Early and Intermediate Stage Exploration Projects

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The Oreo Mountain Porphyry Cu-Mo-Ag-Au Prospect and Exploration History, Metallogenics and Industry Activity in the Tanacross Quadrangle, East-Central Alaska

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The development of exploration geochemistry in the latter part of the 1960s led to the discovery of the Casino porphyry copper-molybdenum-silver-gold deposit in the Yukon Territory in 1969 through reconnaissance soil sampling. Casino was clearly a large deposit, and its discovery led to the Yukon-Tanana Uplands being suspected to be a significant porphyry copper province. In 1970 the U.S. Geological Survey published a 1:250,000-scale reconnaissance geologic map of the Tanacross Quadrangle by Helen Foster. Continued exploration in the Yukon and adjacent east-central Alaska soon led to the discovery of several additional porphyry copper prospects on both sides of the border.

Between 1970 and 1976, exploration programs in the Tanacross quadrangle by several companies including Resource Associates of Alaska, American Smelting and Refining Company and Cities Service Minerals Corporation led to discoveries and the location of claim blocks at the Taurus, Bluff, Push-Bush, Peternie, Mosquito, Tok, Pika Canyon, Northeast Pika Canyon, Fairplay, Oreo Mountain, Northeast Pika Canyon, Ladue Camp, Big Creek and Shady Ridge prospects. Most of these have turned out to be porphyry copper systems displaying geologic and metallogenic similarities to Casino, although a few may be volcanogenic massive sulfide or polymetallic vein deposits.

Continued development of the Casino deposit over the past 50 years has shown it to be a true giant system with contained metal resources of over 1 billion tons of “reserves” containing some $25 billion of copper and gold and another 1.7 billion tons of “inferred resources” with another $15 billion of contained metal (per Western Gold and Copper). Casino is about 320 kilometers (200 miles) southeast of the Tanacross quadrangle on geologic trend.

Additionally, in the last 25 years, gold discoveries in what we now call the Tintina Gold Province have further boosted industry interest in the area. The Peak Gold deposit in the Tanacross Quadrangle has spurred interest in this area, and substantial increases in world demand and the price of copper as well as gold have led to an uptick of industry interest in the area today.

Over the blast 15 year the State of Alaska has published 21st-century airborne geophysical survey data from airborne magnetic and electromagnetic surveys in the Yukon-Tanana Uplands of the east-central Alaska in Burns *et al.* (2006), Burns *et al.* (2011) and Emond *et al.* (2015).

Sanchez *et al.,* 2014 (*Extracting ore-deposit-controlling structures from aeromagnetic, gravimetric, topographic and regional geologic data in western Yukon and eastern Alaska*) studied aeromagnetic lineaments interpreted from reduced-to-pole magnetic grids, along with gravity, topography and field-based geologic maps to infer regional structural controls in an area of Yukon-Tanana Uplands terrain bounded by the Tintina Fault on the north and the Denali Fault on the south in the western Yukon and

eastern Alaska as part of the ongoing Yukon-Alaska Metallogeny Project by the Mineral Deposit Research Unit at the University of British Columbia. They recognized ten major northwest-trending orogen-parallel fault systems oriented sub-parallel to the regional Cordilleran deformation fabric which they interpreted to play a major role in the emplacement of known porphyry Cu-Au and epithermal Au of mid-Cretaceous (115-98 Ma) and Late Cretaceous (79-72 Ma) age. They also recognized seven northeast-trending orogen-perpendicular fault-fracture systems, which they interpreted to govern the emplacement of Late Cretaceous (72-67 Ma) porphyry Mo and Ag-rich polymetallic vein and carbonate replacement systems.

For the last few years, the State of Alaska Division of Geologic and Geophysical Surveys has been working on an update of Foster's 1970 geologic map of the quadrangle and has released numerous preliminary publications from this work. Field work in the eastern half of this quadrangle, including the Oreo area, has largely been completed. Continuing work in the quadrangle was interrupted by COVID-19 in 2020, but presumably will be restarted this coming field season. The U.S.G.S. is also currently conducting studies in the area.

