MONGOLIAN GOLD-COPPER SKARN DEPOSIT

Exploration Evaluation & Mapping Engine Manual

Based on Certified Data from the 2011 Mongolian Minerals Resource Council
(Эрдэс Баялгийн Мэргэжлийн Зөвлөл)

Date: June 2026

Format: Spatial Evaluation and System Integration Report

Status: Active Specification

1. Executive Summary

This report establishes the technical specification, spatial dataset parameters, and mapping framework for the target gold-copper skarn/porphyry style deposit in Mongolia. The resource is associated with contact limestones and boundary metasomatites, bounded to the north-west by a major regional fault line.

The total reserve mass (Categories B + C) stands at **2,690.32 kt**, with a mean Gold Equivalent (AuEq) grade of **0.722 g/t**, containing a baseline of **1,487.80 kg of gold** (under the 2011 resource model) and **2,313.41 t of copper**. When rendered in the interactive spatial visualizer, the calibrated block model grid—utilizing local grade trend vectoring (SW gradient enrichment) and standard gold-to-equivalent conversion ratios—computes an active in-situ contained gold estimate of **1,674.70 kg**. This document outlines the execution of the web-based geological mapper, 3D visualizer, and the verification framework designed to reconcile these figures.

2. Deposit Geometry & Resource Matrix

The orebody is divided into three distinct geological blocks based on resource classification and structural controls. Spatial coordinates are established on a relative grid centered on the NE Body origin (0, 0).

Ore Zone	Strike/Dip Vector	Geometry Footprint	Tonnage (kt) & Grades
North-East (NE) Body *95.1% of Reserves*	Strike: 300°–330° Dip: 20°–25° SW	Length: 250–400 m Width: 25–120 m Thickness: 2.0–12.0 m	Cat B: 2,569.8 kt @ 0.728 g/t AuEq Cat C: 81.6 kt @ 0.679 g/t AuEq
Central Body *High-Grade Target*	Fault Controlled NE-Trending	Length: 400 m Width: 120 m Position: ~400m SW of NE Body	High-grade local anomalies averaging **2.10 g/t AuEq**
South-West (SW) Body *Silver Anomaly*	Strike: 315° Dip: 30° NW	Lens 1: 150 × 70 m Lens 2: 60 × 50 m	Cat C: 38.8 kt @ 0.484 g/t AuEq characterized by high Silver (103.5 g/t)

3. Commodity Recovery & Economic Evaluation

The mining evaluation operates under a baseline 3-year open-pit design with a throughput of **600.0 ktpa** (totaling 1,800.0 kt of processed ore, or 66.9% of reserves). Metallurgical recoveries are projected at **83.3% for Gold** via combined gravity-flotation processing.

The economic baseline is governed by a **0.516 g/t AuEq cut-off**, representing the breakeven cost limit per tonne of ore. The financial breakdown is summarized below under modern commodity prices (Gold @ \$2,300/oz, Copper @ \$9,000/t, Silver @ \$28/oz):

Financial Metric	3-Year Baseline (66.9% Mined)	Full Life of Mine (100% Mined)
Total Ore Processed	1,800.00 kt	2,690.32 kt
Recovered Gold (Au)	829.12 kg (26,657 oz)	1,239.34 kg (39,845 oz)
Recovered Copper (Cu)	1,315.52 t (2.90 M lbs)	1,966.40 t (4.33 M lbs)
Recovered Silver (Ag)	5.71 t (183,680 oz)	8.54 t (274,560 oz)
Gross Commodity Value	**\$78.29 Million**	**\$117.02 Million**
Estimated Extraction Cost	-\$57.20 Million (at \$31.78/t)	-\$85.50 Million (at \$31.78/t)
Net Operating Value	**\$21.09 Million**	**\$31.52 Million**

4. Visualizer Mapping Application Manual

The interactive visualizer web application is a high-performance, responsive portal built using vanilla JavaScript, HTML5 Canvas, and Three.js for 3D graphics. It is situated in the project workspace and consists of three main coordinate-aware interfaces:

4.1 2D Spatial Map View

- **Collar and Trench Symbology:** Plotted using Cartesian coordinates flipped along the vertical axis. Drill collars are rendered as circles (**o**) and surface trenches are plotted as rotated rectangles (**[]**) oriented perpendicular to strike.
- **Controlling Fault Line:** A heavy black dashed line indicating the structural lineament runs along $Y = X + 100$ (45.0° orientation).
- **Grade Vector Arrow:** Shows the increasing grade vector heading SW.

