

The Amaruq Deposits – Building a Customized Toolset and Using a Flexible Geomodel: Optimization from Discovery to Mine Development

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ABSTRACT

The Amaruq deposits are in the Kivalliq region of Nunavut, northern Canada, 50 km northwest of Agnico Eagle's Meadowbank mine. The claims cover 116,716 hectares on Inuit-owned and federal crown land. The region is underlain by Archean supracrustal rocks of the Woodburn Lake group. Gold mineralization is hosted in mafic and ultramafic sub-volcanic rocks interlayered with fine-grained clastic rocks, chert, graphitic iron-rich mudstone and iron formation.

In April 2013, Agnico Eagle acquired 100% interest in the virgin gold prospect. Since then, Amaruq has quickly grown to a satellite mine development project to the Meadowbank mine. The aggressive exploration program has included 272,000 m of drilling (1,065 holes) as well as fieldwork, prospecting, geochemistry and an airborne VTEM survey covering 81,000 hectares from 2013 through 2016. A 100 m-spaced till sampling survey has been using arsenic as an efficient gold pathfinder leading to new targets.

The exploration tools and techniques have been carefully developed for the Amaruq exploration program; their effectiveness is continually being weighed and the program adjusted. At each stage, careful field observations have been made at local and regional scales. Geophysical surveys using airborne and ground-based MAG and EM systems have been useful for following subsurface rock units and determining drill targets. With up to 10 drill rigs working concurrently, it has been important to establish and maintain good drill core logging practices including careful observations; maintaining uniformity via a simple legend, a core library, and identification charts; using portable XRF equipment for lithotyping; and taking good quality photographs of all core. The identification of marker horizons has been key to unravelling the geometry of the rock sequence. Leapfrog Geo™ software has been used to create implicit 3D models in real-time as the drill campaign progresses, so the team has been able to determine drill targets in 3D, and use the model for continual resource re-estimation. On-site portable XRF assaying of samples from the systematic till geochemical survey has given immediate feedback for tracking gold pathfinder elements (e.g., arsenic), speeding up the siting of targets in the regional exploration program.

The best understood deposit on the property, Whale Tail, is a newly recognized specimen of hybrid, stratabound- and vein-type iron-formation-hosted gold deposits. Whale Tail and Mammoth have been shown to form a continuous mineralized system 2.3 km long, between surface and 730 m deep locally, which remains open at depth and along strike. Recent drilling and mapping have shown the nearby V Zone to be a significant set of mineralized structures dipping shallowly to the southeast from surface to at least 540 m depth, with locally abundant visible gold. Regional reconnaissance prospecting has identified several gold-anomalous areas outside of the Whale Tail – Mammoth area that warrant further exploration.

An indicated open pit resource at Amaruq was estimated at 2.1 million ounces gold (16.9 million tonnes grading 3.88 g/t gold), almost all in the Whale Tail deposit, and an inferred resource (at both open pit and underground depths) was estimated at 2.1 million ounces of gold (11.7 million tonnes grading 5.63 g/t gold), evenly divided between the Whale Tail deposit and V Zone, as of December 31, 2016. An internal technical study in 2016 led to the company's mid-February 2017 approval to develop a satellite open pit mine at Amaruq (subject to the receipt of final permits). Initial mining will be from a pit in the Whale Tail deposit followed by a pit at V Zone.

INTRODUCTION

The Amaruq property is located at 65°24'25"N latitude and 96°41'50"W longitude, approximately 2,600 km northwest of Toronto and 120 km north-northwest of the hamlet of Baker Lake (the nearest population centre) in the Kivalliq Region of Nunavut Territory, Canada (Figure 1). Agnico Eagle Mines Ltd. ("Agnico Eagle") based in Toronto holds 100% interest in the Amaruq project as well as the Meadowbank mine 50 km to the southeast, and the Meliadine mine development 350 km to the southeast of Amaruq.

Due to its setting in the tundra of northern Canada, in an area with very little human population, modern geological mapping of the Amaruq area is relatively recent, dating back to the 1970s, with brief regional gold exploration done by previous operators a decade later. Amaruq was essentially a virgin gold prospect when Agnico Eagle began exploration there in 2013. This paper describes why the company selected this site and the tools it has used to move the greenfields project to a satellite mine development in less than four years. It goes on to describe the geological setting and the model of the mineralization as it is understood in February 2017.

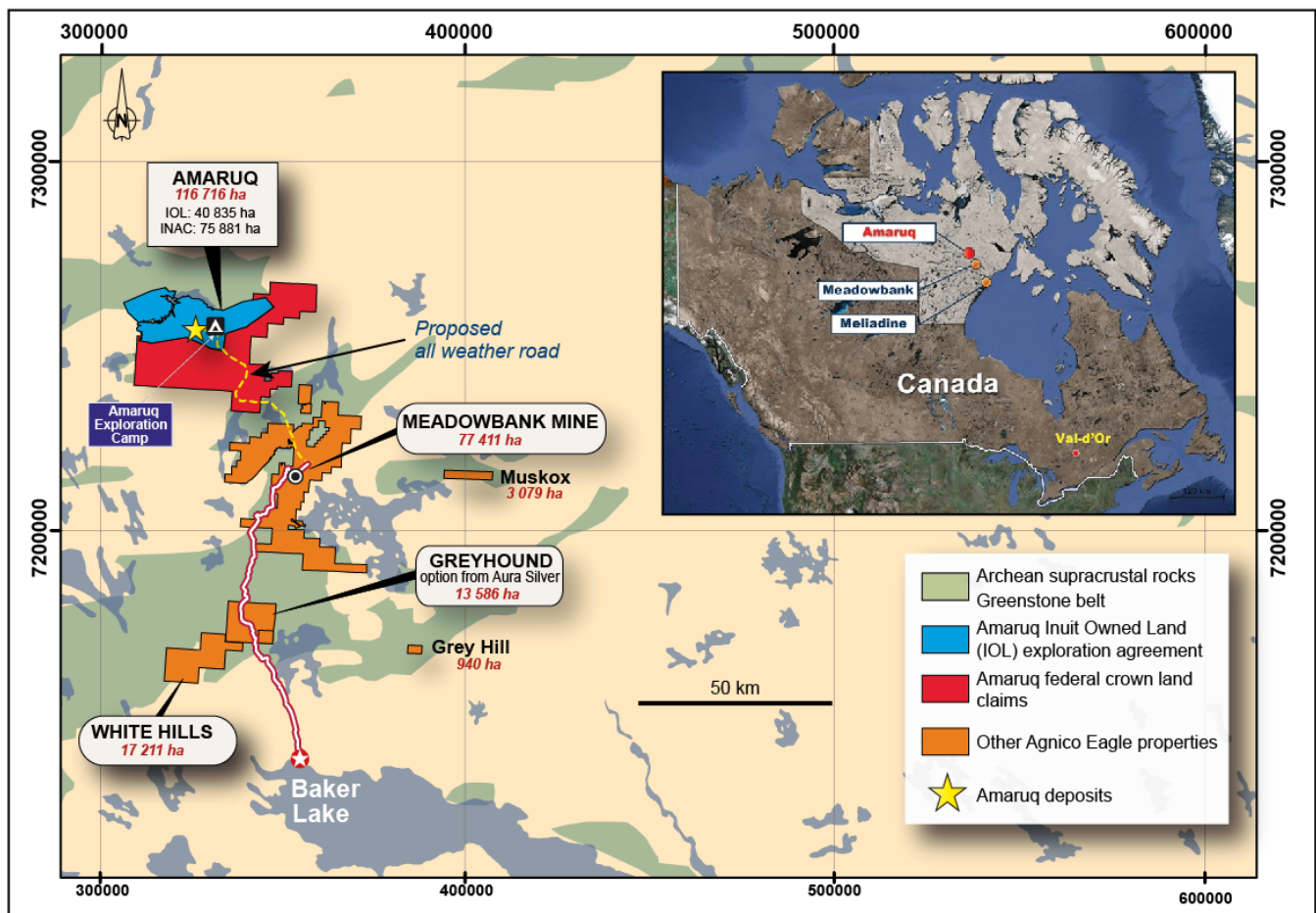


Figure 1: Location map of Agnico Eagle's projects in Nunavut, with landholdings in the Meadowbank area. Coordinates in UTM Nad 83 Zone 15 projection.

EXPLORATION HISTORY

Early Exploration

The first modern geologic work in the Amaruq region took place from 1976 to 1981 when the Geological Survey of Canada (GSC) mapped several northeast-trending linear belts of mafic to ultramafic supracrustal rocks in the Amer Lake area. Reports from the work highlighted the presence of numerous occurrences of altered and mineralized ultramafic rocks (e.g., Annesley 1981a, 1981b). At that time, gold mineralization associated with ultramafic rocks was being sought, as the same association had been observed at the Kerr Addison mine in Ontario, Canada, which produced 11 million ounces of gold between 1938 and 1966.

