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**A Field Tour of Alaskan Base Metals Deposits**

**A Monday Morning Musing from Mickey the Mercenary Geologist**

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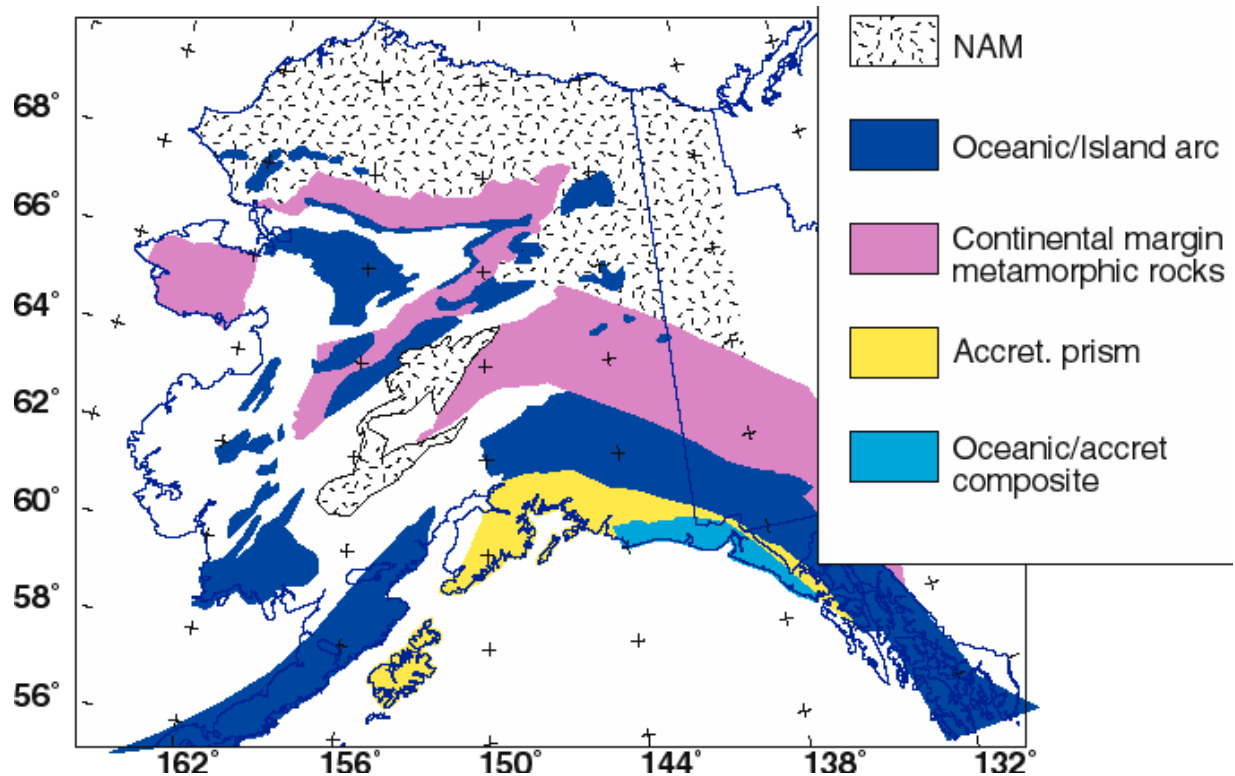
**September 9, 2013**

The United States of America purchased Alaska from Russia in 1867 for \$7.2 million, or about 2 cents per acre. Along with the Louisiana Purchase in 1803, this acquisition must be considered most important in the building of our country. Alaska is big; at over twice the area of Texas, it is larger than all but 18 countries in the world and stretches into the Eastern Hemisphere. In 1959, it became the 49<sup>th</sup> State in the Union.



**The State of Alaska Superimposed on the Lower 48.**

Alaska is a geologically diverse state with rocks varying in age from late Precambrian to Quaternary. Located on the long-lived tectonic boundary between the Pacific and North American plate, Alaska is composed of “accreted terranes”, or geological slices of different rock types of diverse ages sutured against one another. A region with accreted terranes is evidence that continent-building has occurred repeatedly along a plate margin.



