economic Development
By Frankie Pillifant

Thank you for inviting me to talk with you about the mining industry in Alaska. My name is Frankie Pillifant and I work as a Minerals and Mining Development Specialist for the Department of Community and Economic Development, Division of Trade and Development. Today I will help set the stage for the other invitees to discuss in more details the points brought up by myself.

Despite record low prices for metals and coal, the preliminary estimates for 1999 mineral industry are \$45 million invested in exploration; \$18 million invested in development projects and \$986 million in production valued overall at \$1.049 billion. Several medium sized mines, Illinois Creek, Nixon Fork, Alaska Gold (Nome Placer) and a number of small placer mines were closed in 1999. Red Dog near Kotzebue increased production and continues to be the world's largest producer of zinc. Greens Creek mine on Admiralty Island remains one of the largest producers of silver in the U.S. Fort Knox mine near Fairbanks is Alaska's largest gold producer with an average daily production of approximately 1,000 ounces of gold. The Pogo gold deposit north of Delta spurred 60% (approximately \$30 million dollars) of the exploration conducted in Alaska this year.

Opportunities for mineral development rely on the geology, gold price and infrastructure/access.

Map of selected mines, coalfields and significant mineral resources of Alaska (by Swainbank and Szumigala, October 1998)

Coal: Point Lay, world class quality and quantity but no access (bituminous: coal containing 15-20% volatile matter)

Healy-Usibelli

Wishbone Hill (Matanuska Valley, subbituminous: higher carbon, lower moisture)

Beluga (Cook Inlet)

Bering River (Cordova)

Gold: Tintina Gold belt

POGO: Southeast Yukon, ending at Donlin Creek

Fort Knox

Illinois Creek (Viceroy Resources has completed some drilling and is due to decide what role if any they will have with this property soon)

Nixon Fork

Platinum: prices recently hit record highs and there is increased interest in locating these resources in Alaska.

Volcanic Massive Sulfides:

Zinc, Lead, Gold, Silver
Zinc, lead, silver

Greens Creek
Red Dog (60% of the industry in Alaska Includes
deep new -1999-discovery)
North side Alaska range, Richardson district

Uranium: Bokan Mountain, Southeast

DGGS-Geophysical surveys of the Fortymile and Livengood areas were released, and they also participated in a joint Federal-State survey of part of Prince of Wales Island. The release of these surveys is greatly anticipated and are seen as encouragers of exploration.

Cost of survey to the expenditure of exploration dollars in Alaska

DGGS-DMLW working on gathering baseline data for ambient water quality

This information and more can be found in the Annual Minerals Industry report, summaries and tip sheets put out by DCED and DGGS. This information can also be found on the DCED and DGGS websites.

Generally optimistic on the mining industry in Alaska

- Metal prices are increasing
- London Financial Times: showed Alaska dropped only 20% in exploration compared to much higher percentages for other countries, states,
- Net increase of 11,000 new claims last year, meaning new exploration is an indicator of the future, not present health of the mining industry in a region.
- Continuing to remove uncertainty in permitting equals an improved business environment.

Part of my job is fielding questions and providing information on Alaska and the opportunities here, either through the various trade shows in Vancouver and Toronto, Canada and in Alaska and Washington states and via direct inquiries fielded from many locales such as Africa, Australia, Poland, the lower 48 states.

Further, Dick Swainbank in Fairbanks and I provide staff support for the Alaska Minerals Commission members when necessary. This years report was well received and you may have visited personally with AMC members last week during their annual report visit.

This years report of the Alaska Minerals Commission:

Finding A: A crisis in Alaska's ability to issue permits

The loss of DEC funding for a core group of competent, institutionally knowledgeable perimeters *is leaving mining, seafood processors, rural and municipal sewage plant operators and oil field developers at risk.* The ability of the private and public sector to

foster economic development, improve infrastructure and enhance the quality of life in Alaska has been reduced as well.

Essentially, the shift of DEC's water quality program from a General Fund program to a User Pay program coupled with policy direction and the postponement, cancellation or completion of projects has reduced fees to DEC and therefore reduced the ability to continue employing an institutionally knowledgeable core permitting staff.

The mining industry has readily demonstrated its willingness to support the user pay system but this has proved to be an inappropriate system for Alaska. Alaska's industrial sector is not large enough to support ADEC's permitting program through fees on a sustaining basis. A core group of knowledgeable perimeters is necessary to challenge the EPA, other Agencies and environmental groups.

That concludes my presentation. Please call me at 465-5463 with any questions. Thank you for your attention.

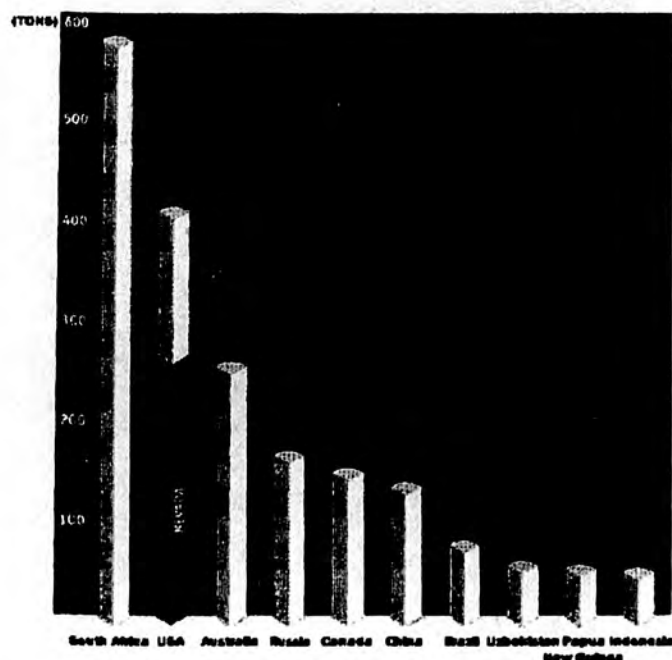
Dr. Lance Miller

Red Diamond Mining Co.

Economic Development and Tourism Committee - February 23, 2000

Report on mineral deposits in Alaska and the global perspective - Lance Miller

- Metal prices, world class mineral deposits (definition) and why companies are working (or at least looking) in Alaska (Fraser Institute Report)
- Mining companies in the late 1990's recognized the need for profits/revenues rather than resources - this resulted in more rigorous project evaluation criteria (grade, size, access)
- The exploration process, why many companies want advanced projects (desire for shareholder equity and return) and the challenges in Alaska
- Alaska in a global perspective & why we need to be competitive (e.g. gold resources in Nevada, Canada, South Africa [1.45 billion ounces of gold], China, Uzbekistan, Australia, Russia)
- Alaska's rich metallogenic framework, where & why different deposit types occur (geologic/deposit history over 400 million years)
- Deposits occur in Alaska of gold, lead, zinc, molybdenum, copper, silver, platinum/palladium, nickel, tin, mercury and rare earth elements
- World class deposits in Alaska (e.g. present/past operations = Red Dog, Greens Cr., Kennecott; undeveloped resources = Quartz Hill, Brady Glacier, Bokan Mountain)
- Sustainable development of Alaska's mineral deposits will be critical for the economic strength of the state
- Future development of mining in Alaska, especially in SE, is severely threatened by impending moratoriums on road construction on national forest lands

PREV**1994 WORLD GOLD PRODUCTION (Top Ten Producers)****WORLD'S TOP GOLD PRODUCING COUNTRIES**

COUNTRY	1984 PRODUCTION TONS	1994 PRODUCTION TONS	% CHANGE 1984-1994
South Africa	683.3	583.9	-10%
USA			
Nevada	66.0	401.6	510%
All Other States	27.4	144.6	430%
Australia	39.1	256.2	560%
Russia	269.0	164.7	-10%
Canada	86.0	146.1	70%
China	59.0	130.0	120%
Brazil	61.5	75.4	20%
Uzbekistan	N/A	64.4	
Papua New Guinea	18.7	60.6	220%
Indonesia	3.6	55.3	1440%



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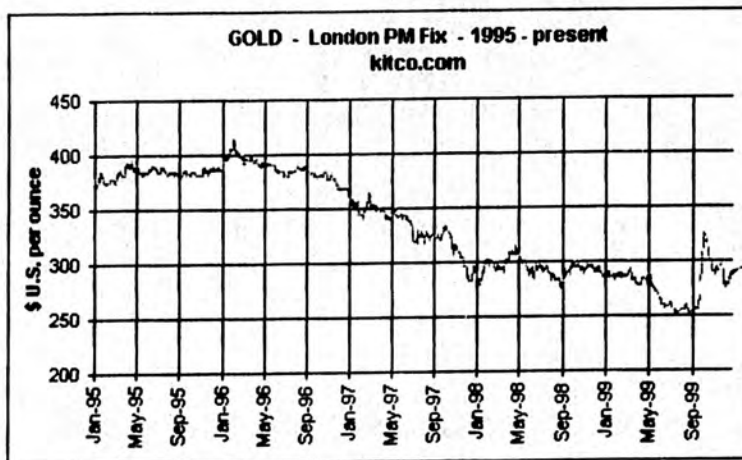
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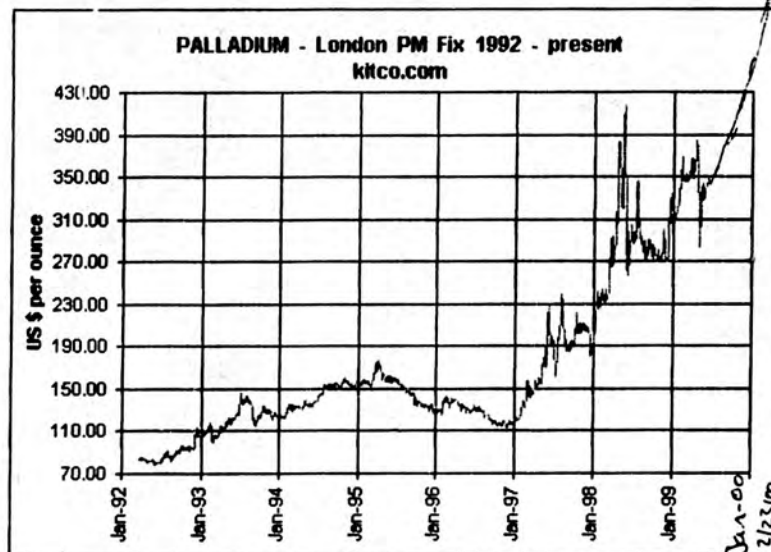
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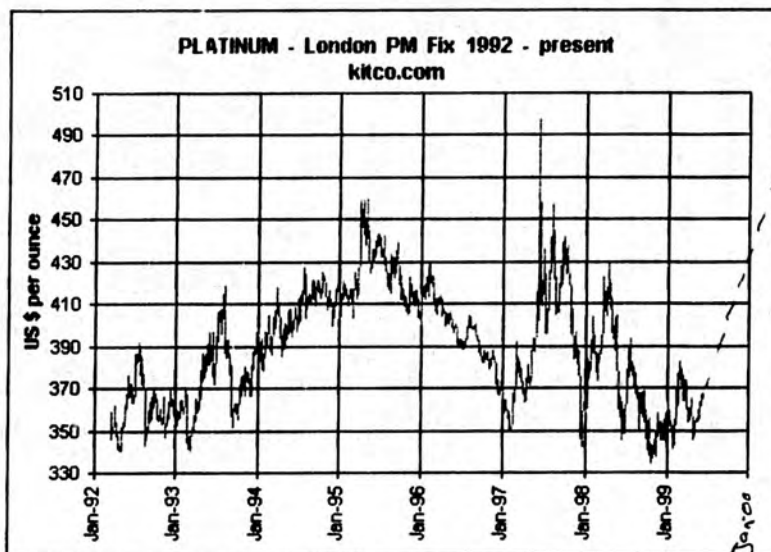
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Annual Survey of Mining Companies 1999/2000:

Executive Summary

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In 1997 the Fraser Institute launched its annual survey of mining companies to assess how various public policy factors such as taxation and regulation affect exploration investment in Canada. The 1998 survey was expanded to include 17 US states, Mexico, and Chile. This year, we have added Nunavut, Texas, Argentina, Australia, and Peru. We look forward to further expanding the survey in the years ahead.

Policy Potential Index: A "Report Card" to Governments

While geological and economic evaluations are always requirements for exploration, increasingly it is a region's policy climate that drives investment decisions.

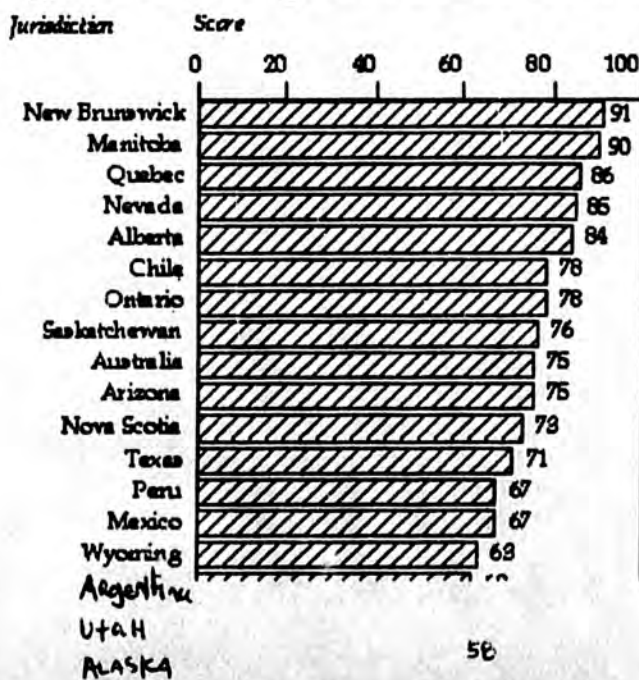
The Policy Potential Index is a composite index that measures the effects on exploration of government policies, including taxation, environmental regulations, duplication and administration of regulations, native land claims, protected areas, infrastructure, labour, and socioeconomic agreements. The highest possible score on this index is 100. The five regions with top ratings for their policy climates include New Brunswick (91), Manitoba (90), Quebec (86), Nevada (85), and Alberta (84). Quebec increased its score dramatically from 59 on last year's survey. The improvement is a result of more favourable ratings in every possible policy category. The worst performing jurisdictions, based on policy, are British Columbia (6), California (17), Wisconsin (18), Montana (23), and Washington, Colorado and Nunavut (tied at 30). British Columbia has been rated the worst jurisdiction for each of the 3 years that the survey has been conducted.

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Figure 1: Policy Potential Index



AK = 19 OF 35

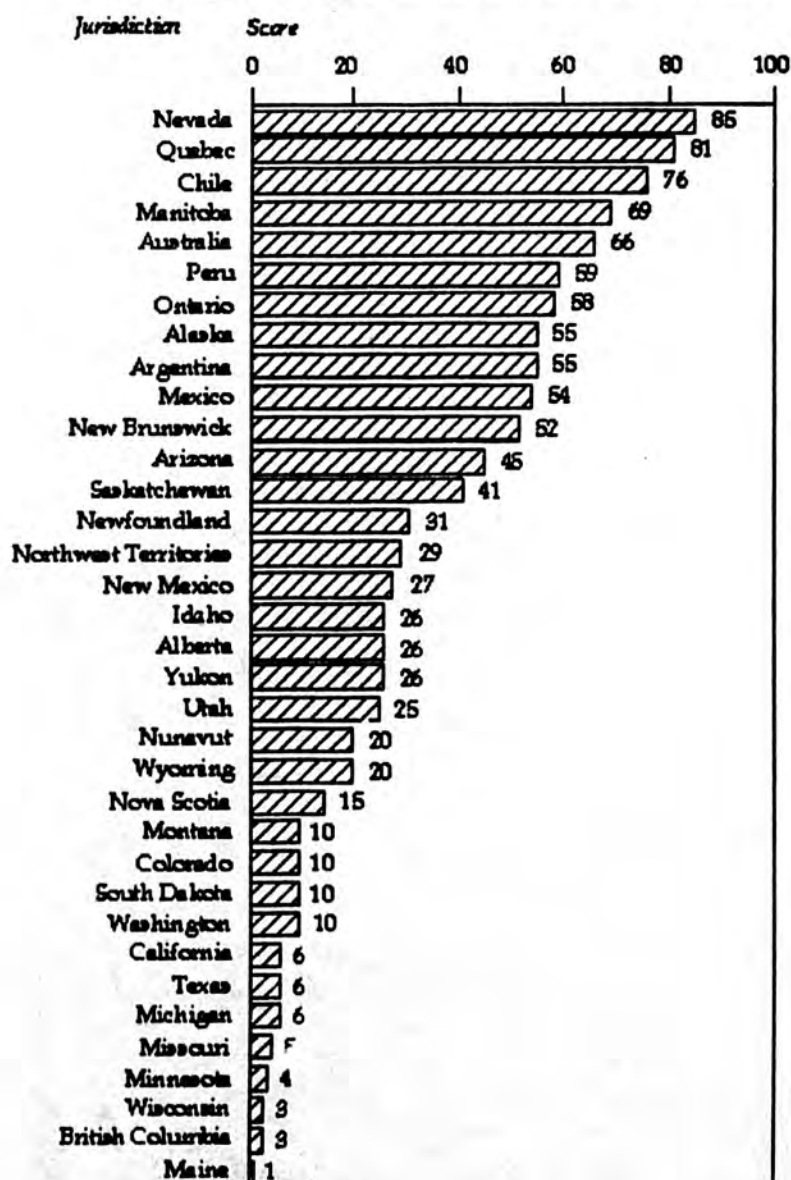
AT BOTTOM
- CAI = 17
= BC = 6

place contenders Chile and Australia in terms of investment attractiveness, even though the two latter countries have reputations of attracting high levels of exploration investment based on mineral potential and favourable investment environments.

Also placing in the top ten jurisdictions for overall investment attractiveness are Peru (59), Ontario (58), Argentina and Alaska (tied at 55), and Mexico (54).

On the other end of the scale, Maine (1), Wisconsin and British Columbia (tied at 3), Minnesota (4), and Missouri (5), were rated the least attractive areas for new mining investment. British Columbia's low rating on the investment attractiveness index is mainly due to its abysmal performance on the policy potential index. Wisconsin's low investment attractiveness score suggests the results of its moratorium on mining and well-publicized anti-mining attitude as well as its low score on the mineral potential index. Maine did poorly because of its bottom rating on the mineral potential index and its mediocre performance on policy. Other low scoring jurisdictions include Michigan, Texas and California (tied at 6).