Growing interest in the area's gold potential in 1983 led joint venture partners Comaplex Minerals (through its wholly owned subsidiary Wollex Exploration) and Asamera Minerals (operator) to conduct regional reconnaissance and gold prospecting that revealed gold mineralization in the Amaruq area and elsewhere including in the Meadowbank area 50 km to the southeast of Amaruq. The partnership followed up with

mapping, prospecting, geophysics and diamond drilling programs from 1985 to 1990, to better define the known occurrences and identify new targets. Grab rock samples from quartz - carbonate - base metal sulphide - bearing vein systems associated with shear zones and/or with iron formations yielded many high-grade assays, grading up to several ounces of gold per ton.

One area with such assays was discovered in 1989 in the South Amer Lake area (now part of the Amaruq project) by geologist Marcelle Hauseux and prospector Sandor Surmàcz, both working as consultants for the Comaplex/Asamera joint venture (Barham and Mudry, 1990). The occurrence was described as being hosted by isoclinally folded, strongly pyrrhotite-sulphidized and siliceous iron formation along with gabbroic sills and ultramafic flows. Grab samples yielded elevated gold values (14.2, 14.5, 15.9 and 21.7 grams per tonne (g/t) gold). At this time, the occurrence was known as the "IRV" showing, in honour of GSC geologist Irvine Annesley, who described the ultramafic rocks of this area in his Ph.D. thesis (Annesley, 1989). Follow-up detailed mapping of the IRV showing in 1990 confirmed its significant gold potential and additional work was recommended (Barham et al., 1991), but did not take place.

The partnership had obtained strongly anomalous gold assays from sheared and sulphidized oxide facies iron formation in the Meadowbank area in 1987. A small prospecting and mapping program in 1988 revealed the surface expression of a zone of gold mineralization at the Third Portage and North Portage prospects. These two prospects were later joined to form the Portage deposit that is currently being mined at the Meadowbank mine, owned by Agnico Eagle. While the partners Comaplex and Asamera concentrated their efforts on exploring the Meadowbank area, the exploration permits and claims in the Amaruq area were allowed to expire in 1991, and therefore became federal crown lands. From then on, the exploration focus in the region was the significant Third Portage/North Portage discovery and a few other nearby targets. As a result, the Amaruq area was almost untouched by any mining exploration work for roughly 22 years.

From 1996 to 2005, there was a new sequence of government (GSC) - driven mapping campaigns, under the Western Churchill National Geoscience Mapping Program (NATMAP), designed to provide modern geological maps of late Archean greenstone belts in that part of the Canadian Shield with strong mineral potential but lacking an adequate geoscientific infrastructure. This initiative notably resulted in a series of bedrock geology maps and an associated geoscientific database comprising both a compilation of historical work and new field

observations. One of these maps (Zaleski, 2005) partly covered the Amaruq area including the IRV showing location (Figure 2).

In 1999, the Government of Canada created the Nunavut Territory, and the area hosting the IRV gold showing was transferred to the jurisdiction of Inuit-owned lands.

Exploration by Agnico Eagle Mines (2007 to Present)

Project-generation Activities and Conceptual Thinking
Leading to Area Selection

Agnico Eagle acquired 100% interest in the Meadowbank property in 2007, with the objective of advancing the project to commercial mining as soon as possible. Meadowbank was then considered as an advanced exploration project, so it was handed over to the company’s Abitibi-based Eastern Canada exploration team to continue resources definition drilling and prepare the project for the mine construction team. The first year was almost entirely devoted to advanced exploration work over the whole Meadowbank property, but in 2008-2009 a strong emphasis was placed on regional target identification to find the next deposit capable of feeding the processing plant that was being built at Meadowbank. Commercial production was declared at Meadowbank in 2010 with an expected mine life of 8 to 10

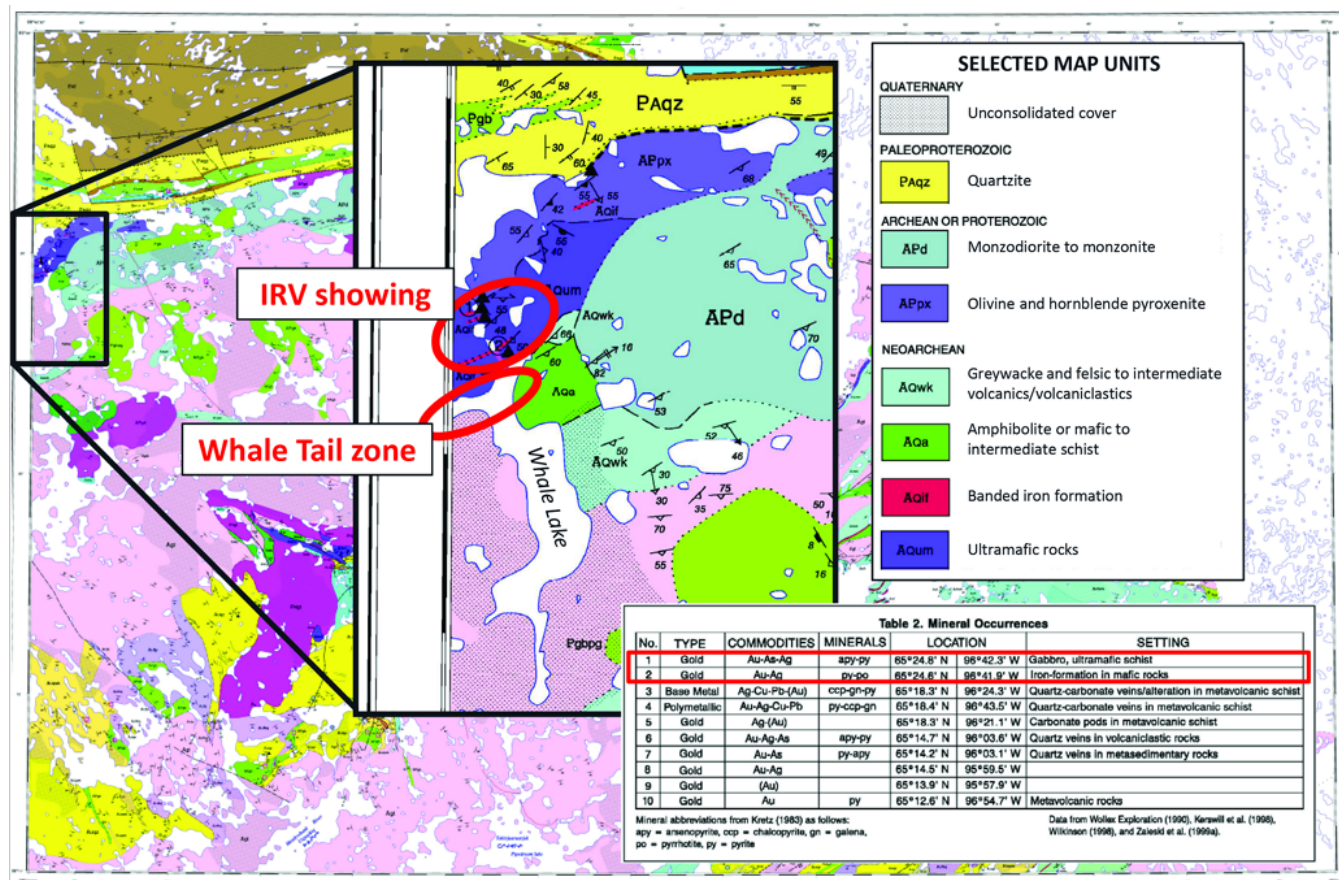


Figure 2: Geological Survey of Canada Map 2068A, a regional geological map of the Meadowbank River area (Zaleski, 2005), with the IRV showing area expanded.

years; there was no other obvious deposit in the vicinity to extend the life of the mine at that time.

This was the exploration team's first campaign in the Arctic. There were significant logistical, financial, operational, socio-cultural, and human challenges to face while operating in an arctic region where the climate is severe and changes dramatically from long, cold, windy, dry, and sunless winters to short, warm, relatively wet, and nightless summers. While the exploration team had already developed expertise in gold and silver discovery in the Abitibi greenstone belt of Quebec and Ontario, in the Arctic they had to learn about a completely new geological territory, with new rock packages hosting new styles of mineralization in a different geological province. These grounds had been the subject of relatively few mineral exploration programs, but there were good governmental and private database compilations available for the Meadowbank area. Agnico Eagle's geologists fed the available compilations into their own database together with their own new field observations on the Meadowbank property, and historical showings in the region. By 2010, the team had located many promising targets within 100 km of the Meadowbank mine where fieldwork was warranted.