**Generalized Tectonic Map of Alaska (After USGS, 1999)**

Note that the Aleutian Islands, Alaska's southwest archipelago, comprise the "oceanic/island arc" shown above and are part of the Pacific Rim's "Ring of Fire". The Aleutians are the current foci of active volcanism and seismicity

On March 27 1964, south-central Alaska was the locus of the second largest earthquake ever recorded by seismograph (9.2 on the Richter scale). It occurred on a mega-thrust fault in the subduction zone with an epicenter in Prince William Sound at a depth of 26 km. The quake and subsequent landslides and tsunamis killed 143 people and caused devastation along the entire West Coast of North America and as far away as Hawaii, Japan, and Louisiana.

That said, the four projects I visited in Alaska are located within tectonically stable areas and have little seismic risk.

Because of its location along a major plate boundary and diverse geology, Alaska is a resource-rich state with world-class deposits of oil, gas, copper, gold, lead, zinc, and silver:



### Mines, Projects, and Towns in Alaska

Recently I was fortunate to tour four major base metal projects in Alaska. I traveled from Seattle to Anchorage to Fairbanks to Kotzebue and back to Anchorage in four very busy days.

The entire excursion went like clockwork thanks to logistics organized by three companies that jointly sponsored the analyst tour: [Northern Dynasty Minerals Ltd](#), [Nova Copper Inc](#), and [Zazu Metals Corp](#). I discuss the field trip and the companies' projects below.

It started off as my typical busman's holiday, with a short weekend in Seattle that included a John Mayall performance and a Seattle Mariners game.

On Monday morning July 15, I flew to Anchorage and arrived in the early afternoon. I was joined by 11 other analysts for presentations by executive personnel of [Northern Dynasty Minerals Ltd \(NAK.MKT; NDU.T\)](#).

Northern Dynasty's Pebble project is a world-class copper-gold-molybdenum porphyry project located between Cook Inlet and the Bristol Bay region of southwest Alaska. The company acquired Pebble in 2001 from Cominco Ltd. In mid-2007, Northern Dynasty entered into a 50% joint venture with Anglo American Plc whereby the latter must fund the first US\$1.5 billion of project costs, i.e., thru permitting and well into construction. Another industry giant, Rio Tinto owns 18% of the shares of NAK.

Pebble's current resource estimate is 5.94 billion tonnes in the measured and indicated category containing 55 billion lb copper, 67 million oz gold, and 3.3 billion lb molybdenum, and 4.84 billion

tonnes in the inferred category containing 26 billion lb copper, 40 million oz gold and 2.3 billion lb molybdenum. Recoverable quantities of silver, palladium and rhenium also occur in the deposit. Pebble is the largest undeveloped deposit of both copper and gold in the world. There are many untested targets in the district and exploration potential is high.

According to the company, the Pebble project has a well-defined path to development based on key project strengths that include:

- A known mineral resource with the tonnes, grade, metallurgy and geometry to support a long-life mine;
- Favorable terrain at low elevation with low population density;
- A stable and predictable regulatory environment;
- Significant financial resources;
- Broad public support for responsible resource development in Alaska.

Monday presentations included Northern Dynasty's CEO Ron Thiessen on corporate strategy and a project overview, Bruce Jenkins on fisheries science and mitigation strategy, Sean Magee on public affairs and community project update, and Washington, D.C.-based attorney Tom Collier on the regulatory regime and politics of permitting Pebble. After cocktails and dinner, we listened to John Shively, CEO of the operating company Pebble Partnership Limited, and Trefon Angasan, head of a local native corporation surrounding Pebble lands that is very supportive of the project.

Tuesday morning started early with technical geology and engineering presentations by Jim Lang and Steve Hodgson. We then boarded a bus to the airport, split into two groups, and flew 330 km southwest via charter plane to project headquarters at the village of Iliamna on the shore of the eponymous lake. Our tour included examination of core illustrating various rock types, alteration styles, and copper-gold-molybdenum mineralization. We were also given a drive around the local native community, and several residents voiced support for the project.

After lunch, we enjoyed a helicopter fly-over of the deposit that, at my request, included a short hike and examination of the discovery outcrop. The Pebble outcrop was discovered in 1987 by Cominco geologists whilst exploring for epithermal gold-silver deposits in southwest Alaska and the drill hole discovery was made two years later in 1989.

Pebble serves as a firm reminder to the mining business that giant ore deposits are usually discovered by the tried and true methods of boot leather and drilling.



