

TYPES OF GRANITE ROCK

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ABSTRACT

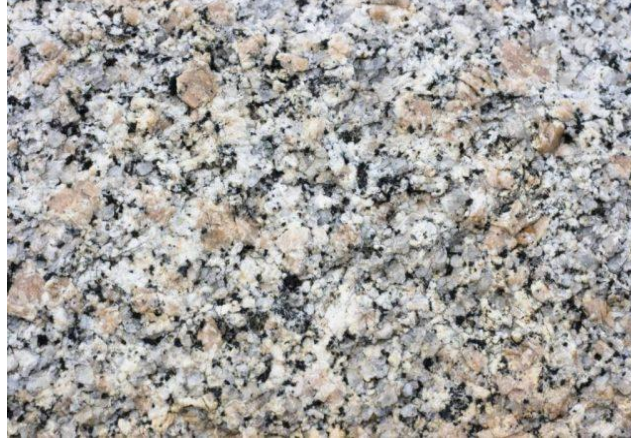
Granite is the most common intrusive rock in Earth's continental crust, It is familiar as a mottled pink, white, gray, and black ornamental stone. It is coarse- to medium-grained. Its three main minerals are feldspar, quartz, and mica, which occur as silvery muscovite or dark biotite or both. Of these minerals, feldspar predominates, and quartz usually accounts for more than 10 percent. The alkali feldspars are often pink, resulting in the pink granite often used as a decorative stone. Granite crystallizes from silica-rich magmas that are miles deep in Earth's crust. Many mineral deposits form near crystallizing granite bodies from the hydrothermal solutions that such bodies release.

INTRODUCTION

Description

Granite is the most widespread of igneous rocks, underlying much of the continental crust. Granite is an intrusive igneous rock. Intrusive rocks form from molten material (magma) that flows and solidifies underground, where magma cools slowly. Eventually, the overlying rocks are removed, exposing the granite. Granites usually have a coarse texture (individual minerals are visible without magnification), because the magma cools slowly underground, allowing larger crystal growth.





Name origin: The name appeared for the first time in works of the English botanists, physician and philosopher Caesalpinus in the 16th century.

Group – plutonic.

Colour: Pink-grey.

Structure: Massive, confining.

Texture: phaneritic (medium to coarse grained). , holocrystalline, pan-hypidiomorphically grained, porphyric in places.

Major minerals of Granite: orthoclase, quartz, biotite, muscovite and plagioclase which is twinned according to the albite law and oscillatory zoned. Chemical composition of the core corresponds to oligoclase and andesine (An₃₀₋₃₈), whereas more acidic oligoclase and andesine occur in the margin.

Physical and Chemical Properties of Granite



Granite is a type of igneous rock that is commonly used in construction and building materials. It is composed of minerals such as feldspar, quartz, and mica, and has several physical and chemical properties that make it a desirable material for various applications.

Physical Properties of Granite:

1. **Hardness:** Granite is a very hard and durable material, with a Mohs hardness scale rating of 6-7 out of 10.
2. **Density:** Granite has a high density, with an average specific gravity of 2.65 grams per cubic centimeter.
3. **Color:** Granite comes in a wide range of colors, including white, black, gray, pink, and red.
4. **Texture:** The texture of granite is usually coarse-grained and granular, with visible mineral grains.
5. **Porosity:** Granite has low porosity, which means that it is resistant to water absorption and weathering.

Chemical Properties of Granite:

1. **Composition:** Granite is primarily composed of minerals such as feldspar, quartz, and mica, with smaller amounts of other minerals such as hornblende, biotite, and pyroxene.
2. **Acid Resistance:** Granite is resistant to acids, which makes it a good material for use in kitchen countertops and other applications where exposure to acids is possible.
3. **Thermal Stability:** Granite is thermally stable and can withstand high temperatures without breaking down or changing in color or texture.
4. **Reactivity:** Granite is generally not reactive with other chemicals, which means it can be used in a wide range of applications without being affected by chemical reactions.
5. **Durability:** Granite is a very durable material that can withstand wear and tear, making it a popular choice for flooring, walls, and other surfaces that see heavy use.

