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Geometallurgical Mapping and Mine Modelling - Comminution Studies: La Colosa Case Study, AMIRA P843A

by

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Declaration of originality

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Statement of Ethical Conduct

The research associated with this thesis abides by the international and Australian codes on human and animal experimentation, the guidelines by the Australian Government's Office of the Gene Technology Regulator and the rulings of the Safety, Ethics and Institutional Biosafety Committees of the University.

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Abstract

La Colosa is a world-class porphyry gold (Au) project located in Colombia, currently undergoing pre-feasibility analysis. As part of collaboration between AngloGold Ashanti and the AMIRA P843A GeM^{III} Project, the application of emerging geometallurgical characterisation testing and modelling tools has been incorporated into the early stages of project development.

The aim of the geometallurgical study is to map inherent comminution variability across the La Colosa deposit providing information critical for mine/mill design and optimisation. In this study, site-based data incorporating 17,505 multi-element assays, 275 QXRD bulk mineralogy measurements, 15,195 EQUOtip rebound hardness values, 9015 sonic velocity measurements, 16,676 density measurements and routine geological logging information from 92 diamond drill holes has been integrated with a range of geometallurgical comminution tests (i.e. 155 A*b values and 151 BMWi values).

The thesis demonstrates the integration techniques used at La Colosa to link routine data acquisition methods with comminution test results through the development of proxy support models. The integration incorporates a range of statistical techniques including principal component analysis, regression modelling and geostatistics. By creating proxy models, comminution index estimates can be propagated into the geological database enabling comminution processing domains to be defined. These domains provide the first spatial representation of comminution performance and variability at La Colosa and these can be compared with traditional geological domains.

In general, the comminution hardness of the rocks is related to proximity to structural corridors (trending 350), to topographic surface and the western contact between intramineral diorite and hornfels. The study shows that, overall, La Colosa rocks are intermediate to hard in terms of crushing and grinding. Seven hardness domains were identified for crushing and seven for grinding.

This study will provide the foundation for ongoing comminution characterisation as the La Colosa project evolves through project cycles into an operational mine.

Keywords

Geometallurgy, Comminution Modelling, Comminution Mapping, Orebody Knowledge, La Colosa

Australian and New Zealand Standard Research Classifications (ANZSRC)

091414: Mineral Processing/Beneficiation (50%)
0403: Geology (50%)

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Abbreviations Contained in this Thesis

AMIRA: Australian Minerals Industry Research Association

CODES: Centre of Excellence in Ore Deposit Studies (University of Tasmania)

JKMRC: Julius Kruttschnitt Mineral Research Centre

GeM^{III}: Geometallurgical Mapping and Mine Modelling, the parent project of this thesis

GML: Geometallurgical Matrix level

JKRBT: Julius Kruttschnitt Rotary Breakage Tester

BMWi: Bond Ball Mill Work index

kWh/t: Kilowatt Hours per Tonne

GeMCi: GeM Comminution Index

ICP: Inductively Coupled Plasma

QAQC: Quality Assurance/Quality Control

PCA: Principal Component Analysis