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Learn in this hall about characteristics of igneous rocks, including their meaning, types, formation process, textures and practical uses. Discover the differences between intrusive and extrusive igneous rocks and explore how they shape the Earth’s crust. Characteristics of Igneous Rocks: Meaning, Types, and Formation Table of Contents Introduction Meaning, Formation, and Types of Igneous Rocks • Origin of Magma • Texture of Igneous Rocks • Classification Based on Silica Content Characteristics of Igneous Rocks • Chemical Composition and Mineral Content • Economic Uses of Igneous Rocks • Differences Between Intrusive and Extrusive Igneous Rocks Conclusion Introduction Rocks are the solid foundation of the Earth’s crust, and among them, igneous rocks hold a unique place due to their direct connection with the molten processes occurring deep inside the planet. As the first rocks to form on Earth, they provide a fundamental understanding of geological evolution. This blog explores the meaning, types, formation, and characteristics of igneous rocks, with added depth on texture, mineral composition, and their practical uses. READ ALSO – Features of Metamorphic Rocks, Types and Formation Meaning, Formation, and Types of Igneous Rocks Igneous rocks are formed through the cooling and solidification of molten rock material known as magma or lava. These rocks originate either from beneath the Earth’s surface or as a result of volcanic eruptions. The word “igneous” is derived from the Latin term ignis, meaning fire. Origin of Magma Magma is generated deep within the Earth, primarily in the upper mantle and lower crust. It forms due to intense heat and pressure, subduction of tectonic plates, or decompression melting at divergent boundaries. This molten material may remain underground or rise to the surface through cracks and fissures. Igneous rocks are classified based on their location of formation: Intrusive Igneous Rocks: Formed when magma cools slowly beneath the Earth’s crust. These rocks, such as granite and diorite, have large, visible crystals due to prolonged crystallization. Extrusive Igneous Rocks: Formed when lava erupts onto the surface and cools rapidly. These include basalt, pumice, and obsidian, usually fine-grained or glassy in appearance. Texture refers to the size, shape, and arrangement of the mineral crystals within a rock. Common textures include: Coarse-Grained (Phaneritic) – Slow cooling; visible crystals (e.g., granite). Fine-Grained (Aphanitic) – Rapid cooling; microscopic crystals (e.g., basalt). Glassy – Very rapid cooling; no crystals (e.g., obsidian). Porphyritic – Mixed cooling; large crystals in a fine-grained matrix. Igneous rocks are also grouped based on their silica (SiO_2) content: Felsic Rocks: Rich in silica; light-colored (e.g., granite). Intermediate Rocks: Moderate silica levels; medium color (e.g., diorite). Mafic Rocks: Low silica; rich in iron and magnesium; dark-colored (e.g., basalt). Ultramafic Rocks: Very low silica; very high in iron/magnesium (e.g., peridotite). Igneous rocks have a range of distinctive physical and chemical properties that are directly related to their origin and formation. Crystalline Texture and Structure Most igneous rocks are composed of interlocking crystals, whose sizes vary based on the cooling rate. This crystalline texture is often uniform, massive, and without layering. Hardness and Durability These rocks are typically hard and dense, making them resistant to erosion and suitable for construction, paving, and ornamental use. Lack of Fossils Due to their origin from molten materials, igneous rocks do not contain fossils. This contrasts with sedimentary rocks, which frequently preserve biological remains. Common minerals found in igneous rocks include: Quartz Feldspar Mica Amphibole Pyroxene The presence and proportion of these minerals determine the rock’s color, density, and economic value. Non-Layered (Massive) Appearance Unlike sedimentary rocks, igneous rocks lack stratification or bedding. Their solid, massive structure is often used to identify them in the field. Presence of Pores in Some Rocks Extrusive rocks like pumice and scoria often exhibit porous textures due to trapped gas bubbles during rapid cooling of lava. Granite is widely used in construction, countertops, and monuments. Basalt is used in road bases and railway ballast. Pumice is employed in polishing and lightweight building materials. Obsidian was historically used for cutting tools due to its sharp edges. Their hardness, aesthetic appeal, and abundance make them valuable in industries ranging from construction to architecture and abrasives. FeatureIntrusive Igneous RocksExtrusive Igneous RocksFormation LocationBeneath the Earth’s surfaceOn the Earth’s surfaceCooling RateSlowRapidCrystal SizeLarge and visibleSmall or invisibleTextureCoarse-grainedFine-grained or glassyExamplesGranite, DioriteBasalt, Obsidian, PumiceFossil PresenceAbsentAbsentPorosityRarely porousOften porous (e.g., pumice) READ ALSO – Formation of Sedimentary Rocks | types and features What is the origin of the word “igneous”? What is the major difference between intrusive and extrusive igneous rocks? Name two examples each of intrusive and extrusive igneous rocks. Which type of igneous rock is likely to have a glassy texture? What are the four classifications of igneous rocks based on silica content? Why do igneous rocks typically lack fossils? What are the main textures used to classify igneous rocks? What does the crystal size in igneous rocks indicate about their cooling history? Which minerals are commonly found in igneous rocks? Mention two economic uses of igneous rocks. READ ALSO – Common Rocks Found in Nigeria | Types and their Locations Conclusion Igneous rocks form the foundational base of the Earth’s crust and offer deep insight into geological processes. Their formation from molten magma or lava, whether inside the Earth or on its surface, leads to two broad classifications—intrusive and extrusive. The characteristics of these rocks, including their texture, mineral content, and durability, not only make them scientifically significant but also valuable in construction and industry. Understanding their formation, classification, and features is essential for students, geologists, and professionals in the earth sciences, as these rocks reveal much about the planet’s history and structure. The igneous rocks are one of the three main types of rock found on earth; the others are sedimentary rock and metamorphic rock. They are the hardest and heaviest rock on earth. They are also called the ‘new’ rocks or magmatic rocks. Sometimes they are referred to as parent rock because all other rock types are formed from them. The term ‘Igneous’ is obtained from ‘igneus’, which is the Latin word meaning ‘fire’. Igneous rocks are generally formed by the process of cooling and solidification of hot molten magma. When hot, molten magma at 600 to 1,300 °C (1,100 to 2,400 °F) cools and crystallizes at the earth’s surface or inside the crust, they solidify into igneous rock. The magma develops underground, either in the lower crust or the upper mantle, due to the extreme heat and pressure. When magma gushes out to the surface through cracks or volcanoes, it is called lava. Igneous rocks are formed either at volcanoes on the earth’s surface or deep inside the crust when it is in melted form. Igneous rock can look different and have many different compositions, depending on how quickly they cool and solidify. For example, two rocks from identical magma can become either granite or rhyolite. Nevertheless, most igneous rocks are mainly composed of silicate minerals. The presence of igneous rocks in an area might be evidence of a past volcano. Igneous rocks are of two main categories based on where the molten rock solidifies. They are named and described below. How are Igneous Rocks Formed Extrusive or volcanic igneous rocks are formed on the earth’s surface when lava exists and cools almost instantly when exposed to a relatively cool temperature in the atmosphere. The quick cooling of the lava prevents the mineral crystals from growing and forms a fine-grained or even glassy texture. These fine-grained rocks are known as aphanitic, from a Greek word meaning ‘invisible’. Hot gas bubbles are trapped in the quenched lava, forming a vesicular texture. Extrusive igneous rocks are found in: Hawaii Volcanoes National Park, HawaiiSunset Crater Volcano National Monument, ArizonaCrater Lake National Park, Oregon Fine-grained that are too small to be identified without a microscopeSome have rectangular crystalsSome have vesicles, which are holes caused by gas bubblesVery hard Intrusive or plutonic igneous rocks develop when magma is trapped deep inside the earth and solidifies without ever reaching the surface. The magma cools and solidifies very slowly over thousands or millions of years in chambers of pre-existing rocks. Slow cooling allows individual mineral grains to grow very long, forming rock with visible, large crystals. Intrusive igneous rocks are found in: Acadia National Park, MaineJoshua Tree National Park, CaliforniaYosemite National Park, California Coarse-grained that are big enough to be seen with the naked eyeUniform textureShiny, flat crystals whose edges interlock and fit together like jigsaw puzzle piecesHard Some common examples of igneous rocks are listed and described below with their names: Igneous Rocks Basalt is a hard, black-colored extrusive igneous rock composed mainly of plagioclase and pyroxene minerals. Pumice is a light-colored vesicular extrusive igneous rock. It is composed primarily of silica and A1-oxide but may contain metal oxides, calcite, or salts. Obsidian is a dark-colored, extrusive igneous rock that forms due to the rapid cooling of molten rock and thus does not form crystals. Obsidian is produced from felsic lava, rich in lighter elements such as silicon and oxygen. Rhyolite is a light-colored, fine-grained extrusive igneous rock typically consisting of quartz and feldspar minerals. Scoria is a dark-colored vesicular extrusive igneous rock formed due to trapped gas at the time of solidification. It is composed of almost 50% silica and 10% calcium oxide with lesser contents of potash and soda. Dacite is a light-colored (white to light gray), extrusive igneous rock consisting primarily of plagioclase and quartz. Granite is a light-colored, course-grained intrusive igneous rock consisting of quartz, feldspar, and mica minerals. It is the most common intrusive igneous rock. Gabbro is a dark-colored, course-grained intrusive igneous rock that contains feldspar, pyroxene, and sometimes olivine. Diabase is a dark grey to the black-colored, course-grained intrusive igneous rock consisting primarily of plagioclase feldspar and pyroxene minerals. The grains in diabase are more extensive than those in basalt but smaller than those in gabbro. Diorite is a coarse-grained intrusive igneous rock with a contrasting mix of black and white mineral grains. It consists of a mixture of feldspar, pyroxene, hornblende, and sometimes quartz. Pegmatite is a light-colored, course-grained intrusive igneous rock consisting of quartz, feldspar, and mica, having a similar silicic composition as granite. Peridotite is a dark-colored, coarse-grained intrusive igneous rock consisting of small amounts of amphibole, feldspar, quartz, or pyroxene. Igneous rocks are commonly used in flooring, landscaping, and construction purposes. However, its uses are specific to its types. Some specific importance apart from the general ones is given below: Granite Construction of buildings and statuesBuilding kitchen countertops Basalt Rich source of ironCommonly used as an ingredient of concrete