Mineral composition and variations



Granite is a type of igneous rock that is composed of several minerals. The mineral composition of granite can vary depending on the location where it was formed, but the most common minerals found in granite include:

1. **Feldspar:** This is the most common mineral found in granite, accounting for up to 60% of the rock's composition. The two main types of feldspar found in granite are orthoclase and plagioclase.
2. **Quartz:** Quartz is another common mineral found in granite, accounting for up to 30% of the rock's composition. It is a hard and durable mineral that gives granite its characteristic toughness.
3. **Mica:** Mica is a mineral that is commonly found in granite, accounting for up to 10% of the rock's composition. It is a shiny and reflective mineral that gives granite its characteristic sparkle.
4. **Hornblende:** Hornblende is a dark-colored mineral that is sometimes found in granite, accounting for up to 5% of the rock's composition. It is a hard and durable mineral that can give granite a darker color.
5. **Biotite:** Biotite is another dark-colored mineral that is sometimes found in granite, accounting for up to 5% of the rock's composition. It is a type of mica that gives granite a dark, almost black color.

There can be variations in the mineral composition of granite depending on the location where it was formed. For example, some types of granite may contain more biotite than others, which gives them a darker color. Additionally, some types of granite may contain other minerals, such as garnet or tourmaline, which can affect their color and texture. The mineral composition of granite can also be affected by weathering and erosion, which can alter the rock's appearance over time.

Texture and grain size



Texture and grain size are important characteristics of granite and can vary depending on the location where it was formed and the conditions under which it was formed.

Texture: The texture of granite is generally described as coarse-grained and granular, which means that it is composed of visible mineral grains. The individual grains of minerals can vary in size and shape, but they are typically larger than the grains found in other types of rocks. This coarse-grained texture gives granite its characteristic appearance and durability, making it a popular choice for use in construction and building materials.

Grain size: The grain size of granite can vary depending on the conditions under which it was formed. The size of the mineral grains in granite is generally determined by the rate at which the magma cools and solidifies. If the magma cools slowly, the mineral grains will be larger, whereas if it cools quickly, the mineral grains will be smaller. As a result, the grain size of granite can vary from fine-grained to very coarse-grained, depending on the rate of cooling. The grain size of granite can also have an impact on its properties. Coarse-grained granite is generally more durable and resistant to weathering than fine-grained granite because it has a stronger interlocking structure. However, fine-grained granite can have a smoother texture and be easier to work with, which makes it a popular choice for use in decorative applications such as countertops and tiles.

Color variations and causes



Granite can have a wide range of colors, ranging from white and gray to pink, red, green, blue, and black. The color variations in granite are caused by a combination of factors, including the mineral composition of the rock, the rate at which the magma cools and solidifies, and the presence of other minerals or impurities.

