

Promotional

brochures

Yemen Geological Survey and Mineral Resources Board



perlite

البرلايت

Yemen Geological Survey and Mineral Resources Board



Definition

Perlite is a generic name for an amorphous volcanic alumina-silicate rock that expands by a factor of 4-20 when rapidly heated to 760-980 C and has a relatively high-water content (2-5%) typically formed by the hydration of obsidian.

Physical properties

- Jet-black to grey color.
- Bulk density (ore 1,100Kg/m<sup>3</sup> or 30Kg/m<sup>3</sup> for expanded perlite.
- Hardness range 5.5-7 on Moho scale.



Characteristics

- Thermal and sound insulation.
- Uses in many applications.
- Great reserves.

Applications

- In the agriculture fields.
- As insecticide
- Chemical container.
- Oil well drilling.
- Foundry industry.
- Filtration.
- Thermal and sound insulations.
- Some porcelain industry.

Chemical Composition(%)

SiO <sub>2</sub>	67.57-74.98	K <sub>2</sub> O	2.99-5.10
Al <sub>2</sub> O <sub>3</sub>	11.02-12.04	CaO	0.09-1.89
F <sub>2</sub> O <sub>3</sub>	1.32-2.80	TiO <sub>2</sub>	0.0-0.51
L.O.I	2.21-4.82	Na <sub>2</sub> O	1.53-4.64



# Black sands

## الرمال السوداء

Yemen Geological Survey and Mineral Resources Board



### Definition

Are sedimentary deposits (placer deposits) of heavy minerals that accumulate with sand, silt, and clay in coastal and beach environments, it has black color, consisting of heavy minerals from magnetite, Ilmenite, zircon, Xenotime, garnet, olivine, pyroxene, monazite. ect.

- Specific gravity > 2.89.
- Sources for titanium, rutile, zircon and ree.

### Physical properties

### Characteristics

- Average grade of heavy minerals up to 15%
- Contains 0.08-1.38%Ilmenite,0.18-0.32 %zircon,0.03-0.10%rutile and 1.36-1.52%magnetic mineral.
- Great reserves.
- Easy of accessible and exploitation by surface and open bit mining.

- Defense industries, aircraft and spaceships structures and engines.
- Source for rare earth elements (REE).
- Advanced technology and refractories.
- Medical industries.
- Glass and ceramic industry.
- Abrasive paper.
- Paint industry.
- Foundry industry
- Many other industrial fields.

### Applications

### Chemical Composition(%)

Minerals	Formula	Wt%
Ilmenite	FeTiO <sub>3</sub>	0.08-1.38
Rutile	TiO <sub>2</sub>	0.03-0.10
Zircon	ZrSiO <sub>4</sub>	0.18-0.32
Garnet	FeAlSiO <sub>9</sub>	---
Magnetite	Fe <sub>3</sub> O <sub>4</sub>	1.36-1.52
Monazite	REE Th, U phosphate	---





Definition

It is a term given to a large group of minerals made mainly of aluminum silicate which contain different proportions of potassium, sodium and calcium as main oxides. Its main types are potash spar, soda spar, anorthite feldspar.

Physical properties

- Hardness (6-6.5) on Moho scale.
- Specific gravity (2.5-2.8).
- Multi-colored (white, grey, red, yellow, meaty or rose, buff brown ...ect)
- Semitransparent.
- Melting point range between 1,100-1,500°C



Characteristics

- Great reserves.
- There are different types.
- Suitable for use in various industrial fields.
- Easy of accessible and exploitation by surface and open bit mining.

Applications

- Glass and ceramic industry.
- Pottery and bone ceramics industry.
- As abrasive and glazing material.
- Refractory and welding electrode.
- Filler in paints, rubber, plastic and batteries.
- Dentistry (teeth industry).
- As flux agent in steel alloy industry.