Pumice Abrasive – removing dead skin from the bottom of feetMaking of lightweight materials such as toothpaste and cosmetic products Gabbro Polishing surfacesThe raw material of gold and silver About 95% part of the earth’s crust consists of igneous rock. Earth’s moon also consists of igneous rock.There are about 700 types of igneous rocks known to us.The ocean floor is made of basalt, which is an igneous rockPumice, the lightest rock on earth, is an igneous rock.The Giant’s Causeway in Northern Ireland was made from a lava flow that erupted 55 million years ago. As the lava cooled, it split and formed about 40,000 basalt pillars.Batholiths are a substantial igneous intrusion extending deep in the earth’s crust. Q.1. Which characteristic is common to extrusive igneous rocks? Ans. A fine-grained and glassy texture commonly characterizes extrusive igneous rocks. Q.2. What is the difference between intrusive igneous rocks and extrusive igneous rocks? Ans. Intrusive igneous rocks are formed when magma solidifies on the surface of the earth. In contrast, extrusive igneous rocks are formed from magma that cools and solidifies within the earth’s crust. Q.3. Is limestone an igneous rock? Ans. No, limestone is a sedimentary rock. Q.4. The melting of metamorphic or igneous rock forms what substance? Ans. The melting of metamorphic or igneous rock forms magma. Q.5. What is the origin of fine-grained igneous rock? Ans. The origin of fine-grained igneous rock is magma that erupts from volcanoes in the form of lava. Q.6. Can an igneous rock become another igneous rock? Ans. Indirectly, yes. An igneous rock changes into sedimentary rock or metamorphic rock. The metamorphic rock can then again change into igneous rock through the rock cycle. Q.7. What is required for an igneous rock to weather? Ans. The igneous rock must be exposed to the earth’s surface for weathering. Q.8. Do igneous rocks contain fossils? Ans. Igneous rocks rarely have fossils in them. Q.9. Do igneous rocks have layers? Ans. No, igneous rocks do not have layers. Q.10. Do igneous rocks float? Ans. The only known igneous rock that floats in water is pumice. Article was last reviewed on Friday, February 17, 2023 Andesite is a fine-grained, extrusive igneous rock composed mainly of plagioclase with other minerals such as hornblende, pyroxene, and biotite. The specimen shown is about two inches (five centimeters) across. Igneous rocks are formed from the solidification of molten rock material. Some form below Earth's surface. Some form on or above Earth's surface. We describe these two basic types: Intrusive igneous rocks crystallize below Earth's surface, and the slow cooling that occurs there allows large crystals to form. Examples of intrusive igneous rocks are: diabase, diorite, gabbro, granite, pegmatite, and peridotite. Extrusive igneous rocks erupt onto the surface, where they cool quickly to form small crystals. Some cool so quickly that they form an amorphous glass. These rocks include: andesite, basalt, dacite, obsidian, pumice, rhyolite, scoria, and tuff. Pictures and brief descriptions of some common igneous rock types are shown on this page. Rhyolite is a light-colored, fine-grained, extrusive igneous rock that typically contains quartz and feldspar minerals. The specimen shown above is about two inches (five centimeters) across. ADVERTISEMENT Scoria is a dark-colored, vesicular, extrusive igneous rock. The vesicles are a result of trapped gas within the melt at the time of solidification. It often forms as a frothy crust on the top of a lava flow or as material ejected from a volcanic vent and solidifying while airborne. The specimen shown above is about two inches (five centimeters) across. Unakite is a colorful rock composed of green epidote and pink orthoclase. It is formed when granite, an igneous rock, is metamorphosed by hydrothermal activity. Attractive pieces of unakite are often used to make cabochons, tumbled stones, small sculptures, and other lapidary items. It is named after the Unaka Mountains of eastern Tennessee. Igneous rocks are classified based on their mineral composition, texture, and other characteristics. The classification system commonly used in geology categorizes igneous rocks into two main groups: intrusive (plutonic) and extrusive (volcanic) rocks. These groups are further subdivided based on mineral composition and texture. Here’s a basic overview of the classification: 1. Intrusive (Plutonic) Igneous Rocks: These rocks form from magma that cools and solidifies beneath the Earth’s surface. The slower cooling rate allows for the growth of visible mineral crystals. Intrusive rocks tend to have a coarse-grained texture. 1.1. Granite: Rich in quartz and feldspar, granite is a common intrusive rock. It is light-colored and often used in construction. 1.2. Diorite: Diorite is intermediate in composition between granite and gabbro. It contains plagioclase feldspar, pyroxene, and sometimes amphibole. 1.3. Gabbro: Gabbro is a mafic rock composed mainly of pyroxene and calcium-rich plagioclase feldspar. It’s the intrusive equivalent of basalt. 1.4. Peridotite: Peridotite is an ultramafic rock composed of minerals like olivine and pyroxene. It’s often found in the Earth’s mantle. 2. Extrusive (Volcanic) Igneous Rocks: These rocks form from lava that erupts onto the Earth’s surface. The rapid cooling rate results in fine-grained textures, but some extrusive rocks can also exhibit porphyritic texture, with larger crystals (phenocrysts) embedded in a finer matrix. 2.1. Basalt: Basalt is a common extrusive rock that’s dark-colored and rich in iron and magnesium. It often forms volcanic landscapes and oceanic crust. 2.2. Andesite: Andesite is intermediate in composition between basalt and dacite. It contains plagioclase feldspar, amphibole, and pyroxene. 2.3. Rhyolite: Rhyolite is a fine-grained volcanic rock rich in silica. It’s the extrusive equivalent of granite and often has a light color. 3. Pyroclastic Igneous Rocks: These rocks are formed from volcanic ash, dust, and debris that are ejected during explosive volcanic eruptions. They can have a wide range of compositions and textures. 3.1. Tuff: Tuff is a rock made up of consolidated volcanic ash. It can vary in composition and texture, depending on the size of ash particles. 3.2. Ignimbrite: Ignimbrite is a type of tuff formed from hot pyroclastic flows. It often has a welded texture due to the high temperatures during deposition. It’s important to note that the classification of igneous rocks isn’t limited to just these examples. Within each category, there’s a range of rock types with varying compositions and textures. Additionally, modern geology also considers mineralogical and chemical analyses, along with the context of rock formation and geological history, to refine the classification of igneous rocks. Igneous rocks are composed primarily of minerals that crystallize from molten material (magma or lava). The mineral composition of igneous rocks plays a significant role in determining the rock’s properties, appearance, and classification. Here are some common minerals found in igneous rocks: 1. Quartz: Quartz is a common mineral in igneous rocks, particularly in felsic rocks like granite and rhyolite. It’s composed of silicon and oxygen and often appears as clear, glassy crystals. 2. Feldspar: Feldspar is a group of minerals that are essential components of many igneous rocks. The two main types are: Orthoclase Feldspar: Common in both felsic and intermediate rocks, orthoclase feldspar can impart pink, reddish, or gray colors to the rocks. Plagioclase Feldspar: Plagioclase is more common in intermediate to mafic rocks. Its composition can vary from calcium-rich (calcic) to sodium-rich (sodic) varieties, resulting in a range of colors. 3. Olivine: Olivine is a green mineral found in ultramafic rocks like peridotite and basalt. It’s composed of magnesium, iron, and silica. 4. Pyroxene: Pyroxene minerals, like augite and hornblende, are common in mafic and intermediate rocks. They have dark colors and are rich in iron and magnesium. 5. Amphibole: Amphibole minerals, such as hornblende, are found in intermediate rocks and some mafic rocks. They’re darker in color and are often associated with the presence of water during magma formation. 6. Biotite and Muscovite: These are types of mica minerals often found in felsic rocks. Biotite is dark-colored and belongs to the mafic mineral group, while muscovite is light-colored and belongs to the felsic group. 7. Feldspathoids: These are minerals similar in composition to feldspar but with less silica. Examples include nepheline and leucite. They’re found in certain alkali-rich igneous rocks. 8. Magnetite and Ilmenite: These minerals are sources of iron and titanium in mafic and ultramafic rocks. The specific combination of these minerals and their relative proportions determine the overall mineral composition of an igneous rock. This composition, along with the texture (grain size and arrangement of minerals), helps geologists classify and understand the rock’s origin and geological history. Additionally, accessory minerals, which are present in smaller amounts, can also provide important clues about the conditions under which the rock formed. Bowen’s Reaction Series is a concept in geology that explains the sequence in which minerals crystallize from a cooling magma. It was developed by the Canadian geologist Norman L. Bowen in the early 20th century. The concept is crucial for understanding the mineralogical composition of igneous rocks and the relationship between different types of rocks. Bowen’s Reaction Series is divided into two branches: the discontinuous series and the continuous series. These series represent the order in which minerals crystallize as the magma cools, with minerals higher on the series crystallizing at higher temperatures. Discontinuous Series: This series involves minerals that have distinct compositional changes as they crystallize from the cooling magma. It includes: Ol/Pyx Series (Olivine-Pyroxene Series): Minerals in this series are olivine and pyroxene. Olivine crystallizes at higher temperatures, followed by pyroxene at lower temperatures. Ca Plagioclase Series: This series involves the crystallization of calcium-rich plagioclase feldspar, such as anorthite. It starts at higher temperatures and continues as the magma cools. Na Plagioclase Series: This series includes sodium-rich plagioclase feldspar, such as albite. It crystallizes at lower temperatures than the calcium-rich plagioclase. Continuous Series: The minerals in the continuous series have compositions that vary gradually as they crystallize, forming a solid solution between two end-member minerals. The continuous series includes: Ca-Na Plagioclase Series: This series involves the solid solution between calcium-rich and sodium-rich plagioclase feldspar. As the magma cools, the composition of plagioclase gradually shifts from calcium-rich to sodium-rich. Amphibole-Biotite Series: Minerals in this series include amphibole (e.g., hornblende) and biotite mica. The composition of these minerals varies gradually with cooling. Na-K Feldspar Series: This series encompasses the solid solution between sodium-rich and potassium-rich feldspar. As the magma cools, the composition shifts from sodium-rich to potassium-rich. The concept of Bowen’s Reaction Series helps explain why certain minerals are commonly found together in specific types of igneous rocks. As the magma cools, the minerals crystallize in a predictable order based on their melting points and chemical compositions. This has significant implications for understanding the mineralogical evolution of magmas, the formation of different rock types, and the processes occurring within the Earth’s crust and mantle.