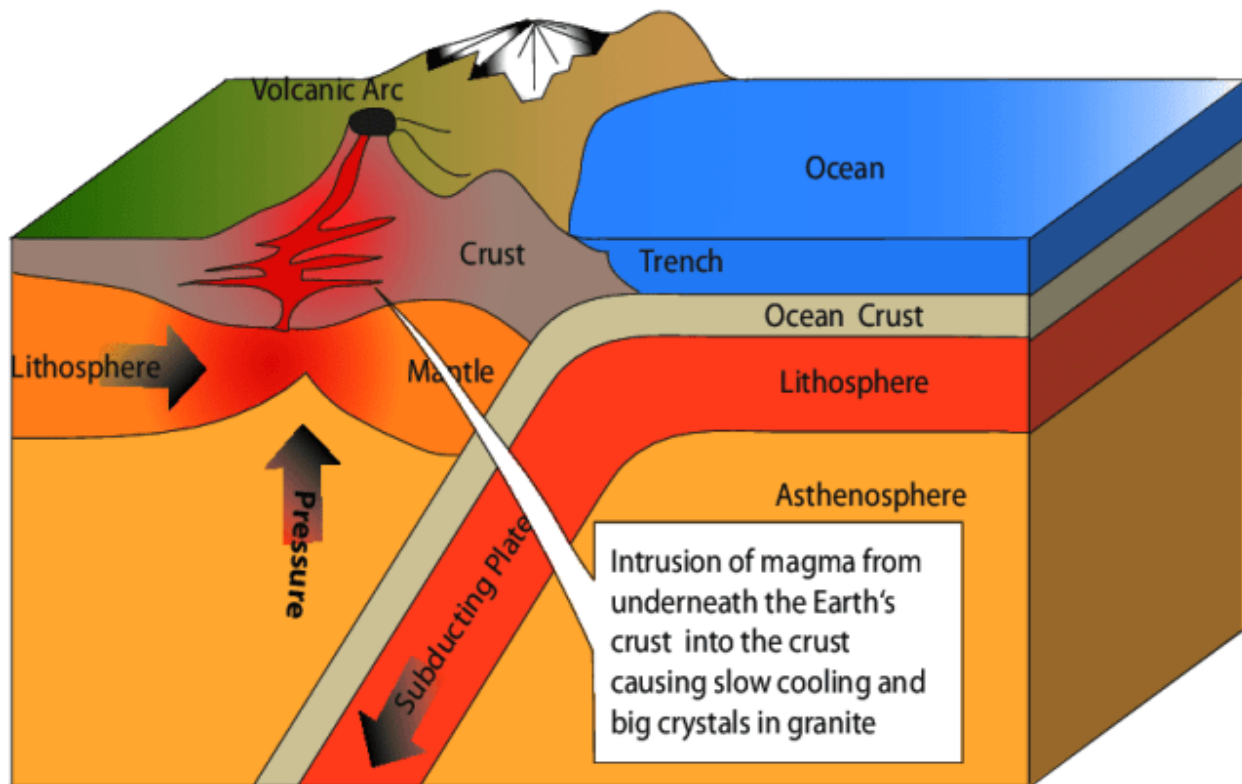
Here are some common color variations in granite and their causes:

1. **White and Gray:** Granite that is predominantly made up of feldspar and quartz will generally be white or gray in color. The presence of small amounts of other minerals can give the rock a speckled appearance, with darker or lighter spots.
2. **Pink and Red:** The presence of potassium feldspar in granite can give it a pink or red color. The shade of pink or red can vary depending on the concentration of potassium feldspar.

3. **Green:** The presence of minerals such as chlorite or epidote in granite can give it a green color. These minerals are typically found in granite that has been exposed to high levels of heat and pressure.
4. **Blue:** The presence of minerals such as sodalite or lazurite can give granite a blue color. These minerals are typically found in granite that has been exposed to hydrothermal activity.
5. **Black:** The presence of minerals such as biotite or hornblende can give granite a black color. The concentration of these minerals can vary, resulting in different shades of black.

In addition to the mineral composition of the rock, the rate at which the magma cools and solidifies can also have an impact on the color of granite. Slow cooling can result in larger mineral crystals and a lighter color, while rapid cooling can result in smaller mineral crystals and a darker color. Impurities such as iron or manganese can also cause color variations in granite.

Formation and Occurrence of Granite



Granite is an igneous rock that forms from the slow crystallization of magma beneath the Earth's surface. The formation of granite typically involves three main stages:

1. **Melting:** Granite forms from the melting of pre-existing rocks, such as sedimentary or metamorphic rocks, that are subjected to high temperatures and pressures deep within the Earth's crust.
2. **Magma formation:** When these rocks melt, they form a molten material called magma, which is less dense than the surrounding rocks and rises towards the Earth's surface.
3. **Crystallization:** As the magma cools and solidifies, it forms large mineral crystals that interlock with each other to form the characteristic coarse-grained texture of granite.

The occurrence of granite is typically associated with areas of high tectonic activity, such as mountain ranges and volcanic regions. Granite is commonly found in the roots of mountain ranges, where it forms large plutons or batholiths that extend deep beneath the Earth's surface. These plutons and batholiths can be exposed at the surface through erosion or uplift, revealing the characteristic outcrops of granite that are commonly seen in mountainous regions.

Granite can also occur in smaller bodies, such as dikes and sills, which are formed when magma is injected into fractures or cracks in the surrounding rocks. These smaller bodies of granite can be found in a variety of geological settings, including volcanic regions and areas of high tectonic activity.

Overall, the formation and occurrence of granite is closely linked to the processes of plate tectonics and the movement of the Earth's crust over time. As the Earth's crust is subjected to high temperatures and pressures, rocks are melted and transformed into new types of rock, including granite. These processes can take millions of years to complete, resulting in the formation of the spectacular landscapes that we see today.

