



**SNS COLLEGE OF TECHNOLOGY**  
**(AN AUTONOMOUS INSTITUTION)**  
**COIMBATORE-35**

**II BE / III SEMESTER**

**UNIT III**

**19CET201-ENGINEERING GEOLOGY**



# SYLLABUS

**Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Sandstone, Limestone, Shale, Quartzite**



# PETROLOGY

- *Is a branch of geology, which deals with study of rocks (Petro=rock, Logos=study)*

## ROCKS

### IGNEOUS

- most abundant
- primary rocks
- source is magma or lava

### SEDIMENTARY

- thin veener above the Sial and Sima in Oceanic and Continental Crusts
- secondary rocks

### METAMORPHIC

- proportion is similar to that of Igneous rocks
- change of forms of Ig. And Sed. Due to Temperature, Pressure and Chemical Fluids



# Importance of petrology in civil Engg.

It provides an opportunity to interpret the physical properties of individual rocks, likewise: texture, structure, mineral composition, chemical composition etc.



- This helps in knowing the *strength, durability, colour, appearance, workability* etc.



- These properties are very important for CE to know because different rocks are suitable for different purposes and no rock is ideal or best suited for all purpose.



**Granite:** hard, competent, durable => suitable for foundation

**Limestone:** comparatively soft=> best for flooring

**Marble:** soft and attractive=> flooring/sculpturing etc.

**Sandstone:** sculpturing, wall etc.



**VOLCANO:** A gap in the Earth's Crust where molten rocks and other material escape onto the Earth's surface

**IGNEOUS ROCKS:** The rocks formed through volcanic action OR  
The rocks which are derived from a molten mass "magma or lava"

## SOURCE OF IGNEOUS ROCKS:

### **Magma:**

Molten mass comprising most abundant elements in earth – Si, Al, Fe, Ca, Mg, K, H & O. Where the  $\text{SiO}_2$  is most abundant amongst all.

Temperature of Magma- **1040<sup>0</sup> to 1200<sup>0</sup> C**



# BROAD CLASSIFICATION OF IGNEOUS ROCKS

**Volcanic rocks**  
**(Extrusive rocks)**  
-Lava or Magma flows  
-Pyroclastic flows

**Intermediate rocks**  
**(Hypabyssal rocks)**

**Plutonic rocks**  
**(Intrusive rocks)**  
-dykes, sills, batholiths,  
laccoliths etc.

Name comes  
from Greek god  
of the underworld  
- Pluto



# FORMS OF VOLCANIC ROCKS

→ Extrusive (volcanic) igneous rocks form when molten rock erupts from Earth's interior through a volcano or fissure and cools rapidly at the surface in form of Lava and hence it does not have any specific shape

**Lava flows:** On eruption lava simply flows on the surface and on the basis of surface appearance, lava flows are described as blocky lava and ropy lava





# CLASSIFICATION OF ROCKS

- ❑ Igneous,
- ❑ Sedimentary and
- ❑ Metamorphic Rocks

## ***TYPES OF ROCKS***

<b><i>IGNEOUS</i></b>	<b><i>SEDIMENTARY</i></b>	<b><i>METAMORPHIC</i></b>				
 Granite	 Scoria	 Sandstone	 Limestone	 Marble	 Slate	
 Pumice	 Obsidian	 Shale	 Conglomerate	 Gypsum	 Quartzite	 Gneiss



# IGNEOUS, SEDIMENTARY VS METAMORPHIC ROCKS

The main difference between Igneous, Sedimentary and Metamorphic rocks, is the way that they are formed, and their various textures.

Read more: <http://www.differencebetween.net/science/nature/difference-between-igneous-sedimentary-and-metamorphic-rocks/#ixzz78y13PErV>



# GRANITE

- **Granite** is a coarse-grained igneous rock composed mostly of quartz, alkali feldspar, and plagioclase.
- It forms from magma with a high content of silica and alkali metal oxides that slowly cools and solidifies underground.
- It is common in the continental crust of Earth, where it is found in igneous intrusions.
- These range in size from dikes only a few inches across to batholiths exposed over hundreds of square kilometers."