This page reveals the different ways in which types of igneous rock can be used. Granite This is a hard igneous rock made up of clearly visible crystals of various minerals. Granite looks good when it is polished and because it is also a very hard rock, it is often used for the façades (fronts) of buildings, for expensive kitchen worktops and gravestones. Basalt A dark-coloured, fine-grained rock. Basalt is one of the main rocks to form the oceanic crust (the part of the Earth's surface under the Ocean). When basaltic lava cools down it can form hexagonal columns such as seen in the Giants Causeway in Northern Ireland (see top right picture). Basalt can be a rich source of iron and it is commonly used as an ingredient of concrete. Pumice Pumice is formed in volcanic eruptions when gas is violently released from the still molten rock, creating a rock with thousands of tiny bubbles in it. Pumice is very light, so light in fact that it can sometimes float on water. People often use pumice stones to remove dead skin from the bottom of their feet. It is also used in abrasive (harsh) cleaning products and as an ingredient in lightweight construction materials. Glossary Abrasive - a hard, gritty substance that is used to smooth a surface Crystals - pieces of mineral Façade - the front of something, usually a building Hexagonal - a structure with six sides Minerals - a material that is naturally made in rocks Molten - something that becomes a liquid when it gets hot enough Igneous Rocks form from magma or lava. The two types are intrusive (from magma) and extrusive (from lava).Igneous rocks form through the cooling and solidification of magma or lava. These rocks are distinctly different from sedimentary and metamorphic rocks, which originate from the deposition of material at the Earth’s surface and the transformation of existing rocks under pressure and temperature changes. Let’s explores the nature of igneous rocks, their types, formation processes, properties, classification, and textures.Igneous rocks form from the solidification of molten rock material. They are categorized based on their origin, texture, and mineral composition. Unlike sedimentary rocks, which form by the compaction and cementation of various particles, or metamorphic rocks, which are formed from the alteration of existing rock types in the Earth’s crust due to heat and pressure, igneous rocks originate directly from molten material.Igneous rocks are characterized by several distinct properties:Crystalline Texture: They often have a crystalline texture due to the interlocking of crystals that form as the molten rock cools.Hardness and Density: Most igneous rocks are hard and dense.Mineral Content: They contain a variety of minerals, including quartz, feldspar, mica, and olivine.Color Variations: Their color ranges from light (in rocks with high silica content) to dark (in rocks with low silica content).The main classification of igneous rocks is by their formation:These rocks form when magma erupts onto the Earth’s surface, where it is called lava, and cools rapidly. This rapid cooling often results in fine-grained textures. Examples of extrusive igneous rocks include:Basalt: A dark, fine-grained rock, commonly found in oceanic crust.Andesite: Typically found in volcanic arcs associated with subduction zones.Plutonic or intrusive igneous rocks form when magma cools slowly beneath the Earth’s surface, leading to the formation of large crystals. Examples of intrusive igneous rocks include:Granite: Known for its coarse-grained texture and used commonly in countertops.Gabbro: A dense, dark-colored rock, often found in the Earth’s oceanic crust.Knowing the word origins of the terms helps in remembering what they mean:Igneous: Comes from the Latin word “ignis” meaning “fire,” highlighting the rock’s fiery origin.Volcanic: Named after Vulcan, the Roman god of fire, referring to rocks formed from lava that erupts from volcanoes.Plutonic: Named after Pluto, the Roman god of the underworld, representing their formation deep within the Earth.Remember that “intrusive” rocks form inside the ground from magma, while “extrusive” rocks form externally, from lava.Igneous rocks form at various locations on Earth, including:Mid-Ocean Ridges: Basaltic rocks form as magma rises and cools at these spreading centers.Volcanic Arcs: Arcs are associated with subduction zones, where andesites and rhyolites are common.Hot Spots: The Hawaiian Islands, where basaltic lava flows are typical, are an example of a hot spot.Continental Crust: This is where granite and other plutonic rocks form.Igneous rocks are classified based on their texture, mineral composition, and the environment of formation. The key factors include:Texture: Grain size, shape, and arrangement of crystals.Composition: Based on the silica content, they are categorized as felsic, intermediate, mafic, or ultramafic.Formation Environment: This is whether they are volcanic or plutonic.The classification of igneous rocks based on composition revolves around the silica (SiO2) content and the proportion of various minerals present in the rock. This classification categorizes igneous rocks into four primary groups: felsic, intermediate, mafic, and ultramafic. Each group has distinct characteristics and typical rock types associated with it.Definition: Felsic rocks are rich in silica (over 65%) and contain a high proportion of lighter minerals like quartz and feldspar. The term “felsic” derives from “feldspar” and “silica”.Characteristics: These rocks are generally light in color, ranging from white to pink or light grey. They have a high content of aluminum, potassium, and sodium.Examples:Granite: A coarse-grained rock, typically light in color, used widely in construction.Rhyolite: The volcanic equivalent of granite, usually fine-grained and often exhibiting flow bands.Definition: Intermediate rocks consist of roughly equal amounts of felsic and mafic minerals, with silica content typically between 52% and 65%.Characteristics: They display a mix of light and dark minerals, resulting in a more diverse color range from grey to greenish.Examples:Diorite: A coarse-grained plutonic rock with a salt-and-pepper appearance, commonly used in decorative architecture.Andesite: The extrusive counterpart of diorite, commonly found in volcanic arcs associated with subduction zones.Definition: Mafic rocks have a lower silica content (45-52%) and are rich in iron and magnesium. The term “mafic” combines “magnesium” and “ferric” (iron).Characteristics: These rocks are darker in color, typically grey, green, or black. They are denser than felsic rocks.Examples:Basalt: A fine-grained volcanic rock, often forming the ocean floor and volcanic islands.Gabbro: The intrusive equivalent of basalt, featuring a coarse-grained texture.Definition: Ultramafic rocks have the lowest silica content (less than 45%) and are very rich in iron and magnesium minerals.Characteristics: They are the darkest and most dense among the igneous rocks, typically green to dark grey or black.Examples:Peridotite: Dominantly composed of the mineral olivine and often found in the Earth’s mantle.Dunite: Almost entirely made up of olivine, it is sometimes mined for its olivine content.The color of igneous rocks generally darkens as the silica content decreases. Felsic rocks, with their high silica content, tend to be light-colored. Meanwhile, ultramafic rocks, with the lowest silica content, are the darkest. This color variation often provides a quick visual clue to the rock’s composition and, by extension, its origin and formation process.Igneous rocks exhibit various textures:Phaneritic: Coarse-grained texture due to slow cooling (typical of plutonic rocks). Granite is a common example of a phaneritic igneous rock. This rock has large, visible crystals of minerals such as quartz, feldspar, and mica.Aphanitic: Fine-grained texture due to rapid cooling (typical of volcanic rocks). Basalt is a classic example of an aphanitic igneous rock. The crystals are so small that they are often not visible to the naked eye.Porphyritic: Contains both large and small crystals, indicating a complex cooling history. Porphyritic andesite is a rock that displays a porphyritic texture that has large crystals (phenocrysts) embedded in a finer-grained matrix.Glassy: Formed from very rapid cooling, resulting in a non-crystalline structure. Obsidian is a volcanic glass that exhibits a glassy texture. This texture forms when lava cools so rapidly that atoms do not have time to arrange into a crystal structure.Identifying igneous rocks involves two key steps: first, distinguishing them from sedimentary and metamorphic rocks, and then determining their specific type. Here is a list of practical tips for identifying a rock:Usually, you can tell a rock is igneous just by looking at it. Using a magnifying glass helps in examining structure, too.Texture:Igneous rocks often have a crystalline texture with interlocking grains.Sedimentary rocks typically show layers or are composed of fragments cemented together.Metamorphic rocks usually have a foliated or banded appearance due to pressure.Grain Size:Fine-grained or glassy textures are common in volcanic igneous rocks.Coarse-grained textures, where individual minerals are visible, are typical of plutonic igneous rocks.Sedimentary grains are often rounded, while metamorphic rocks have elongated minerals.Presence of Fossils:Fossils are present in many sedimentary rocks but absent in igneous rocks.Voids or Vesicles:Igneous rocks, particularly volcanic ones, may have voids (vesicles) left by escaping gases.Lack of Layering:Unlike sedimentary rocks, igneous rocks generally do not have layers.Once you know the rock is igneous, the next step is identifying the specific type of rock. Some of the key characteristics are visible, but others rely on physical and chemical tests and knowing the rock’s origin.Color and Composition:Light-colored rocks (high in silica) suggest a felsic composition (e.g., granite, rhyolite).Dark-colored rocks indicate a mafic or ultramafic composition (e.g., basalt, gabbro).Texture:Coarse-grained textures where minerals are easily visible are characteristic of plutonic rocks, such as granite.Fine-grained or glassy textures suggest volcanic rocks, such as basalt or obsidian.Mineral Composition:Identify key minerals: quartz, feldspar, olivine, pyroxene, amphibole.Rocks with quartz and potassium feldspar are typically felsic.Rocks with olivine and pyroxene are typically mafic or ultramafic.Hardness and Density:Igneous rocks are generally hard and dense, especially mafic and ultramafic rocks.Presence of Phenocrysts:Large, well-formed crystals (phenocrysts) in a finer matrix suggest a porphyritic texture, indicative of complex cooling histories.Magnetic Properties:Some mafic rocks, like basalt, have magnetic properties.Reaction to Acid:Some igneous rocks, like those containing calcite, fizz upon contact with dilute hydrochloric acid.Location and Geological Context:The location where the rock was found provides clues. For example, granite is often found in continental crust, while basalt is common in oceanic crust and volcanic islands.Use of a Hand Lens or Microscope:A closer inspection of grains and crystals can provide more information about the rock’s composition and history.Identifying igneous rocks requires careful observation of physical characteristics and an understanding of their formation processes. It’s a skill that improves with practice and experience.

