

Introduction to Mining Geology

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Key concepts, objectives, and practical tools for understanding the geological aspects of mineral extraction.

1. What Is Mining Geology?

Aspect	Description
Definition	The branch of geology that studies the occurrence, distribution, and extraction of mineral resources.
Primary Goal	To locate economically viable ore bodies, assess their size and quality, and provide data for safe, efficient mine design.
Scope	• Exploration (prospecting ? detailed drilling) • Resource estimation • Mine planning & design • Environmental and geotechnical evaluation

2. Basic Geological Concepts for Miners

Concept	Relevance to Mining
Lithology	Identifies rock types that host ore; influences drilling, blasting, and processing.
Stratigraphy	Determines vertical and lateral continuity of ore-bearing layers.
Structure (folds, faults, joints)	Controls ore geometry, influences stability, and dictates access routes.
Mineralogy	Defines ore grade, processing method, and potential contaminants.
Alteration & Metamorphism	Often accompany ore formation; serve as pathfinders in exploration.
Geochemical Anomalies	Guide sampling programs and target refinement.

3. Types of Mineral Deposits

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Deposit Type	Typical Host Rocks	Formation Mechanism	Common Examples
Igneous (Magmatic)	Granites, diorites, gabbros	Crystallization & magmatic differentiation	Cu?porphyry, Ni? sulfide
Sedimentary	Sandstones, shales, carbonates	Chemical precipitation, placer processes	Pb?zinc (MVT), gold placers
Metamorphic	Metasediments, schists	Metasomatism, fluid?rock interaction	Talc, graphite
Hydrothermal	Varied (often volcanic)	Hot aqueous fluids deposit minerals in fractures	Au?vein, Ag?Pb? Zn
Volcanogenic Massive Sulfide (VMS)	Oceanic crustal basalts	Seafloor hydrothermal vents	Cu?Zn?Pb
Laterite	Weathered basalts, ultramafics	Intense chemical weathering	Ni, Co, Al

4. Exploration Workflow

1. Regional Reconnaissance

- Review geological maps, satellite imagery, and existing literature.
- Identify prospective terrains and structural trends.

2. Geophysical Surveys

- **Methods:** Magnetic, gravity, IP/resistivity, EM, seismic.
- **Purpose:** Detect anomalies associated with ore bodies or structures.

3. Geochemical Sampling

- Soil, stream sediment, rock chip, and vegetation analyses.
- Statistical treatment (e.g., box?plots, variograms) to pinpoint anomalies.

4. Detailed Mapping & Structural Analysis

- Field mapping at 1:10?000–1:5?000 scale.
- Measure orientations of bedding, faults, joints.

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5. Drilling Program

- **Core vs. Reverse?Circulation (RC)** – core for detailed lithology/mineralogy, RC for rapid grade checks.
- Design **diamond?hole** collars to intersect target zones with appropriate spacing.

6. Assay & Laboratory Work

- Fire assay, ICP?MS, mineralogical studies (XRD, QEMSCAN).