Geological conditions necessary for granite formation

The formation of granite is a complex process that requires specific geological conditions. Here are the key geological conditions necessary for granite formation:

1. **High temperatures:** Granite forms from the melting of pre-existing rocks, which requires temperatures of at least 600 degrees Celsius. These high temperatures are typically found deep within the Earth's crust, where the rocks are subjected to intense pressure and heat.
2. **High pressures:** The formation of granite also requires high pressures, which compress the rocks and increase their melting temperature. These pressures are typically found at depths of at least 5-10 kilometers below the Earth's surface.
3. **Slow cooling:** As the magma cools and solidifies, it forms large mineral crystals that interlock with each other to form the characteristic coarse-grained texture of granite. This slow cooling process is necessary to allow the crystals to grow and form an interlocking structure.
4. **Water content:** The presence of water in the magma is also important for granite formation. Water can act as a catalyst for the melting of rocks, and can also help to transport the mineral components that make up granite.
5. **Felsic composition:** The mineral composition of granite is dominated by feldspar and quartz, which are both classified as felsic minerals. Felsic minerals are typically associated with the continental crust, and are formed from the melting of older rocks that have been subjected to high temperatures and pressures.

Overall, the formation of granite requires a combination of high temperatures, high pressures, slow cooling, water content, and a felsic mineral composition. These conditions are typically found in areas of high tectonic activity, such as mountain ranges and volcanic regions, where the Earth's crust is subjected to intense geological forces over long periods of time.

Worldwide distribution of granite deposits

Granite is a widely distributed rock that can be found on all continents of the world. It is typically associated with areas of high tectonic activity, such as mountain ranges and volcanic regions. Here are some examples of major granite deposits around the world:

1. **North America:** Large granite deposits can be found throughout the United States and Canada, with notable locations including the Sierra Nevada in California, the Rocky Mountains in Colorado, and the Canadian Shield in Ontario and Quebec.
2. **South America:** The Andes mountain range in South America is home to a variety of granitic rocks, including the famous Inca citadel of Machu Picchu in Peru.
3. **Europe:** The European continent has numerous granite deposits, with notable locations including the Scottish Highlands, the Iberian Peninsula, and the Alps.
4. **Africa:** The African continent has several major granite deposits, including the Nigerian Younger Granite ring complexes and the Cape Granite Suite in South Africa.
5. **Asia:** Asia has a wide distribution of granite deposits, including the Himalayan mountain range, the Chinese Red River batholith, and the Korean Peninsula.
6. **Australia:** Australia has a significant granite deposit known as the Yilgarn Craton, which covers much of Western Australia.
7. **Antarctica:** Granite can also be found on the continent of Antarctica, where it forms the bedrock of much of the continent's interior.

Overall, the worldwide distribution of granite deposits is closely linked to the processes of plate tectonics and the movement of the Earth's crust over time. As the Earth's crust is subjected to high temperatures and pressures, rocks

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Applications and Uses of Granite



Granite is a versatile rock that has many applications due to its durability, strength, and aesthetic appeal. Here are some of the most common applications of granite:

1. **Countertops:** Granite is a popular choice for kitchen and bathroom countertops due to its durability, heat resistance, and natural beauty. It is available in a wide range of colors and patterns, making it a versatile choice for interior design.
2. **Flooring:** Granite is also used as a flooring material, particularly in high-traffic areas such as commercial buildings, airports, and shopping malls. It is highly durable and resistant to abrasion, making it ideal for heavy use.
3. **Building facades:** Granite is commonly used as a cladding material for building facades due to its durability and aesthetic appeal. It is often used in combination with other materials, such as glass and metal, to create modern and striking architectural designs.
4. **Monuments and memorials:** Granite is a popular material for monuments and memorials due to its durability and ability to withstand weathering over time. Many famous monuments, such as Mount Rushmore and the Lincoln Memorial, are made of granite.
5. **Landscaping:** Granite is also used for landscaping purposes, such as in garden pathways, retaining walls, and decorative boulders. Its natural beauty and durability make it an attractive and long-lasting choice for outdoor applications.
6. **Sculptures and art:** Granite is a popular material for sculptures and art due to its durability and ability to hold intricate details. Many famous sculptures and artworks, such as the David statue by Michelangelo, are made of granite.