Blatt, Harvey; Tracy, Robert J. (1996). Petrology (2nd ed.). W.H. Freeman. ISBN 978-0-7167-2438-4.Fisher, Richard V.; Schmincke, H.-U. (1984). Pyroclastic Rocks. Berlin: Springer-Verlag. ISBN 3-540-12756-9.Irvine, T. N.; Baragar, W. R. A. (2011). “A Guide to the Chemical Classification of the Common Volcanic Rocks”. Canadian Journal of Earth Sciences. 8 (5): 523–548. doi:10.1139/e71-055Philpotts, Anthony R.; Ague, Jay J. (2009). Principles of Igneous and Metamorphic Petrology (2nd ed.). Cambridge, UK: Cambridge University Press. ISBN 9780521880060.Schmincke, Hans-Ulrich (2003). Volcanism. Berlin: Springer. ISBN 978-3-540-43650-8. doi:10.1007/978-3-642-18952-4

Related Posts Igneous rocks have many uses at home. Common ones include construction (aggregate, dimensional, or facing stone), making countertops, flooring tiles, landscaping, and paving. Also, they make statues, roads, or rail ballast, marking cemeteries, and some, like rhyolite, are ornamental stones. How you will use igneous rock depends on the properties of the exact rock you have. It is time to look at what igneous rocks are? How are they formed, types, classification, and what are examples of igneous rocks and their uses? Igneous rocks get their name from the Latin word ignis, which means fire, describing formation, i.e., from hot molten material. They are one of the main types of rocks and the Primary rock since they form from magma that starts the rock cycle. Others are sedimentary and metamorphic rocks. Igneous rocks form when molten (magma or lava) rock cools and crystalizes or solidifies inside the Earth’s crust or on the Earth’s surface. The molten (hot liquid or semi-liquid) rock is known as magma if trapped inside the Earth’s crust and lava if it makes its way to the Earth’s surface. It originates from the lower crust or upper mantle. Magma melts at very high temperatures, i.e., 600 to 1,300 °C or 1,100 to 2,400 degrees Fahrenheit. This melting occurs at active plate boundaries and hot spots. Contrary to what many assume, the mantle has solid material. Igneous rocks Examples - From top left to bottom -granodiorite, andesite, syenite, gabbro, rhyolite, basalt, granite, and an ignimbrite - Photo credit: Rojinegro81, Wikimedia, CC BY-SA 3.0 There are two main groups of igneous rocks. The first group is intrusive or plutonic, which forms when magma solidifies inside the Earth’s surface. The other is extrusive when lava solidification occurs near or on the Earth’s surface. Extrusive and intrusive rock formation Intrusive or plutonic igneous rocks form when magma cools and solidifies inside the Earth’s crust. These rocks are coarse-grained or have a phaneritic texture due to the slow cooling of the intrusions (intrusive rock bodies). Why? Because these intrusions get insulation from country rock and can take thousands to millions of years to cool and solidify. Since they form inside the Earth’s crust, erosion and tectonic activities may expose these rocks to the surface. Examples of intrusive igneous rocks include diorite, gabbro, pegmatite, granite, diabase, and peridotite. And if you want to know some of the common intrusive rock bodies, they are stocks, batholiths, sills, dikes, and laccoliths. Extrusive or volcanic igneous rocks form when lava (molten magma) cools and solidifies on or very close to the Earth’s surface. These rocks have fine or glassy textures because of the rapid cooling and solidification that doesn’t allow large crystals to form. Some volcanic rocks may have a bubbly or vesicular texture if the magma traps hot gas bubbles. Extrusive igneous rocks form from a volcanic eruption or oozing fissures. Some activities that produce them are hotspots and divergent or convergent boundaries. Examples of extrusive igneous rocks include andesite, basalt, obsidian, scoria, tuff, rhyolite, dacite, and pumice. Note: Subvolcanic or hypabyssal Besides the extrusive and intrusive, some igneous rocks are known as subvolcanic or hypabyssal. These refer to those formed at intermediate depths, especially in sills and dykes. Since cooling occurs relatively slowly, their grain size is medium. There are two main ways in which geologists classify igneous rocks, i.e., by their texture and chemical composition. Let us look at each of these two ways. Texture in igneous rock refers to crystal sizes and mainly tells us more about the cooling rate. But may reveal other things such as the way of formation, e.g., via an eruption. A slower cooling rate generally results in larger crystals while fast in smaller ones. However, the composition may also influence the crystal sizes. TextureDescriptionRock examplesAphaniticThe aphanitic texture features fine-grains (not visible by the naked eye) rock. It forms by rapid lava cooling on or near the Earth’s surface, i.e., extrusive. To see the crystalline structure or grains, one needs a petrographic microscope to see them.Basalt, rhyolite, and andesitePhaneriticThe phaneritic texture has coarse grains with large crystals visible to a naked eye (unaided eye). These rocks form via slow cooling of magma that allows crystals to grow large and are usually intrusive igneous rocks.Granite, gabbro, and diorite PorphyriticPorphyritic texture features large crystals 65%) volcanic igneous rock formed by rapid cooling of lava that gives time for no formation of crystals. It is a felsic rock despite being black and sometimes brown, tan, or green. Other rare colors are red, orange, yellow, or blue. Historically, obsidian has made weapons, ornaments, mirrors, and some tools. Other uses are as an ornament, making sculptures, etc. Modern applications include making decorative aggregate, pebbles, or gravel and making surgical tools. Obsidian – Photo credit: James St. John, Wikimedia CC BY 2.0 Pumice is a light-colored vesicular extrusive igneous rock formed from violent volcanic eruptions. This low-density, rough-textured volcanic glass (has non-crystalline) stone has white, cream, gray, tan, green-brown, blue, or black and is a felsic rock. Uses of pumice include making aggregate for low density and insulative bocks or concrete. Others are landscaping, horticulture (substrate for hydroponic gardening media, abrasive (in soap, personal care, rubber erasers, etc.), absorbent cat litter, ground cover, etc. Pumice stones – Photo credit: Mauro Cateb, Wikimedia, CC BY-SA 3.0, Tuff is a soft, porous, volcanic igneous rock. It forms when magma, ash, or rock blasted into the air by explosive volcanic rock settles, is compacted, and cemented. So, its texture is pyroclastic and has more than 75% ash. Tuff’s main use is in construction, i.e., building walls or houses, making construction aggregate, etc. Also, it works as a facing, landscaping or curbing stone, paver, or even making artifacts, sculptures, and monuments. Tuff – Photo credit: Marek Novotňák, Wikimedia, CC BY-SA 4.0 Rhyolite is a light-colored (pink, gray, or reddish) fine-grained to glassy silica-rich extrusive igneous rock. But may have larger mineral crystals (porphyritic). It mainly has quartz, sanidine, and plagioclase, plus smaller amounts of biotite or hornblende. Its fractured nature makes rhyolite have few uses in manufacturing or construction. But people use it as crushed stone when there are no other options. Historically it made scrapers, projectile heads, or blades if it was what was only available. Pinkish Rhyolite - Photo Credit: Michael C. Rygel, Wikimedia, CC BY-SA 3.0 Diorite is hard, intermediate (moderate in silica, low in alkali metals), and coarse-grained intrusive igneous rock. It forms when magma cools slowly beneath the Earth’s surface and has mainly dark and light-colored speckles, especially black and white. But it may have a gray, dark gray, green, or blue tint. Diorite is a hard and durable stone comparable to granite. Its uses are making construction aggregate or drainage stones. Also, they make dimensional stones (facing stones, tiles, cubbing, pavers, ashlars, etc.), and you can use them for landscaping, making sculptures, etc. Andesite is an intermediate (52%-63% silica), fine-grained to porphyritic volcanic rock. Its constituent is between basalt and rhyolite and is an equivalent of diorite an intrusive rock. Andesite is dark gray or bluish-gray to gray but lighter than basalt. Uses include making aggregate (not for concrete) or fill, slip-resistant tiles, sculptures, monuments, and landscaping. Andesite - Photo credit: LassenNPS, Flickr, CC BY 2.0 Gabbro is a dark-colored, coarse-grained intrusive igneous rock. This dark-gray to green-gray mafic rock has a composition similar to basalt, an extrusive counterpart. So, they are both rich in plagioclase feldspar and pyroxene and may have small amounts or not of olivine, hornblende, and other minerals. Since it accepts polishing, gabbro, solid as black granite in the dimensional stone market, and it makes kitchen countertops, facing stones, floor tiles, cemetery markers, or other dimension stones. Also, you can use it for paving, curbing, ashlars, etc., or crushed to make aggregate for road construction, railway ballast, etc. Gabbro – Photo credit: James St. John, Wikimedia, CC BY 2.0 Scoria is one of the vesicular dark-colored (mafic) volcanic glass that may have crystals or not. This rock is black, dark-brown, or purplish red and has a composition like basalt or an andesite rock. Scoria makes lightweight aggregate and concrete. This concrete offers great insulation. Also, you can use it as roofing granules, a ground cover, and a hydroponic gardening substrate. More uses are drainage stone, rip rap, low-quality road metal, etc. Scoria – Photo credit: I, Jonathan Zander, Wikimedia, CC BY-SA 3.0 Peridotite is dense, ultramafic (>45% silica), coarse-grained, dark-colored intrusive igneous rock with mostly olivine and pyroxene. It is also high in magnesium, has a substantial amount of iron, and is mostly green but may be greenish-gray, yellowish-green, or nearly black. Uses of peridotite include making serpentine (when hydrated at low temperatures. Some deposits may have diamonds, sulfide, and chromite ores. Also, some peridotite serves as ornamental stones Peridotite - Photo credit: HAROUY Jean-Michel, Wikimedia CC BY-SA 4.0, Pegmatite is an intrusive igneous rock with large crystals (>0.4) formed during the crystallization of the last magma. This coarse-grained rock has quartz, feldspar, and mica, and its composition is similar to granite. However, there are felsic and mafic pegmatite rocks. Colors depend on the constituents and may be pink, white, gray, or black. One of the pegmatite’s economic values is it may contain gemstones and rare earth minerals. Examples include tin, lithium, tungsten, topaz, aquamarine, fluorite, apatite, etc. Also, the beautiful pegmatite rocks are cut and polished to make facing stones, countertops, tiles, etc. Kimberlite – Photo credit: Woudloper, Wikimedia, CC BY-SA 1.0 Kimberlite is an ultramafic, dark-colored (dark blue-green or softer/yellow when oxidized) intrusive igneous rock. Its texture is porphyritic, i.e., it has large crystals in a fine-grained matrix and is composed of olivine (>35%) and other minerals like mica, calcite, and serpentine. The main economic value of kimberlite is that its matrix often hosts diamonds. Also, this hard and heavy rock may work as a building, paving, curbing, or landscaping stone, make countertops, decorative aggregate, sculptures, or moments among other uses. Syenite is an intermediate (60-65% silica), coarse-grained intrusive igneous rock with a composition like granite but lacking or low in quartz (less than 5%). It mainly has orthoclase feldspar with small amounts of plagioclase, augite, mica, and magnetite. Syenite is