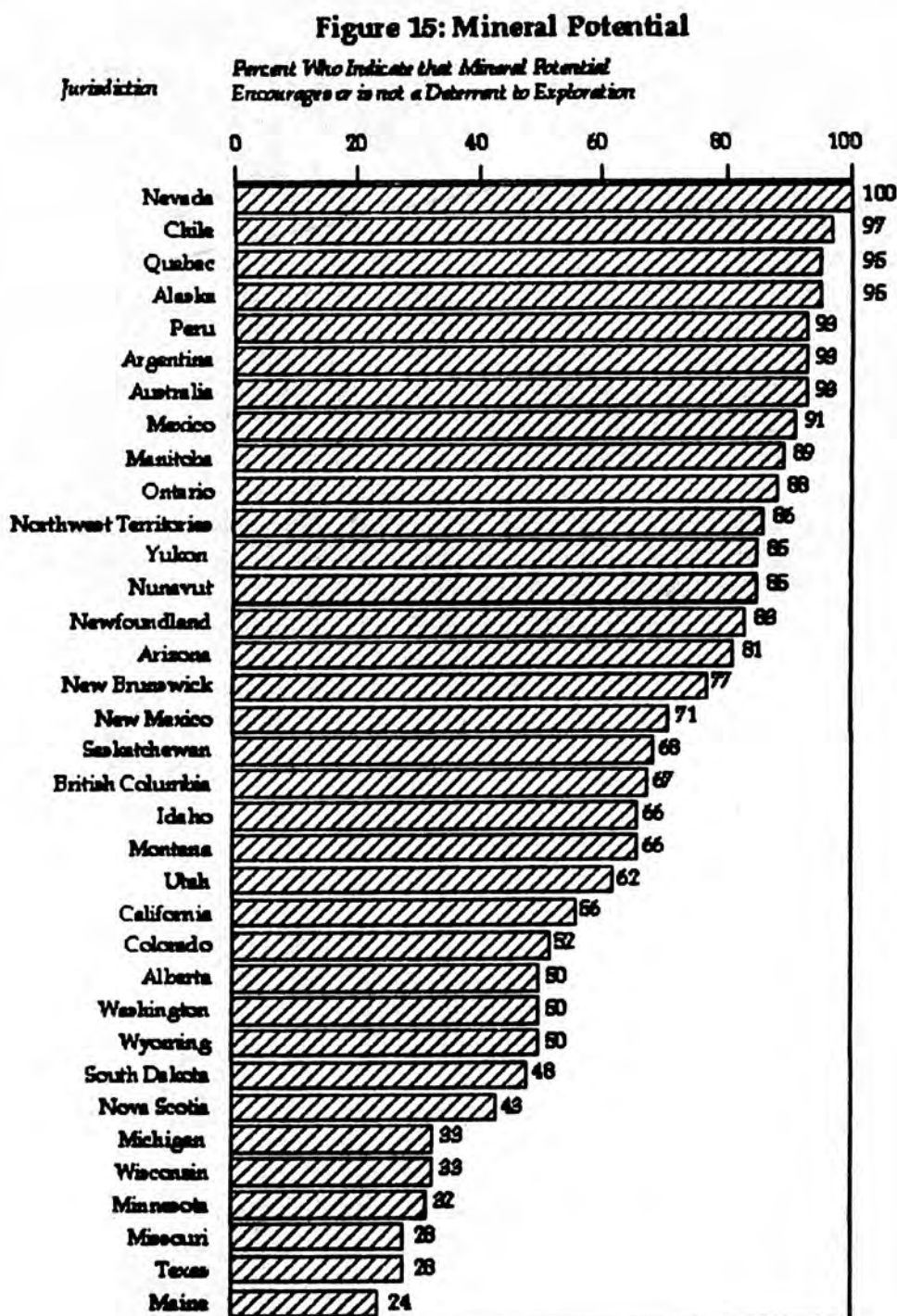
Figure 3: Investment Attractiveness Index



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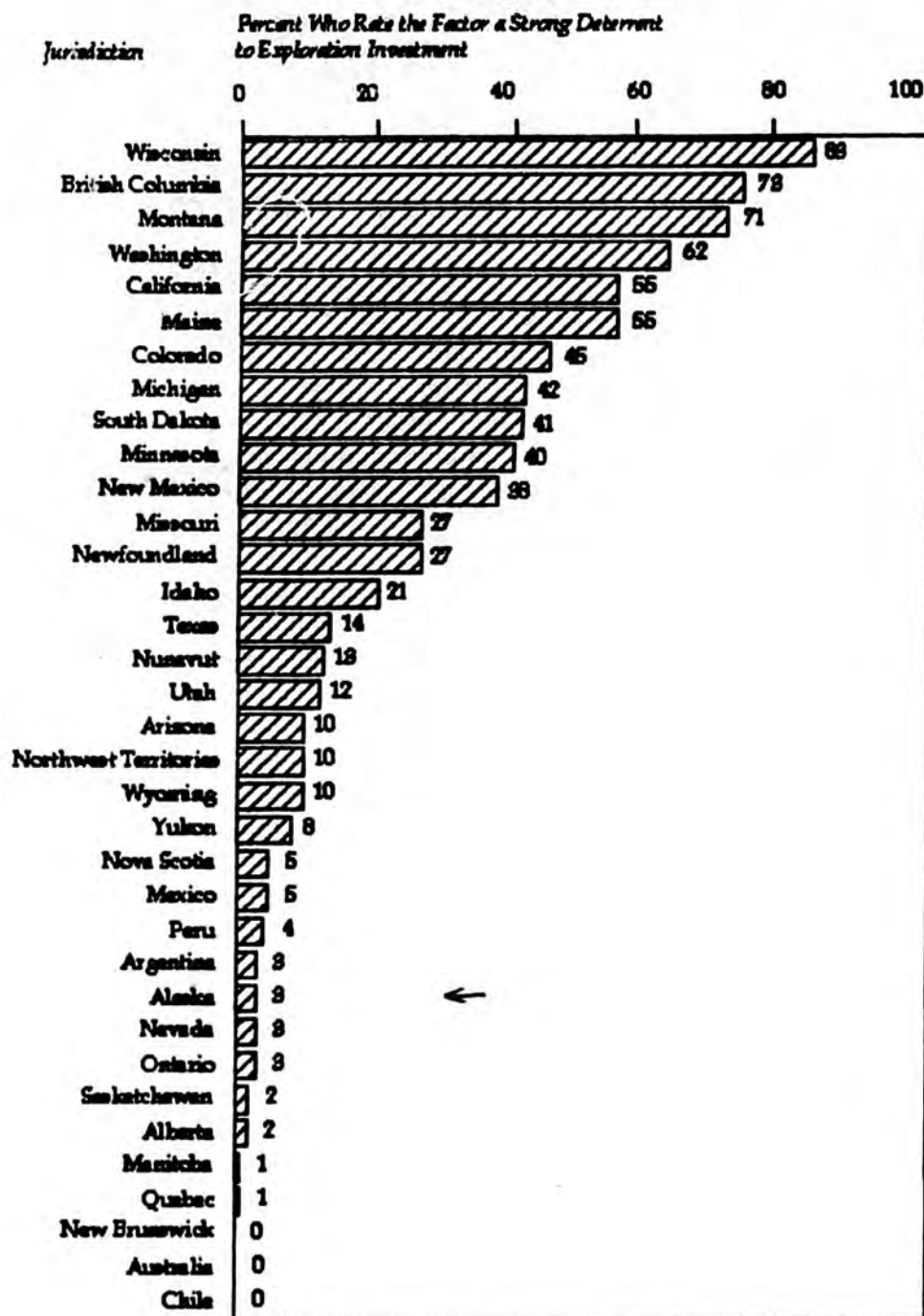
Uncertainty Concerning the Administration, Interpretation and Enforcement of Existing Regulations

"... I was heavily involved in the permitting of a lead, zinc project in British Columbia. This project was the first to go through the new permitting process. The time taken was far and above the set timetable, new issues were constantly tabled after documents were submitted and the costs were far and above those budgeted. This must change or exploration in BC will cease."

- President & CEO of a junior mining company

"Alberta and Nevada show a genuine regard for those persons or companies

Figure 16: Uncertainty Concerning the Administration, Interpretation, and Enforcement of Existing Regulations



Environmental Regulations

"BC must reverse its position/policies on land use. Miners, loggers, ranchers, etc. must be allowed to use the land instead of being legislated and regulated off it."
- Director of a junior mining company

"British Columbia['s] [m]ining policies (moratorium on uranium) and park boundaries (Windy-Craggy) change after the discovery of a deposit." You need "[c]onsistency. Set the rules and guidelines and keep them, so mining companies

will know what to expect."

- Senior Geologist of a senior mining company

"Quebec" has the most favourable policies. "The province is very pro-mining offering incentives and realistic environmental practices."

- Exploration Manager of a junior mining company

"British Columbia's 'Environmental Review Process' is misnamed; in reality it is a 'political review process.' Serious environmental issues and good science take a back seat to political grandstanding and generalized public opinion."

