Role of advanced geophysical processing in searching for the next giant Gold-Copper deposit in North Sumatra

Introduction

The ‘Sihayo Project’ is a highly prospective exploration area within a portfolio of sites in the Mandailing Natal district of North Sumatra, Indonesia (Fig 1). The region coincides with the geologically prolific Trans Sumatra Fault Zone (“TSFZ”) and the associated Neogene Magmatic Arc, which is the result of an oblique collision of two tectonic plates and associated subduction. The TSFZ hosts a number of significant gold projects including the giant Martabe deposit (6 Moz Au, 60 Moz Ag). 50km to the south-east of Martabe lies the Sihayo Project which has until now, received very little modern exploration attention outside of the proven sediment hosted resources at Sihayo-1.

Figure 1 Significant mineral deposits along the Trans Sumatra Fault Zone, Sumatra, Indonesia, including the Martabe deposit which is located 50km northeast of the Sihayo Project (Sihayo Pungkut).

Figure 2 Sihayo-Pungkut Contract of Works (“CoW”) which covers an area of 66,000 Ha

The Sihayo Project comprises the north and south blocks of the Sihayo-Pungkut Contract of Works (“CoW”) and covers an area of 66,000 Ha (Fig 2). The tenement is highly prospective for porphyry and epithermal mineralisation styles, as well as sediment hosted deposits which are proven at Sihayo-1.

Sihaylo-1

The Sihaylo-1 deposit occurs at the top of a hill on the edge of a major dilation pull apart basin (Fig 3). The deposit is situated within the sedimentary package consisting of Permian aged calcareous sediments
and volcaniclastics, which are unconformably overlain by shallow basin-origin Tertiary sandstones and siltstones. The mineralisation type is categorised as Sedimentary Hosted Disseminated Gold.

On behalf of the CoW owner (PT Sorikmas Mining) and joint Venture partner (PT Aneka Tambang Tbk), Australian-based, majority-owner and operator “Sihayo Gold Limited” has been focussed on the Sihayo Starter Project (Fig 4), pursuing near-mine exploration opportunities that will enhance existing operations. To this end, Sihayo Gold Limited commenced a successful diamond drilling program in July 2019, on the back of an integrated exploration program which had been underway since 2009.

As a result, the existing JORC resource estimates and ore reserves of the Sihaylo Starter Project currently stand at:

- Mineral Resources: 24 Mt @ 2.0 g/t Au containing 1.5 Moz Au
- Ore Reserves: 12 Mt @ 2.1 g/t Au containing 840 koz Au

Figure 3 Sihayo- Sambung interpreted geology long section (north-west to south-east)

Figure 4 Sihayo Project Growth Pipeline

The next drill-ready project is the epithermal Au and Ag target further south at “Hutabargot Julu” which is potentially transformative, should a giant Martabe-analogue discovery be made.
Beyond these priorities, at least 20 further identified porphyry and epithermal prospects exist in the tenement (Fig 4). Their diverse range of mineralisation styles include: carbonate-hosted gold, low to intermediate – sulphidation epithermal-vein gold, gold-copper skarn, gold-copper porphyry and lead zinc skarn.

Regional Prospectivity focused by geophysics

To guide the Sihayo Project growth pipeline and investigate all further prospects within the greater Sihayo-Pungkut Contract of Works (“CoW”) – a regional exploration program managed by Sihayo Gold Limited and incorporating the services of Intrepid Geophysics (Melbourne) is ongoing in 2020/2021.

Sihayo Gold Limited engaged Intrepid Geophysics to reprocess Sihayo’s geophysics data collection (legacy and acquired over a range of times) and incorporate them into tenement scale and regional scale models. Intrepid Geophysics was awarded the contract due to their 30 years of experience in advanced geophysical processing and integrated geological interpretation, utilising their own commercial products: Intrepid and GeoModeller software.

The first stage of this project focused on QAQC and reprocessing, standardising, and optimising of the Sihayo Project’s collective airborne magnetics, gravity and radiometrics data sets.

Key Findings Stage One

1. The data was found to be of high quality, but due to acquisition over a long period of time, some effort was required to perform QAQC, reprocess, merge and re-grid.
2. Advanced processed/filtered products (grids and images) comprised the modern deliverables.
3. Airborne geophysics is the only unified and detailed dataset covering the CoW and is critical to mapping geological structure, especially given the mountainous jungle environment.
4. Magnetic data derivative products show detailed, complex structure of the Sumatra Fault Zone.
5. Two near-mine targets (Hutabargot Julu and Sihayo 2) are reaffirmed as drill-ready for 2021.

Example Total Magnetic Intensity (TMI) Advanced Processing

The most difficult part of the magnetic processing was calculating a correct RTP grid in this equatorial region. Beyond this step, the magnetic processing products now prove to be good representations of the geology in the area, and they are being verified via ground geological mapping in 2021 by the Sihayo Project field geologists.

One example of a new enhancement delivered is the variable GRF, gradient of the TMI vertical component, VBzz. This filter simulates the zz component that would be measured by a full tensor magnetic gradients instrument. 2D TMI Reduction to Pole, or extraction of the magnetic vector components requires allowing for the variable declination/inclination of the field (Cooper and Cowen, 2005). This method uses a post-processing spatial adjustment with a Taylor series, to approximate the induced vector angle changes.

The filter is a two-stage filter process:
- VBz – use the GridFFT Component filter to calculate the vertical component of the field. Choose variable option for large area grids and set the Taylor series value to 3.
- VBzz – when the VBz process has completed execute a new GridFFT first vertical derivative process on the VBz grid to compute the VBzz result.

The VBzz filter pushes the data quality to its limits, often showing data artefacts and noise in the magnetic data. At the same time, we advocate that the frontier of data limits should be investigated with an open mind that herein new geology knowledge revealing mineralised deposits may be discovered (Fig 5).
Stage Two

The second stage of work currently in progress, focuses on incorporating the new geophysical products into high quality local and regional geological models for detailed interpretation, and prospect targeting purposes.

These will be used to help define and prioritise the targets over the 66,000Ha with plans to complete ground truthing regionally during 2021. Some of these outcomes will be available in time for the EAGE 2021 presentation.

Conclusions

By using advanced software and innovation, Intrepid Geophysics have assisted Sihayo Gold Limited to more effectively confirm and prioritise their mineralisation targets, within shorter time frames. As well this work has tested conventional interpretations and already contributed to a more robust geological understanding – with more work to come.

Modern re-processing and enhancements enabling incorporation of the geophysics into tenement scale and regional scale geological modelling and interpretation has been an important part of the exploration strategy. It has already added value for regenerative scope beyond the Sihayo Starter Project, as new and prioritised targets are derived from new and legacy geophysical survey data. This is the essence of our mantra ‘3D Geology from Geophysics’ especially important when exploring undercover and under tree-canopy.

References