One of these targets identified through compilation was the former IRV showing in the Amaruq area. The impressive, well-mineralized surficial exposure of the showing and positive recommendations included in the last Comaplex/Asamera internal report (Barham et al., 1991) that had never been followed up, helped make IRV a first-order priority.

Ground Acquisition Including Political Risk Assessments

After identifying the IRV historical gold occurrence as having high exploration potential, Agnico Eagle initiated negotiations with Nunavut Tunngavik Inc. (NTI), an organization responsible for administering mineral rights on Inuit-owned lands. An agreement was signed in early 2013, at which time Agnico Eagle obtained 100% interest in the property¹. The resulting NTI exploration concession is identified as Inuit-owned Land (IOL) area BL43-001, that was subsequently expanded to cover a total area of 40,835 hectares. This agreement includes the right for Agnico Eagle to obtain a production lease from NTI to mine any ore found on land covered by the exploration agreement. During the exploration phase, lands within exploration concessions can be held for up to 20 years.

Since then, the company added 75,881 hectares of mineral rights to the project. The additional claims are held under the Northwest Territories and Nunavut Mining Regulations and administered by Indigenous and Northern Affairs Canada, and

¹ From its acquisition in 2013, the project was internally referred to as IVR (instead of IRV) and subsequently renamed Amaruq in 2014, when the discovery of the Whale Tail zone demonstrated that gold mineralization extends well beyond the former IRV showing area. The "IVR" nomenclature is, however, still in use when referring to the former IRV showing area and its component I, V and R zones.

are referred to as federal crown land. At the time of this writing, the property therefore totals 116,716 hectares.

The Nunavut Territory is a politically stable, low risk and mining friendly jurisdiction. This is why Agnico Eagle feels comfortable making a major commitment to the Amaruq project, turning it into a cornerstone operational base of the corporation. Starting with the 2007 acquisition and mine development at the Meadowbank property, then the acquisition of Meliadine in 2010 and more recently Amaruq in 2013, the company has demonstrated its belief in the great mineral potential of Nunavut. Agnico Eagle is confident in its ability to successfully embrace the challenges of mine development and operation in this harsh environment for decades to come.

Exploration Techniques and Their Effectiveness

2013: With all required sub-surface and surface permits in hand, Agnico Eagle's exploration team began its first exploration campaign at Amaruq in April 2013. However, as part of a cost-minimizing effort, the Meadowbank/Amaruq exploration budget for that year was only US\$240,000. The small-budget program was definitely expected to be the last opportunity to make a significant discovery before giving up on the Meadowbank region, once the mine's reserve were expected to be exhausted in 2017.

The plan was simple: (1) use an existing government regional airborne magnetic survey and a detailed map of the IVR showing (Barham et al., 1991) to design a 40 line-km magnetic (MAG) and horizontal loop electromagnetic (HLEM) ice-based ground survey; (2) use the MAG and EM responses of this survey to infer the location and geometry of the ultramafic- and iron formation-hosted sulphide mineralization; and (3) conduct a four-hole, 500 m drill program into the best targets with concurrent prospecting traverses and geological mapping. The MAG information was very efficient at identifying the iron formations and, to a lesser extent, some of the ultramafic rocks, allowing them to be distinguished from the supposedly less favourable clastic sedimentary rock packages in the vicinity. The EM data worked well to highlight the sulphide-bearing portions of the rock package, not only in the iron formation and sheared volcanic rocks but also in the clastic sedimentary rocks where pyrrhotite-rich (and locally graphitic) horizons occur. The combination of the MAG, EM and surface geology datasets allowed for an understanding of the rock unit geometry, and thus the drill targeting.

The drill program and mapping took place in late July and August 2013, with the first two holes targeting the main IRV Zone, showing structure below its surface expression (Figure 3a). The targeted structure (now referred to as the "I Zone") was intercepted in both holes, and the conductor was explained by significant pyrrhotite content. The right ingredients appeared to be there visually, but without gold assays readily available the field team had to decide whether to continue to drill that target or test other ones. The decision was made not to put all our eggs in one basket, but to try other targets with the last two planned holes. This decision turned out to be a good one, since the assays from the first two holes returned anomalous but only marginal

gold results (0.9 g/t gold over 5.7 m and 2.2 g/t gold over 6.3 m core length).

A separate MAG-EM anomaly (now referred to as the “R Zone”), located about 600 m to the southeast, was the target of the third drill hole (Figure 3a). Again, pyrrhotite mineralization was encountered in the sheared volcano-sedimentary rocks. The assay results received later indicated that the gold grades again were marginal (2.4 g/t gold over 3.3 m, 2.7 g/t gold over 3.3 m, and 1.4 g/t gold over 3.0 m core length).

For the final hole in the program, the initial plan was to drill-test a long EM conductor (now referred to as the “V Zone”) located about halfway between the two previously tested structures but slightly discordant to them. However, the field mapping crew had identified a cluster of decimetre- to metre-scale angular boulders of strongly silicified, arsenopyrite-rich sedimentary rock about 350 m southwest of the third drill hole along the same conductor (Figure 3a). The discovery of this boulder train, potentially sourced from the same conductor that was intersected by the third drill hole, led to a decision to relocate the fourth drill hole to the boulder train cluster. The arsenopyrite-rich boulders were a more attractive target because historical data had demonstrated a strong positive correlation between arsenic content and gold grades (e.g., Barham and Mudry, 1990). The fourth hole was drilled to test this target, and it became the “discovery hole” intersecting 4.6 g/t gold over 17.1 m including 6.2 g/t gold over 6.9 m and 6.0 g/t gold over 5.0 m core length. The longest intercept was in a sheared and altered zone containing up to 5% arsenopyrite at the contact of a volcanic rock package with a sedimentary rock package. This justified adding a budget for a second phase of drilling in 2013.

The high-grade intercept over a significant thickness by hole IVR13-004 convinced management that a quick follow-up was warranted on this discovery, especially because the nearby Meadowbank mine was expected to deplete its reserves within four years and there was hope that potential ore at Amaruq could take over as source of ore to feed the mill within about five years.

A supplemental budget of US\$580,000 allowed 10 more holes to be drilled, eight of which were drilled on the R Zone discovery with additional success (Figure 3b). The other two targeted other conductors (V Zone area) in between the I and R zones. Hole IVR13-012 in this program (Figure 3b), which had been the initial target for hole IVR13-004, returned relatively weak results of 0.7 g/t gold over 5.1 m. In other words, if the decision had not been made to drill hole IVR13-004 below the arsenopyrite-rich boulders during the initial drill program, it is very likely that the Amaruq project would have been shut down then and would not have grown to its current size. The company would probably be preparing to progressively ramp down the Meadowbank mine as the reserves are exhausted and would be investing in closure and rehabilitation work at the site instead of extending the life of the Meadowbank mill using feed from the Amaruq satellite mine development. The early history of this

project shows how careful field observations, decisive action, and financial and management capacity can be critically important to success in mining exploration.

The 2013 drilling campaign ended with a total of 14 drill holes (2,329 m) and gold occurrences discovered within the I, R, and V Zones, the most significant of them being the R Zone at that time (Lavoie and Lavoie, 2013).

2014: The exploration campaign in 2014 started with re-logging the 14 holes drilled in 2013, and a first pass of three-dimensional (3D) geological modelling to better understand the distribution of the host rocks and controls of mineralization. This work established the basis on which the current geological model of Amaruq is built (e.g., recognition of NE-SW structural controls in the IVR area, etc.), but general conclusions were that the IVR area geology is not simple and that additional drilling, more uniformity in core logging and better core photographs were required to advance efficiently. The MAG-EM ground survey coupled with surface mapping remained the best tools for drill targeting.

Early phase 2 drilling in July 2014 quickly demonstrated the significance of the Whale Tail discovery, and proved that the Amaruq project could become very meaningful for the company. It became clear that many subparallel gold-bearing zones were present at Whale Tail, hosted close to the interface between a sediment-dominated, carbon-rich chert-mudstone-greywacke sequence to the south and a silicate-sulphide iron formation – ultramafic volcanic rock sequence to the north. Gold mineralization hosted in the sedimentary sequence was more similar to the IVR prospect (silica-flooding with arsenopyrite and pyrrhotite), whereas gold-bearing mineralization in the silicate-sulphide iron formation and ultramafic rocks was quite different, comprising mostly finely disseminated to massive pyrrhotite in an amphibole-carbonate gangue with no arsenopyrite. The exploration team had to change their understanding of which combinations of rock types and mineralization bear significant gold. Whale Tail was demonstrating that pyrrhotite is well correlated with gold if hosted in silicate-facies iron formations, whereas arsenopyrite is a better gold indicator if the host rock is chert or clastic sedimentary units.