- Vice President of a junior mining company

Figure 17: Environmental Regulations

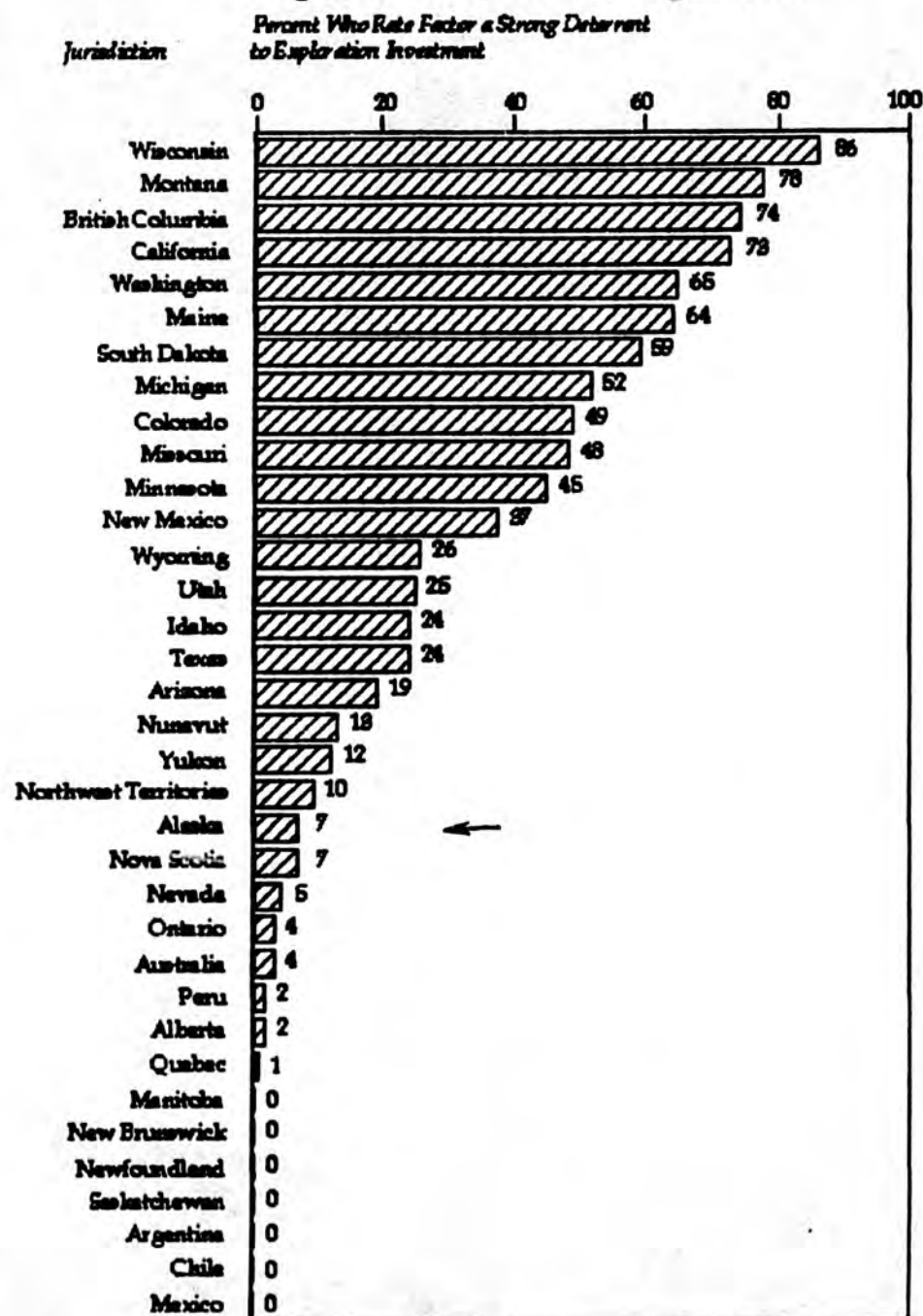
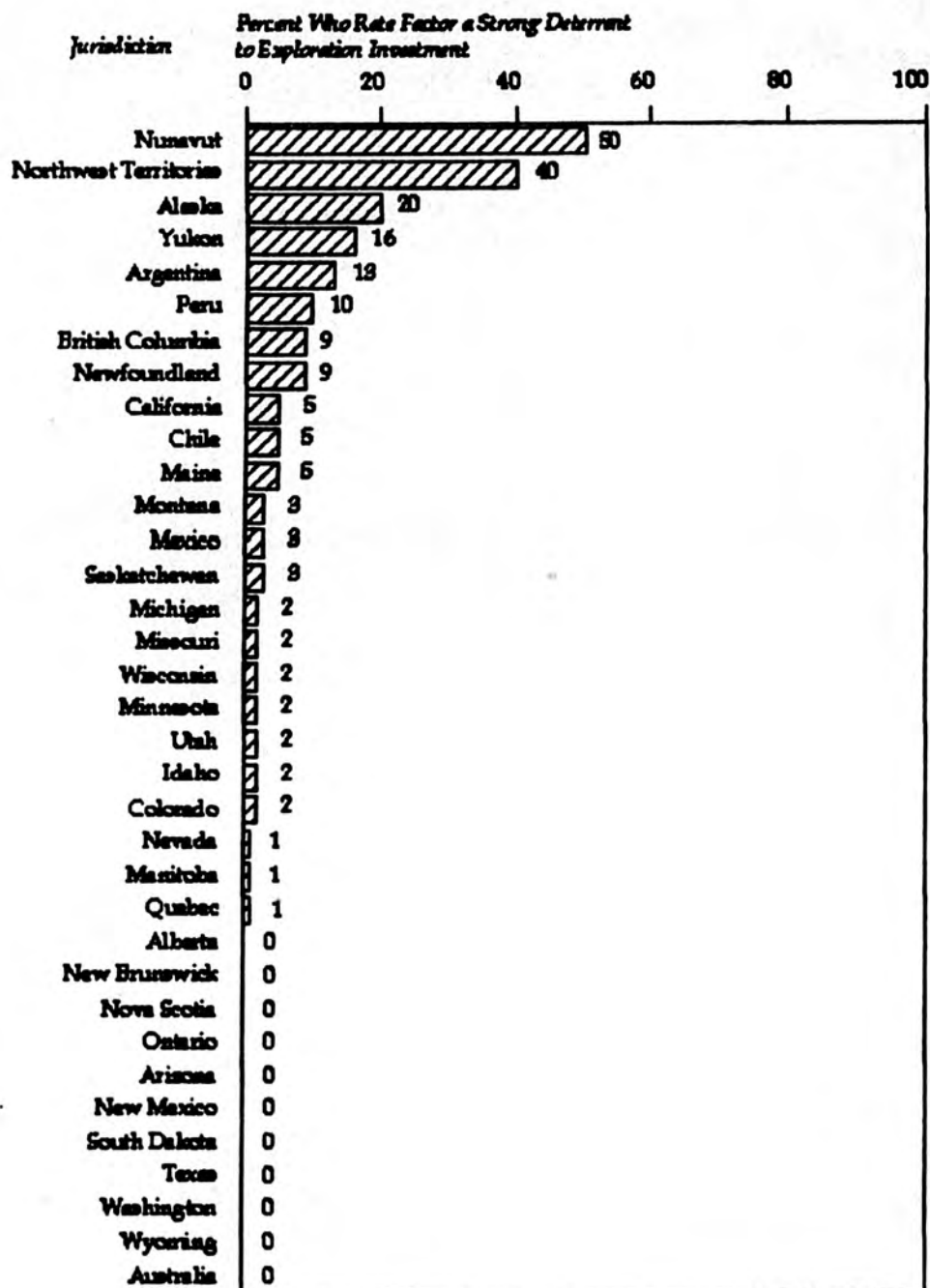


Figure 24: Infrastructure



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EXPLORATION REVIEWS

ALASKA

Regional Correspondent: **Curtis J. Freeman** (SEG 1996)

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For the fourth straight year, the value of the Alaska mineral industry has topped the \$1 billion mark. However, mineral exploration expenditures dropped for the first time since 1992, coming in at approximately \$46 million, a decrease of 20% from 1998. The most active region of Alaska was the Eastern Interior, where 72% of total Alaska exploration expenditures was invested on 48 separate prospects. Total gold resources increased 6%, to approximately 60.2 million ounces.

WESTERN ALASKA

Cominco American's as-yet unnamed new discovery, located 6 miles north of the **Red Dog** mine, intersected significant lead-zinc-silver mineralization below a barite cap. That is, if you call intercepts such as 240 feet grading 20% Zn, 5% Pb and 4 opt Ag "significant"!

Viceroy Alaska, a subsidiary of **Viceroy Resources Corp.**, has reached an agreement with the state of Alaska to take over mining and decommissioning of the **Illinois Creek** heap leach gold mine. The two-phase program outlined by Viceroy includes confirmation drilling of the existing reserve base followed by mining and reclamation plans to be submitted by January 31, 2000. Due diligence drilling has been completed and the Tundra Telegraph says the results support continued mining of the deposit.

Placer Dome has reported that its summer drilling efforts confirmed the grade of the 11.5-million-ounce **Donlin Creek** gold deposit.

NovaGold Resources has signed a deal with **Viceroy Resources** on NovaGold's 50 square mile **Rock Creek** project near Nome. Viceroy can earn a 65% interest in the project by expending \$8 million on property exploration, making cash payments totaling \$2 million and completing of a pre-feasibility study. The primary target area encompasses the 720,000-ounce Rock Creek deposit. Viceroy completed minimal work in 1999. NovaGold will act as operator until Viceroy has expended \$5 million on the project.

EASTERN INTERIOR

Kinross Gold's Fort Knox mine produced 97,256 ounces of gold in the third quarter and 265,685 ounces of gold through the first nine months of 1999. Total production for 1999 is expected to reach 60,000 ounces. In late September, Fort Knox produced its one-millionth ounce of gold. The company continued its efforts to evaluate its **Ryan Lode** and **True North** deposits with the goal of bringing their Fairbanks district production to the 500,000-ounce-per-year level by 2001.

Kinross Gold has entered a joint venture agreement with **Teryl Resources Corp.** on Teryl's **Westridge** claims south of the **True**

North deposit. Kinross can earn a 70% interest in the deposit by expending \$1.5 million on exploration and making cash payments to Teryl totaling \$285,000 over 5 years. Minimal work was completed on the **Westridge** claims in 1999.

Tri-Valley Corporation has staked a 10-square-mile area covering a newly identified gold trend on its **Richardson** project in the Richardson district.

The State of Alaska **Division of Geological and Geophysical Surveys** completed its planned airborne geophysical program over about 950 square miles of the **Salcha** and **Goodpaster** mining districts. These surveys are scheduled to be released to the public in early 2000.

Camnor Resources and partner **Oromin Exploration** announced results from their initial work program on the **South Salcha** property in the Caribou district. Three east-west-trending gold-in-soil anomalies were delineated by grid-controlled soil sampling. These anomalies measure 200 meters wide and range from 800 meters to 1,400 meters in length. Altered gneiss and intrusive rocks contain variable amounts of quartz veining with up to 3% disseminated pyrite and 1% disseminated arsenopyrite.

Great American Minerals has joint ventured its **Uncle Sam** properties in the Richardson district to **Kennecott Exploration**. Kennecott can earn a 51% interest in the project by expending \$1.5 million on exploration and making cash payments of \$260,000 over six years. Kennecott can earn additional interest in the property through a series of optional cash payments and work expenditures. Preliminary work on the Uncle Sam prospect revealed gold in rock grab samples up to 0.16 ounces per ton and anomalous gold in soil samples up to 430 parts per billion. The northwest trend of mineralization on the Uncle Sam prospect is parallel to that of the nearby **Pogo** trend.

Teck Corp. and partner **Sumitomo Metal Mining** reported that their 1999 surface exploration drilling program intercepted auriferous quartz bodies in two new areas of the property, one at relatively shallow depths in a water monitoring well in lower **Liese Creek** and another in a shaft pilot hole at depths below previously known mineralization. In addition, two north-trending, steeply east-dipping shear-hosted quartz veins were discovered in the **North Zone**. Updated reserves should be announced before year-end. Drilling also was conducted at the **Sonora Creek** prospect southeast of the main deposit where east-west trending quartz veins along a strike length of several hundred feet have returned some values in excess of 1 ounce per ton gold. A soil grid in this area is reported to be substantially better than the original **Liese** soil anomaly.

