NEWSLETTER
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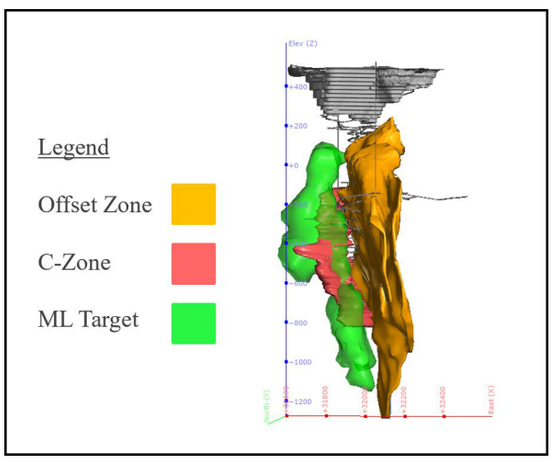
XploreIQ Case Study: Increasing Life of Mine with Machine Learning Algorithms

Impala Canada is a leading Canadian palladium producer, operating the Lac des Iles Mine northwest of Thunder Bay, Ontario. Lac des Iles is one of the largest producing palladium mines in Canada, with plans of reaching 12,000 tonnes per day from underground resources in 2021. Currently, Measured and Indicated Resources are estimated at 72.9Mt at 2.14 g/t Pd for 5 million ounces of contained palladium (Oct 2018).

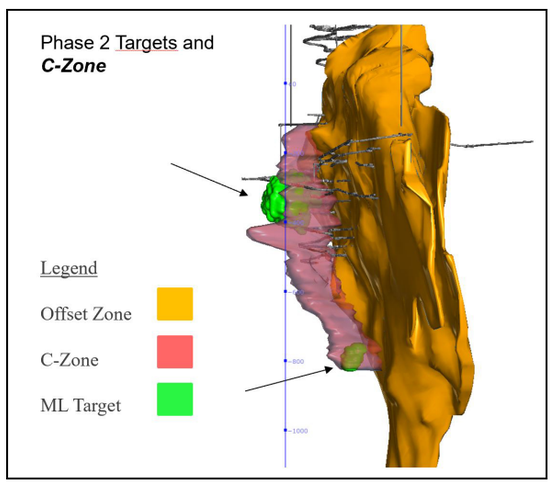
SGS' Project Scope and Results

SGS Geological Services was engaged by Impala Canada to generate underground and surface near mine exploration targets around Lac des Iles C-Zone. SGS used its methodology developed during the Integra Gold Rush Challenge (XploreIQ), which it won in 2016, to develop two passes of targeting through a combination of its data science capabilities, machine learning tools and algorithms, and geological / PGE deposit knowledge to generate a series of algorithm-generated and weight of evidence (WoE) targets. The C-Zone is directly linked with one of the major high priority targets generated through XploreIQ.

XploreIQ, the SGS machine learning methodology and toolkit, focuses on exploration targeting and mineralization vector creation using historical and current data. The methodology "cleans" and prepares the data to be analyzed by multiple types of ML algorithms and creates prospectivity maps that are used to generate 2D or 3D targets. Information is stored and analyzed in the form of block models of different sizes, depending on the area of the target zone. Targeting was done in two stages for Impala Canada to improve the level of precision. In the first pass, SGS applied a 25mX25mX25m block model. The second pass focused on areas of interest defined via the first pass and used a smaller 5mX5mX10m block model.



PHASE ONE TARGETING & RESULTS



PHASE TWO TARGETING & RESULTS

Lac des Iles C-Zone

The new Pd rich zone (C-Zone), discovered in 2018, consists of two mineralized trends, including a north-south trend parallel to the central Offset Zone and a southwest- striking trend. The southwest trend generally follows the western contact between the intrusion and the basement rocks and the Southeastern domain of the Offset Zone. Palladium mineralization in the C-Zone is hosted within geological units (Leuco GABVt and Qtz Diorite) that are compositionally distinctive from those that host the Offset Zone resources (Pyroxenite, GAB-Vt and Norite). C-Zone is still an exploration stage target; with encouraging results reported in June 2019. Example results included 74.9 m with 2.93 g/t Pd, including 19.2m with 6.38 g/t Pd and 5.0m with 9.00 g/t Pd (hole 19- 520). SGS XploreIQ successfully generated drill-ready exploration targets for Impala Canada through two-tiered ML-enabled modelling. Using these targets, Impala Canada has refined and prioritized its near-mine drilling program as part of its 2018-19 exploration campaign, which has led to a major palladium discovery. This discovery has the potential to extend the life of mine and optimize the ore body value.