Additional drilling in the Whale Tail area, systematic photographs of all core, whole-rock litho-geochemistry and detailed documentation of key geologic features during core logging by experienced geologists were instrumental in developing an in-depth early understanding of the mineralization at Whale Tail. This systematic, well-coordinated and organized data integration at such an early stage was critical in gradually building a well-constrained geological model for resource estimation. One particularly critical element was the identification of two mafic-ultramafic marker horizons: one of transitional to calc-alkaline affinity and the other of tholeiitic affinity.

existing drill holes. The re-logging used a new logging legend based on careful reviews of all rock units, structural features, alteration styles, mineralization types, and lithochemical signatures documented at Amaruq. The most powerful tool for this was the complete collection of core photographs, which emphasizes their value. The new logging legend greatly simplified the core loggers' work, allowing them to benefit from a core library and identification charts, as well as real-time quantitative lithotyping using a portable XRF (pXRF) device available in the core shack. This improved the quality of logging significantly, eased real-time 3D modelling, and accelerated the process of estimating the resources, allowing for frequent updates.

The US\$16-million 2015 phase 1 exploration program included drilling 162 holes (48,081 m) from March through June. The result was an expansion of the Whale Tail deposit including filling in the gap under Whale Lake. The inferred mineral resource estimate at Amaruq had grown to 9.7 million tonnes grading 6.47 g/t gold for 2.0 million ounces of gold as of June 30, 2015.

The company expanded the geophysical MAG-EM coverage on the project to total coverage of 81,000 hectares (71% of the expanded property). The interpretation of the resulting geophysical dataset allowed a better understanding of the structural controls on the distribution of mineralized zones. Additional targets were developed and investigated using till sampling, prospecting, mapping, and drilling, which led to the discovery of mineralization in the east and west parts of Mammoth Lake.

An important tool that led to new discoveries during 2015 was based on recognizing a significant correlation of gold and arsenic in the mineralization hosted in chert-clastic sediments at Whale Tail and IVR. Given the abundance of glacial sediments throughout the Amaruq property (Boulianne-Verschelden et al.,

2017), the exploration team designed a surface till sampling program on a 100 m by 100 m grid pattern over an area covering favourable geology extending from 2 km west of Mammoth Lake to 2 km east of Whale Lake. At each site two samples were collected; one was sent to a laboratory to be assayed for gold and other pathfinder elements, while the other was kept on-site for portable (p) XRF analysis using a handheld Innov-X DPO-2000 Delta Professional XRF spectrometer (4 W rhodium anode X-Ray tube). Gold cannot be directly quantified adequately using pXRF because the detection limit is too high at roughly 3 grams per tonne. However, pXRF analysis provides highly time- and cost-effective information regarding the distribution of gold pathfinder elements, and arsenic is currently considered as the most efficient gold pathfinder at Amaruq (e.g., de Bronac de Vazelhes et al., 2017; Figure 4a). On-site pXRF analysis led to the detection of three distinct arsenic dispersion trains in till (Figure 4b). All three trend north to northwest and are 1,000 to 1,500 m long. This trend is consistent with the general known ice flow direction and glacial transport distance in the region (Boulianne-Verschelden et al., 2017), and also with gold-bearing boulder dispersion trains identified in previous prospecting at Amaruq. The sources of these anomalous trains were thus interpreted to lie close to the southern end of each trend, which corresponds in each case with the same stratigraphic horizons displaying MAG and EM anomalies where gold mineralization had already been found at Whale Tail and Mammoth Lake. To summarize, pXRF arsenic analysis on till samples allowed a quick, inexpensive and efficient way of expanding the number of gold discoveries at Amaruq.

A US\$20-million phase 2 exploration program including 64,556 m of drilling as well as additional prospecting and geochemical sampling (soil, till and rock) began in July and ended late October 2015. The inferred mineral resource grew to 16.9 million tonnes grading 6.05 g/t gold for 3.3 million ounces of gold at Amaruq as of December 31, 2015.

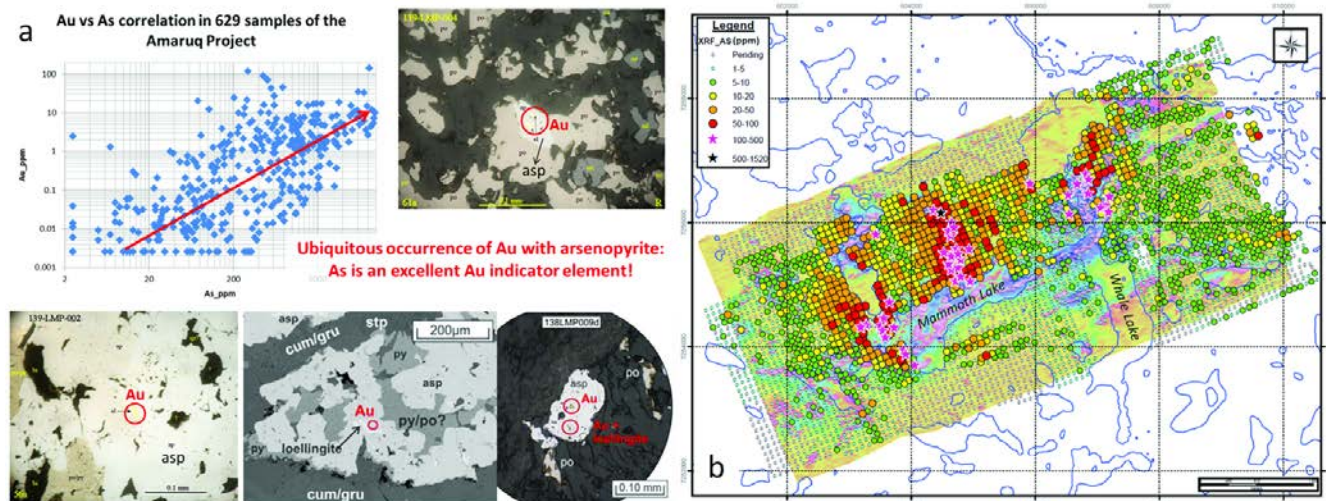


Figure 4: (a) Photomicrographs and an arsenic vs. gold plot demonstrate the correlation of gold with arsenopyrite in mineralization at the Whale Tail deposit and IVR zones. ap/asp = arsenopyrite, bi = biotite, cum = cummingtonite, el = electrum, gru = grunerite, mt = magnetite, po = pyrrhotite, py = pyrite, qz = quartz, stp = stilpnomelane. (b) Map of till sampling geochemical survey north of Whale Lake and Mammoth Lake shows high arsenic anomalies (red) that formed targets for drill-testing.

2016: In 2016 the team continued advancing the understanding of the mineralization and increased the size of the known gold deposits using 127,751 m (526 holes) of additional diamond drilling coupled with customized state-of-the-art tools (3D modelling, pXRF analysis, etc.). In parallel with exploration and delineation drilling, Agnico Eagle decided to partner in new targeted academic geoscientific research on banded iron formation-hosted/associated gold deposits (Mercier-Langevin et al., 2017). Amaruq exploration spending from 2013 through the end of 2016 totaled approximately US\$83 million for 272,000 metres of drilling (1,065 holes).

The Amaruq resource estimate was updated to 16.9 million tonnes grading 3.88 g/t gold for 2.1 million ounces of gold in open pit indicated resources (almost all in the Whale Tail deposit), 4.9 million tonnes grading 4.81 g/t gold (0.8 million ounces gold) in open pit inferred resources (mainly in the V zone), and 6.8 million tonnes grading 6.22 g/t gold (1.4 million ounces gold) in underground inferred resources (mainly in the Whale Tail deposit) as of December 31, 2016.

2017: Whale Tail is now seen to be a steeply to moderately dipping deposit at least 2.3 km long from near-surface to locally as deep as 730 m including multiple horizons of gold-bearing, vein-rich and silica-altered volcano-sedimentary rocks, with surface and underground potential. The V Zone in the IVR deposit forms a series of anastomosing quartz vein structures immediately north of Whale Tail, dipping shallowly toward Whale Tail from surface to at least 540 m depth. The 2016 discovery of additional V Zone lenses has allowed it to be planned as a second source of open pit ore.