Chemical Composition(%)

SiO <sub>2</sub>	67.64- 76.86	K <sub>2</sub> O	1.92-12.78
Al <sub>2</sub> O <sub>3</sub>	10.70-20.39	CaO	0.47
F <sub>2</sub> O <sub>3</sub>	0.06-2.00	TiO <sub>2</sub>	0.04
MgO	0.04	Na <sub>2</sub> O	1.18-12.78





Definition

It is the sedimentary rock known as sandstone, which consists of unconsolidated quartz grains it contains a high percentage of silicon dioxide (SiO<sub>2</sub>) up to greater than 98% and few impurities of iron oxides, feldspar and kaolinite.



Physical properties

- Hardness (Quartz) 7 on Moho scale.
- Specific gravity 2.23.
- Melting point 1,410°C.
- Boiling point 2,225°C.
- Transparent to semitransparent.

Characteristics

- Contains high percentage of SiO<sub>2</sub>.
- Great reserves.
- Easy of accessible and exploitation by surface and open bit mining.

Applications

- Main raw material for manufacture of various types of glass.
- Ceramic industry.
- Silicone fiber glass, Optical fiber glass, silicon element and silica gel production.
- Solar cell industry.
- Adhesive.
- Blasting sand and frac sand in oil wells.
- Foundry industry.
- High-frequency oscillator.
- Chemical industries (Silicon carbide, Sodium silicate Silicon nitride, ect)
- Many other uses field.

Chemical Composition(%)

SiO <sub>2</sub>	99.70-88.78	K <sub>2</sub> O	-
Al <sub>2</sub> O <sub>3</sub>	12.20-0.04	CaO	-
F <sub>2</sub> O <sub>3</sub>	0.90-0.04	TiO <sub>2</sub>	0.90-0.03
L.O. I	-	Na <sub>2</sub> O	-



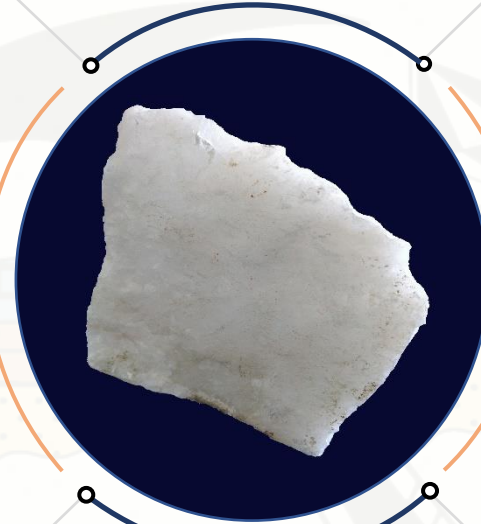


Definition

It is silicate industrial mineral that consists mainly of silicon dioxide (SiO<sub>2</sub>), with percentage range between 97-100% it sometimes contains a few impurities of iron oxides.

Physical properties

- Hardness 7 on Moho scale.
- Specific gravity 2.65.
- Transparent to semitransparent.
- Color often white.
- Piezoelectric properties.



Characteristics

- Contains high percentage of SiO<sub>2</sub> and few impurities.
- Great reserves.
- Easy of accessible and exploitation by surface and open bit mining.

Applications

- Glass and ceramic industry.
- Elemental silicon production.
- Manufacturing microprocessor chips in electronics.
- Solar cell industry.
- Silicon alloy industry.
- Electrical and optical equipment's industry.
- Chemical industries (Silicon carbide, Sodium silicate, Silicon nitride .... ect)
- Many other uses field.

Chemical Composition (%)

SiO <sub>2</sub>	98.40-96.10	K <sub>2</sub> O	0.5-0.01
Al <sub>2</sub> O <sub>3</sub>	0.82-0.09	CaO	1.12-0.27
F <sub>2</sub> O <sub>3</sub>	0.31-0.01	TiO <sub>2</sub>	0.08-0.01
L.O.I	-	Na <sub>2</sub> O	0.18-0.01



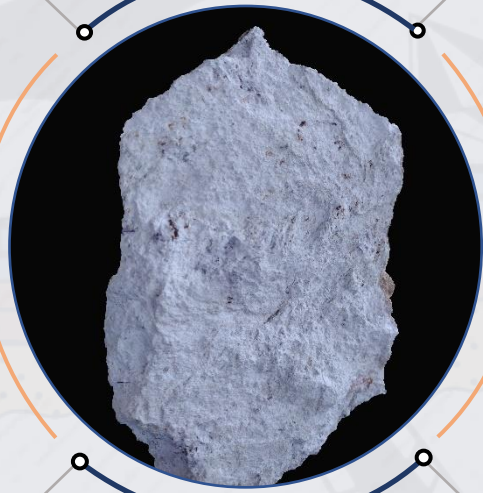


Definition

Kaolin is called in commercially the China clay, it is the clay mineral consists mainly of hydrated aluminum silicates that called Kaolinite, which is the white clay.