light-colored, especially pink or grey but may vary to include brick red. Uses of syenite include a dimensional stone for facing, paving, foyers, landscaping, curbing, or flooring. Also, it makes aggregate construction, natural cement, dolomite and magnesium refractories, sculptures, monuments, cemetery markers, etc. Did you know it is preferred to granite since it resists fire better? Syenite – Photo credit: Schubertan, Wikimedia, CC BY-SA 4.0 Anorthosite is a coarse-grained, light-colored intrusive rock with over 90% plagioclase feldspar and less than 10% mafic minerals. This felsic rock is white, yellow, brown, grayish, pinkish, or smoky. Uses of anorthosite include a source of titanium, aluminum, and labradorite (gemstone). Also, they make high-quality aggregate, floor tiles, paving, landscaping, or curbing. More uses are abrasives, filler (in plastics, paints, or rubber), flocculants, binders, ceramics, etc. Anorthosite - Photo credit: James St. John, Wikimedia, CC BY 2.0 Dacite is a fine-grained, light-colored (white to gray) volcanic rock with mainly plagioclase and quartz. It is low in alkali metal oxides, and its composition falls between andesite and rhyolite. Usually, it has more quartz than andesite and less plagioclase than rhyolite. Uses of dacite include aggregate and fill for road and construction (not for concrete being high in silica). Other uses are building, paving, curbing, or landscaping stone, and it made projectile points, knife blades, and scrapers in ancient times. Dacite – Photo credit: James St. John, Wikimedia CC BY 2.0 Diabase is a fine-grained, dark-colored (mafic) intrusive igneous rock formed on shallow intrusion (subvolcanic) with similar composition as basalt or intrusive gabbro. Uses of diabase are paving stone, making monuments, or aggregate for concrete, subbase drainage stones, railroad ballast, landscaping controlling erosion. Also, diabase or dolerite is building stones for foundation, walls, or ashlars and architectural stone for stair treads, window sills, columns, flooring tiles, countertops, and facing stone. Did you know that Stonehenge construction used diabase rock? Diabase - Photo credit: James St. John, Flickr, CC BY 2.0 Dunite is an ultramafic, coarse-grained, light yellowish-green plutonic igneous rock that is nearly composed of olivine (>90%). However, it may have other components like chromite, magnetite, pyrope, and pyroxene. Uses of dunite are as a building or architectural stone, paving, landscaping, and making aggregate for making roads, mortar, railway ballast, etc. More applications are cement manufacturing, carbon dioxide sequestering, monuments, etc. Granodiorite is a coarse-grained, intermediate, grayish-white intrusive rock whose composition is between granite and diorite. Its mafic content is higher than granite, while its quartz content is lower than diorite. Also, its orthoclase feldspar is less than plagioclase feldspar. Uses include crushed stone for road building or fill (not good for concrete since it is high in silica), paving, curbing, landscaping, and making monuments. Also, if cut and polished, it will serve as an architectural stone such as for foyers or facing stone. Granodiorite - Photo credit: James St. John, Wikimedia, CC BY 2.0 Komatiite is a dark-colored, ultramafic volcanic rock derived from the mantle. It has a spinifex texture and is high in magnesium oxide (at least 18% by weight). This black, gray, or gray-green rock has mainly olivine and pyroxene and is low in potassium, silicon, and aluminum. Komatiite is an extremely rare rock with economic value hosting gold and nickel-copper sulfide minerals. Komatiite rock - Photo credit: KarlaPanchuk, Wikimedia, CC BY-SA 4.0 Igneous rocks are rocks that formed from the cooling and solidification of magma or lava. Magma is molten rock that is below the surface of the Earth, and lava is molten rock that has reached the surface. As magma or lava cools, the minerals in it crystallize and form rocks. The texture and mineral composition of igneous rocks depend on the rate of cooling and the composition of the magma or lava. Igneous rocks are one of the three main rock types, along with sedimentary and metamorphic rocks. The term "igneous" comes from the Latin word for "fire," alluding to their origins from volcanic activity or the Earth's internal heat.How Igneous Rocks FormedIgneous rocks are formed from the cooling and solidification of molten rock, also known as magma or lava. Magma is found deep within the Earth's mantle, where it is heated by the decay of radioactive elements. When magma reaches a certain temperature and pressure, it becomes less dense and rises towards the surface. If the magma erupts onto the surface as lava, it cools rapidly and forms extrusive igneous rocks. If the magma cools slowly within the Earth's crust, it forms intrusive igneous rocks.Types of Igneous RocksIgneous rocks are divided into two main types based on where they cool and solidify:Intrusive Igneous RocksIntrusive igneous rocks, also known as plutonic rocks, are formed when magma cools and solidifies below the Earth's surface. The magma rises up from the mantle, the layer beneath the crust, and gets trapped in cracks or pockets in the crust. As it cools slowly, the minerals in the magma come together and form crystals. The size of the crystals depends on how slowly the magma cools. If it cools very slowly, the crystals have time to grow large. If it cools more quickly, the crystals are smaller. Some common Examples of intrusive igneous rocks are granite, diorite, and gabbro.Extrusive Igneous Rocks Extrusive igneous rocks, also known as volcanic rocks, are formed when magma cools and solidifies above the Earth's surface. This happens when magma erupts from a volcano and comes out onto the ground as lava. The lava cools quickly, so the crystals in extrusive igneous rocks are usually small or even invisible. Some common Examples of extrusive igneous rocks are basalt, andesite, and rhyolite. Igneous Rocks ClassificationIgneous rocks are classified based on their texture, composition, and the environment of formation.TextureThe Texture of Igneous Rocks refers to the physical characteristics of the rock, such as the size and arrangement of its mineral grains. Here are the main textural categories:Phaneritic: These rocks boast large, easily visible mineral grains, словно a canvas splashed with colorful pebbles. Slow, underground cooling gives these "coarse-grained" rocks their signature look. Examples include granite, diorite, and gabbro.Aphanitic: In contrast, these rocks hide their mineral secrets, their grains so tiny they're invisible to the naked eye. Think of them as "fine-grained" paintings, their textures smooth and almost glass-like. Quick surface cooling is the artist behind their look. Examples include basalt, rhyolite, and andesite.Porphyritic: These rocks have a mix of large and small crystals. The large crystals, called phenocrysts, formed earlier in the magma chamber, while the smaller crystals formed later as the magma cooled more quickly.Glassy: No crystals, smooth and shiny like glass. Example: obsidian.An igneous rocks chart showing the chemical composition, examples, and textures of different types of igneous rocks, such as granite, basalt, andesite, and rhyolite.Chemical CompositionComposition-Based Classification:Felsic: These rocks are light-colored and rich in silica (SiO_2), typically containing more than 65%. They are dominated by quartz and feldspar minerals, with minor amounts of pyroxene and amphibole. Examples include granite, rhyolite, and obsidian.Intermediate: These rocks fall between felsic and mafic in both silica content (52-65%) and mineral composition. They typically contain feldspar, hornblende, and pyroxene. Examples include diorite and andesite.Mafic: These rocks are dark-colored and have a silica content of 45-52%. They are dominated by mafic minerals like pyroxene and olivine, with minor amounts of feldspar. Examples include basalt and gabbro.Ultramafic: These rocks are the darkest and have the lowest silica content (65%), making it a felsic rock. Its presence in high mountain ranges, such as the Alps and the Andes. Granite is an important rock because it is used in construction, as well as for making countertops, flooring, and other decorative items.Gabbro Gabbro is a dark-colored, coarse-grained igneous rock that is also formed from slowly cooling magma. It is the most common intrusive igneous rock after granite and is often found in large masses called plutons. Gabbro is composed primarily of plagioclase feldspar and olivine. The plagioclase feldspar crystals give gabbro its dark color, while the olivine crystals contribute to its hardness. Gabbro is less common than granite in Earth's crust, but it is found in many important geological formations, such as the Earth's mantle and the cores of some planets and moons.Pegmatite Pegmatite is an extremely coarse-grained igneous rock that is formed from very slowly cooling magma. It is often found in veins and dikes, which are thin, tabular bodies of rock that intrude into existing rock. Pegmatite is composed of a wide variety of minerals, including quartz, feldspar, mica, and gemstones such as tourmaline and beryl. The wide variety of minerals in pegmatite is due to the slow cooling rate of the magma, which allows the minerals to have time to grow large and form complex crystals. Pegmatite is an important source of gemstones and other valuable minerals.Extrusive Igneous Rocks ExamplesVolcanic rocks examplesPhoto from The Rock and Gem Book Basalt Basalt is a dark-colored, fine-grained igneous rock that is formed from rapidly cooling lava on the surface of the Earth or beneath the surface of the ocean. It is the most common extrusive igneous rock and is often found in layers called flows. Basalt is composed primarily of plagioclase feldspar and pyroxene. The plagioclase feldspar crystals give basalt its dark color, while the pyroxene crystals contribute to its hardness. Basalt is a very common rock in Earth's crust and is found on all of the continents and most of the oceans. It is also found on other planets and moons in our solar system.AndesiteAndesite is a gray-colored, fine-grained igneous rock that is formed from intermediate-composition lava. It is the second most common extrusive igneous rock and is often found in layers called flows. Andesite is composed primarily of plagioclase feldspar, amphibole, and pyroxene. The plagioclase feldspar crystals give andesite its gray color, while the amphibole and pyroxene crystals contribute to its strength and durability. Andesite is closely associated with the formation of continental margins and volcanic arcs. It is also an important source of some valuable minerals, such as hornblende and magnetite.Rhyolite