On the basis of an internal technical study, the Amaruq deposit was approved in February 2017 for development as a satellite open pit mine to the Meadowbank operations, pending the receipt of the required permits, which are currently expected to be received in the third quarter of 2018. Initial mining will be from a pit in the Whale Tail deposit followed by a second pit at V Zone. The construction of a 62-km all-weather exploration road from Meadowbank began in early 2016 and is expected to be completed in late 2017. The permit for the Amaruq exploration ramp and bulk sample collection was received in December 2016, and an environmental impact statement was submitted in June 2016 in support of the Whale Tail satellite pit.

REGIONAL GEOLOGICAL SETTING

The Amaruq area is underlain by Archean supracrustal rocks of the Woodburn Lake group within the Rae domain of the Western Churchill geological province of the Canadian Shield (Figure 5a). The Churchill Province is subdivided into the Rae and Hearne domains, separated by a northeast-trending, major crustal-scale suture called the Snowbird Tectonic Zone. The Woodburn Lake group occupies a central position along a northeast-trending zone of comparable Neoproterozoic supracrustal belts that have been interpreted as rift-related deposits characterized by ultramafic-mafic rocks, terrigenous sedimentary rocks, and locally recognized sialic basement rocks.

The Woodburn Lake group comprises multiple cycles of bimodal volcanic rocks, associated felsic to mafic volcanoclastic

rocks and iron formation overlain by quartzite and wacke (Pehrsson et al., 2013). The supracrustal rocks are enclosed by a voluminous suite of 2.62–2.60 Ga granite, and intrusive relationships can be demonstrated locally. Subsequent to the emplacement of the Neoproterozoic granite, the region was affected by four phases of ductile deformation. The dominant regional trends are defined by northwest-verging tight to isoclinal D2 folds and associated faults that resulted in the imbrication of volcanic rocks, basement, and quartzite and greywacke panels. The duration of penetrative ductile deformation in the region is limited by the undeformed deposits and intrusions of the ca. 1.84–1.81 Ga lower Baker Lake Group (MacLachlan et al., 2000).

Northwest of the Woodburn Lake group, deformed and metamorphosed Paleoproterozoic continental basin deposits of the Amer Group locally preserve unconformable relationships to the underlying 2.61 Ga granite.

Metamorphic paragenesis in the area range from dominant greenschist to local upper amphibolite facies (Zaleski, 2005). Strain is typically strongly partitioned, so that supracrustal rocks commonly show excellent preservation of primary textures pseudomorphed by metamorphic minerals.

PROPERTY GEOLOGY

Mineralized occurrences on the Amaruq property are hosted within a northeast-southwest-trending sequence of mafic and ultramafic subvolcanic/volcanic rocks interlayered with various combinations of fine-grained clastic rocks, chert, graphitic iron-rich mudstone and iron formation (Figure 5b). The rocks vary from undeformed to strongly foliated, with undulating but generally moderate southeast dips. Zones of intense discordant shearing and stratabound quartz-sulphide-carbonate-amphibole alteration commonly occur near or at the transition between rock packages that are dominated by ultramafic, mafic, clastics, or chemical sedimentary rocks. These shear-associated and stratabound mineralization styles seem to coexist in different proportions at each significant gold occurrence at Amaruq. Sulphide mineralization also occurs as layers, lenses and dissemination in clastic and chemical sedimentary units, following and/or defining thin compositional layering interpreted to be bedding. The following sections describe the significant geological features characterizing the Amaruq deposits, with emphasis on the Whale Tail deposit, which is currently the best understood due to the large amount of drilling completed there since July 2014.

Host Rocks

At Amaruq, two mafic-ultramafic volcanic units are useful as marker horizons particularly in the Whale Tail deposit, because of their significant lateral extent and distinctive litho-geochemical signatures. The two marker horizons can be seen on Figure 5b as the purple units that are separated by the Central Sedimentary Sequence (CSS). The northernmost ultramafic marker is continuous southwest to northeast throughout the whole Mammoth-Whale Tail-IVR trend (Figure 5b) and has a tholeiitic affinity.

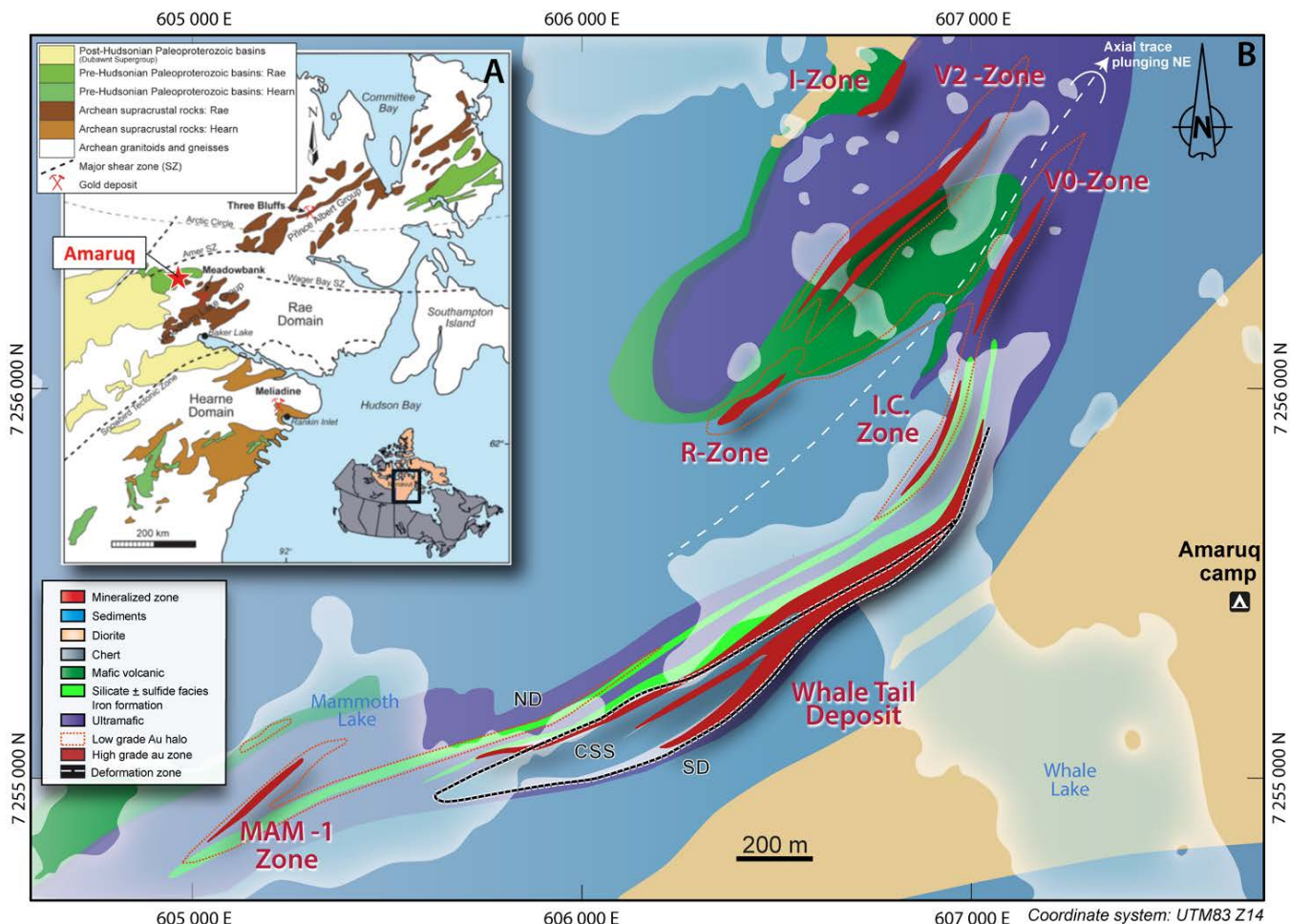


Figure 5: Geology of the Amaruq Project and Regional Geology. (a) Simplified geology of the Rae and Hearne domains in the Western Churchill Province of the Canadian Shield, with location of Amaruq and other significant deposits (Meadowbank, Meliadine, Three Bluffs). Modified from Davies et al. (2010). (b) Geological map of the Amaruq project. ND = Whale Tail North Domain rock package; CSS = Whale Tail Central Sedimentary Sequence; SD = Whale Tail South Domain rock package.

The southernmost mafic-ultramafic marker unit is a komatiite to komatiitic basalt package of transitional to calc-alkaline affinity best identified in the Whale Tail area (Figure 5b). It seems to pinch out progressively to the southwest towards Mammoth but is still recognized to the northeast in the IVR area. A significant portion of the current geological and geometrical understanding of Amaruq relies upon the spatial disposition of these two marker horizons.