Physical properties

- Hardness: 2-2.5 on Moho scale.
- Specific gravity :2.5-2.65.
- Fine grained, often white in color, gradually gray then yellow.
- High melting point:1,785°C.
- Dry shrinkage at 110°C is 14%.
- PH :4-9.



Characteristics

- Contains high percentage of Al<sub>2</sub>O<sub>3</sub> and few impurities from Quartz.
- Great reserves.

Applications

- Ceramic industry.
- Filler in Paper, paints, rubber and plastic industry.
- Soaps and detergents industry.
- Adhesives and sealant.
- Source for Al metals.
- Cosmetics and pharmaceutical industry.
- Refractory and other uses.

Chemical Composition (%)

SiO <sub>2</sub>	47.9	59.65	K <sub>2</sub> O	0.5	0.28
Al <sub>2</sub> O <sub>3</sub>	32.7	28.18	CaO	0.8	0.45
F <sub>2</sub> O <sub>3</sub>	3.2	2.72	TiO <sub>2</sub>	1.3	0.50
L.O.I	11.3	7.05	P <sub>2</sub> O <sub>5</sub>	0.5	0.55

بعد الفصل

قبل الفصل



# Fluorite

## الفلوريت

Yemen Geological Survey and Mineral Resources Board

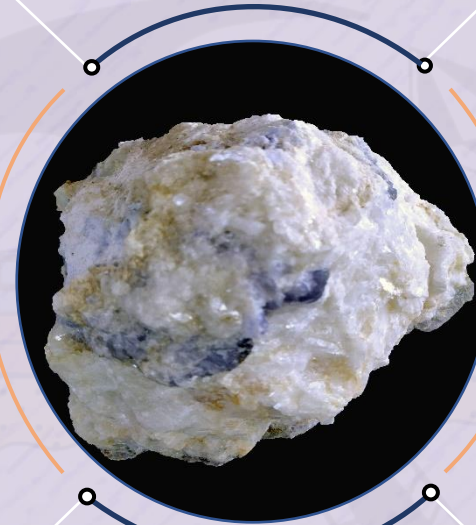


### Definition

It is a natural calcium fluoride ( $\text{CaF}_2$ ) and is considered the most common fluorine mineral and is also called fluorspar.

### Characteristics

- Contains high percentage fluorine 48.9%F.
- Easy of accessible and exploitation by artisan mining method.



Chemical Composition(%)

$\text{SiO}_2$	5.22	$\text{MgO}$	1.34
$\text{Al}_2\text{O}_3$	0.48	$\text{CaO}$	50.44
$\text{F}_2\text{O}_3$	1.01	$\text{P}_2\text{O}_5$	0.15
L.O.I	7.38	F	33.78

### Physical properties

- Multiple colors, including green to violet, through yellow to colorless.
- Hardness :4 on Moho scale.
- Specific gravity: 3.18.
- Melting point: 1,360°C.
- Fluorescence.
- Glassy luster.

### Applications

- Acid grade for hydrofluoric acid, fluorine and Cryolite production.
- Metallurgical grade in the Uranium, Aluminum, Niobium/Tantalum recovery.
- Many chemical compounds industry.
- As a refrigerated agent and solvent material.