# INTRUSION



Volcanic Neck



Batholith

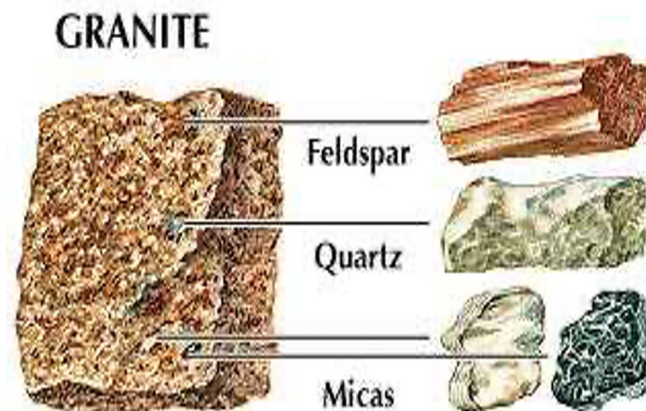


Dikes



# DESCRIPTION

- ❑ The word "granite" comes from the Latin *granum*, a grain, in reference to the coarse-grained structure of such a completely crystalline rock.
- ❑ Granitic rocks mainly consist of feldspar, quartz, mica, and amphibole minerals, which form an interlocking, somewhat equigranular matrix of feldspar and quartz with scattered darker biotite mica and amphibole (often hornblende) peppering the lighter color minerals.





# DESCRIPTION



Equigranular matrix



Amphibole



phenocrysts



# DESCRIPTION

- Occasionally some individual crystals (phenocrysts) are larger than the groundmass, in which case the texture is known as porphyritic.
- A granitic rock with a porphyritic texture is known as a granite porphyry.
- Granitoid is a general, descriptive field term for lighter-colored, coarse-grained igneous rocks.
- Petrographic examination is required for identification of specific types of granitoids. Granites can be predominantly white, pink, or gray in color, depending on their mineralogy.



# OCCURRENCE

- ❖ Granitic rock is widely distributed throughout the continental crust. Much of it was intruded during the Precambrian age; it is the most abundant basement rock that underlies the relatively thin sedimentary veneer of the continents.
- ❖ Outcrops of granite tend to form tors, domes or bornhardts, and rounded massifs.
- ❖ Granites sometimes occur in circular depressions surrounded by a range of hills, formed by the metamorphic aureole or hornfels.
- ❖ Granite often occurs as relatively small, less than 100 km<sup>2</sup> stock masses (stocks) and in batholiths that are often associated with orogenic mountain ranges.
- ❖ Small dikes of granitic composition called aplites are often associated with the margins of granitic intrusions. In some locations, very coarse-grained pegmatite masses occur with granite





Outcrop



Bornhardt



Hornfels



Batholith



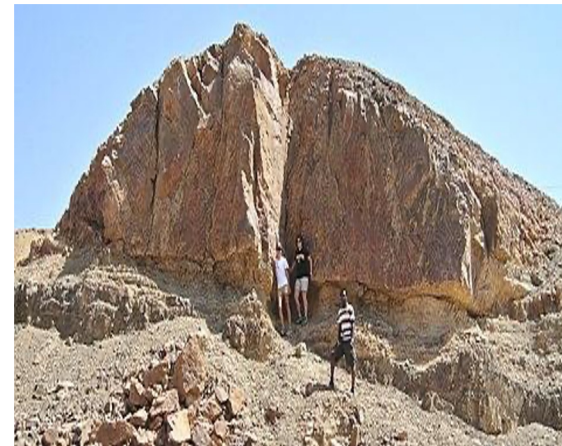
Aplites



Dikes



Pegmatite



Stocks



# PHYSICAL PROPERTIES

- The average density of granite is between 2.65 and 2.75 g/cm<sup>3</sup> (165 and 172 lb/cu ft), its compressive strength usually lies above 200 MPa, and its viscosity near STP is 3–6·10<sup>20</sup> Pa·s.
- The melting temperature of dry granite at ambient pressure is 1215–1260 °C (2219–2300 °F); it is strongly reduced in the presence of water, down to 650 °C at a few k Bar pressure.
- Granite has poor primary permeability overall, but strong secondary permeability through cracks and fractures if they are present.



# DISTRIBUTION

India is known to have a rich abundance of granite deposits and other natural stones.

In fact, it is consider one of the leading granite exporters in the world.