Whale Tail Host Rocks Sequence

The host sequence of the Whale Tail deposit is divided into three domains by the two aforementioned marker horizons (Figure 5b and 6a, b). The lack of symmetry/repetition in the distribution of these markers suggests the rocks form a homoclinal sequence, but work is still needed to confirm this. Preliminary observations such as graded bedding in clastic sedimentary units suggest the sequence youngs towards the south. The following thus describes the Whale Tail host

sequence from the interpreted oldest to youngest (from north to south).

The Whale Tail north domain is composed of a clastic sedimentary sequence (greywacke, mudstones and minor chert) overlain to the south by a significant ultramafic flow sequence, acting as the first marker horizon, which is easily recognizable as a sequence of talc-chlorite-carbonate schists with variable foliation intensity. Rare undeformed rock shows relict spinifex texture. The thickness of the sequence varies (averaging 100 m), and it has considerable lateral extent on the scale of kilometres. It has a typical primitive (tholeiitic) geochemical signature with flat rare earth and incompatible element patterns when observed on spidergrams normalized to primitive mantle. Thinly bedded silicate-facies iron formation horizons are intercalated with the flows, locally being the dominant lithology over metre-thick intervals. Principal iron silicates are chlorite, cummingtonite/grunerite, iron-actinolite/tremolite and stilpnomelane. Iron-rich carbonates are also abundant. A major, metre- to decametre-thick silicate-sulphide iron formation

sequence tops the north domain rock pile. Pyrrhotite is generally the only sulphide present. This unit is a significant host to gold mineralization and seems to mark the transition from an ultramafic volcanic regime to a quieter, chemical and clastic sedimentary regime with more felsic material being introduced in the rock sequence.

The Whale Tail central domain, also referred to as the central sedimentary sequence (CSS), exclusively comprises carbon-rich clastic (greywacke and mudstone) and chemical (chert and iron formation) sedimentary rocks. The chemical sedimentary units, in which chert is the dominant lithology (with very minor silicate and/or sulphide iron formation), are concentrated in three specific levels of the clastic sequence: (1) in a 1- to 5-metre-thick interval along the northern edge of the CSS in sedimentary continuity with the iron formation sequence topping the north domain; (2) in a 1- to 20-metre-thick interval in the middle of the CSS; and (3) in a 1- to 20-metre-thick interval along the southern edge of the CSS, where it contacts the south domain. The latter chert-rich level contains significantly more black mudstone horizons (carbon- and locally graphite-rich) with abundant sulphides (pyrite and pyrrhotite) commonly displaying preserved sedimentary/diagenetic textures (e.g., framboidal nodules). These three chert-rich levels in the CSS are also very significant hosts to gold mineralization at Whale Tail.

The Whale Tail south domain sequence (SD) starts with another significant mafic-ultramafic flow sequence that acts as a second marker horizon. It can look very similar to the first marker unit, but it has a distinctive transitional to calc-alkaline magmatic affinity that allows discrimination on normalized rare earth and incompatible element plots. The thickness of the second marker unit varies from 3-5 to 20 m, again with significant lateral extent on a kilometre scale. This unit grades into a more mafic, schistose, chlorite-biotite volcanic/volcaniclastic rock package grading into turbiditic greywackes with minor cherts. A foliated diorite pluton bounds the south domain on the south. Only minor gold is hosted in the south domain.

IVR Host Rocks

The layout of the two marker horizons suggests that the favourable host rock sequence at Whale Tail progressively transitions from the weakly to moderately deformed, homoclinal sequence described above to a complexly strained, folded and transposed, volcanic-dominated sequence towards IVR (Figure 5b and 6a, b). The main host rocks at IVR are fine to medium grained, mafic to ultramafic volcanic rocks of tholeiitic affinity, commonly interlayered with lesser cherts and silicate \pm sulphide iron formation horizons. This host sequence is interpreted as laterally equivalent to Whale Tail's north domain, whereas the easternmost part of IVR seems dominated by transitional to calc-alkaline ultramafics that are together interpreted as the lateral equivalent of Whale Tail's south domain.

Mammoth Host Rocks

Similar to IVR, the favourable host rock sequence at Mammoth is essentially made up of dominant ultramafic volcanic rocks of tholeiitic affinity alternating with lesser mafic volcanics, clastic sedimentary rocks, and silica and/or iron-rich chemical sedimentary units (chert and silicate \pm sulphide iron formations).

Again, in terms of Whale Tail's stratigraphy, the host rock sequence at Mammoth is laterally equivalent to the Whale Tail north domain (Figures 5b and 6b), with no known equivalent of the CSS nor the south domain.

Structure

When contemplated at the property scale, the Mammoth-Whale Tail - IVR host rock sequence is interpreted as defining a regional folding pattern, with Mammoth and Whale Tail being part of the south limb of a gently east-plunging, moderately inclined, tight antiformal fold (Grondin Leblanc et al., 2017), and IVR sitting in the hinge zone (hence the more developed structural complexity there; Valette et al., 2017). Work is still needed to understand the complete geometry of the rock sequence but Figure 6 summarizes the current interpretation with emphasis on the elements defining the fold geometry and the position of the mineralized zones. The undulating geometry of the host sequence in the Mammoth-Whale Tail segment (i.e., fold limb structural domain) is well revealed by the 3D distribution of the marker horizons (Figures 6b to e). In the southwest-facing cross-sections, the lithological units are subvertical, openly undulating with dips of 50–60° but varying with depth. The layering has an overall form of an open S fold with a hectometric wavelength. The overall attitude of the host sequence progressively shifts to shallower dips and north-northeast orientation approaching the IVR area (fold hinge structural domain; Figures 6b, f and g). The intensity of deformation is also stronger in general, but the strain is still partitioned into specific corridors favourably developed in mafic-ultramafic volcanics.

The most obvious structural feature at Amaruq is a penetrative schistosity (herein after referred to as S_m , for “main schistosity”) oriented east-northeast with moderate (45–60°) dips to the southeast, which makes it mostly parallel to stratification. This schistosity is coeval with tight to isoclinal, inclined to recumbent folds interpreted as associated with the regional folding pattern described at the beginning of the section. The main schistosity is affected by a subsequent deformation event responsible for a shallowly dipping crenulation cleavage associated with open chevron-style mesoscopic folds (S_{m+1}). Both the S_m and S_{m+1} fabrics seem to have controlled vein emplacement, and at least some of the veins are seen to be folded, crenulated, and/or boudinaged in high-strained S_{m+1} corridors. At least one late, brittle deformation event may be responsible for a steeply dipping, roughly north-south fracture cleavage (S_{m+2}). Different structural studies are currently ongoing at Amaruq to better unravel the structural history, assess the structural controls on gold mineralization and evaluate the impact of deformation on mineralized bodies (e.g., Grondin Leblanc et al., 2017 and Valette et al., 2017).