4.2 3D Block Model View

- **Subsurface Cube Grid:** Renders block model cubes filtered in real-time by grade. Cubes are color-coded based on the strict hexadecimal standards:
  - **Waste** Grade < 0.30 g/t AuEq (#808080)
  - **Low Grade** 0.30 to 0.516 g/t (#00FF00)
  - **Medium Grade** 0.516 to 1.00 g/t (#FF4500)
  - **High Grade** Grade > 1.00 g/t (#FF00FF)
- **3D Drill Trace Paths:** Cylindrical traces descending into the topography, colored by the specific average grade of the hole.
- **Orbit Controls:** Left-click drag to rotate scene, right-click drag to pan, and wheel scroll to zoom.

4.3 Drill Hole Cross-Section View

Allows geologists to slice through the orebodies at custom angles (e.g. 45° parallel to the controlling fault, or 135° perpendicular to strike). Projects neighboring drill paths (within 70m perpendicular distance) and body shells onto a vertical 2D plane for structural boundary verification.

4.4 Absolute Ingestion & Export Features

- **UTM Transformer:** Translates relative coordinates into WGS 84 / UTM Zone 48N coordinate formats instantly using input Easting/Northing tie points.
- **Transformed CSV Exporter:** Compiles coordinates, depths, assay means, and transformed absolute UTM values into a downloadable spreadsheet file.
- **Map Image Exporter (PNG):** Exports the active viewport directly as a high-resolution PNG image named `final_georeferenced_grade_map.png`, matching standard reporting requirements.

5. Future Drilling & Extension Directives

To further outline the economic potential of the deposit, the exploration team has established target parameters for subsequent infill and step-out delineation programs:

5.1 Target Vector 1: Central Body High-Grade Delineation

Concentrating on the Central block (positioned ~400m SW of the NE Body origin around relative coordinates `(-282, -282)`), future campaigns prioritize infill gridding at 25 × 25 m or 50 × 50 m spacings around historical holes `ETDH-066` and `ETDH-079`. The target is to map out localized skarn segments containing grades **> 2.0 g/t AuEq**.

5.2 Target Vector 2: Southwest Strike Extension

Situated in the far SW license sector (centered around relative coordinates `(-600, -500)`), future exploration executes step-out drill holes along the 300°–330° structural strike direction of the primary controlling fault. The target profile centers on discovering shallow high-silver anomaly lenses (grades **> 100 g/t Ag**).

5.3 Vertical Model Clipping

To optimize geological modeling performance and focus calculations on the open-pit minable domains, exploration boundaries are clipped at a maximum vertical depth of **-270 m** from topography. Active block modeling focuses on the shallow skarn layers between **0 and 150 m depth**.

5.4 Strategic Development & Mining Opportunities

- **Open-Pit Expansion:** Successful step-out drilling along the Southwest Strike Corridor (Target Vector 2) offers the opportunity to identify shallow mineralization, potentially extending the baseline open-pit mine life from 3 years to over 5 years.
- **Underground Transition Potential:** Delineating the deep, fault-controlled high-grade core in the Central Block (Target Vector 1) between -150 m and the -270 m clipping depth provides exploration data required to evaluate a future underground decline transition targeting high-grade skarn pockets (>2.0 g/t AuEq) after open-pit exhaustion.
- **High-Value Silver Metallurgical Bypass:** The significant silver anomaly (>100 g/t Ag) identified in the SW block presents an opportunity to refine metallurgical flowsheets, potentially introducing a specialized silver-cyanidation circuit to unlock significant byproduct credits.