Western Keltic Mines and joint owner **Rimfire Minerals** announced additional results from rock samples on the **Boundary** and **Southeast Surf** prospects. The Boundary prospect returned gold in excess of 100 ppb in 20 of 54 rock samples collected with the highest value being 0.72 opt Au. Anomalous gold is associated with bismuthinite and arsenopyrite. The results of 472 soil samples collected in Phase 2 defined a 1,400 by 700 meter gold anomaly with values ranging from 10 to 240 ppb within a broader arsenic and bismuth halo measuring 3,000 by 5,000 meters. Work on the Southeast Surf consisted of collection of 349 soil and 42 rock samples which defined three separate gold anomalies ranging from

700 by 2,500 meters to 300 by 1,500 meters, with gold values ranging from 10 to 90 ppb. Sixteen of 42 rock samples collected returned gold values greater than 100 ppb, with values ranging up to 0.13 opt Au. Most of the anomalous samples were from the **Spur** zone, located directly uphill from one of the newly identified soil anomalies. Gold is associated with up to 4% arsenopyrite in milky to vuggy quartz veins hosted by altered granitic rocks. Anomalous gold also was discovered in the **Ol' Timer** prospect, where it occurs in association with arsenopyrite-bearing quartz veins hosted in sericite-altered augen orthogneiss.

Copper Ridge Exploration announced the results from 325 soil samples collected during its Phase 2 field program on its **Goodpaster** claims north of **Pogo**. Anomalous metals include gold (up to 273 ppb), arsenic, bismuth, lead, antimony, and tellurium. Three anomalous areas were defined, including an area measuring approximately 1.5 by 1.5 miles on the western end of the project, where gold values show a close association with bismuth, arsenic, tellurium, and lead. The target overlies gneissic rocks which are similar to those hosting the Pogo deposit, as well as rocks of the Goodpaster batholith.

Hyder Gold and joint venture partner **Rimfire Minerals** announced the results of Phase 2 soil and rock sampling on their **Eagle** and **Bou** prospects in the southern Goodpaster district. Work on the Eagle prospect consisted of collection of 548 soil samples which returned gold values up to 320 ppb over a 3,000 by 1,500 meter area. Anomalous gold is associated with anomalous bismuth, arsenic and antimony. Gold in rocks returned values up to 615 ppb from quartz veins in Cretaceous granite. The company also announced discovery of two new showings, the **Thunder** and **Cairn** prospects on their Bou property. Rock samples from the Thunder showing returned gold values up to 2.16 grams per tonne over a 300 meter long northeast trending rubble-crop zone. The Cairn showing, located 1,500 meters south of the Thunder showing, returned gold values up to 2.92 g/t over a 700 meter long east-west trending rubble-crop zone. Grab samples with values up to 3.96 g/t were found elsewhere on the Bou property.

Almaden Resources and **Williams Creek Exploration** announced that initial stream sediment sampling on their **Sonora** claim block south of the **Pogo** deposit has outlined anomalous gold in four streams draining a common ridge in one area of the property and anomalous gold in two other drainages. Additional work is being planned for next season.

Ventures Resource Corp. and **Teck Corp.** announced preliminary results from their **Veta** property joint venture. Their joint venture completed 8,000 feet of core drilling in 10 holes on the **North Veta** and **Serpentine** prospects in 1999. The best intercept from the five drill holes on which assays have been released was 23 feet grading 0.03opt Au. Results are pending on the other drill holes. Extensive stream sediment and pan concentrate sampling returned anomalous gold values over a widespread area of the North Veta property.

Cusac Gold Mines Ltd. announced acquisition of the 8,000-acre **Moran dome** prospect in the Melozitna district. Cusac can earn an 80% interest in the property from **Cariboo Drilling Co.** by paying US\$10,000 and issuing 400,000 Cusac common shares. Previous work on the property indicated anomalous tin, tungsten, and lead in alluvial gold concentrates and anomalous gold in stream silts from five areas of the property.



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... from 31 EXPLORATION REVIEWS, CONT.

ALASKA RANGE

Atna Resources and **Grayd Resources** announced results from their 10,260-foot, 14-hole diamond core drilling program on the **Dry Creek** volcanogenic massive sulfide deposit in the Bonfield district. Significant widths of massive to semi-massive sulfide mineralization were encountered, however base metal grades were generally lower than drilling results in 1998. With the results from three holes still pending, the best intercept to date graded 3.37% Zn and 1.09% Pb over 14 feet in hole DC99-66. The results prompted **Atna** to terminate its interest in the **Dry Creek** and **Anderson Mt.** projects.

Diamond drilling by **Camnor Resources** and partner **Oromin Resources** on the **Discovery** zone at the **Cirque** volcanogenic massive sulfide prospect in the Bonfield district intercepted 5.5 meters grading 2.84 g/t Au, 74.5 g/t Ag, and 8.08% Zn, 2.11% Pb and 1.36% Cu. The **Discovery** zone has been traced for 700 meters along strike to the west to the **JA** prospect and remains open along strike and down dip to the north. Additional lower grade mineralization was intercepted at the **Dol** zone located 500 meters north of the **Discovery** zone and 250 meters lower in elevation.

Atna Resources diamond drilled three holes totaling 2,442 feet on the **Caribou Dome** stratiform copper project in the Valdez Creek district. Drill intercepts include 5 feet of 5.9% Cu and 5 feet of 1.9% Cu. Geophysical surveys indicate the mineralized horizons extend for up to 700 feet west of the **No. 2 zone** and also identified a 600-foot-long anomaly south of, and parallel to, the eastern mineralized zone.

Additional high-grade gold was discovered by **Grayd Resources** on their **White Gold Trend** on the **Rumble Creek JV** in the Delta District. Results included 61.4 g/t Au in a grab sample at the **Low Showing**, 19.7 g/t Au from a pit sample near the **Goldberg Saddle** and 1.6 g/t Au over 15 meters in a hand trench on the **Low Showing**. Mineralization is associated with low-sulfide quartz-sericite alteration and is part of an 8-kilometer-long trend.

Fort Knox Gold Resources has signed an agreement with **American Copper and Nickel Company (ACNC)** to acquire 100% interest in ACNC's **Nikolai** property in the central Alaska Range. **Fort Knox** intends to focus on the platinum and palladium potential of the property rather than the copper-nickel potential, which was the subject of previous exploration. Values up to 1.8 g/t Pd were recovered on the **Canwell** prospect, while values up to 15.6 g/t Pt and 2.6 g/t Pd were collected on the **Odle** prospect.

SOUTHEAST ALASKA

Kennecott (70.3%) and **Hecla** (29.7%) reported that the **Greens Creek** mine produced 2,575,718 ounces of silver at a cash cost of \$1.89 per ounce during the third quarter of 1999. Total production costs were \$4.33 per ounce of silver. The mine also produced 20,423 ounces of gold, 6,824 tons of lead and 18,193 tons of zinc in the quarter.

Rubicon Minerals announced additional results for the newly discovered **RW** massive sulfide showing at its **Palmer** volcanogenic massive sulfide project near Haines. Hole **RMC99-13** intersected 7.2 feet grading 13.48% Zn, 0.21% Cu and 0.37 opt Ag. This intersection extends mineralization 260 feet downdip below previous drilling.

Mineral Deposits of Alaska

Preface

LANCE D. MILLER

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AND RICHARD J. GOLDFARB

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Mineral resources have been important to the Alaskan economy for hundreds of years. The Indians, Eskimos, and Aleuts used gold, copper, and other metals for jewelry, utensils, and weapons and as items of trade. The Russians, who arrived in 1728, showed only minor interest in minerals, focusing instead on furs. Nonetheless, records show that they mined iron ore on the Kenai Peninsula in 1793 and located gold there in 1834. In addition, the Russians were aware of copper-rich occurrences in the Copper River basin.

The mining industry grew rapidly in Alaska after the United States purchased the region from Russia in 1867. By 1870, gold was being mined near Windham Bay and near Sitka, in southeastern Alaska. The first major hard-rock gold mining began at the Alaska-Juneau, Perseverance, and Treadwell mines near present-day Juneau following the discovery of placer gold near tidewater in 1880. Significant placer mining operations for gold soon spread northward into districts such as Fairbanks, Nome, Iditarod, and Circle.

The exploitation of mineral resources, particularly gold, influenced the settlement and development of much of the state. Major cities such as Nome, Fairbanks, and Juneau, the capital, were originally built around early mining camps. By 1996, more than 33 million oz of gold, as well as significant amounts of copper, lead, zinc, silver, and platinum-group elements, had been produced. In addition, there has been minor production of nickel, tin, mercury, and uranium.

Alaska is presently experiencing a renaissance in mining on federal, state, private, and native lands. From 1990 to 1996, the minerals industry had an annual value of approximately \$600 million, with a record 1 billion in 1996. Nearly 3,500 year-round jobs were directly attributed to the minerals industry. Looking forward into the twenty-first century, the outlook is even better. Major mines such as Red Dog are in production. Recently completed exploration at the Red Dog sedimentary exhalative deposit has significantly expanded the reserve base and major mine expansion is contemplated. The Nixon Fork gold skarn deposit was put into production in 1995, with the first ore poured in November. The Greens Creek mine resumed production in late 1996, following renewed exploration and development of the volcanogenic massive sulfide deposit. The Fort Knox gold mine, near Fairbanks, is under construction and is scheduled to yield ore by late 1996. In southwest Alaska exploration success has yielded a significant gold resource at Donlin Creek. In addition, the Kensington-Jualin project is at an advanced stage. Recent actions by the state of Alaska with regard to government-sponsored geophysical mapping, land-use priorities, environ-

mental regulations, taxation, and mineral exploration incentives suggest that responsible growth of the minerals industry will be favored there as projected oil-based revenues decline sharply throughout the remainder of the decade.

Alaska clearly remains elephant country, as evidenced by the discovery of four world-class ore deposits (Greens Creek, Red Dog, Fort Knox, and Quartz Hill) in the past twenty years. Because of the great mineral potential of the state, we believe this monograph will serve as a useful guide to the economic geology of the many and varied mineral deposit types within Alaska. Much of the description will remain useful well into the future. Some of the interpretations may indeed change as more information becomes available about specific deposit types; however, the genetic models presented here reflect our geologic understanding of these mineral systems in the 1990s. In addition to being a useful reference for mineral deposits in the state, the metallogenic setting of Alaska's deposit is similar to other parts of the Pacific Rim, where much exploration and mining is presently being focused. Therefore, this monograph should also be a useful reference for geologists working in cordilleran-type settings that extend beyond the borders of Alaska.