**One Half of the Pebble Tour Group**



**Pebble Leached-Cap Outcrop**

We returned to Anchorage in late afternoon. I had a couple of hours in the hotel to take care of emails and daily internet research before dinner and wine courtesy of [Nova Copper Inc \(NCQ.MKT; NCQ.T\)](#), the host of our next visit.

Among the guests at dinner was Ted Leonard representing the Alaska Industrial Development and Export Authority (AIDEA). AIDEA is a State-owned enterprise agency whose mission is to fund infrastructure projects for the economical benefit of the people of Alaska.

It has already spent \$10 million to study and identify a preferred road alignment from the Alaska Pipeline haul road into the Ambler District. Earlier this year, AIDEA received an additional \$8.5 million from the State Legislature to complete conceptual design and initiate permitting for the Ambler Mining District Industrial Access Road. AIDEA has hired a project manager for technical issues and a community liaison manager to facilitate permitting of the road. It plans to submit a draft EIS for review to the Corp of Engineers in March 2014.

The Ambler road will be modeled after the highly successful Red Dog haul road and storage, loading, and port facilities. That project, built in the mid-1980s, and is owned and operated by AIDEA and leased to the Red Dog mine. It is an infrastructure project that has been paid off in full and now generates annual revenue for Alaska's general fund.

The evening's festivities ended early for me as I needed sleep after a few days on the go-go-go.

The following day started early with a shuttle to the airport, commercial flight to Fairbanks, and a charter to NCQ's flagship projects in northwest Alaska.

The Ambler district consists of two contemporaneous and adjacent Devonian mineralized belts:

- A volcanogenic massive sulfide belt in the Brooks Range that contains Nova Copper's Arctic deposit and several other deposits along a 120 km strike length.

Based on an open-pit mine scenario, Arctic hosts an indicated resource of 23.8 million tonnes grading 3.26% Cu, 4.45% Zn, 0.76% Pb, 0.71 g/t Au, and 53.2 g/t Ag; and an inferred resource of 3.4 million tonnes grading 3.22% Cu, 3.84 % Zn, 0.58% Pb, 0.59 g/t Au, and 41.5 g/t Ag .

In addition, there are nine drilled occurrences and numerous other massive sulfide prospects in Nova Copper's extensive land package in the Ambler belt. Two deposits with resources are controlled by other companies.

- A carbonate-hosted copper-cobalt belt to the south in the Cosmos Hills that hosts Nova's Bornite deposit.

Based on an open-pit mining scenario, Bornite contains an indicated resource of 6.8 million tonnes grading 1.19% Cu and inferred resource of 47.7 million tonnes grading 0.84% Cu at the Ruby Creek deposit. In the deeper South Reef deposit, the current inferred resource is 43.1 million tonnes grading 2.54% Cu. This recently discovered deposit is open along strike and down dip.

Again, there is strong exploration potential here with two other drilled occurrences and numerous other copper-cobalt prospects in the Cosmos Hills.

You've heard me say this many times before: *Every good geologist knows that grade is king*. As per above, Nova Copper's projects have that key characteristic.

After six hours in transit, hungry analysts were treated to a multi-course lunch at the Bornite camp and then went to the core shed for presentations by CEO Rick Van Nieuwenhuyse and geologist/project manager Scott Petsel.



This time we were split into three groups for core exams of both projects; a brief look at the Berg pit, the only surface exposure at Bornite, that was cut short by voracious mosquitoes; and a helicopter flyover of Arctic to the north across the Kobuk River valley.

Here are some photos from the tour:



**Bornite Camp and Kennecott's Ruby Creek Shaft**

My thanks goes out to an accommodating (and skilled) helicopter pilot who heeded my request to view the discovery outcrop at Arctic. He flew on the north side of the ridge in heavy fog while I took this photo of gossan and alteration on top of the ore body:



**Arctic Gossan Outcrop**



**Ambler District Tour Participants**



With no rest for the weary, we hopped right on the plane and flew about an hour to the coast, arriving in Kotzebue in the late afternoon for the third leg of my tour, sponsored by [Zazu Metals Corp \(ZAZ.V\)](#).

After a brisk walk with bags in hand to the local hotel, we settled in and then met up for dinner. A corporate presentation by ZAZ President Matt Ford was often punctuated by commentary from the always glib CEO Gil Aztmon and a barrage of questions from yours truly. Other company presentations included geology by Joe Britton and environment and permitting by consultant Mike Travis.