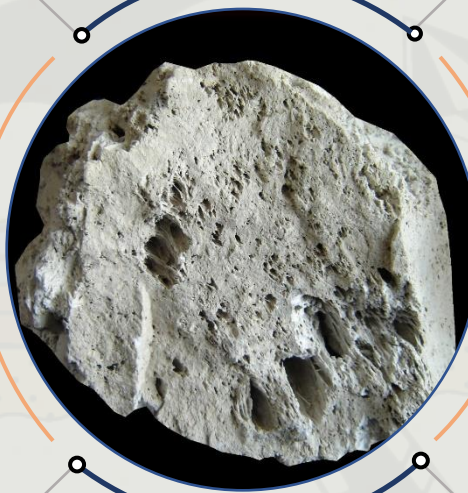


Definition

It is volcanic acidic rock light in color (white to gray) which have cellular structure resulting from gas leakage during the volcanic eruption making it lightweight and floating on water.

Physical properties

- Glassy texture - low density: < 1g/cm<sup>3</sup>)
- Hardness: range 2-2.5 on Moho scale.
- Lightweight.
- Durability.
- High porosity.
- Heat and sound insulation.



Characteristics

- Great reserves.
- Suitable for use in many industrial and construction fields.
- Easy of accessible and exploitation by surface and open bit mining.

Applications

- Abrasive materials industry.
- Toothpaste making.
- Lightweight aggregate.
- Thermal and sound insulations.
- Pozzolanic cement industry
- Many other of uses.

Chemical Composition(%)

SiO <sub>2</sub>	74.21-58.40	K <sub>2</sub> O	4.72-3.23
Al <sub>2</sub> O <sub>3</sub>	11.44 -7.59	CaO	7.81-0.01
F <sub>2</sub> O <sub>3</sub>	5.00-1.84	TiO <sub>2</sub>	0.47-0.07
L.O. I	10.89-1.31	Na <sub>2</sub> O	7.06-3.62



# Scoria

## الاسكوريا

Yemen Geological Survey and Mineral Resources Board

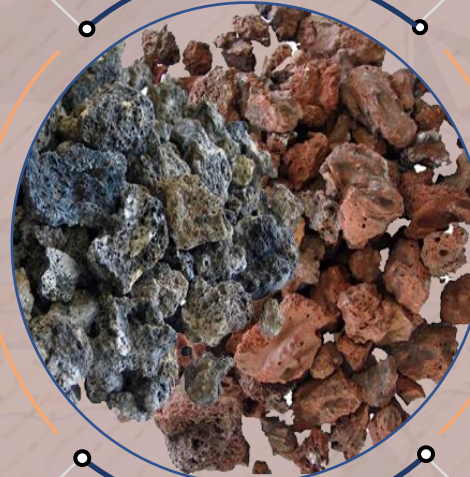


### Definition

Scoria is a pyroclastic, highly vesicular, dark-colored volcanic rock formed by eruption volcanoes as a molten blob and cooled in the air to form scoria as discrete grains called clasts and have basaltic or andesitic in composition.

- low density: 0.7-1.5 g/cm<sup>3</sup>.
- Thermal and sound insulation.
- Lightweight.
- Durability.
- High porosity.

### Physical properties



### Characteristics

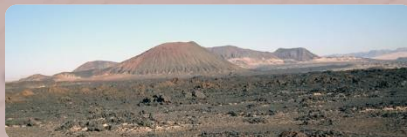
- Great reserves.
- Suitable for use in many construction fields.
- Easy of accessible and exploitation by surface and open bit mining.

- Cement industry.
- lightweight aggregate.
- Brick production
- Thermal insulation material.
- Many other of uses.

### Applications

### Chemical Composition(%)

SiO <sub>2</sub>	51.14-37.10	K <sub>2</sub> O	1.75-0.01
Al <sub>2</sub> O <sub>3</sub>	18.40 -11.60	CaO	12.05-7.30
F <sub>2</sub> O <sub>3</sub>	14.70-9.60	MgO	11.70-2.70
L.O. I	-	Na <sub>2</sub> O	4.20-2.80



