# Geology Cheatsheet

A concise reference guide to geology, covering minerals, rocks, geological processes, and dating methods. Perfect for students, researchers, and anyone interested in Earth sciences.

## Minerals

### Mineral Identification

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| **Hardness (Mohs Scale)** | Resistance to scratching. Scale ranges from 1 (Talc) to 10 (Diamond). |
| **Streak** | Color of the mineral in powdered form obtained by scratching it on a streak plate. |
| **Luster** | How light is reflected from a mineral's surface (e.g., metallic, glassy, dull). |
| **Cleavage/Fracture** | How a mineral breaks. Cleavage is breaking along smooth planes, fracture is irregular breakage. |
| **Color** | Visual color of the mineral, but can be unreliable due to impurities. |
| **Specific Gravity** | Density of the mineral relative to water. |

### Common Mineral Groups

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| **Silicates** | Most abundant group; contains silicon and oxygen (e.g., quartz, feldspar). |
| **Carbonates** | Contains carbon and oxygen (e.g., calcite, dolomite). |
| **Oxides** | Contains oxygen and a metal (e.g., hematite, magnetite). |
| **Sulfides** | Contains sulfur and a metal (e.g., pyrite, galena). |
| **Halides** | Contains halogen elements (e.g., halite, fluorite). |
| **Native Elements** | Minerals made of a single element (e.g., gold, silver, copper). |

## Rocks

### Igneous Rocks

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| **Intrusive (Plutonic)** | Cool slowly beneath the surface; large crystals (e.g., granite, diorite). |
| **Extrusive (Volcanic)** | Cool quickly on the surface; small or no crystals (e.g., basalt, rhyolite). |
| **Felsic** | High silica content; light-colored (e.g., granite, rhyolite). |
| **Mafic** | Low silica content; dark-colored (e.g., basalt, gabbro). |
| **Intermediate** | Between felsic and mafic (e.g., diorite, andesite). |
| **Ultramafic** | Very low silica content; very dark-colored (e.g., peridotite). |

### Sedimentary Rocks

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|---|---|
| **Clastic** | Formed from fragments of other rocks (e.g., sandstone, shale, conglomerate). |
| **Chemical** | Formed from precipitation of minerals from solution (e.g., limestone, rock salt). |
| **Organic** | Formed from the accumulation of plant or animal remains (e.g., coal, coquina). |
| **Breccia** | Clastic sedimentary rock with large, angular fragments. |
| **Sandstone** | Clastic sedimentary rock composed mainly of sand-sized minerals or rock grains. |
| **Shale** | Fine-grained, clastic sedimentary rock composed of mud that is a mix of flakes of clay minerals and tiny fragments of other minerals, especially quartz and calcite. |

### Metamorphic Rocks

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| **Foliated** | Minerals are aligned in layers due to directed pressure (e.g., schist, gneiss). |
| **Non-Foliated** | No layered texture (e.g., marble, quartzite). |
| **Regional Metamorphism** | Occurs over large areas due to tectonic forces. |
| **Contact Metamorphism** | Occurs locally due to heat from magma intrusion. |
| **Slate** | Foliated metamorphic rock created through alteration of shale or mudstone by low-grade regional metamorphism. |
| **Marble** | Non-foliated metamorphic rock resulting from the metamorphism of limestone or dolomite. |

## Geological Processes

### Weathering

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| **Physical Weathering** | Breakdown of rocks without changing their chemical composition (e.g., frost wedging, abrasion). |
| **Chemical Weathering** | Breakdown of rocks by altering their chemical composition (e.g., oxidation, dissolution). |
| **Erosion** | The process by which soil and rock are removed from the Earth's surface by wind, water, ice, or gravity. |
| **Abrasion** | The mechanical scraping of a rock surface by friction between rocks and moving particles during their transport by wind, glacier, waves, gravity, running water or erosion. |
| **Oxidation** | A type of chemical weathering that occurs when oxygen reacts with minerals in rocks, especially those containing iron. |
| **Dissolution** | A process where minerals in a rock are dissolved by water, especially if the water is acidic. |

### Plate Tectonics

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| **Divergent Boundaries** | Plates move apart; new crust is created (e.g., mid-ocean ridges). |
| **Convergent Boundaries** | Plates collide; crust is destroyed (e.g., subduction zones, mountain ranges). |
| **Transform Boundaries** | Plates slide past each other horizontally; crust is neither created nor destroyed (e.g., San Andreas Fault). |
| **Subduction** | One tectonic plate slides beneath another, often resulting in volcanic activity and earthquakes. |
| **Faulting** | Fractures in the Earth's crust where movement has occurred, leading to earthquakes. |
| **Folding** | Bending of rock layers due to compressional forces, creating anticlines (upfolds) and synclines (downfolds). |

### Mass Wasting

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| **Creep** | Slow, gradual downslope movement of soil and rock. |
| **Landslide** | Sudden downslope movement of a mass of soil and rock. |
| **Mudflow** | Rapid flow of a mixture of soil, rock, and water. |
| **Rockfall** | Free fall of detached rocks from a cliff or steep slope. |
| **Slump** | A type of landslide where a mass of soil or rock moves downslope along a curved surface. |
| **Debris Flow** | A type of fast-moving flow of sediment and water with a high concentration of coarse material. |

## Geological Dating

### Relative Dating

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| **Law of Superposition** | In undisturbed rock sequences, the oldest layers are at the bottom, and the youngest are at the top. |
| **Principle of Original Horizontality** | Sedimentary layers are initially deposited horizontally. |
| **Principle of Cross-Cutting Relationships** | A geological feature that cuts across another is younger than the feature it cuts. |
| **Unconformities** | Gaps in the geological record due to erosion or non-deposition. |
| **Fossil Succession** | Fossil organisms succeed one another in a definite and determinable order, and any time period can be recognized by its fossil content. |
| **Index Fossils** | Fossils that are widely distributed, lived for a short period, and are useful for dating rocks. |

### Absolute Dating (Radiometric Dating)

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| **Half-Life** | The time it takes for half of the parent isotopes to decay into daughter isotopes. |
| **Carbon-14 Dating** | Used to date organic materials up to ~50,000 years old (half-life: 5,730 years). |
| **Potassium-Argon Dating** | Used to date rocks millions of years old (half-life: 1.3 billion years). |
| **Uranium-Lead Dating** | Used to date very old rocks and minerals (half-life: 4.5 billion years for U-238). |
| **Rubidium-Strontium Dating** | Another method for dating old rocks, particularly useful for dating metamorphic rocks. |
| **Assumptions** | Constant decay rate, closed system (no addition or loss of parent or daughter isotopes). |