Experts claim that there are over 100 different varieties of granites found in the country that vary distinctively in their color and texture.



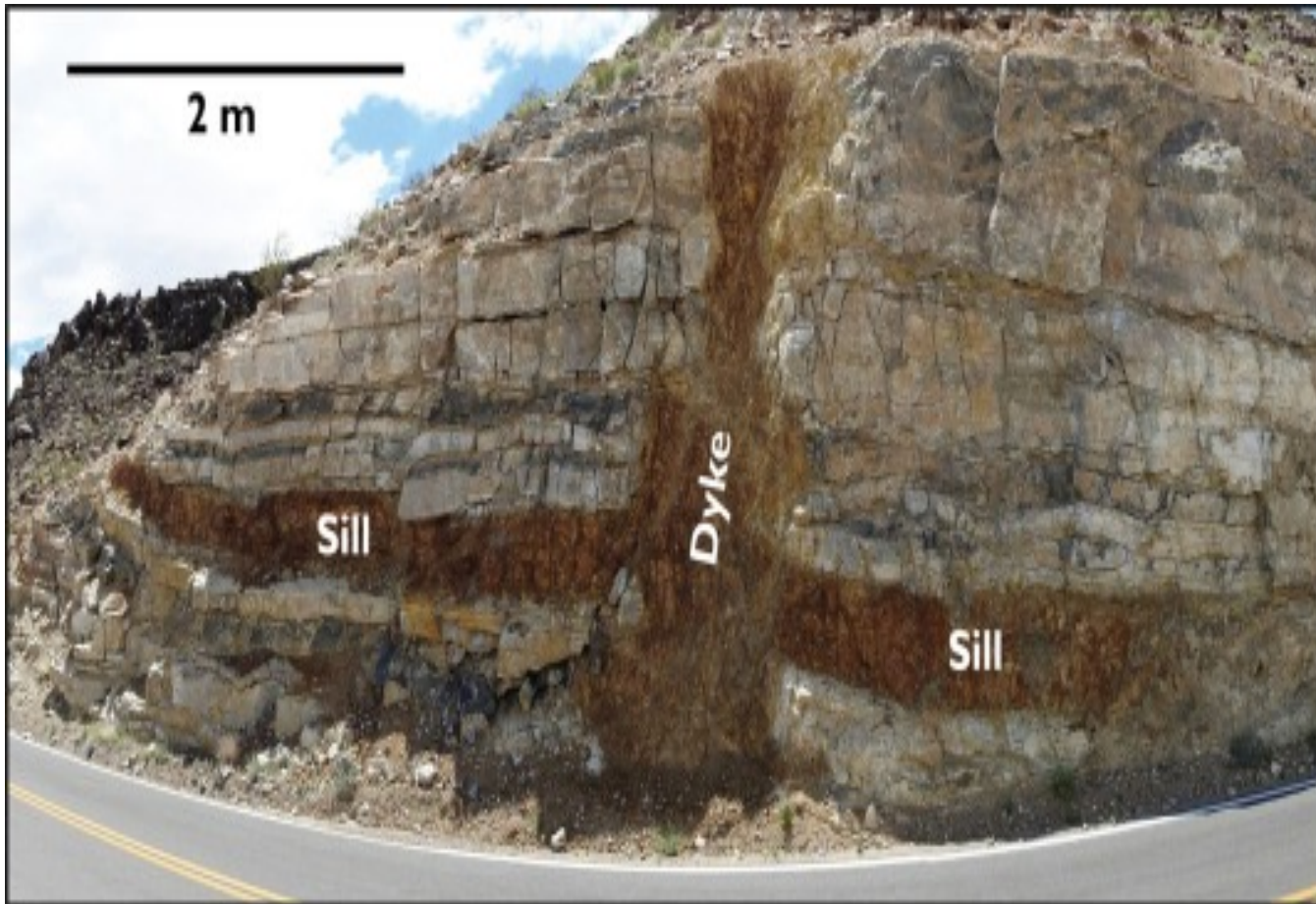
# USES

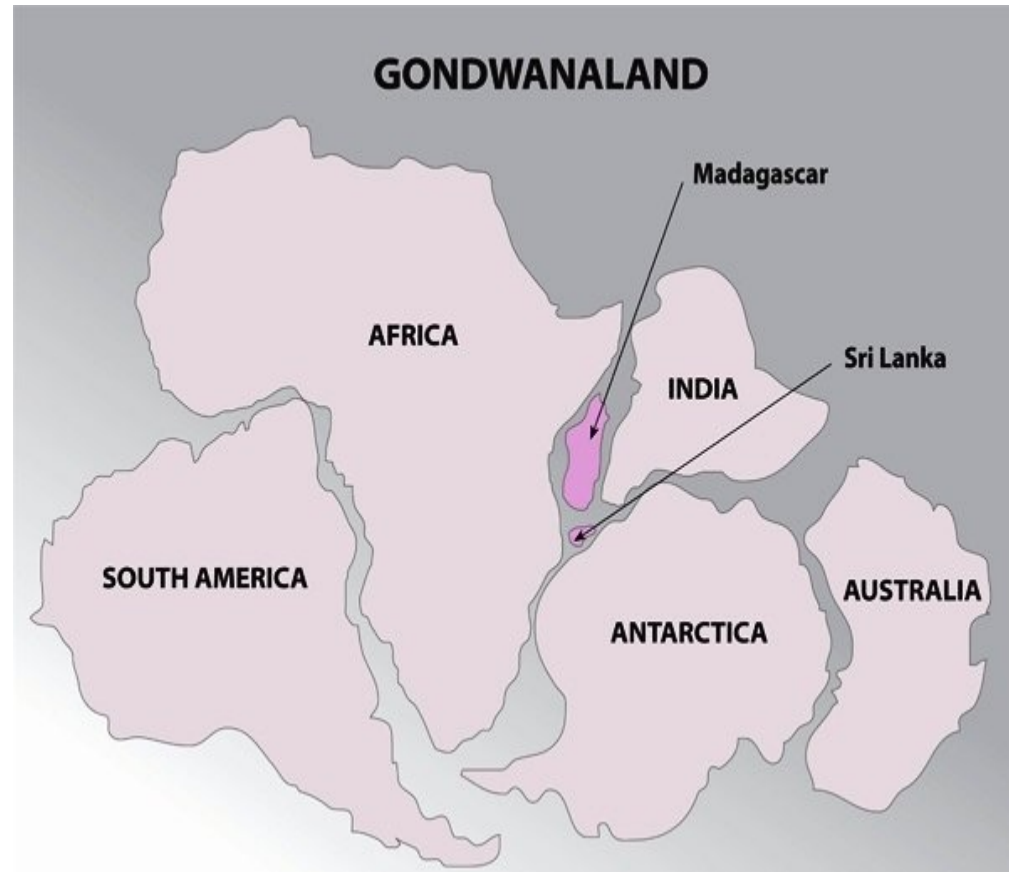
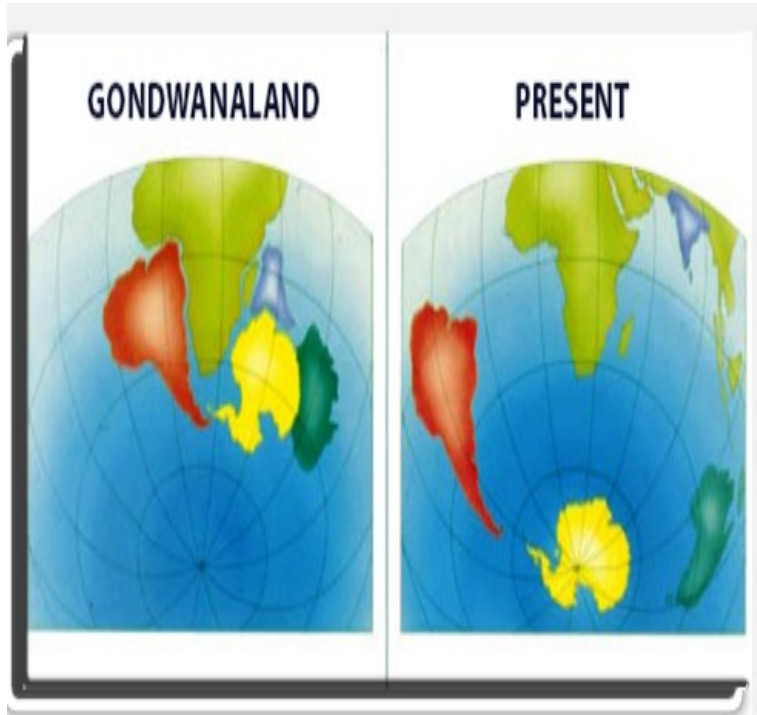
- ❖ These stones are largely used to build monuments, buildings, tiles, and surface plates etc.
- ❖ Due to the innate beauty and toughness, Indian granite stones outperform their counterparts against a wide range parameters.
- ❖ Granite is the most prominent material in this sector, for the export sectors like monuments, flooring slab, kitchen countertops, sculptures and exports.



