

# Geometallurgy Project Proposal

**Date:** December 15<sup>th</sup> 2020 (Updated April 21<sup>st</sup>)

**Project Title:** Geometallurgy Guideline Series

**Problem Statement:** There is general confusion within geology, mining, and metallurgical functions of how geometallurgy can be used to add value for greenfield or brownfield project development, and within an operating site. This involves:

- Lack of understanding of different phases of the geometallurgy project life cycle (e.g. during exploration, scoping, preliminary study, definitive study and operational phases)
- Lack of clear guidelines for setting up a geometallurgy program in projects and/or operating sites to predict a reasonable project outcome.
- Lack of information and guidance regarding metallurgical sampling protocols.
- Lack of definition of team make up for successful geometallurgy project and lack of understanding about the roles the disciplines play in setting up a geometallurgy strategy for a project.

**Purpose Statement / Statement of Intent:**

- Provide roadmap and maturity framework in a way that is accessible to multiple stakeholders (metallurgists, process engineers, geologists, mining engineers, mineralogists, financiers, etc.)
- Provide a geometallurgy flowsheet and guidance for a roadmap to responsibly maximize the value of a mineral resource.
- Offer guidance for geological, mining, and metallurgical data usage and methodologies for geometallurgical modelling.
- Provide a listing of typical ore characterization tests (grade, comminution, recovery, environmental, materials handling, geotechnical, solids storage, etc) to relate geological, mining and metallurgical performance.
- Provide guidance on team make-up, roles, project definition and value statement for a holistic geometallurgy program.
- Describe techniques to develop orebody models by relating a low volume of metallurgical test results with a high volume of geological characterization results.

**Objectives:**

- Facilitate a team of geologists, mining engineers, metallurgists, and other related disciplines to come together to collaborate on developing the guideline(s)
- Provide a platform where the group can share their ideas on topics, scope, and direction for the guideline(s)
- Collect and reference geometallurgy best practices (use case and case study examples, as well as references to existing resources)
- Encourage and demonstrate a multi-discipline, holistic approach, rather than approaching geometallurgy as a separate discipline (de-siloing)

**Scope**

In Scope	Out of Scope
<ul style="list-style-type: none"><li>• Guidance on information input requirements for geometallurgy analysis</li><li>• Guidance on development of clear project objective, scope, and value</li></ul>	<ul style="list-style-type: none"><li>• Document that is prescriptive as to what tests and methods to use, as well as being prescriptive as to how to do one single way of doing geometallurgy</li></ul>

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<p>statement to help define the desired end product</p> <ul style="list-style-type: none"><li>• Suggested team make-up</li><li>• Develop a generic roadmap that it can cover any kind of orebody (types of activities, typical tests, modeling methods, QAQC and ore body defined specifics)</li><li>• Getting knowledge about good geometallurgical practices to the market</li><li>• Demonstrating the value of geometallurgy</li><li>• Glossary of definitions</li></ul>	<ul style="list-style-type: none"><li>• Guidance of what level of risk to take in model predictions</li><li>• Education regarding geological, mining or metallurgical understanding (rather, it's about the connection between the three)</li><li>• Model development itself</li><li>• Should not directly reference or be associated with any particular service providers that commercially offer geometallurgy related test or project services.</li><li>• An all-encompassing "how-to" for geometallurgy</li></ul>
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### Additional Sections

- A common taxonomy is needed for reaching clarification and benchmarking: define terms, basic vocabulary, a description of typical test work, and a framework for approach

**Deliverable:** A series of guidelines for Geometallurgy mainly focusing on the generic roadmap covering the life cycle stages, including a discussion on the key ingredients needed to successfully, profitably, and responsibly execute a project based on the roadmap.

- 1) Part One: High level document that outlines the progressions of the five stages (see figure in related work), including a flowsheet that shows how the stages are linked.
- 2) Part Two: Operational geometallurgy for sites that have not been developed using a formal geometallurgical focussed approach. Intent would be to guide site metallurgists to source and consider data from mining and geology.
- 3) Part Three: Guideline to cover the four study phases from exploration through definitive study.
- 4) Part Four: Guideline for operational geometallurgy for sites that have been through the prior 4 steps.

**Key Stakeholders:** Mining companies, Geologists, Mineralogists, Mining Engineers, Metallurgists, Mine/Mill Operations, Mine/Mill Managers

### Intended Audience:

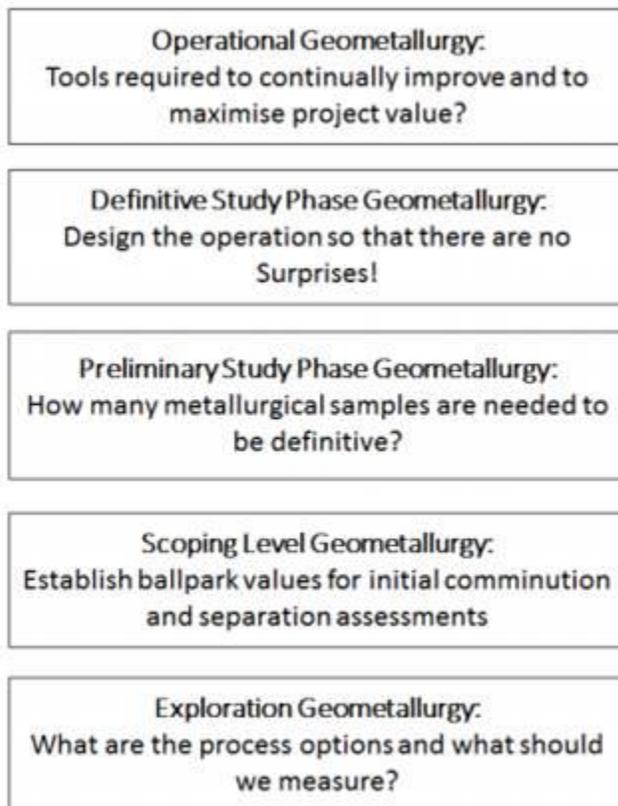
- Exploration teams
- Miners, geologists and processors (because if ore is changing, the miners and processors need to know and react accordingly) – feedback loop to the geologists and mining engineers
- Individuals outside of the geometallurgy field (executive summary could be useful)
- Funding institutions and marketplace

### Related Work:

- SGS Technical Paper: Improved Production Forecasting through Geometallurgical Modeling at Iron Ore Company of Canada
- JORC code
- NI 43-101 Standards of Disclosure for Mineral Projects
- Geological Survey of Finland: How to Set Up and Develop a Geometallurgical Program

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- [CRC Ore Understanding Mine to Mill](#)
- Link to Steve Morrell website – education materials <https://www.smctesting.com/videos>
- [SGS Geometallurgy Framework](#)
- AusIMM & SME Technical papers – Dean David “Geometallurgical Guidelines for Miners, Geologists and Process Engineers - Discovery to Design”- Monograph 30 , “Geometallurgy” SME Mineral Processing Handbook
- 911 Metallurgist



**Figure 1 Geometallurgy steps through a project life cycle**

Image source: Dean David Technical paper (as listed above).