Genesis Software Update

The Right Balance Between Automation and User Control

We continued to improve the functionalities of our Genesis application while remaining faithful to our renown approach: keeping the software simple, user-friendly and efficient. Genesis now integrates all the functionalities of our old software suite and much more. It is now possible to execute all the operations of a resource estimation project including the validation of drilling data, the QAQC, modeling of intervals, compositing, variography, estimation, classification and powerful reporting tools of block models. All these operations can be carried out automatically, with a few mouse clicks, with a minimum number of parameters. Moreover, with new fully integrated graphics, these operations are now simpler and user friendly.

The Best Implicit Models: Planar Envelopes!

We have developed what we think is the best form of "automatic" modelling. This type of envelope best generated on a plane, e.g., veins or dykes. The steps to create one are the following:

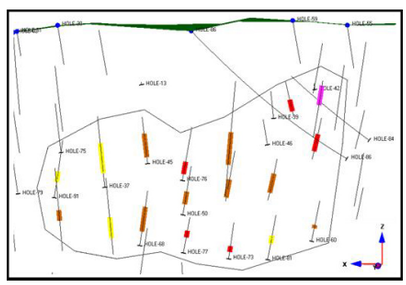
1.Create Mineralized Intervals ("MI")

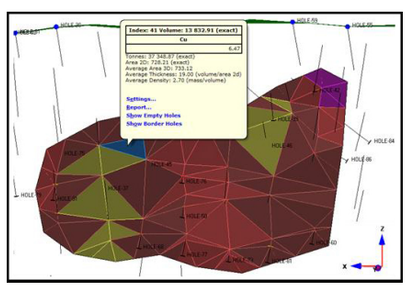
2.Tag them with the same name

3.Generate the planar envelope

The MIs can be created automatically (optimization of revenues) or manually. The margin for extrapolation is set by the user in meters. Also, the user can decide to limit the extent to the half distance to barren drillholes. Once generated, you can edit the extents polygon to customize the margin in every direction (figure 1).

The geological modeling is increasingly facilitated. The technology seeks geometric veracity. The final volume is always snapped where you want it and has almost no bias (vs implicit models). Also, the planar envelope can be limited by a topographic surface, so the margin won't extend beyond the ground.





Once the planar envelope is created, you get a lot of information: minimum, maximum and average thickness, the exact volume, the tonnage, the area and the grade (figure 2). The grade is calculated from the mineralized intervals. It is possible to get this information for every triangle in the solid.

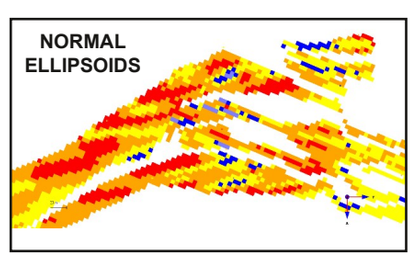
We think this algorithm is one of the best tools in the industry as of 2020 because it retains the best from the classic meshing and adds automation of the implicit modelling and the creation and the adjustments are quickly realized.

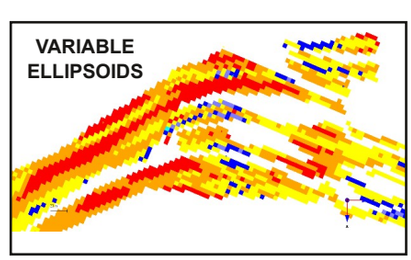
Inboard Variography and Estimation Methods

Our new variographic modeling tool automatically creates directions of interest, for example, using an ellipsoid directly drawn on the screen and visualizes spatial continuity in 3D. The creation of variographic models is greatly simplified with a more user-friendly and dynamic interface. Likewise, our estimation methods are constantly enriched with the most modern algorithms used by the industry: estimation of irregular blocks, by panels or by local anisotropy (LAK). In addition to the standard quality control of the estimation by KNA, several tools are now added such as the "actual number of composites used" considering the weights assigned to the composites, the graphs of comparison between block models and composites and the averages and histograms of the declusterized composites.

Variable Ellipsoids

The tools for creating and manipulating block models are also constantly improving for the sake of efficiency. For example, it is now possible to generate variable search ellipsoids directly from a block model without having to create multiple polylines first. In many projects, the estimation with standard ellipsoids (figure 3) vs the variable ellipsoids (figure 4) are astounding!





Pits, Digitization and More!

In addition to all these functionalities designed for resource estimation, there are several tools for carrying out specific tasks ranging from the automatic digitization of polylines from digital images to the optimization of pits. Constantly on the lookout for the needs of our customers, Genesis evolves for you.

The Yellowknife City Gold Project

SGS Geological Services (SGS) has recently completed the First Mineral Resource Estimate on the Yellowknife City Gold Project for TerraX Minerals Inc., now Gold Terra Resource Corp. The Property extends for 10 to 60 km north, south, and east of the city of Yellowknife in the Northwest Territories., and is 100% owned by Gold Terra.