# DOLERITE

- Dolerite is an **igneous rock**, that is, rock initially molten and injected as a fluid into older sedimentary rocks
- Dolerite sills and dykes are intrusions of igneous rock formed by **molten magma from the Earth's mantle, which forced its way to the surface through cracks in the rock layers**. Cracks may form when there is tension in the Earth's surface, e.g. the break-up of Gondwanaland.









# DOLERITE





# TEXTURES

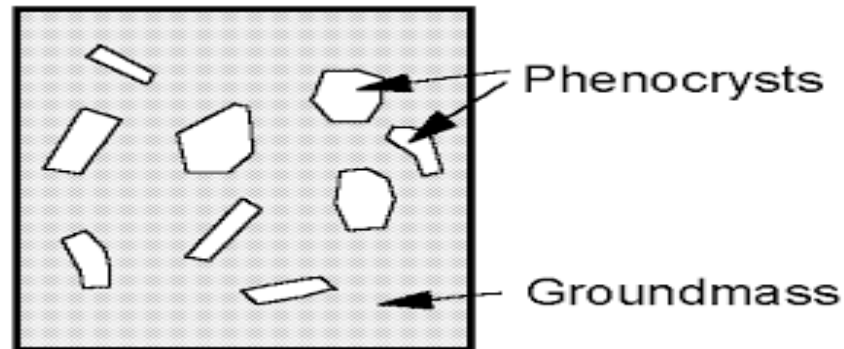
- ❖ **Ophitic texture** laths of plagioclase in a coarse grained matrix of pyroxene crystals, where in the plagioclase is totally surrounded by pyroxene grains. This texture is common in diabases and gabbros.





# TEXTURES

- ❖ **Subophitic texture:** similar to ophitic texture where in the plagioclase grains are not completely enclosed in a matrix of pyroxene grains
- ❖ **Porphyritic Texture:** Minerals formed at different temperatures  
Large crystals (phenocryst) are embedded in a matrix of smaller crystals (groundmass)