Rhyolite is a light-colored, fine-grained igneous rock that is formed from rapidly cooling lava on the surface of the Earth or beneath the surface of the ocean. It is the third most common extrusive igneous rock and is often found in layers called flows. Rhyolite is composed primarily of quartz and feldspar. The quartz crystals give rhyolite its light color, while the feldspar crystals contribute to its strength and durability. Its presence is often associated with volcanic plateaus and stratovolcanoes, such as Mount Rainier and Mount Fuji. It is also an important source of some valuable minerals, such as mica and gemstones such as quartz and smoky quartz.Characteristics of Igneous RocksIgneous rocks exhibit several distinctive characteristics:Crystalline Structure: Igneous rocks are crystalline, meaning they have a regular arrangement of atoms, forming visible crystals.Varying Composition: Igneous rocks exhibit a wide range of compositions, reflecting the varied sources of magma or lava.Inherent Strength: Igneous rocks are generally strong and durable due to their interlocking crystal structure.Role in the Rock Cycle: Igneous rocks are the primary rocks in the rock cycle, forming from magma or lava and eventually being weathered, transported, and deposited to form sedimentary rocks. Mount Rushmore South Dakota, is carved into a mountainside primarily composed of granite.Igneous Rocks Applications and Uses Igneous rocks are a diverse group of rocks with a wide range of applications and uses. Their unique properties, such as strength, durability, and heat resistance, make them valuable resources in various industries.Construction:Granite: One of the most popular igneous rocks for construction, granite is known for its strength, beauty, and resistance to weathering. It is widely used for countertops, flooring, tiles, and building exteriors.Basalt: Another strong and durable rock, basalt is commonly used for paving stones, curbstones, and railroad ballast. It is also crushed and used as an aggregate in concrete.Pumice: This lightweight and porous rock is used in concrete and other building materials to reduce weight and improve insulation. It is also used as an abrasive in cleaning products and cosmetics.Sculpting and Art:Granite, marble, and gabbro: These igneous rocks are prized for their aesthetic qualities and used for sculptures, monuments, and other artistic creations. Obsidian: This volcanic glass is used to make sharp tools and jewelry.Industrial Applications:Basalt: Basalt fibers are used to reinforce composites for aircraft and other high-performance applications.Scoria: This vesicular basalt is used as a filter media in water treatment plants.Perlite: This expanded volcanic glass is used as a lightweight aggregate in insulation and building materials.Other Uses:Gemstones: Gemstones like obsidian, opal, and agate are formed from igneous rocks.Abrasives: Pumice and other igneous rocks are used in grinding wheels, sandpaper, and other abrasive products.Geothermal Energy: Igneous rocks play a role in geothermal energy production. Hot magma or rocks beneath the Earth's surface can be tapped for geothermal energy.Agriculture: Crushed igneous rocks can be used as soil amendments to improve drainage and fertility.Archaeological Significance: Igneous rocks provide valuable insights into Earth's geological history and past volcanic activity.Igneous rocks are a fascinating and diverse group of rocks. They come in a variety of colors, textures, and compositions, and they can be found in many different places around the world. See also: What Gems Are Found in Igneous RockGranite Vs Gabbro - Similarities and DifferencesTypes of Intrusive Igneous Bodies Igneous rocks are formed when magma cools and solidifies below the earth’s surface. They are formed naturally and mined using heavy machinery and undergo industrial processing. They are usually hard and can withstand harsh climatic conditions. There is quite a number of these rocks with various uses. Examples are diorite, scoria, pegmatite, gabbro, basalt, pumice, and granite. Some of their applications are: 1. for the construction of monuments Granite, which is used in the construction of buildings and statues, is ideal for this type of structure as it is easy to curve into preferred shapes and sizes. It also makes perfect kitchen and bathroom tops. 2. as a toothpaste ingredient Pumice manufactures toothpaste due to its ability to clean any tough stains thoroughly. 3. as a stain removal agent Pumice is applied as an abrasive during the manufacture of soaps and cleaners. It serves as the stain removal agent in these detergents. 4. Used during manicure and pedicure Due to its non-toxic nature, pumice is used during the removal of dead skin on human feet and hands. Pumice rocks also come in handy when grinding and polishing glass for television. 5. Construction of walls and countertops Gabbro, also referred to as black granite, has several uses, including the manufacture of flooring and countertops materials. Garden pavings are mostly made of this type of rock. Since they can withstand adverse weather conditions, they are perfect for coastal regions to build lakes and ocean break walls to prevent flooding and erosion. The salty air doesn’t affect them. 6. Construction of bridges Peridotite rocks are used in the development of roads and bridges. They are firm and can withstand harsh weather; therefore suitable for this kind of building that requires a firm foundation and durability guarantee. 7. Manufacturing of tiles Another type of igneous rock is the andesite rock. They have a few uses, including the construction of roadside beds, statues, and monuments. They are also used in designing landscapes and gardens through beautiful tiles. They have an outstanding ability to resist slip, making them perfect for manufacturing interior and exterior tiles. 8. Making of sharp objects Obsidian rocks make sharp objects such as knives, arrowheads, and spearheads. Other weapons curved from these rocks include swords, knives, and daggers. They can be shaped into the desired shape and sizes under the right conditions. This type of rock makes functional quality objects not quickly broken. 9. Building stone Limestone is used in the construction industry as building stones and makes cement. Besides, some of the glass used in construction comes from limestone. 10 Roofing and decoration Slate is excellent as a roofing material. However, most people use it to decorate their houses’ backyard or front area. 11. Making bricks Shale or mudstone makes excellent bricks. It is a soft and easily broken stone but is processed to create beautiful building stones. It also helps to lay a firm foundation, especially for road construction. Enjoy sharper detail, more accurate color, lifelike lighting, believable backgrounds, and more with our new model update. Your generated images will be more polished than ever.See What's NewExplore how consumers want to see climate stories told today, and what that means for your visuals.Download Our Latest VisualGPS ReportData-backed trends. Generative AI demos. Answers to your usage rights questions. Our original video podcast covers it all—now on demand.Watch NowEnjoy sharper detail, more accurate color, lifelike lighting, believable backgrounds, and more with our new model update. Your generated images will be more polished than ever.See What's NewExplore how consumers want to see climate stories told today, and what that means for your visuals.Download Our Latest VisualGPS ReportData-backed trends. Generative AI demos. Answers to your usage rights questions. Our original video podcast covers it all—now on demand.Watch NowEnjoy sharper detail, more accurate color, lifelike lighting, believable backgrounds, and more with our new model update. Your generated images will be more polished than ever.See What's NewExplore how consumers want to see climate stories told today, and what that means for your visuals.Download Our Latest VisualGPS ReportData-backed trends. Generative AI demos. Answers to your usage rights questions. Our original video podcast covers it all—now on demand.Watch Now Granite boulders at Joshua Tree National Park, California. Photo by Eva DiDonato. Igneous rocks are “fire-born,” meaning that they are formed from the cooling and solidification of molten (melted) rock. The word igneous derives from ignis, the Latin word for “fire.” Molten rock material is known as magma until it is erupted onto the surface when it then is termed lava. There are two broad types of igneous rocks: Intrusive (plutonic) rocks Extrusive (volcanic) rocks Intrusive (Plutonic) Rocks Intrusive igneous rocks solidify within Earth. These rocks are also known as plutonic rocks—named for Pluto, the Roman god of the underworld. Intrusive igneous rocks are generally wholly crystalline and characterized by large crystal sizes visible to the naked eye because they cool slowly. An outcrop of the Almo Pluton in City Of Rocks National Reserve, Idaho. NPS photo. Featured Video—Yosemite Granite Extrusive igneous rocks are erupted onto the surface or into the atmosphere. Extrusive igneous rocks are also termed volcanic rocks—named for Vulcan, the Roman god of fire. Volcanic rocks have generally smaller crystal size and usually have a very-fine-grained or glassy groundmass that formed due to rapid cooling at the time of eruption. Volcanic rocks are erupted as lava flows or lava domes during nonexplosive (effusive) eruptions or as shattered bits of rock (volcanic ash, tephra, and volcanic bombs which are collectively called pyroclasts) during explosive eruptions. Pyroclastic rocks are made of volcanic ash and other pieces of pulverized volcanic rock. The term pyroclastic means “fire-broken” from “pryo-” (fire) and “-clastic” (broken) in Greek. Pyroclastic rocks include ash-fall and tephra-fall deposits as well as ash-flow tuffs (ignimbrites) that form from pyroclastic density currents. Igneous rocks are classified both by their chemical composition, mineral composition, texture, and structure. Texture and structure refer to the relationships between crystals, groundmass, vesicles, and other components of a rock. Composition and Minerals Igneous rocks are mostly made of the most common elements found in the Earth’s crust. In descending order, they are: Oxygen (O) Silicon (Si) Aluminum (Al) Iron (Fe) Calcium (Ca) Sodium (Na) Magnesium (Mg) Potassium (K) Almost all igneous rocks are silicates meaning that silicon and oxygen are the two most common elements in them. Composition of igneous rocks is expressed as weight percent silica, which ranges from about 45 to 78 (wt % SiO2). Low silica rocks have higher concentrations of iron and magnesium. In turn, high silica rocks have less iron and magnesium, and more sodium and potassium. The two major divisions of igneous rocks based on composition are: Mafic - high in magnesium and iron (and low in silica) Silicic - high in silica (and low in magnesium and iron) Dark colored diabase (mafic) dikes intrude through light colored granite (silicic) at Acadia National Park, Maine. NPS photo by Georgia Hybels. Intermediate rocks are those that have compositions between mafic and silicic. Mafic 45-52 weight % SiO2 Intermediate 52–66 weight % SiO2 Silicic >66 weight % SiO2 Intrusive (Plutonic) Gabbro Diorite Granite Extrusive (Volcanic) Basalt Andesite Rhyolite Rock types have been defined for rocks that have compositions in between the six shown in the chart above. For example, the intrusive rock granodiorite has a composition between diorite and granite. The volcanic basaltic andesite has a composition between basalt and andesite. Dacite and rhyodacite are in between andesite and rhyolite, with rhyodacite having more silica than dacite. Sentinel Rock is the type locality of the Sentinel Granodiorite. Granodiorite is an intrusive (plutonic) rock that is intermediate between Granite and Diorite. Yosemite National Park, California. NPS image by Greg Stock. Ultramafic (those with less silica and more iron and magnesium than mafic rocks) plutonic rocks such as dunite, peridotite, and pyroxenite are found in some national parks like Great Smoky Mountains and Kenai Fjords national parks. Ultramafic volcanic rocks are extremely rare, and are not found in any NPS unit. Other terms (such as basic, acidic, felsic, etc.) that generally describe the composition of igneous rocks exist, some of which are older terms and have fallen out of use by many American geologists. Related Links Intrusive rocks are classified on the proportion