Zazu's flagship project is a 50-50 joint venture with Teck Mining Company at the Lik lead-zinc-silver deposit, located 22 km from the giant Red Dog mine. Zazu is the operator and can earn up to 80% of this project by spending \$40 million by 2018. Teck also owns 100% of the Su deposit, which adjoins Lik to the south.

Lik, like Red Dog, is a sedimentary-exhalative deposit and has an indicated resource of 18.9 million tons grading 8.37% Zn, 2.75% Pb, and 1.59 g/t Ag. Inferred resources include 1.1 million tons grading 7.18% Zn, 2.28% Pb, and 1.06 g/t Ag. An adjacent, deeper inferred resource to the north contains 5.2 million tons grading 9.65% Zn, 3.25% Pb, and 1.48 g/t Ag. Exploration potential along strike to the north and down dip is high. The undeveloped zinc resources at Lik and Su are collectively among the largest in the world.

We also heard from Lori Henry, COO of NANA, the local native corporation. NANA is a strong supporter of Zazu's project and its future development and has a strong working relationship with Teck at Red Dog.

Likely because Kotzebue is situated in a dry part of the planet, it was early to bed for our group in what was nearly broad daylight all night long above the Arctic Circle.

After breakfast the next morning, we took off in cool, misty weather for a flyover of the coast to view the State-owned concentrate storage, loading, and port facilities for the Red Dog mine. We then flew along the haul road but we were forced to land at Teck's mine camp and wait for heavy fog to lift. About an hour later, we made it to Lik.

We examined core and hiked up a small hill to view the camp and flatlands below where glacial till covers the deposit:



**Lik Core Showing Massive Sphalerite-Galena-Pyrite**

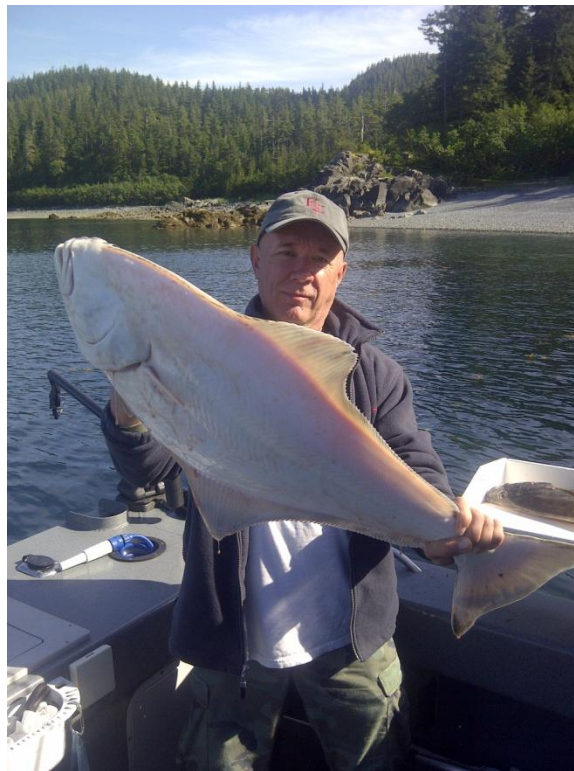


**Tour Participants, Camp, and Flat Terrain over Lik Deposit**

Due to the weather delays, we hurried back to the plane and flew to Kotzebue just in time to catch the early afternoon flight to Anchorage. Luckily, I had my usual stash of snacks in the backpack as there was neither time nor a place to get lunch.

Upon arrival, we retired to an airline club lounge to meet with representatives of the aforementioned AIEDA, James Hemsath and Lori Stender. They discussed the State's support for development of the project and answered our many questions. AIEDA is currently reviewing Zazu's engineering analysis of infrastructure needs, including upgrade and expansion of storage, loading, and port facilities and building of a spur to Lik from the current haul road.

When this meeting ended in the late afternoon, I met up with a geologist friend in the business. Never among ones to decline a fishing opportunity, we had lines in the water in Prince William Sound 15 hours later. Here's the best of our keeper catch, which also included sockeye salmon, yelloweye rockfish, and prawns:



**Prince William Sound Halibut**

The four Alaskan projects I visited are all significant, undeveloped, base and precious metal deposits. While all face challenges, the State of Alaska government and citizenry overwhelmingly support the mining industry and the financial benefits it provides to a region with high costs and few economic opportunities.