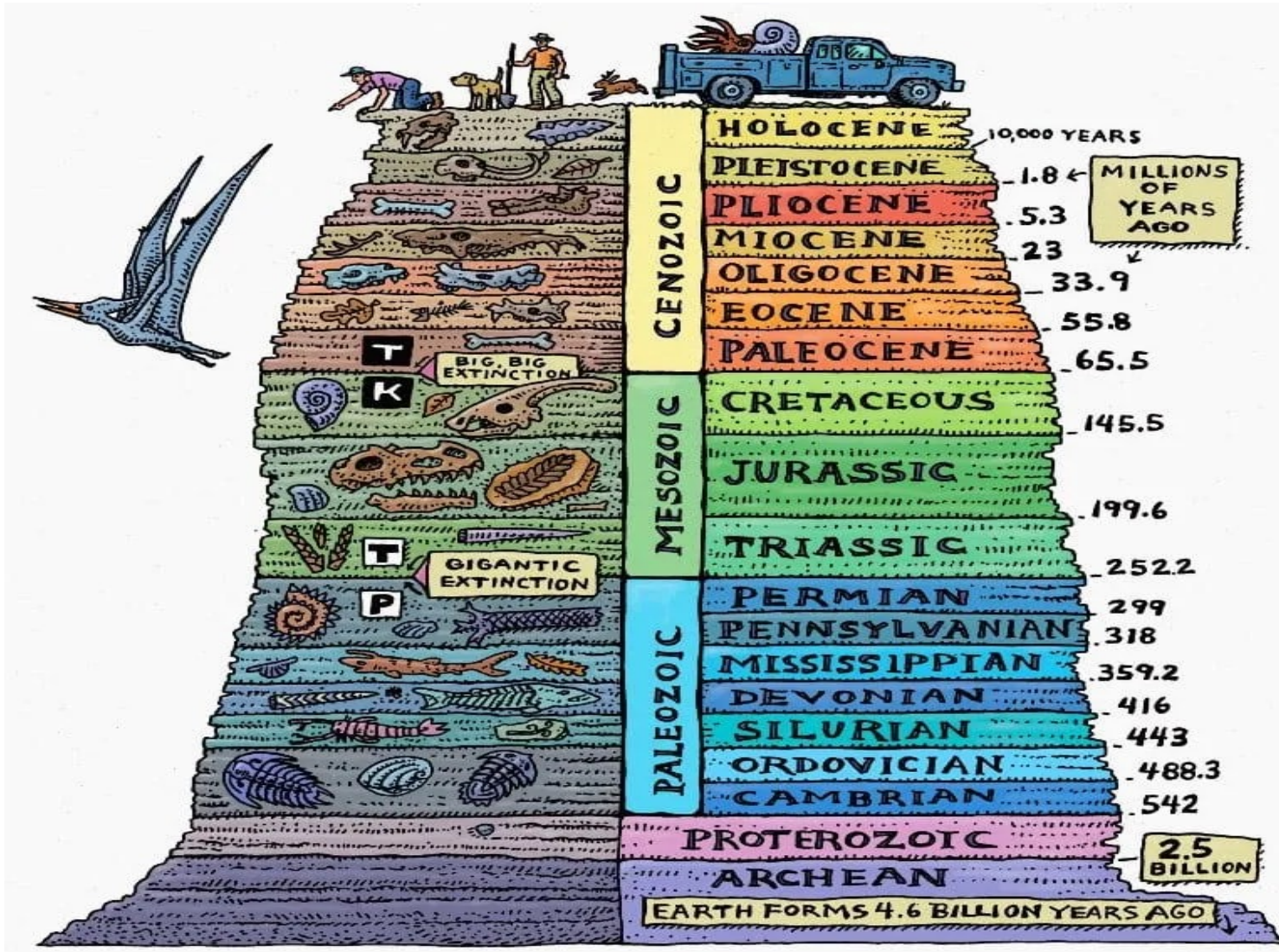
# DISTRIBUTION

- ❖ **Tholeiitic dolerite** - occur in karroo of South Africa and those of Tasmania and Antarctica were intruded.
- ❖ **Alkali dolerites** - occur in Scotland particularly in where they may form large sills. Midlands of England, as at Rowley Regis, near Birmingham; in the Clee hills, Shropshire and Derbyshire.



In geological timescale this Karoo dolerite intruded approximately 83 million years ago during the Mesozoic era







# USES

- ❑ Diabase is crushed and used as a construction aggregate for road beds, buildings, railroad beds (rail ballast), and within dams and levees.
- ❑ Diabase can be cut for use as headstones and memorials; the base of the Marine Corps War Memorial is made of black diabase "granite" (a commercial term, not actual granite).
- ❑ Diabase can also be cut for use as ornamental stone for countertops, facing stone on buildings, and paving. A form of dolerite, known as bluestone, is one of the materials used in the construction of Stonehenge



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A dolerite pillar in the organ pipe, Tasmania, Australia



# Marine Corps War Memorial





# CONCLUSION

- A dolerite is the medium-grained equivalent of a basalt - a basic rock dominated by plagioclase and pyroxene.
- One of its distinguishing character is its ophitic texture.
- Dolerite is typically found as a hypabyssal igneous rock, typically within dykes, however, it may also occur in sills.
- Tholeiitic dolerite and alkali dolerite are the two types









## 5 FAMOUS MONUMENTS MADE FROM GRANITE

Here are some of the most famous monuments made from granite.



**MOUNT RUSHMORE**  
IN SOUTH DAKOTA



**BRIHADEESWARAR TEMPLE**  
IN INDIA



**AVUKANA BUDDHA STATUE**  
IN SRI LANKA



**DIANA, PRINCESS OF WALES  
MEMORIAL FOUNTAIN**  
IN LONDON



**VIETNAM VETERANS  
MEMORIAL**  
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# THANK YOU..