This monograph contains 15 papers. The first is an overview describing the metallogenic evolution of Alaska. Goldfarb (1997) takes us forward in time and synthesizes the tectonic development of Alaska and associated ore formation in oceanic environments between 700 and 150 Ma. Deposits associated with oceanic settings include shale-hosted Zn-Pb-Ag, carbonate-hosted copper, and polymetallic volcanogenic massive sulfide deposits. The last 150 m.y. are characterized by collisional tectonics, voluminous calc-alkaline magmatism, and the formation of epigenetic Cu and Mo porphyry deposits, skarn deposits, epithermal precious metal systems, Fe-rich Alaska-type zoned ultramafic bodies, and mesothermal gold lodes.

Among the world-class ore deposits in production in Alaska, the Red Dog mine stands out. In the paper on shale-hosted Zn-Pb-Ag and barite deposits of Alaska, Schmidt (1997a) describes Red Dog as a vent-dominated end member of the shale-hosted type of massive sulfide deposits. Most of the significant shale-hosted mineralization in northern Alaska is shown to be within Carboniferous rocks that are mainly associated with restricted basins proximal to extensional faults. In a related chapter, Schmidt (1997b) describes two types of strata-bound carbonate rock-hosted deposits in nearby platform environments that represent additional base metal-rich exploration targets developed along the passive

North American Paleozoic continental margin. The first type, which she favors as being similar to Mississippi Valley-type or Irish-type deposits, includes Zn-Pb $\pm$ Ag stockworks, lenses, breccias, and disseminations; the second deposit type includes epigenetic stockworks of Cu-Co $\pm$ Zn. Schmidt synthesizes and presents the available information on both the shale- and carbonate-hosted deposit types, concluding each chapter with a discussion of the potential for favorable host rocks in Alaska.

It takes a rare deposit to make a major mining company, such as the replacement copper ores in the Wrangell Mountains did for Kennecott. In the paper on the Kennecott deposits, MacKevett, Cox, Potter, and Silberman (1997) describe and evaluate the unique setting of these deposits and propose a model of ore genesis in which oxidized copper-bearing brines circulated through the Nikolai greenstone. The copper was deposited at low temperatures in karst-type openings that exploited a series of northeast-striking joints. Although this type of deposit is not widely recognized, its characteristics serve as a reminder that not all deposit styles fit established models. Hence, the explorationist should beware.

Ninety percent of the gold production in Alaska has been derived from Cretaceous and early Tertiary lode deposits and associated placers in metamorphosed terranes. In the paper on gold deposits in metamorphic rocks of Alaska, Goldfarb, Miller, Leach, and Snee (1997) present the regional setting as well as the geochemical, structural, and mineralogical characteristics of the major lode systems in the state. These deposits all formed under mesothermal pressure-temperature conditions in greenschist facies rocks. Mass balance work supports the hypothesis that gold was mobilized from background concentrations in midcrustal rocks and that the ore-transporting fluids have a metamorphic signature. Goldfarb and the others summarize their paper with a genetic model in which the lode deposits are shown to have commonly formed in second- and third-order structures in convergent tectonic settings. Although their paper is an overview, much specific deposit information is introduced that will help the explorationist.

Three other papers are concerned with epigenetic gold-bearing lodes in Alaska. Two of these discuss the auriferous ore settings in east-central and southwestern Alaska, where data from fissure-type veins and stockwork systems are interpreted as showing distinct genetic relationships with magmatism. In a paper on precious metals associated with Late Cretaceous-early Tertiary igneous rocks of southwestern Alaska, Bundtzen and Miller (1997) describe the deposits in the Kuskokwim mineral belt and define a metallogenic model for the development of the gold-silver-polymetallic deposits of the region. This paper is an excellent descriptive summary of an underexplored region in Alaska that has recently been the focus of widespread exploration efforts, with recent exploration success at Donlin Creek. With the discovery and development of the Fort Knox deposit during the past few years, there has been a boom in exploration and development in the Yukon-Tanana terrane in east-central Alaska and adjacent Yukon Territory. Recent exploration successes at the True North and Stone Boy projects have highlighted the need for reassessment of exploration models. The magmatic origin for mid-Cretaceous gold systems in this area is explored and

discussed in the paper by McCoy, Newberry, Layer, DiMarchi, Bakke, Masterman, and Minehane (1997). The authors integrate new $^{40}\text{Ar}/^{39}\text{Ar}$ ages with fluid inclusion and stable isotope data to support a model in which low-salinity, CO_2 -rich, gold-bearing fluids were derived from the evolving magmas of host intrusions.

The paper by Gray, Gent, Snee, and Wilson (1997) describes the geologic and geochemical setting of epithermal Hg-Sb veins of southwestern Alaska and epithermal gold veins of the Alaska Peninsula and the Aleutian Islands. These regions represent parts of the state where shallow crustal rocks are still preserved and are therefore favorable for epithermal ore deposits. New geochronologic data from the Hg-Sb vein deposits temporally link ore formation to Late Cretaceous magmatism. Significant precious metal exploration targets may exist at depth in these systems, with Au-As-W-rich mineralization occurring below exposed Hg-Sb ores. Perhaps more intriguing, from the standpoint of exploration, is the potential for large epithermal lode gold systems associated with Tertiary volcanic rocks on the Alaska Peninsula. Gray and the others forward the hypothesis that the gold-bearing systems may be associated with arc-related Cu porphyry systems. Between the remoteness of the region described in this paper and the extensive magmatic activity of the Aleutian arc, the potential for discovery of significant new ore systems is high.

The voluminous information on Alaskan volcanogenic massive sulfide deposits is brought together in the paper by Newberry, Crafford, Newkirk, Young, Nelson, and Duke (1997b). Spatially distributed throughout much of Alaska, such deposits provide exciting exploration opportunities for precious and base metals. Past development of Late Cretaceous, Tertiary Cyprus-type, and Besshi-type ores characterizes much of the Prince William Sound area. The Late Triassic belt of mainly kuroko-type systems within rocks of the Alexander terrane in southeastern Alaska and British Columbia includes the huge Windy Craggy deposit and the extremely precious metal-rich Greens Creek ores. Early Paleozoic massive sulfides in the southern part of southeastern Alaska have been the focus of consistent industry attention during the past few years, and middle to late Paleozoic ores of the Ambler district in northwestern Alaska are again being evaluated. The paper by Newberry and the others describes and catalogs these deposits in addition to presenting interesting models for exploration.

Young, St. George, and Bouley (1997) address the tectonic association of porphyry copper occurrences through time in Alaska. Over the geologic history of the state, the authors identify ten distinct episodes of porphyry copper formation. Computer-generated palinspastic reconstructions are used to place these episodes in appropriate tectonic settings. The most abundant and the most economically significant occurrences are associated with Cretaceous intermediate igneous rocks. In the paper on molybdenum porphyry occurrences, Ashleman, Taylor, and Smith (1997) present the most detailed geologic description to date on Quartz Hill, one of the largest porphyry molybdenum deposits in the world. They tie a detailed understanding of the local deposit geology to the current models of porphyry systems to develop an improved genetic model for Quartz Hill. Development of such a local

model has been a long-term problem, because Quartz Hill shows features characteristic of both typical subduction-related ore systems and Climax-like, rift-related porphyry bodies.

The paper on skarn deposits of Alaska by Newberry, Allegro, Cutler, Hagen-Levelle, Adams, Nicholson, Weglarz, Bakke, Clautice, Coulter, Ford, Meyers, and Szumigala (1997a) describes over 300 skarn deposits and occurrences throughout Alaska. This paper is an extensive compilation of published material as well as recent research by the authors. As an interesting exploration guide, the authors suggest that although the host terrane seems to have little influence on the type of skarn, it may influence pluton composition, which will in turn control the skarn oxidation state. Additionally, Newberry and the others forward a model whereby the metals are derived from the plutons. After presenting all their descriptions and data, the authors point out how pluton characteristics should be used in skarn exploration.

Mafic and ultramafic complexes account for the production and existing resources of platinum-group elements, asbestos, and iron in Alaska. In the paper on mineral occurrences associated with these complexes, Foley, Light, Nelson, and Harris (1997) classify these igneous rock types based upon age, lithology, tectonic setting, structural and petrologic features, and metallogeny and identify five distinct types of related ore deposits. For the precious and base metal explorationist, this paper will provide some intriguing ideas for targets, since many of the platinum-group element placer and lode deposits also have yielded by-products of gold, silver, and copper.

Tin has not received the same attention that precious metals have in Alaska; however, Hudson and Reed (1997) forward the suggestion, based upon their geologic models, that under the right economic conditions, the state could be a significant producer of tin. They describe tin deposits associated with placers, veins, skarns, and greisens. Their optimistic view of the potential for significant discovery of tin is based upon the link between widespread Middle Cretaceous crustal melting in central and western Alaska and their new recognition of a broad regional tin belt.

Uranium, thorium, and rare metal deposits are uncommon in Alaska, but minor production of uranium has occurred from Bokan Mountain, in southeastern Alaska. In the paper on rare metal deposits, Thompson (1997) describes the igneous-hosted uraniferous Bokan Granite Complex and the sedimentary rock-hosted Death Valley deposit on the Seward Peninsula. Although the economic outlook for uranium is bleak, this paper presents some important geologic characteristics of unique mineral deposits that may provide economically valuable minerals in the future.

The metallic minerals industry has figured significantly in the economics of Alaska and the future looks bright, but few all-encompassing geologic references are available that detail the numerous and varied mineral deposit types of the state. The lack of a comprehensive, up-to-date reference on the economic geology of Alaska has spurred the idea of this monograph.

Such an effort was deemed timely given the resurgence of exploration and mining in the 1980s and 1990s, both in the state and internationally. Three years of work has culminated in this volume.