Northern Dynasty's Pebble project has drawn significant opposition from a local *rico* who owns a fishing and hunting lodge in the area and the usual national environmental non-government organizations (ENGOS). It appears this litigious, eco-fundamentalist, trust-funded gang of ENGOS must always have an



oil project (Keystone pipeline) and an Alaska project (Pebble) to protest vociferously. Do their motivations lie in securing public donations to fund these organizations in the luxurious style to which they have become accustomed?

Opposition or not, NAK and its partner are committed to the project. They have spent over \$150 million and counting on environmental baseline studies to document the risks of the project, likely the most comprehensive document of its kind ever assembled. Pebble's staff and consultants have designed scientifically-sound engineering solutions to mitigate those risks. The company has strong Alaskan government and local native support, seems confident the project will be permitted for development, and, assuming it can be shown to be economic, that it will be financed for construction.

On the other hand, Nova Copper's Arctic and Bornite projects and Zazu Metal's Lik project have not encountered significant opposition to date and in fact, have good local support from NANA and the local borough (county) government. The State appears ready to play a major role in financing the infrastructure these projects require and has already committed substantial resources to the effort.

However, it is clear to me all four projects will require the commitment of financial support by the State of Alaska for access, power, and/or other infrastructure before private-sector financing, development, and mining can occur.

Over the past 10 years, exploration and mining projects in the Second and Third Worlds have repeatedly encountered difficulties with the permitting process, NGO and native opposition, security of mineral tenure, resource nationalism, and even outright government appropriation. Because of these inherent risks, I see a move of mining capital to geopolitically-stable jurisdictions where mineral tenure is secure and the rule of law is paramount.

Although permitting and development are often long and arduous tasks in the United States, I am optimistic that the time is nigh for tapping the world-class mineral deposits in the interior and remote parts of Alaska and helping secure more independence for America's natural resource demands.

I sincerely thank the management teams of Northern Dynasty Inc, Nova Copper Corp, and Zazu Metals Inc for invitations to visit their projects and covering my expenses on this whirlwind tour.

Ciao for now,

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Mercenary Geologist



The [\*\*Mercenary Geologist Michael S. "Mickey" Fulp\*\*](#) is a Certified Professional Geologist with a B.Sc. Earth Sciences with honor from the University of Tulsa, and M.Sc. Geology from the University of New Mexico. Mickey has 35 years experience as an exploration geologist and analyst searching for

economic deposits of base and precious metals, industrial minerals, uranium, coal, oil and gas, and water in North and South America, Europe, and Asia.

Mickey worked for junior explorers, major mining companies, private companies, and investors as a consulting economic geologist for over 20 years, specializing in geological mapping, property evaluation, and business development. In addition to Mickey's professional credentials and experience, he is high-altitude proficient, and is bilingual in English and Spanish. From 2003 to 2006, he made four outcrop ore discoveries in Peru, Nevada, Chile, and British Columbia.

Mickey is well-known and highly respected throughout the mining and exploration community due to his ongoing work as an analyst, writer, and speaker.

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**Disclaimer:** Northern Dynasty Ltd, Nova Copper Inc, and Zazu Metals Corp paid for or will reimburse all travel expenses associated with this tour. I am not a certified financial analyst, broker, or professional qualified to offer investment advice. Nothing in a report, commentary, this website, interview, and other content constitutes or can be construed as investment advice or an offer or solicitation to buy or sell stock. Information is obtained from research of public documents and content available on the company's website, regulatory filings, various stock exchange websites, and stock information services, through discussions with company representatives, agents, other professionals and investors, and field visits. While the information is believed to be accurate and reliable, it is not guaranteed or implied to be so. The information may not be complete or correct; it is provided in good faith but without any legal responsibility or obligation to provide future updates. I accept no responsibility, or assume any liability, whatsoever, for any direct, indirect or consequential loss arising from the use of the information. The information contained in a report, commentary, this website, interview, and other content is subject to change without notice, may become outdated, and will not be updated. A report, commentary, this website, interview, and other content reflect my personal opinions and views and nothing more. All content of this website is subject to international copyright protection and no part or portion of this website, report, commentary, interview, and other content may be altered, reproduced, copied, emailed, faxed, or distributed in any form without the express written consent of Michael S. (Mickey) Fulp, Mercenary Geologist.com, LLC.

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