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Competitive Exams: Minerals and Rocks geography notes on minerals and rocks & types of rocks

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The Crust:

There are eight abundant elements in the earths' crust:

- Oxygen 47%
- Silicon 28%
- Aluminium 8.1%
- Iron 6%
- Magnesium 4%
- Calcium 2.4%
- Potassium 2.3%
- Sodium 2.1%

There are eight important elements in the whole earth:

- Iron 35%
- Oxygen 30%
- Silicon 15%
- Magnesium 13%
- Nickel 2.4%
- Sulphur 1.9%
- Calcium 1.1%
- Aluminium 1.1%

Rock Types

Rocks are aggregates of mineral grains or crystals. They are classified into three major types according to origin:

Igneous rocks are those that solidify from a melt (called magma, a molten mixture of rock-forming minerals and usually volatiles such as gases and steam). Since their constituent minerals are crystallized from molten material, igneous rocks are formed at high temperatures.

1. Igneous
2. Sedimentary
3. Metamorphic

Basic Characteristics

1. These are solidified from a molten magma and water cannot percolate through them.
2. They usually do not occur in distinct beds or strata like sedimentary rocks.
3. Igneous rocks are generally not fossiliferous.
4. Igneous rocks are generally granular and crystalline.
5. It is less affected by chemical weathering as the water does not percolate in them easily.
6. These rocks are generally weathered by mechanical weathering.

Most of the igneous rocks consist of silicate minerals:

(a) Acidic when 65 to 85 per cent: acid igneous lack in iron and magnesium; quartz and feldspar are common minerals and granite is the common rock.

(b) basic igneous rocks with 45 to 60 per cent silica content are dominated by ferromagnesium minerals and have very low amount of feldspar and basalt, gabbro, dolerite are the examples.

(c) Intermediate igneous rocks have 45 per cent silica and examples are diorite and andesite.

(d) Ultra-basic igneous rocks have less than 45 per cent silica and example is Peridotite. The great majority of the igneous rocks are composed of silicate minerals and oxygen.

Highlights of Igneous Rocks

The major mineralogical components of igneous rocks can be divided into two groups: felsic (from feldspar and silica) and mafic (from magnesium and ferrous iron).

- The felsic minerals include quartz, tridymite, cristobalite, feldspars (plagioclase and alkali feldspar), feldspathoids (nepheline and leucite), muscovite, and corundum. y Because felsic minerals lack iron and magnesium, they are generally light in colour and consequently are referred to as leucocratic.

- The mafic minerals include olivine, pyroxenes, amphiboles, and biotites, all of which are dark in colour.
- Supersaturated minerals include quartz and its polymorphs and a low-calcium orthorhombic pyroxene (called hypersthene).
- Extrusive igneous rocks are: Rhyolite (felsic minerals, typically quartz, feldspars, and mica); Andesite (felsic minerals without quartz, usually including plagioclase feldspar and amphibole); Basalt (mafic minerals, typically plagioclase feldspar, pyroxene and olivine).
- Intrusive igneous rocks are: Granite, Diorite, Gabbro and Peridotite.
- Igneous rocks has two parts: Intrusive and Extrusive.

Intrusive Rocks

Intrusive has seven parts:

1. Plutonic: deep-seated origin; rocks have coarse grain size; diorite, gabbro, granite, peridotite and syenite are examples. The largest partially exposed pluton is a batholith.
2. Hypabyssal: originates due to cooling and solidification of rising magma.
3. Batholith: large body of igneous rock formed beneath the Earth's surface by the intrusion and solidification of magma. A well-known batholith is located in the Sierra Nevada range of California, US; Murha pahar at Ranchi is another example.
4. Laccolith: in geology, any of a type of igneous intrusion that has split apart two strata, resulting in a domelike structure; the floor of the structure is usually horizontal. A laccolith is often smaller than a stock. A well-known example of a laccolith is found in the Henry Mountains, Utah.
5. Sill: also called sheet-tabular igneous intrusion emplaced parallel to the bedding of the enclosing rock. Although they may have vertical to horizontal orientations, nearly horizontal sills are the most common.
6. Stocks: with outcrop and mainly composed of granite.
7. Dykes: sheet-like body which rises upward from a magma chamber and cuts discordantly through the bedding plane of the country rock. Dyke of Zimbabwe is the largest example.

Extrusive Rocks

Extrusive is of two types: Explosive type and Quiet Type: Bombs are big fragments; lapilli peas size; tuffs are volcanic materials; breccia or agglomerates mixture of smaller and larger parts.

Igneous Rocks

Igneous Rocks are divided into six types on the basis of textural characteristics:

- (1) Pegmatitic igneous rocks (very coarse-grained like pegmatitic granites, pegmatitic diorite, pegmatitic syenite)
- (2) Phaneritic igneous rocks (coarse-grained like granites, diorites)
- (3) Aphanitic igneous rocks (fine-grained rocks like basalt, felsite, rocks of sills and dykes)
- (4) Glassy igneous rocks (grainless like pitch stones, obsidians, pumice, perlite)
- (5) Porphyritic igneous rocks (mixed-grained).
- (6) Fragmental igneous rocks (consisting of bombs, breccia, volcanic dusts, tuffs).

Granite

Coarse or medium-grained intrusive igneous rock that is rich in quartz and feldspar; it is the most common plutonic rock of the Earth's crust, forming by the cooling of magma (silicate melt) at depth.

- Granite may occur in dikes or sills.
- Rocks containing less than 20 percent quartz are almost never named granite, and rocks containing more than 20 percent (by volume) of dark, or ferromagnesian, minerals are also seldom called granite.
- The minor essential minerals of granite may include muscovite, biotite, amphibole, or pyroxene.
- Mineral composition of granite: Feldspar(52.3%); Quartz(31.3%); Mica (11.5%); Hornblende (2.4 %); Iron (2.0%) and others (0.55%)
- Granites are generally resistant to erosion but when the rocks are well jointed, they are easily weathered and very peculiar landform is generated, called tors

Basalts

- Extrusive igneous (volcanic) rock that is low in silica content, dark in colour, and comparatively rich in iron and magnesium.
- Some basalts are quite glassy (tachylytes), and many are very fine-grained and compact; it is more usual, however, for them to exhibit porphyritic structure, with larger crystals (phenocrysts) of olivine, augite, or feldspar in a finely crystalline matrix (ground-mass).
- Olivine and augite are the most common porphyritic minerals in basalts; porphyritic plagioclase feldspars are also found. Basaltic lavas are frequently spongy or pumiceous; the steam cavities become filled with secondary minerals such as calcite, chlorite, and zeolites.
- Basalts may be broadly classified on a chemical and petrographic basis into two main groups: the calc-alkali and the alkali basalts;
- Normal alkali basalt contains olivine and, commonly, aluminosilicate-bearing augite.

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- Feldspar is most dominant (46.2%); Augite (36.9%); Olivine (7.6 per cent); Mineral Iron (9.5 per cent).