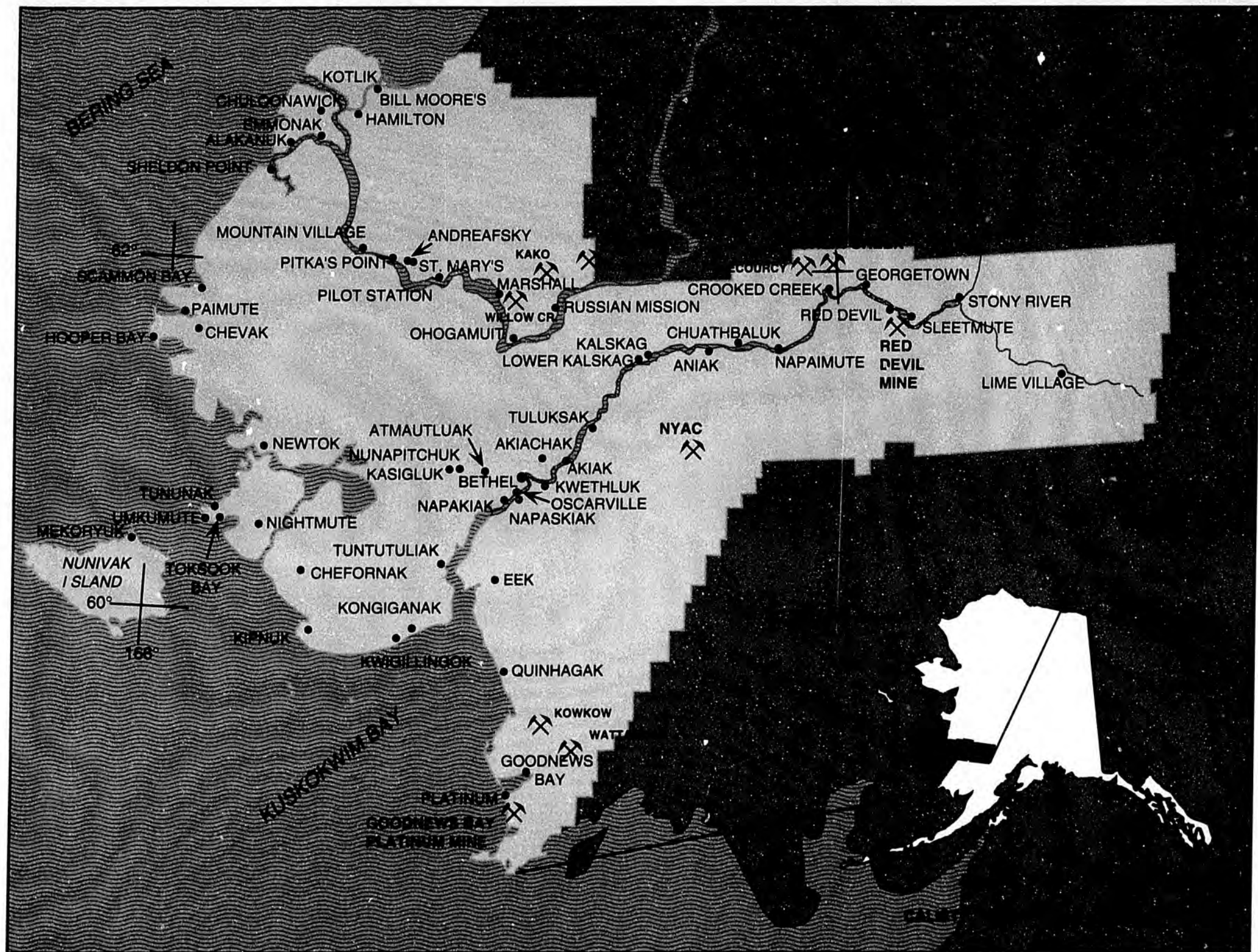
This monograph is a team effort representing the work of 48 authors and some 35 *Economic Geology* reviewers, each of whom devoted much free time to this project. In addition, various companies and organizations have generously contributed money to help defray printing costs. The contributors include Cominco Exploration, Cyprus Metals, Echo Bay Mines, Kennecott Exploration, Placer Dome U.S., Inc., and Sealaska Corporation. We thank the numerous people and companies who have been connected with this project.

We hope the reader will find this to be a useful volume on the geology of Alaska's mineral deposits. We are excited about what the future holds for the development of mineral resources in Alaska. Clearly, a sound knowledge of the economic geology of Alaska's mineral deposit types is integral to successful exploration and development of these resources.

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June McAtee
Calista Corporation
Donlin Creek Project



Donlin Creek Project

- Placer Dome has been actively exploring since 1995 and has spent approx. \$30 Million to date on a camp supported exploratory drilling effort (More than 400 drill holes completed)
- Results indicate a measured, indicated and inferred gold resource of 11.5 million ounces (about 360 tons of gold) in the ground.
- Region lacks infrastructure resulting in high capital cost (power, roads, river port, etc...)
- Remote location - May require 400 barge trips per year during operation of mine.
- Seasonal shipping window is 100 days - Requires significant inventory of materials.

zero tolerance drug free zone w/mandatory drug testing
Banking Capabilities



Shareholder overview

Donlin Creek Project

●	Year	95	96	97	98	99
● Employed		20	172	91	55	28-40
● Wages (in thou)	\$122	1,174	976	664	700	
● % of Workforce	50	51	56	55	50-70	
● % Turnover	20	250	22	22	8.2	



**REQUEST FOR FUNDING
PRELIMINARY ENGINEERING AND DESIGN
CROOKED CREEK DONLIN CREEK MINE ROAD**

PROJECT BACKGROUND

The Donlin Creek mine is a lode-gold exploration project located 15 miles north of the village of Crooked Creek (population 144). Small placer mining operations (total production 35,000 oz.) have been present in the area since 1915. In the mid-1980's, Calista geologists determined that a significant lode source could exist in the uplands above the existing placer mining operations near Snow Gulch.

In 1988 and 1989 Western Gold Mining and Exploration Ltd. (WestGold) spent \$2 million drilling and trenching the Donlin Creek deposit. Based on their fieldwork they estimated the Donlin Creek gold reserve to be over 400,000 ounces. In 1995, Placer-Dome North America (PDNA) operated a \$2 million exploration and drilling program. In 1996 and 1997 they extended \$18 million on additional drilling and exploration work at Donlin Creek, delineating a 3.6 million-ounce gold resource. Successful field results in 1998 produced an estimated 11.5 million ounces of resource which could lead to a preliminary mine feasibility determination by the end of 1999.

The level of exploration and financial investment PDNA is making at the Donlin Creek Project is a sign this area is considered a very advanced exploration property. The actual development cost for a mine facility will require an outlay of more than \$600 million dollars. The construction of an access road is just one of the costs associated with developing a producing mine. It is in the best interest of the mining industry that the State of Alaska encourages the development of remote mines.

An airstrip suitable for Hercules and DC-6 type aircraft was constructed at American Creek. Although it was expensive, Placer-Dome and Calista believed the expenditure was necessary to conduct advanced exploration. The airstrip will meet this project's needs for exploration support, but it will not be sufficient for use during actual construction and development of a mine. Long-term mine development will require access to the mine site over land. Over the next two years, it is essential to link the mine site with the Kuskokwim River via a road.

There is minimal road access to the Donlin Creek area. A pioneer road is in place from the placer mine sites at Snow Gulch and Queen Gulch. PDNA constructed an additional one and one half miles of road during 1997 from Queen Gulch to American Creek. The road provides access to the general location of the exploration camp, which was constructed in 1996. The road project and campsite represent a very high level of commitment by PDNA to undertake a viable exploration program to prove up the gold reserve in the area.

PROJECT DESCRIPTION:

Road access from the Kuskokwim River is required to move equipment, supplies and materials into the Donlin Creek area. Engineering studies to design and site a 24-mile road from Donlin Creek South, down the Crooked Creek valley, which terminates on the Kuskokwim River about 0.5 miles South of the Jungjuk Creek confluence, along with construction cost estimates, are required before actual road construction can begin.

Work which needs to be completed as soon possible includes; a) a preliminary engineering analysis, including the delineation of alternative and initial cost estimates and; b) soil borings at critical points along the proposed road alignment and at potential material sites to determine soil suitability. A field program can be completed using locally available equipment and manpower during late winter and early spring. It is estimated that the preliminary engineering and design work will cost \$500,000 for engineering services and field studies. An engineering study will identify a suitable road alignment and determine construction costs. Other work needed is an examination of available mapping and further investigation into the environmental issues so the cost estimate can be finalized.

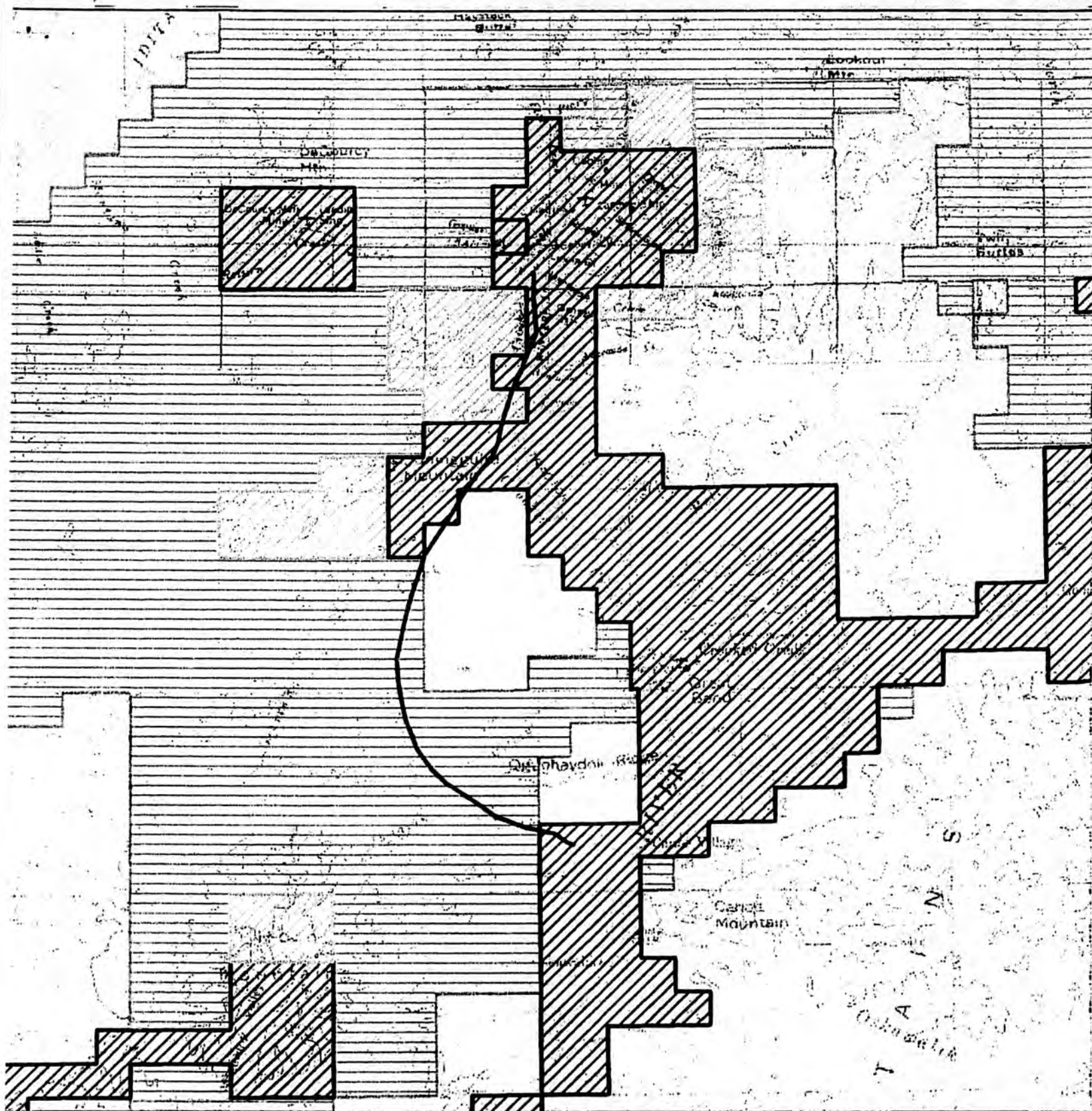
SUMMARY OF DESIGN STUDY SCOPE OF WORK BY TASK