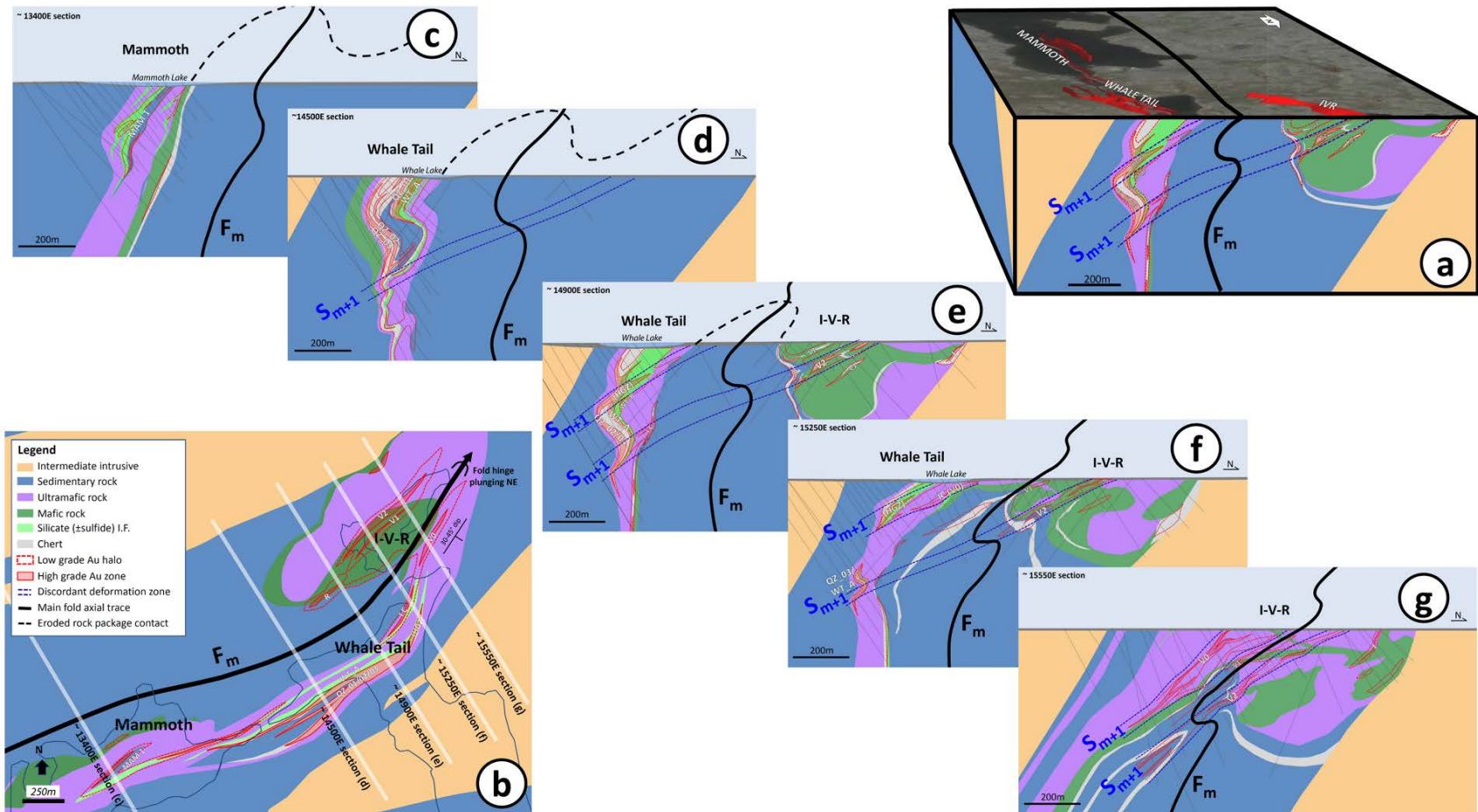


Figure 6: Schematic geological representation of the current interpretation of the Mammoth - Whale Tail - IVR trend and associated mineralized zones. (a) 3D view (looking west) showing the location of the main mineralized zones in plan and section. (b) Geological plan view, legend, and location of the individual sections presented in cross sections (c) to (g) (looking southwest). F_m = Main fold axial trace, associated with the regional main schistosity S_m (not shown on the figure but interpreted as subparallel to F_m); S_{m+1} = shallowly dipping crenulation cleavage associated with open chevron-style mesoscopic folds affecting F_m/S_m in highly strained discordant corridors.

Metamorphism

Preliminary investigations using mineralogy during core logging and some field observations at Amaruq are consistent with Zaleski's (2005) observation that greenschist facies metamorphic conditions prevailed in the area. Peak metamorphic conditions in the upper greenschist zone appear to have been attained during, or soon after, development of the main foliation in these rocks, and had begun to decrease after crenulation of the main foliation (Thompson, 2015). Some amphibolite-grade hydrothermal metamorphism also appears locally.

Gold Mineralization

Three contrasting styles of mineralization coexist at Amaruq. In all three styles, gold is found associated with pyrrhotite and/or arsenopyrite as 25- to 50-micron-wide inclusions or grains along fractures, or simply as free grains in a quartz-rich gangue.

The first mineralization style corresponds with occurrences of pyrrhotite-quartz-amphibole-carbonate as layers, lenses and/or disseminations (Figure 7a), mostly restricted to the silicate-sulphide iron formations of Whale Tail's north domain and best developed in or close to high strain zones where "silica-flooding" and/or quartz veins are abundant. The most significant gold zone of this type (WT_a; see Figure 8a) appears along the ND versus CSS interface, spatially associated with the iron formation topping the ND. Biotite, stilpnomelane and garnet are commonly part of the gangue minerals, but it is currently unclear to what extent they are related to hydrothermal alteration versus metamorphism of iron formation. This style of mineralization typically yields drill intercepts of 5 - 7 g/t gold (Au) over 6 - 8 m, but higher grade and thicker zones also occur locally, such as 21.8 g/t Au over 18.9 m and 11.8 g/t Au over 19.9 m (all assays are capped at 60 g/t Au and are Au grade / core length; Figure 8a), especially where silica alteration ("flooding" and/or veins) is best developed.

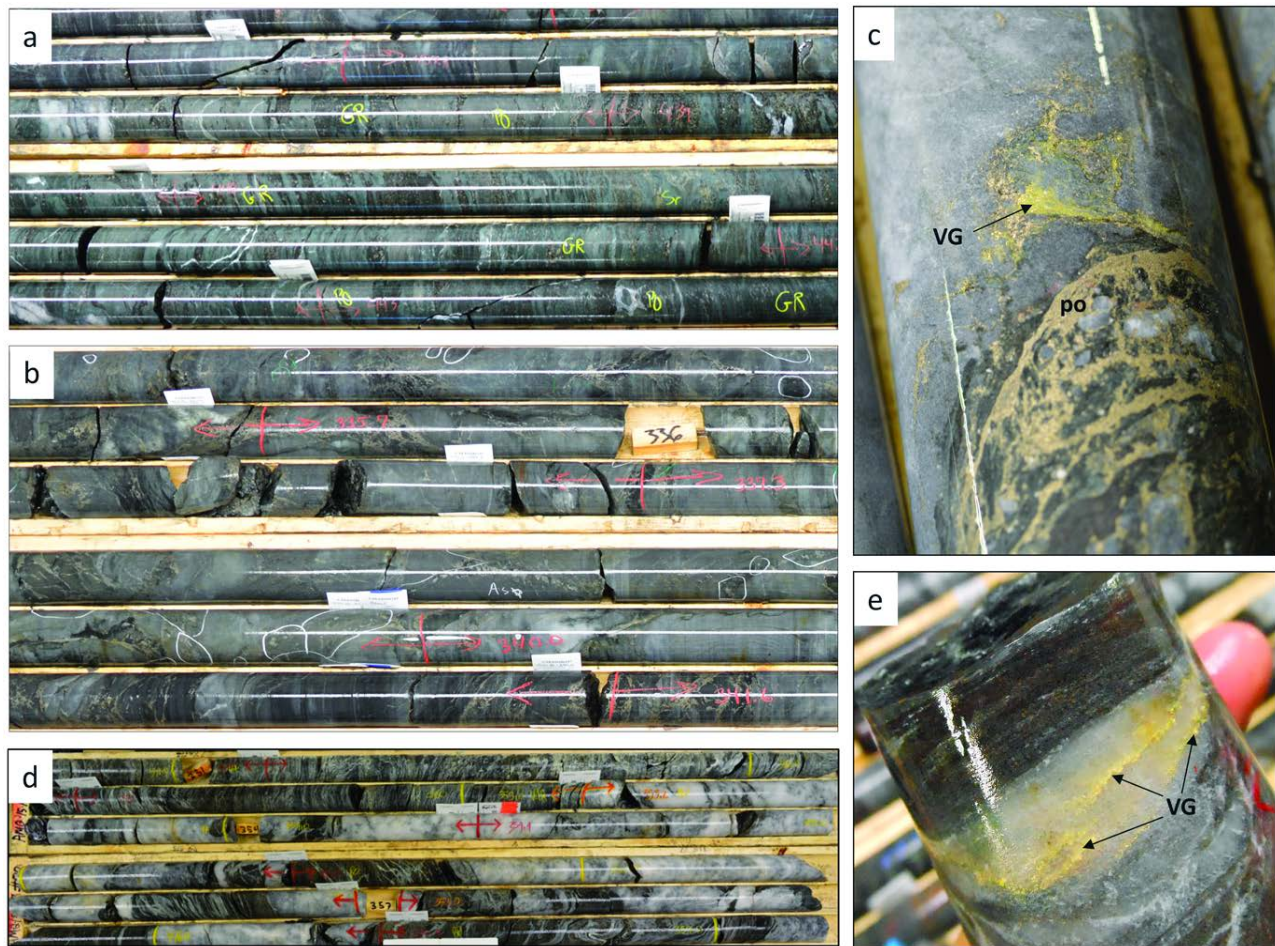


Figure 7: Amaruq core pictures showing typical mineralization types. (a) Silicate-sulphide iron formation with pyrrhotite-quartz-amphibole-carbonate injections and replacement. (b) Chert-rich sedimentary rock with significant silica-flooding and associated arsenopyrite-pyrrhotite injections. (c) Occurrence of visible gold associated with silica-flooding in cherts. (d) Quartz-sulphide-native gold veining in schistose, biotite-altered mafic-ultramafic volcanics. (e) Visible gold in vein described in (d).