of major minerals in them, particularly the relative amounts of quartz, alkali-feldspar, and plagioclase. Mafic and intermediate intrusive rocks also have a significant proportion of minerals that contain iron and magnesium such as olivine, pyroxene, amphibole, and biotite. The different types of mafic intrusive rocks are classified on their relative amounts of olivine, pyroxene, and plagioclase. The minerals found in the three main types of plutonic rocks are: Granite consists mostly of quartz and alkali-feldspar, with relatively minor plagioclase feldspar and mafic minerals (biotite, muscovite and/or amphibole [hornblende]). Diorite consists mostly of plagioclase feldspar, amphibole, and pyroxene. Gabbro consists mostly of pyroxene, olivine, and plagioclase feldspar. The diagram below shows the classification of intrusive igneous rocks in Blue Ridge Parkway and the some of the different types of intrusive rocks beyond the three main types. Rock types are plotted to show the relative amounts of quartz, alkali feldspar, and plagioclase felspar they contain. Because this diagram doesn’t include mafic minerals (olivine and pyroxene), it can’t be used to differentiate the intermediate diorite from the mafic gabbro. (Orange area refers to compositions of units included in the geologic map for Blue Ridge Parkway.) NPS image by Trista L. Thornberry-Ehrlich (Colorado State University). Diagram Showing the Classification of Intrusive Igneous Rocks Triangular shaped diagram shows where rock composition falls between end members (at each corner): quartz, alkali feldspar, and plagioclase feldspar. From top down (quartz-rich to quartz-poor): quartz-rich granitoids (60-100% quartz), then across the triangle from alkali feldspar granite, leucogranite and syenogranite, granite, monzogranite, granodiorite, and tonalite (all 20-60% quartz). Next row down is quartz alkali feldspar syenite, quartz syenite, quartz monzonite, quartz monzodiorite, quartz diorite and quartz gabbro (all 5-20% quartz). Lowest level with almost no quartz content, from alkali feldspar rich to plagioclase feldspar rich is alkali feldspar syenite, syenite, monzonite, monzodiorite, and diorite gabbro norite. Rocks that appear mapped in Blue Ridge Parkway are syenogranite, granite, monzogranite, granodiorite, quartz monzodiorite, quartz monzonite, monzonite, monzodiorite, diorite, and quartz gabbro. Orange area refers to compositions of units included in the GRI GIS data for Blue Ridge Parkway. Numbers refer to the percentage of the mineral constituent (quartz, alkali feldspar, or plagioclase feldspar) in the overall composition of the rock. Numbers 5, 20, and 60 refer to the overall quartz component, whereas numbers 10, 35, 65, and 90 refer to the contribution of plagioclase to the overall composition. The corners represent compositions very rich in the corresponding mineral and poor in the two other minerals, but not necessarily other possible component minerals. NPS image by Trista L. Thornberry-Ehrlich (Colorado State University) following standard International Union of Geological Sciences (IUGS) nomenclature. Volcanic rocks are classified based on their chemical composition as determined by analytical techniques that identify the proportion of major elements found in them. Unlike for plutonic rocks, it is not possible to classify volcanic rocks based on the minerals found in them. Some volcanic rocks contain some crystals (phenocrysts) that grew in the magma chamber prior to eruption, but others contain no crystals at all or are volcanic glass (obsidian). In addition to the mafic (low silica) basalt, and the silicic rhyolite, several subdivisions exist between the two compositional end members. NPS graphic by Allyson C. Mathis. Text diagram showing the relation of rock types between Mafic (on the left) and Silicic (on the right). The rocks are named with their percent by weight of silica (SiO2). From left to right, the rocks listed are: Basalt, 45-52 wt% SiO2; Basaltic Andesite, 52-57 wt% SiO2; Andesite, 57-63 wt% SiO2; Dacite, 63-69 wt% SiO2; Rhyodacite, 69-72 wt% SiO2; Rhyolite, >72 wt% SiO2. Additional types of volcanic rocks are classified based on the amount of other elements such as potassium, sodium, or calcium present in the rock. For example, mafic volcanic rocks with high potassium and sodium are known as trachybasalts. Characteristics and Properties Mafic and silicic rocks have important differences in their characteristics and properties because their composition controls these variables. Two of the most important are melting temperature and viscosity (resistance to flow). Mafic magmas have high melting temperatures and low viscosity. Silicic ones have lower temperatures and high viscosity. Composition also determines what minerals are present in igneous rocks. Mafic rocks contain minerals that are high in magnesium and/or iron such as olivine, pyroxene, amphibole, magnetite, as well as plagioclase feldspar. Quartz (SiO2) cannot form in mafic magmas so this mineral is not found in gabbro or basalt. Feldspars and quartz are the most common minerals in silicic rocks, although these rocks may contain minor amounts of mica (biotite or muscovite), amphibole, magnetite, and other minerals. Mafic Intermediate Silicic Melting Temperature High 1200° C; 2200° F Medium 1000° C; 1800° F Low 700–900° C; 1300–1600° F Viscosity Low Moderate High Common Minerals Olivine, pyroxene, plagioclase feldspar, magnetite Plagioclase feldspar, pyroxene, amphibole, magnetite Potassium feldspar, quartz, mica, amphibole Color Dark Gray or salt-and-pepper Light (However, volcanic glass (obsidian) is dark) Several terms can be used as modifiers when describing compositional rock types, as in “vesicular basalt” or “porphyritic granite.” But some terms can be used alone when the features are characteristic of a single rock type. For example, most pumice is rhyolitic so the composition for this rock type is usually inferred. Similarly, almost all pegmatite has granitic composition. Porphyritic Biotite Granite belonging to the Outer Zone of the Oonatut Granite Complex in Bering Land Bridge National Preserve, Alaska. Porphyritic granite contains a set of crystals that are distinctly larger than the rest of the crystals in the granite. The large crystals are referred to as phenocrysts and the rest of the smaller crystals are referred as the groundmass. Labels indicate examples of some of the different minerals in the granite. NPS photograph by Amanda Lanik. Below are some Rock Types, Parts of Rocks, and Other Descriptors that are most likely to be in common usage. There are many other terms that may be in use, in combination or stand alone, to describe a rock's texture and structure. Rock Types Aplite - A light-colored, fine-grained intrusive igneous rock with sugary texture emplaced at relatively shallow depths beneath Earth’s surface, consisting mostly of feldspar and quartz. Photo (right): An aplite vein within granitic rock. Yosemite National Park, California. Photo by Marli Miller on geologypics.com. Obsidian - Black or dark-colored volcanic glass, usually of rhyolite composition. Basaltic glass is very rare because basalt devitrifies (converts from glass to crystalline material) easily, whereas rhyolite glass does not. Photo (right): Big Obsidian Flow, Newberry Volcano. Newberry National Volcanic Monument, Oregon. Photo by Marli Miller on geologypics.com. Scoria – A very vesicular pyroclastic rock usually of basaltic composition. Photo (right): Lava Cinders at El Malpais National Monument, New Mexico. NPS photo by John Kuehnert. Pumice - A highly vesicular or frothy pyroclastic rock with very low bulk density and thin vesicle walls, usually with rhyolitic composition, formed during some highly explosive eruptions. Photo (right): Airfall pumice. Medicine Lake Volcano, California. Photo by James St. John on Flickr. Pegmatite - An intrusive igneous rock, usually of granitic composition, consisting of exceptionally large interlocking crystals. It commonly occurs in irregular dikes, lenses, and veins, especially at the margins of batholiths, but also as plutons—see Intrusive Rock Types, below. Photo (right): Tourmaline in pegmatitic granite. Crabtree Pegmatite from the Blue Ridge Mountains. Photo by James St. John on Flickr. Groundmass - The finer grained and/or glassy material between the large crystals (phenocrysts) in an igneous rock. Most often used when describing porphyritic volcanic rocks but may be applicable for some plutonic rocks. The groundmass of volcanic rocks may consist of tiny microscopic crystals and/or volcanic glass. Phenocryst - A large crystal in a porphyritic igneous rock. Phenocrysts may be present in some volcanic rocks as well as in intrusive rocks. In volcanic rocks, phenocrysts usually formed in the magma chamber prior to eruption. Naming Basalt Features—Hawaii Volcanoes Example Left image Vesicular Basalt with Olivine, curated collection of Hawaii Volcanoes National Park, Hawaii. Credit: Photo by James St. John on Flickr. Right image Labels added to Vesicular Basalt with Olivine. Credit: Photo by James St. John on Flickr labeled for the NPS by Allyson C. Mathis Aphanitic - The texture of fine-grained igneous rock in which different components are not distinguishable by the unaided eye. Photo (right): Aphantic basalt forms with rapid cooling. Photo by James St. John on Flickr. Pyroclastic – The texture of a rock formed of fragmentary particles (pyroclasts) ejected during highly explosive volcanic eruptions. Pyroclastic means “fire-broken.” See also, Pyroclasts and Pyroclastic Rocks (article). Photo (right): Lava Creek Tuff. Yellowstone National Park, Wyoming, Montana, and Idaho. USGS YVO photo by Ray Salazar (Montana State University). Vesicular - Describes the texture of a rock, especially lava, characterized by abundant vesicles formed as a result of the expansion of gases during the fluid stage of the lava. Pyroclasts such as pumice and scoria also are vesicular. Photo (right): Close-up of vesicular basalt with many air bubbles (vesicles). Craters of the Moon National Monument and Preserve, Idaho. NPS photo by James St. John on Flickr. Porphyritic – The texture of an igneous (volcanic or plutonic) rock that contains large crystals (phenocrysts) in a fine-grained groundmass. Photo (right): Porphyritic rhyodacite, Lassen Volcano National Park, California. Photo by James St. John on Flickr. Intrusive (plutonic) igneous rocks are found in either large bodies (plutons or batholiths) or are thin sheets that either cut across (dikes) or are parallel (sills) to layering in the surrounding rocks. Many intrusive bodies result from the solidification of magma chambers that had been underneath volcanoes and then are later exposed by subsequent erosion. The plutonic rocks in Yosemite, Kings Canyon, and Sequoia national parks are all part of the Sierra Nevada Batholith that formed. Half Dome in Yosemite National Park is a national geoheritage icon that is made of granite solidified from magma tens of millions of years ago. Photo Courtesy of Robert J. Lillie. Other intrusive rocks, especially mafic ones such as gabbros, are found in ophiolite complexes which are sections of oceanic crust that have been uplifted and emplaced onto continental areas through tectonic processes. ► Gabbro Gabbros are found in ophiolite complexes and in some batholiths. These rocks usually have a dark color and contain crystals of pyroxene, olivine, and plagioclase feldspar. Diorite in a roadcut near Rattlesnake Creek in Yosemite National Park, California. NPS photo. Diorite has an intermediate composition and commonly has a “salt and pepper” appearance due to nearly equal