1. Establish Land Ownership for route area
2. Control Survey GPS
3. Air Photo Mapping
4. Route Engineering
5. Geotech Field Work
6. Bridge, Drainage and Alignment Refinement
7. Environmental and Assessment
8. Cost Estimating

PROJECT JUSTIFICATION

The Kuskokwim Corporation, representing 10 villages in the upper Kuskokwim River, are in favor of this project. They will be sending in a resolution or letter of support for this project. Immediate benefits will be to employment of local residents during the construction of the road. It is estimated that during construction of the road it could employ in the neighborhood of 30-50 employees. The road will provide a critical link between the Kuskokwim River, and the mine and campsite at American Creek and Snow Gulch. Without a road, it will be difficult to move equipment and materials to the mine site for the construction and operation of a producing mine. The development of a mine in the region will provide a significant amount of employment opportunities for many years to come. Provided the exploration site does become a mine it is anticipated that 600 employees will be needed during the construction phase, and thereafter for operations an estimated 400 permanent jobs will be needed.

Unappropriated Federal Lands	7.3 Miles
State Selected	6 Miles
ANCSA Selected	1 Mile
ANCSA Conveyed	7.47 Miles
	24.8 Miles (estimate)



0 5 Miles

Proposed Route: Donlin Creek to Canoe Village

Map Base: Steelmate and Iditarod 1:250000 quads
 Projection: UTM zone 4, NAD 1927 Datum
 Calista Land Dept. 2/10/99

-  Proposed Route
-  ANCSA Land Selected
-  Interim Conveyed
-  State Selected

**Carl Hanneman
Teck Resources
Pogo Project**

POGO PROJECT UPDATE

Karl Hanneman, Alaska Regional Manager, Teck Resources, Inc.

House Economic Development Committee

February 23, 2000

Pogo: Gold deposit containing 5.6 million ounces, gross value of \$1.5 billion.
Owners: Sumitomo 60%, Teck 40%
Operator: Teck Resources, Inc.
Location: On State land 35 miles northeast of Delta Junction.
Status: Phase I. Surface Exploration, *(This phase began in 1981, drilling began in 1994, and is ongoing each summer season).*
Phase II. Underground Exploration *(This phase began on March 5, 1999 expected duration, 12-18 months)*
Phase III. Environmental Assessment and Feasibility Study, 1-2 years *(This phase is underway)*
Phase IV. Permitting, 1-2 years
Phase V. Mine Construction, 1-2 years
Phase VI. Operating Life of Mine, 10-15 years
Phase VII. Reclamation

Phase II work is proceeding well. Work began March 5, 1999 with a crew of 35-40 and the tunnel being excavated toward the underground deposit is now 3,500 feet long. This tunnel will provide access to the deposit in order to obtain engineering data about the underground rock strength, projected water inflows, uniformity and extent of mineralization, and practicality of potential mining methods. This information will be used in the upcoming project design and feasibility study that is central to the determination of the economic viability of the deposit. As of February 23, there remain several hundred more feet of tunnel to complete before the deposit is reached.

The heavy equipment necessary to complete the tunnel was hauled to the site over a winter road along an existing RS2477 trail up the Goodpaster River valley during the winter of 1997-1998. Additional fuel and supplies required since that time have been flown to the site via a 1,500 foot airstrip.

Environmental baseline information is being collected in many disciplines, including water quality, air quality, wetlands, fisheries and wildlife. This information will be used to better understand the local environment and to help project designers minimize impacts of any development.

The infrastructure options available to support a future mining operation will have a critical impact on the economic viability of the operation. On-site versus off-site electric power generation and access alternatives of air support, annual winter road, or all-season road are being studied.

PROJECT POTENTIAL

- \$200-250 million construction cost
- 350-450 construction jobs during peak of 2 year construction
- \$125 million annual production
- 10-15 year project life
- 200-300 year round high quality private sector jobs

**Frankie Pillifant
Divison of Trade (DCED)
& Ak. Minerals
Commission**

February 22, 2000

**Mining Industry update for
House Special Committee on Tourism and Economic Development
By Frankie Pillifant**

Thank you for inviting me to talk with you about the mining industry in Alaska. My name is Frankie Pillifant and I work as a Minerals and Mining Development Specialist for the Department of Community and Economic Development, Division of Trade and Development. Today I will help set the stage for the other invitees to discuss in more details the points brought up by myself.

Despite record low prices for metals and coal, the preliminary estimates for 1999 mineral industry are \$45 million invested in exploration; \$18 million invested in development projects and \$986 million in production valued overall at \$1.049 billion. Several medium sized mines, Illinois Creek, Nixon Fork, Alaska Gold (Nome Placer) and a number of small placer mines were closed in 1999. Red Dog near Kotzebue increased production and continues to be the world's largest producer of zinc. Greens Creek mine on Admiralty Island remains one of the largest producers of silver in the U.S. Fort Knox mine near Fairbanks is Alaska's largest gold producer with an average daily production of approximately 1,000 ounces of gold. The Pogo gold deposit north of Delta spurred 60% (approximately \$30 million dollars) of the exploration conducted in Alaska this year.

Opportunities for mineral development rely on the geology, gold price and infrastructure/access.

Map of selected mines, coalfields and significant mineral resources of Alaska (by Swainbank and Szumigala, October 1998)

Coal: Point Lay, world class quality and quantity but no access (bituminous: coal containing 15-20% volatile matter)

Healy-Usibelli

Wishbone Hill (Matanuska Valley, subbituminous: higher carbon, lower moisture)

Beluga (Cook Inlet)

Bering River (Cordova)

Gold: Tintina Gold belt

POGO: Southeast Yukon, ending at Donlin Creek

Fort Knox

Illinois Creek (Viceroy Resources has completed some drilling and is due to decide what role if any they will have with this property soon)

Nixon Fork

Platinum: prices recently hit record highs and there is increased interest in locating these resources in Alaska.

Volcanic Massive Sulfides:

Zinc, Lead, Gold, Silver
Zinc, lead, silver

Greens Creek
Red Dog (60% of the industry in Alaska Includes
deep new -1999-discovery)
North side Alaska range, Richardson district

Uranium: Bokan Mountain, Southeast

DGGS-Geophysical surveys of the Fortymile and Livengood areas were released, and they also participated in a joint Federal-State survey of part of Prince of Wales Island. The release of these surveys is greatly anticipated and are seen as encouragers of exploration.

Cost of survey to the expenditure of exploration dollars in Alaska

DGGS-DMLW working on gathering baseline data for ambient water quality

This information and more can be found in the Annual Minerals Industry report, summaries and tip sheets put out by DCED and DGGS. This information can also be found on the DCED and DGGS websites.

Generally optimistic on the mining industry in Alaska

- Metal prices are increasing
- London Financial Times: showed Alaska dropped only 20% in exploration compared to much higher percentages for other countries, states,
- Net increase of 11,000 new claims last year, meaning new exploration is an indicator of the future, not present health of the mining industry in a region.
- Continuing to remove uncertainty in permitting equals an improved business environment.

Part of my job is fielding questions and providing information on Alaska and the opportunities here, either through the various trade shows in Vancouver and Toronto, Canada and in Alaska and Washington states and via direct inquiries fielded from many locales such as Africa, Australia, Poland, the lower 48 states.

Further, Dick Swainbank in Fairbanks and I provide staff support for the Alaska Minerals Commission members when necessary. This years report was well received and you may have visited personally with AMC members last week during their annual report visit.

This years report of the Alaska Minerals Commission:

Finding A: A crisis in Alaska's ability to issue permits

The loss of DEC funding for a core group of competent, institutionally knowledgeable perimeters *is leaving mining, seafood processors, rural and municipal sewage plant operators and oil field developers at risk.* The ability of the private and public sector to

foster economic development, improve infrastructure and enhance the quality of life in Alaska has been reduced as well.

Essentially, the shift of DEC's water quality program from a General Fund program to a User Pay program coupled with policy direction and the postponement, cancellation or completion of projects has reduced fees to DEC and therefore reduced the ability to continue employing an institutionally knowledgeable core permitting staff.

The mining industry has readily demonstrated its willingness to support the user pay system but this has proved to be an inappropriate system for Alaska. Alaska's industrial sector is not large enough to support ADEC's permitting program through fees on a sustaining basis. A core group of knowledgeable perimeters is necessary to challenge the EPA, other Agencies and environmental groups.

That concludes my presentation. Please call me at 465-5463 with any questions. Thank you for your attention.