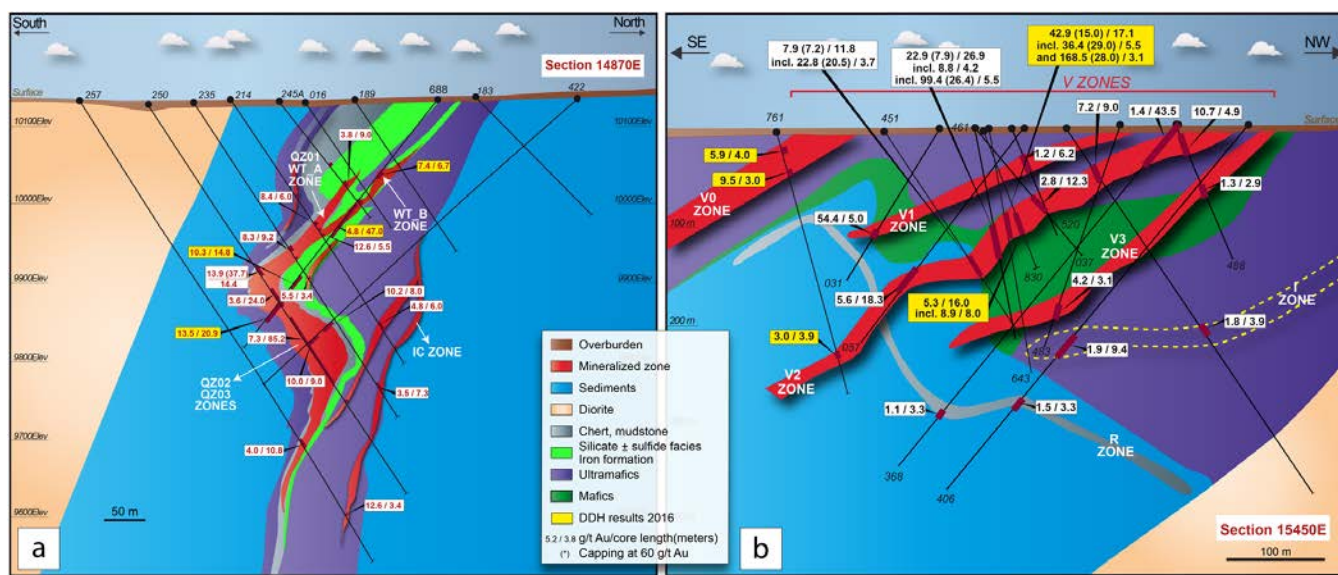


Figure 8: Typical cross-sections with drilling intercepts at: (a) Whale Tail, and (b) IVR.

The second mineralization style comprises “silica flooding” with significant pyrrhotite, arsenopyrite, loellingite and local pyrite stockwork and disseminations, within a gangue of quartz-amphibole-carbonate-chlorite-biotite (Lauzon et al., 2017; Figure 7b). This is the typical mineralization style in Whale Tail’s CSS, where three main ore zones of this type are recognized (QZ01, QZ02, and QZ03; see Figure 8a), spatially associated with the three chert-rich levels occurring in that domain. The hydrothermal flooding responsible for these zones is interpreted to have been at least partially controlled by the rheological contrasts existing at the interfaces between clastic and chert-rich rocks. The gold content of these zones is also very significant (Figure 7c), with typical intercepts of 4.8 g/t Au over 4.6 m, but locally up to 13.5 g/t Au over 17.6 m and 7.6 g/t Au over 23 m (all assays are capped at 60 g/t Au and are Au grade / core length; Figure 8a).

The third mineralization style is represented by different sets of deformed and recrystallized, decimetre- to several metres-thick, quartz ± carbonate ± sulphide ± native gold veins cutting through the whole Mammoth - Whale Tail - IVR rock sequence (Grondin-LeBlanc 2017; Valette et al., 2017; Figure 7d). These veins are best developed in the mafic and ultramafic volcanics, where they are hosted in biotite-carbonate ± sericite altered and moderately to strongly schistose zones. The overall sulphide content of the veins is generally low (1–5% maximum) and most commonly comprises arsenopyrite, galena, sphalerite, and/or chalcopyrite. These veins seem more abundant and best developed in the hinge zone of the regional fold (i.e., in the east half of the Whale Tail deposit and in the IVR area), where they seem to be restricted to shallow southeast-dipping, high-strain corridors (Figures 6e to g). Preliminary observations suggest that most of the veins cut pre-existing mineralization, which together with their overall geometry would suggest they occurred later than the other two previously described mineralization styles (and thus could be hosted in S_{m+1} structures), but the exact timing of the different vein sets is still under investigation (Valette et al., 2017). The main mineralized

zones of vein-style mineralization are V0 and V2 in IVR, and the HGZ and IC zones in Whale Tail (Figure 5), but veins are also found in almost all the other gold-bearing zones at Amaruq in lesser proportions. Their gold content is hard to predict (because of a strong nugget effect; Figure 7e), but it locally yields very significant intercepts in the range of 8 – 10 g/t Au over 4 – 5 m, and up to 15 g/t Au over 17.1 m (all assays are capped at 60 g/t Au and are Au grade / core length). Figure 8b shows a schematic cross-section with vein intercepts in the V zones of the IVR area.

Deposit Model

The zones with the highest gold values at Amaruq are characterized by extensive quartz veining or flooding not restricted to iron formations but also invading other sedimentary and volcanic units. These gold-rich injections caused obliteration of primary compositional layering and are spatially associated to deformation corridors, which is consistent with chemical mobilization of gold and sulphides during main-phase regional metamorphism and deformation. High-strain faulting/shearing and other structural processes, such as the openings created along lithological contacts due to rheological contrasts, acted as important controls on the gold mineralization. These are considered to have been the predominant processes in the creation of the mineralized zones in the chert-rich layers of the CSS at Whale Tail, and in the later quartz veins cutting through the whole sequence. These features make Amaruq a newly-recognized district of mesothermal lode-gold mineralization, including (but not restricted to) hybrid, stratabound- and vein-type iron-formation-hosted gold deposits (Kerswill, 1996; Côté-Mantha et al., 2015). Preliminary investigations regarding the timing and provenance of gold at Whale Tail by Thompson (2015) also suggested the possibility that primary (volcano-sedimentary) enrichment in S, Fe, Au, As, and other components in the Amaruq host rock sequence may have favoured the later development of high-grade mesothermal lode-gold mineralization. This hypothesis is under investigation as part of the current academic geoscientific studies at Amaruq.

CONCLUSIONS

Agnico Eagle has had considerable exploration success since starting to explore the Amaruq property four years ago, making it one of the most significant greenfield gold discoveries in Nunavut and one of the most significant recent large discoveries in Canada. This success was formally recognized with the awarding of the Prospectors & Developers Association of Canada's 2016 Bill Dennis Award to Agnico Eagle's exploration team.

The company's exploration team was able to generate the project because they had access to a good public database of historical work augmented by their own geoscientific compilation of exploration results in a large region around the Meadowbank mine development. The conceptual thinking of the team required an understanding of the historical work as well as an appreciation of the current mining and economic requirements.

From this compilation, the team identified the Amaruq site as having high potential. As the Meadowbank mine began to see its orebody being quickly depleted, the timing of the nearby discovery at Amaruq could not have been better. The exploration team's initial geophysical survey revealed conductors that were drilled, and fortunately one of the first few holes intersected a mineralized zone. The rapid advance of the project since that discovery hole in August 2013 has required the practical application of techniques and tools and a flexible geological model, backed by the company's full support and funding. The result has been an efficient path to an initial mineral resource estimate that continues to grow.

The exploration tools and techniques have been carefully developed for the Amaruq exploration program; their effectiveness is continually being weighed and the program adjusted. At each stage, careful field observations have been made at local and regional scales. Geophysical surveys using airborne and ground-based MAG and EM have been useful for following subsurface rock units and determining drill targets. With up to 10 drill rigs working concurrently, it has been important to establish and maintain good drill core logging practices including careful observations; maintaining uniformity via a simple legend, a core library, and identification charts; using portable XRF equipment for lithotyping; and taking good quality photographs of all core. The identification of marker horizons to unravel the geometry of the rock sequence has been of key importance. Leapfrog Geo™ software has been used to create implicit 3D models in real-time as the drill campaign has progressed, so the team has been able to determine drill targets in 3D, and use the model for continual resource re-estimation. On-site portable XRF assaying of samples from the systematic till geochemical survey has given immediate feedback for tracking gold pathfinder elements (e.g., arsenic), speeding up the siting of targets in the regional exploration program.

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