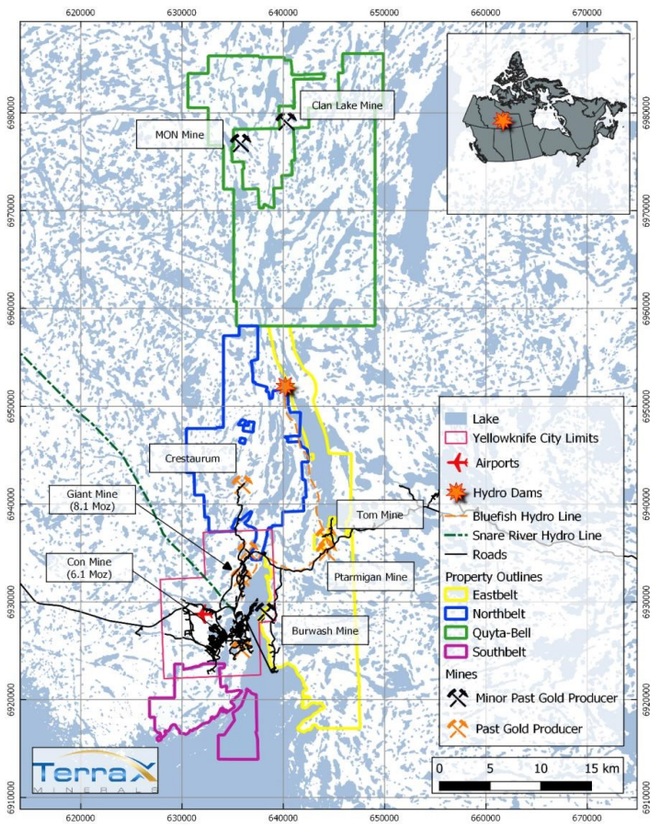
The current Property was assembled through a series of acquisitions (2013-2018), beginning with the acquisition of a property previously referred as the Northbelt Property in 2013. Since acquisition, TerraX has carried out a number of airborne magnetic, electromagnetic and radiometric surveys and ground magnetic and induced polarization surveys, an extensive digital compilation of much of the historic surface geological and geochemical data and surface historic drill data, targeted geological mapping, prospecting and channel sampling, and extensive re-sampling of historic drill core. To date, TerraX has completed 296 diamond drill holes for a total of 61,481 m of core.

The deposits of the Project occur within and in proximity to the Yellowknife Greenstone Belt which occupies the southwest corner of the Archean Slave craton. Gold mineralization on the Property is structurally controlled and exhibits similar geological, structural, and metallogenic characteristics to other Archean Greenstone-hosted quartz-carbonate vein (lode) deposits.

In addition to the Yellowknife City Project, the Slave craton contains several significant gold deposits including the iron formation-hosted gold deposits at Lupin, George Lake, Goose Lake, and Damoti Lake as well as the Giant, Con, Boston, Colomac and Courageous Lake..

On November 4th, 2019, TerraX announced an Inferred mineral resource estimate of 735,000 oz gold, which consists of:

•A pit constrained Inferred resource of 11.6 Mt averaging 1.4 g/t for 523,000 oz of contained gold



•An underground Inferred resource of 1.2 Mt averaging 5.7 g/t for 212,000 oz of contained gold

The classification of the current mineral resource estimates as Inferred is consistent with CIM Definition Standards on Mineral Resources and Mineral Reserves (2014).

A technical report prepared in accordance with National Instrument 43-101 – Standards of Disclosure for Mineral Projects supporting the Inferred mineral resource estimate was filed by TerraX on December 3rd, 2019.

The Inferred mineral resource estimate includes four gold deposits: Sam Otto, Crestaurum, Barney and Mispickel, which are all within a 3 km radius. The estimate incorporates the results from 463 drill holes totaling 90,751 m, from which 201 drill holes totaling 42,447 m were completed by TerraX from 2014 to 2019.

The mineral resource estimate was prepared by Dr. Allan Armitage, P.Geo., from SGS. SGS used Geovia Gems software to construct mineralized wireframes for each zone and then interpolated tonnage and grade into block models constrained by the mineralized wireframes and used inverse distance squared (ID2) interpolation. Block sizes were 5mX2mX2m for Crestaurum and 5mX2mX2m for Barney to generate underground estimates, and 5mX5mX5m for pit constrained estimates on Sam Otto and Mispickel. Appropriate interpolation parameters were generated for each deposit based on the mineralization style and geometry.

The pit shells were created using Whittle pit optimization software and applying the following optimization parameters: US$1,300 gold price; US$2.20/tonne for mining cost; US$16.00/tonne for processing and G&A costs; 90% metallurgical recovery; 5% dilution (external); 5% mining loss; and 55º pit slopes (the deposits occur in areas of extensive outcrop with negligible overburden).

SGS Geological Services

10 boul. de la Seigneurie East,
Suite 203
Blainville Québec,
Canada J7C 3V5
Phone: +1 (450) 433-1050
Phone: +1 (800) 474-6561
Fax: +1-(450)-433-1048
Web: www.sgs.com

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