amounts of light-colored minerals (plagioclase feldspar) and dark-colored minerals (pyroxene and amphibole). Diorite occurs in association with granite in many large plutons and batholiths, such as in the Sierra Nevada Batholith. National Parks with Diorite ► Granite Granite is the most common type of intrusive rock in continental crust and is by far the most-well known type of intrusive rock. Granite makes up the bulk of most plutons and batholiths. The granites in Yosemite National Park, Mount Rushmore National Memorial, and Acadia National Park are among the most well-known rocks of any national park site. Ancient Precambrian granites are also found at the bottom of Grand Canyon, and in Black Canyon of the Gunnison National Park, where they occur with metamorphic rocks. Granite has a silicic composition, and consists predominantly of alkali feldspar and quartz, with some plagioclase feldspar, and a minor amount of mafic minerals (biotite, muscovite, and/or amphibole). Rock Wren perched on the edge of granite rock. Sequoia and Kings Canyon National Parks, California. Photographer Mandy Holmgren, The Institute for Bird Populations. National Parks with Granite Acadia National Park, Maine—[Geodiversity Atlas] [Park Home] [npshistory.com] Bering Land Bridge National Preserve, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Black Canyon of the Gunnison National Monument, Colorado—[Geodiversity Atlas] [Park Home] [npshistory.com] City of Rocks National Reserve, Idaho—[Geodiversity Atlas] [Park Home] [npshistory.com] Grand Canyon National Park, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Grand Teton National Park, Wyoming—[Geodiversity Atlas] [Park Home] [npshistory.com] Kings Canyon National Park, California—[Geodiversity Atlas] [Park Home] [npshistory.com] Joshua Tree National Park, California—[Geodiversity Atlas] [Park Home] [npshistory.com] Mount Rushmore National Memorial—[Geodiversity Atlas] [Park Home] [npshistory.com] Rocky Mountain National Park, Colorado—[Geodiversity Atlas] [Park Home] [npshistory.com] Sequoia National Park, California—[Geodiversity Atlas] [Park Home] [npshistory.com] Yosemite National Park, California—[Geodiversity Atlas] [Park Home] [npshistory.com] Volcanic rocks are found in at least 89 different units of the National Park System. Volcanic rocks result from volcanic eruptions and include lava flows, pyroclastic rocks, and deposits produced by other volcanic processes such as lahars and landslides. Geologists examining the surface of the McCartys Flow. El Malpais National Monument, New Mexico. Photo courtesy of Larry Crumpler. ► Basalt Photographs of basalt from Petroglyph National Monument, New Mexico. The volcanic rock in the monument is basaltic lava, specifically vesicular olivine tholeiite. “Vesicular” describes the texture of the rock, which is characterized by abundant vesicles (cavities) formed by the expansion of gases. NPS photo by by Chanteil Walter (Petroglyph National Monument). Basalt is the most common type of volcanic rock found on Earth. It is typically dark in color and is commonly vesicular, and has either an aphanitic or porphyritic texture. Basalt most often occurs as lava flows that travel great distances or as lava pillows formed in subaqueous eruptions. Scoria and cinders also usually have basaltic compositions. Most shield volcanoes are made up of basaltic lavas and most cinder cones are formed during mildly explosive eruptions of basaltic compositions. Basaltic magmas also may be erupted during phreatomagmatic (hydrovolcanic) eruptions that form maars and tuff rings. Composition: Mafic. 45-52 wt% SiO2 Viscosity: Low Main Minerals: Plagioclase feldspar, pyroxene, and olivine Eruption Types: Effusive, Severe, and sometimes Explosive (VEI 0-2): Hawaiian, Strombolian. Volcano Types: Shield Volcanoes, Cinder Cones, Fissure Volcanoes, Monogenetic Volcanic Fields, Maars and Tuff Rings, Composite Volcanoes. National Parks with Basalt El Malpais National Monument, New Mexico—[Geodiversity Atlas] [Volcanic Resources Summary] [Park Home] [npshistory.com] Grand Canyon National Park, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Grand Canyon-Parashant National Monument, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Haleakalā National Park, Hawaii—[Geodiversity Atlas] [Park Home] [npshistory.com] Hawai'i Volcanoes National Park, Hawai'i—[Geodiversity Atlas] [Park Home] [npshistory.com] Isle Royale National Park, Michigan—[Geodiversity Atlas] [Park Home] [npshistory.com] Kalaupapa National Historical Park, Hawai'i—[Geodiversity Atlas] [Park Home] [npshistory.com] Kaloko-Honokohau National Historical Park, Hawai'i—[Geodiversity Atlas] [Park Home] [npshistory.com] Keweenaw National Historic Park, Michigan—[Geodiversity Atlas] [Park Home] [npshistory.com] Lake Mead National Recreation Area, Arizona and Nevada—[Geodiversity Atlas] [Park Home] [npshistory.com] Lake Roosevelt National Recreation Area, Washington—[Geodiversity Atlas] [Park Home] [npshistory.com] Lava Beds National Monument, California—[Geodiversity Atlas] [Park Home] [npshistory.com] Petroglyph National Monument, New Mexico—[Geodiversity Atlas] [Park Home] [npshistory.com] Pu'uhonau o Honaunau National Historic Park, Hawai'i—[Geodiversity Atlas] [Park Home] [npshistory.com] Pu'ukohola Heiau National Historic Site, Hawai'i—[Geodiversity Atlas] [Park Home] [npshistory.com] Saint Croix National Scenic Riverway, Wisconsin and Minnesota—[Geodiversity Atlas] [Park Home] [npshistory.com] Shenandoah National Park, Virginia—[Geodiversity Atlas] [Park Home] [npshistory.com] Sunset Crater Volcano National Monument, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Voyageurs National Park, Minnesota—[Geodiversity Atlas] [Park Home] [npshistory.com] Yellowstone National Park, Wyoming—[Geodiversity Atlas] [Park Home] [npshistory.com] Andesite and other intermediate lavas are one of the main components of composite volcanoes. Andesitic lavas can sometimes travel great distances, but they make thicker flows than basalt. Many of the lahar deposits associated with composite volcanoes have andesitic composition. Composition: Intermediate. 52–63 wt% SiO2 Viscosity: Intermediate Main Minerals: Plagioclase feldspar, pyroxene, and amphibole Eruption Types: Effusive, Severe, Explosive, and Catastrophic (VEI 0-3): Strombolian, Vulcanian. Volcano Types: Composite Volcanoes, Shield Volcanoes. Andesite from a lava flow on Brokeoff Volcano, Lassen VolcanicNational Park, California. USGS photo. Aniakchak National Monument, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Big Bend National Park, Texas—[Geodiversity Atlas] [Park Home] [npshistory.com] Crater Lake National Park, Oregon—[Geodiversity Atlas] [Park Home] [npshistory.com] John Day Fossil Beds National Monument, Oregon—[Geodiversity Atlas] [Park Home] [npshistory.com] Katmai National Park, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Lake Clark National Park and Preserve, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Lassen Volcanic National Park, California—[Geodiversity Atlas] [Park Home] [npshistory.com] Mount Rainier National Park, Washington—[Geodiversity Atlas] [Park Home] [npshistory.com] Organ Pipe Cactus National Monument, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Pinnacles National Monument, California—[Geodiversity Atlas] [Park Home] [npshistory.com] Saguaro National Park, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Wrangell-St. Elias National Park and Preserve, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Yellowstone National Park, Wyoming—[Geodiversity Atlas] [Park Home] [npshistory.com] Dacites are found in lava domes and in composite volcanoes. Some highly explosive eruptions that form pyroclastic flows are of dacitic composition. Dacitic lava flows are very short and stubby, and dacitic domes are common. Composition: Silicic: 63–69 wt% SiO2 Viscosity: High Main Minerals: Plagioclase feldspar, quartz, and amphibole Eruption Types: Effusive (for lava domes) (VEI 0), Cataclysmic to Mega-colossal (VEI 4-7): Sub-Plinian, Plinian. Volcano Types: Lava Domes, Composite Volcanoes A dacite boulder near the summit of Lassen Peak. Lassen Volcanic National Park, California. NPS photo. Aniakchak National Monument, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Bandelier National Monument, New Mexico—[Geodiversity Atlas] [Park Home] [npshistory.com] Crater Lake National Park, Oregon—[Geodiversity Atlas] [Park Home] [npshistory.com] Great Basin National Park, Nevada—[Geodiversity Atlas] [Park Home] [npshistory.com] Katmai National Park, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Lake Clark National Park and Preserve, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Lassen Volcanic National Park, California—[Geodiversity Atlas] [Park Home] [npshistory.com] Mount Rainier National Park, Washington—[Geodiversity Atlas] [Park Home] [npshistory.com] Organ Pipe Cactus National Monument, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Pinnacles National Monument, California—[Geodiversity Atlas] [Park Home] [npshistory.com] Saguaro National Park, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Valles Caldera National Preserve, New Mexico—[Geodiversity Atlas] [Park Home] [npshistory.com] Rhyolite may be found in lava domes or even lava flows, but most often in pyroclastic deposits formed either through ash-flow or ash-fall. Large-volume rhyolitic lava flows are known from the Yellowstone National Park region and in and around Fort Davis National Historic Site in the Davis Mountains of Texas. Rhyolitic obsidians may be found in some lava flows or domes. Some of the largest eruptions by volume and the most explosive eruptions are of rhyolitic magmas, especially at resurgent calderas like at Yellowstone or Valles Caldera National Preserve where thick ignimbrites (pyroclastic flow deposits) are found. Composition: Low silica: >72 wt% SiO2 Viscosity: Very high Main Minerals: Alkali feldspar, quartz, plagioclase feldspar, and amphibole or mica (muscovite or biotite Eruption Types: Effusive (for lava domes) (VEI 0), Colossal to Apocalyptic (VEI 6-8): Plinian, Utra-Plinian. Volcano Types: Composite Volcanoes, Lava Domes, Explosive Calderas (Resurgent and Summit Calderas) Porphyritic rhyolite (Pleistocene), curated collection of Yellowstone National Park, Wyoming. Photo by James St. John on Flickr. National Parks with Rhyolite Aniakchak National Monument, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Bandelier National Monument, New Mexico—[Geodiversity Atlas] [Park Home] [npshistory.com] Big Bend National Park, Texas—[Geodiversity Atlas] [Park Home] [npshistory.com] Chiricahua National Monument, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Coronado National Monument, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Crater Lake National Park, Oregon—[Geodiversity Atlas] [Park Home] [npshistory.com] Fort Davis National Historic Site, Texas—[Geodiversity Atlas] [Park Home] [npshistory.com] Gila Cliff Dwellings National Monument, New Mexico—[Geodiversity Atlas] [Park Home] [npshistory.com] John Day Fossil Beds National Monument, Oregon—[Geodiversity Atlas] [Park Home] [npshistory.com] Katmai National Park, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Lake Clark National Park and Preserve, Alaska—[Geodiversity Atlas] [Park Home] [npshistory.com] Organ Pipe Cactus National Monument, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Saguaro National Park, Arizona—[Geodiversity Atlas] [Park Home] [npshistory.com] Valles Caldera National Preserve, New Mexico—[Geodiversity Atlas] [Park Home] [npshistory.com] Yellowstone National Park, Wyoming—[Geodiversity Atlas] [Park Home] [npshistory.com]