5.5 Geological Improvement through Infill Drilling & Reserves Reconciliation

The interactive visualizer block model reports an in-situ contained gold figure of **1,674.70 kg**, which is higher than the baseline 2011 report value of **1,487.80 kg**. This difference is explained by three key factors in the current visualizer dataset generation:

- **Spatial Grade Vectoring:** To reflect the geological vectoring trend, the generator applies a gradient boost that increases grade values systematically from the North-East toward the South-West, modeling localized metal enrichment in the SW sector.
- **Assumed Au/AuEq Ratio:** Individual block gold grades (Au) are modeled as a fixed 76.2% of the block's computed equivalent grade ($AuEq$).
- **Mass Calibration:** A block calibration factor is applied to match the total active mass above the 0.30 g/t cutoff to the baseline tonnage of 2,690.32 kt. Because the spatial gradient boost increases the average grade of the generated blocks, the total calculated gold content is elevated.

To reconcile and refine this estimate, the proposed infill drilling program is critical. Implementing a 25 × 25 m or 50 × 50 m infill grid will provide the dense geological data required to replace these synthetic model parameters with measured physical boundaries. This will specifically improve the resource model in the following ways:

1. **Resolving central thickness:** True oriented core logging will replace the vertical apparent thickness (currently 25.0 m) in the block generator with the true structural width (modeled at 5.0 to 8.0 m). This thickness correction will reduce the central body's volumetric footprint, lowering the block calibration factor to match actual geological dimensions and preventing volumetric exaggeration.
2. **Metallurgical circuit verification:** Drilling composites from the SW silver-rich lenses will establish whether a specialized silver cyanidation bypass circuit (which recovers 75% silver but adds a $4.50/t penalty) is economically viable compared to standard flotation, directly refining the grade-recovery relationship.
3. **Eliminating synthetic grade boosts:** Precise assaying under modern QA/QC protocols will verify if the SW gradient enrichment is continuous, removing the need for a synthetic mathematical boost and establishing a verified, certified resource model.

6. Geological Audit: Data Validation & Sampling Risks

A rigorous audit of the historical 2011 exploration database reveals several technical risks that must be validated through modern confirmatory drilling prior to resource estimation or capital deployment:

6.1 Apparent vs. True Thickness Exaggeration

The Central Body high-grade core (averaging **2.10 g/t AuEq**) is modeled with a vertical thickness of 25.0 m. However, because historical holes (such as `ETDH-066` and `ETDH-079`) intersect the vertical controlling fault structure at angled trajectories, they likely drilled down the mineralization plane. The reported 25m thickness represents **apparent thickness**; the true structural width of the skarn zone may be significantly narrower (estimated between 5 m and 8 m), creating a material volumetric overstatement risk.

6.2 Exploration QA/QC and Verification Deficits

The 2011 campaign has no documented Quality Assurance/Quality Control (QA/QC) protocol. The database lacks duplicate assays, blank reference samples, and certified reference standards (CRMs). Consequently, there is an unmitigated risk of sample contamination (smearing of high-grade copper or gold fractions during core cutting) and laboratory calibration drift, which can artificially inflate grade averages.

6.3 Metallurgical and Zonation Disconnect

The South-West (SW) body exhibits extreme silver zonation (averaging **103.5 g/t Ag**) with negligible gold and copper. Standard flotation circuits designed for the NE gold-copper skarn are inefficient for distal silver-rich zones, which generally require cyanidation leaching. Applying a single processing recovery (83.3% gold recovery) and cost baseline across all orebodies represents a major metallurgical disconnect that overstates the value of the SW reserves.

6.4 Core Data Validation Requirements

To de-risk the project, the following validation works are recommended:

- **Twin-Hole Program:** Drill confirmation holes adjacent to `ETDH-066` and `ETDH-079` under strict modern QA/QC standards to verify grade continuity.
- **Oriented Core Logging:** Execute oriented core drilling perpendicular to the 45.0° fault trend to verify structural dips and true thicknesses.
- **Variability Testing:** Conduct independent metallurgical recovery tests specifically on core composites from the SW high-silver lenses.

> **Operational Access Note**
>
> Because the visualization engine is constructed as a client-side web application, it does not require a local database server. To run the visualizer, open the project directory and double-click the `index.html` file or drag it directly into Chrome or Edge.