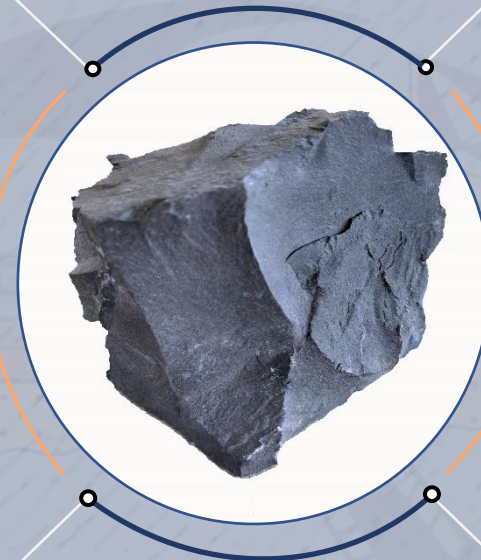


Definition

Basalt is a fine grained basic volcanic rock which has the same chemical composition for gabbro plutonic rocks.

Physical properties

- Density :2.1-2.8 g/cm<sup>3</sup>.
- It has 100%UV rays' resistance.



Characteristics

- Great reserves.
- Suitable for use in many industrial and construction fields.
- Easy of accessible and exploitation by surface and open bit mining.

Applications

- Building stones and decorations production.
- Aggregate concrete production.
- Brick production.
- Soil improvement.
- Rock wool and basaltic fiber industry.

Chemical Composition(%)

SiO <sub>2</sub>	55.60-40.40	K <sub>2</sub> O	1.85-0.27
Al <sub>2</sub> O <sub>3</sub>	16.22 -10.96	CaO	11.88-3.66
F <sub>2</sub> O <sub>3</sub>	15.80-8.41	MgO	11.40-1.30
L.O.I	-	Na <sub>2</sub> O	4.88-1.50





Definition

It is industrial mineral consisting of hydrated aluminum silicate containing the sodium, potassium, calcium and magnesium cations, it formed from alteration of tuff, rhyolite rocks or feldspar and feldspathoid minerals.

Physical properties

- Specific gravity: 2-2.4.
- Hardness: range 3.5- 5.5 on Moho scale.
- High cation exchange capacity.
- High Catalytic power.
- High Adsorptive ability.
- Many of zeolite minerals are fused.



Characteristics

- Great reserves.
- The zeolite percentage reached to 99%.
- Easy of accessible and exploitation by surface and open bit mining.

Applications

- Nuclear waste treatment.
- Mineral waste treatment.
- Nursery, horticulture and silviculture
- Animal nutrition and bad odor control.
- Water purification and gas absorption.
- Soil reclamation
- Oil, gas and chemical purification.
- Many other uses field.

Chemical Composition(%)

SiO <sub>2</sub>	73.19-67.75	K <sub>2</sub> O	4.89-2.06
Al <sub>2</sub> O <sub>3</sub>	13.18 -10.37	CaO	2.58-0.53
F <sub>2</sub> O <sub>3</sub>	4.60-2.01	Na <sub>2</sub> O	1.94-0.01
L.O.I	-	MgO	-



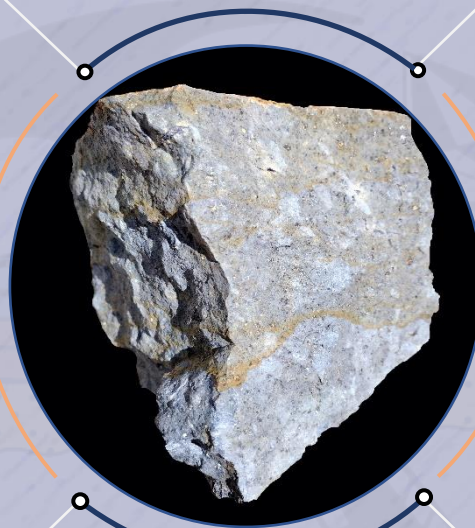


Definition

It is industrial mineral monohydrated aluminum silicate ( $Al_2O_3 \cdot 4SiO_2 \cdot H_2O$ ) and it has physical properties and uses similar to talc mineral, but it differs from it in chemical composition.

Physical properties

- Density: 2.75-2.8 g/cm<sup>3</sup>.
- Hardness: range 1-2 on Moho scale.
- No-plasticity.
- High electrical insulation.
- High relatively oil absorption.
- High heat and shocks resistance.