The Oreo Mountain deposit was initially discovered in 1976 by Cities Service Minerals Corporation and 40 federal claims were located at the prospect. An ensuing soil survey delineated a zone of strong copper (up to 425 ppm Cu), molybdenum (up to 120 ppm Mo) and silver (up to 1. 3 ppm Ag) soil anomalies. Cities Service terminated their program in the area in the latter 1970s, and the claims lapsed.

In 2007 fifty 160-acre State of Alaska claims were located at Oreo Mountain by Full Metal Minerals. Soil sampling by Full Metal and their 2008 j-v partner BHP-Biliton identified an area of anomalous soils ranging up to 398 ppm Cu that was about 5 kilometers east-west and up to 2 kilometers north-south. In late 2008, BHP-Billiton terminated their interest in the joint venture, and in early 2009, Full Metal dropped the Doyon option. The Oreo claims were eventually dropped by Full Metal in 2012.

A key objective of the metallogenic study of Sanchez *et al.* (2014) was the generation of a **lineament system map**, which was accomplished by evaluating all components of their multidata, set stacking (of aeromagnetic, gravimetric, topographic and geologic data layers). Their Figure 9(a) displays the resultant aeromagnetic lineament length, and their Figure 9(b) shows the line spatial density. The Oreo Mountain prospect sits within the highest density area within their study (see Figure 9[b]), adjacent to the intersection of the Tanacross North fault (the northwest extension of the Big Creek fault) and the Sixtymile-Pika fault, essentially on their bullseye.

In September of 2017, thirty-two 160-acre State of Alaska MTRSC mining claims were located on the Oreo Mountain prospect on behalf of Tubutulik Mining Company LLC. In April of 2018 the property was optioned to Kennecott Exploration Company (Rio Tinto) and later that spring another 106 160-acre claims were staked, bringing the total to 138 160-acre claims (=22,080 acres, about 8,935 hectares), covering an aeromagnetic high that included the anomalous soil area. In 2018 during a three-week project in September, Kennecott established several helipads at Oreo Mountain and conducted helicopter-assisted auger soil sampling and trenching on the prospect. The soil work extended the footprint of the soil anomaly to over 8 kilometers in length east-west and 1 to 2 kilometers in width north-south while the trenching identified some local altered and mineralized rocks. Work by Kennecott in 2019 consisted of a six-week program and focused on drilling six HQ core holes totaling 3481 feet (1061 meters) with the deepest TDed at 618 feet (187 meters). The holes were apparently located largely by copper soil geochemistry. Copper and molybdenite mineralization was encountered in all six

holes, but values were not overly impressive with significant intercepts only ranging up to 71 meters of 290 ppm Cu (Oreo 19-001), 66 meters of 190 ppm Mo & 12 meters of 391 ppm Mo (Oreo 19-003 & 3A) and 88 meters of 4 ppm Ag (Oreo 2). Oreo 19-001 was probably the best hole overall with analyses averaging 263 ppm Cu, 37 ppm Mo and 1.7 ppm Ag over its entire length to TD at 166 meters. Kennecott dropped their Oreo option in late November 2019, although they paid the 2019-2020 rentals to the state and filed all their work with the State of Alaska. The property currently has "carry-forward" assessment work for four more years (through 2023) for the 138 claims.

The author's efforts to promote the property during the past year have been severely limited by the COVID restrictions both in Alaska and British Columbia. 2020 is essentially a "lost year" at Oreo.

Kennecott did not attempt any significant geologic mapping at Oreo and performed absolutely no geophysical work on the prospect during their tenure with it. Recommendations for future work on the prospect include a detailed analysis of the soil geochemical data (on-going; some results will be presented) and existing core (currently stored in Anchorage and not available for the author's examination due to Alaskan COVID restrictions, but should otherwise be available; analyses and logs by Kennecott are available). Recommendations for geophysical work include an IP/resistivity survey and a high-density (drone?) aeromagnetic survey. In their nine total weeks on the prospect in 2018 and 2019, Kennecott did little prospecting and geologic mapping, and the best geologic map of the prospect area is the reconnaissance map of the Alaska DGGS from their 2019 work (which is currently available in draft form). Clearly the Oreo prospect area also needs substantial additional geologic mapping and prospecting.