Overall, granite is a versatile material that can be used in a wide range of applications, both functional and decorative. Its durability, strength, and natural beauty make it a popular choice for many different industries, from construction to art and design.

Production of Granite



The production of granite involves several steps, from quarrying the raw material to processing it into finished products. Granite is a natural stone known for its durability, aesthetic appeal, and wide range of applications, such as countertops, flooring, monuments, and decorative elements. Here's an overview of the production process:

1. **Prospecting and Quarrying:** The first step involves identifying suitable granite deposits. Geologists and experts assess the quality, color, and texture of the granite in different areas. Once a suitable deposit is located, the quarrying process begins. This involves drilling holes and using explosives to break the granite away from the bedrock in large blocks.
2. **Block Extraction:** After the granite has been broken into large blocks, heavy machinery, such as excavators and cranes, is used to lift and move these blocks to a processing area. Care is taken to minimize damage to the blocks during this process.
3. **Primary Cutting:** In the processing area, large diamond-tipped saws are used to cut the raw blocks into slabs of varying thickness. These slabs will later be refined and polished into finished products. The primary cutting is a rough shaping process that results in slabs of irregular shapes and sizes.
4. **Transportation:** Once the slabs are cut, they are transported to a factory or fabrication facility where they will undergo further processing. The transportation can involve heavy machinery and logistics, as granite slabs are heavy and require specialized handling.
5. **Resining and Reinforcement (Optional):** Some granite slabs may undergo resining, which involves applying epoxy or other resins to fill any natural fissures or cracks. This helps enhance the strength and

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appearance of the slabs. Additionally, fiberglass or other reinforcement materials may be added to increase the overall strength of the slab.

6. **Cutting and Shaping:** At the fabrication facility, the slabs are cut into specific dimensions according to the intended use, such as countertops or tiles. CNC (computer numerical control) machinery is often used to achieve precise cuts and shapes.
7. **Finishing:** The cut and shaped granite pieces undergo a series of polishing and finishing processes to achieve the desired surface texture and shine. This involves using progressively finer grits of abrasive materials to smooth the surface and bring out the natural luster of the stone.
8. **Quality Control:** Each finished piece of granite is inspected for quality, ensuring that it meets the desired standards in terms of dimensions, color consistency, surface finish, and structural integrity.
9. **Packaging and Distribution:** The finished granite products are carefully packaged to prevent damage during transportation. They are then distributed to retailers, contractors, and customers for various applications, such as installation in residential or commercial spaces.
10. **Installation:** Granite products are installed based on the intended use. For example, countertops are typically installed in kitchens and bathrooms, while granite tiles can be used for flooring, walls, and decorative features.

It's important to note that the granite production process can vary based on factors such as the type of granite, local regulations, technological advancements, and the specific requirements of the finished products.

Summary of key points



- Stone known as “black granite” is usually gabbro which has a completely different chemical structure.
- It is the most abundant rock in the Earth continental crust. In large areas known as batholiths and in the core areas of the continents known as shields are found in the core of many mountainous areas.
- Mineral crystals show that it slowly cools down from the molten rock material which is formed under the surface of the earth and requires a long time.
- If the granite is exposed on the Earth’s surface, it is caused by the rise of granite rocks and the erosion of the sedimentary rock above it.
- Under sedimentary rocks, granites, metamorphosed granites or related rocks are usually below this cover. They are later known as basement rocks.
- Definitions used for granite often lead to communication about the rock and sometimes cause confusion. Sometimes there are many definitions used. There are three ways of defining the granite.
- A simple course on rocks, along with granite, mica and amphibole minerals, can be described as a coarse, light, magmatic rock consisting mainly of feldspar and quartz.
- A rock expert will define the exact composition of the rock, and most experts will not use granite to identify the rock unless it meets a certain percentage of minerals. They might call it alkaline granite, granodiorite, pegmatite or aplite.
- The commercial definition used by sellers and buyers is often referred to as granular rocks that are harder than granite. They can call the granite of gabbro, basalt, pegmatite, gneiss and many other rocks.
- It is generally defined as a “size stone” that can be cut to certain lengths, widths and thicknesses.
- Granite is strong enough to withstand most abrasions, large weights, resist weather conditions and accept varnishes. A very desirable and useful stone.
- Although the cost of granite is much higher than the price for other man-made materials for projects, it is considered a prestigious material used to influence others because of its elegance, durability and quality.

Granite is a type of intrusive igneous rock that is composed primarily of quartz, feldspar, and mica minerals. It is typically formed deep within the Earth’s crust under high pressure and temperatures. Granite is the most widespread of igneous rocks, underlying much of the continental crust. Granite is an intrusive igneous rock. Intrusive rocks form from molten material (magma) that flows and solidifies underground, where magma cools slowly. Eventually, the overlying rocks are removed, exposing the granite. Granites usually have a coarse texture (individual minerals are visible without magnification), because the magma cools slowly underground, allowing larger crystal growth.

Granites are most easily characterized as light colored and coarse grained as a result of cooling slowly below the surface. Color variation is a response to the percent of each mineral found in the sample. The crystals in granite provide a variety of mixed colors — feldspar (pink or red), mica (dark brown or black), quartz (clear pink, white, or black) and amphibole (black).

Granite is high in quartz (about 25%), feldspar, and mica. It is widely used for architectural facades, construction materials, ornamental stone and monuments. Over 40% of dimension stone quarried is granite. Crushed granite is used as a durable construction material in asphalt and concrete used in highway and infrastructure projects.

Type
Rock



Description

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Relation to Mining

Granite is mined as either crushed stone or dimension stone mainly using open pit mining methods. Crushed granite represents 16% of the total crushed stone produced in the U.S., and it is the second-most utilized crushed stone in the U.S. Crushed limestone is by far the most commonly used crushed rock in the U.S., representing 70% of total crushed rock consumption. Crushed granite is used in road construction and railroad beds. Larger pieces of granite are used to stabilize the land around roadways to minimize and even eliminate soil erosion.

Uses

There is an enormous abundance of granite throughout the United States, so it is not a surprise that a significant amount of granite is used in crushed stone applications. Crushed granite represents 16% of the total crushed stone produced in the U.S., and it is the second-most utilized crushed stone in the U.S. Crushed limestone is by far the most commonly used crushed rock in the U.S., representing 70% of total crushed rock consumption. The 16% represented by crushed granite (265,000 tons per year) is used in road construction and railroad beds. Larger pieces of granite are used to stabilize the land around roadways to minimize and even eliminate soil erosion.

Granite is used extensively as dimension stone. It is used in the construction of buildings, both as building blocks and as veneers on frame structures. Because it can be smoothed to a very high polish, granite has found extensive use in

memorials, headstones, monuments, carved decorations on buildings, statues and the like. Approximately 1.5 million tons of dimension stone is produced annually in the United States. Of this, granite accounts for over 400,000 tons (27%), second only to limestone.

Some of the key physical and chemical properties of granite include its hardness, durability, and resistance to weathering. It is also non-porous, meaning it does not absorb liquids, and has a high melting point.

Granite is widely used in construction and design due to its durability, strength, and natural beauty. Common applications include countertops, flooring, building facades, monuments, landscaping, and sculptures.

Granite deposits are found on all continents of the world, typically in areas of high tectonic activity such as mountain ranges and volcanic regions. Notable locations include the Sierra Nevada in California, the Andes in South America, the Scottish Highlands in Europe, the Nigerian Younger Granite ring complexes in Africa, the Himalayan mountain range in Asia, and the Yilgarn Craton in Australia.

How is granite formed?

Granite is formed deep within the Earth's crust under high pressure and temperatures. The process of granite formation typically involves the melting and recrystallization of pre-existing rocks, followed by slow cooling and solidification. To care for granite, it is important to avoid using harsh chemicals or abrasive cleaners that could damage the surface. Instead, use a pH-neutral cleaner and a soft cloth or sponge to clean the surface. It is also recommended to seal granite surfaces regularly to prevent staining and damage.

The cost of granite can vary depending on factors such as the quality of the stone, the size of the project, and the location. Generally, granite is considered a higher-end material and can be more expensive than other types of building materials.

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