Characteristics

- Great reserves.
- High contains of  $Al_2O_3$  reaches to >28%
- Easy of accessible and exploitation by surface and open bit mining.

Applications

- Insecticide industry.
- Refractory brick industry.
- Ceramic industry.
- Cosmetics.
- Filler in paint, rubber and plastic.
- Many other uses field.

Chemical Composition (%)

SiO <sub>2</sub>	75.26-58.76	K <sub>2</sub> O	0.1-0.26
Al <sub>2</sub> O <sub>3</sub>	31.00 -15.30	CaO	0.43-0.55
F <sub>2</sub> O <sub>3</sub>	1.80-1.11	MgO	-
L.O. I	3.43-6.11	Na <sub>2</sub> O	0.0-1.29



# Flint clay

## الطين الصواني

Yemen Geological Survey and Mineral Resources Board



### Definition

It is the fine-grained clay in the microscopic crystallization which is found as massive Kaolinitic rocks and characteristic by oyster(flint) fracture so it's called flint clay.

### Physical properties

- Density: 2.32-2.43 g/cm<sup>3</sup>.
- Bulk density: 2.3g.cm<sup>3</sup>.
- Heat resistance: 1,760-1,800°C.
- Kaolinite ratio: 80-95%.



### Characteristics

- Great reserves.
- High contains of Al<sub>2</sub>O<sub>3</sub> reaches to 32.57 %
- Easy of accessible and exploitation by surface and open bit mining.

### Applications

- Refractory ceramic(brick) industry.
- Fine ceramic industry (sanitary ware, porcelain, electronic and floor tiles)
- Filler or powder in fertilizer (anti-gloss).

Chemical Composition(%)

SiO <sub>2</sub>	81.49-52.82	K <sub>2</sub> O	0.21-0.01
Al <sub>2</sub> O <sub>3</sub>	32.57 -13.28	CaO	3.25-0.01
F <sub>2</sub> O <sub>3</sub>	4.61-0.08	Al	17.26-7.04
L.O.I	-	Kaolinite	33.62-82.45



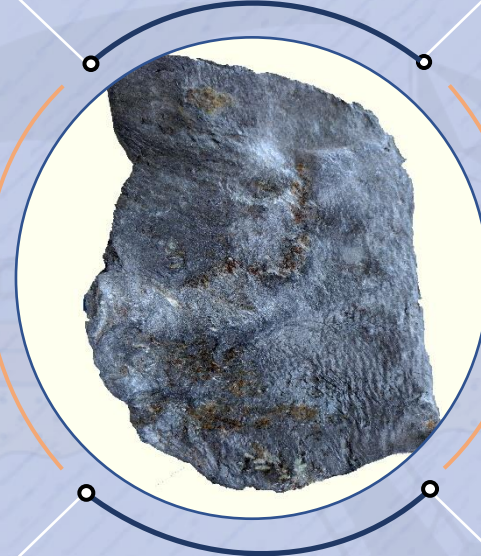


Definition

It is a form of carbon and is black to gray nonmetallic mineral with a metallic or earthy luster.

Physical properties

- Specific gravity: 2.09-2.23.
- Density for crystal graphite 2.266 g/cm<sup>3</sup>.
- Hardness: <2 on moho scale.
- Lubricated fell.
- Chemically inert.
- Leave a trace on the hand.
- Low Co-efficient of friction.
- High melting point:3,650°C so high refractory.
- High evaporate point: 4,500°C.



Characteristics

- Great reserves.
- Easy of accessible and exploitation by surface and open bit mining.

Applications

- Pencil industry.
- Refractories industry.
- Crucible industry.
- Brake lining and bearings
- Batteries industry (dry cell and alkali cell).
- Lubricants industry.
- Many other uses (paints, adhesive, graphene ...ect).

Chemical Composition(%)

SiO <sub>2</sub>	60.37	K <sub>2</sub> O	4.84
Al <sub>2</sub> O <sub>3</sub>	14.26	CaO	2.15
F <sub>2</sub> O <sub>3</sub>	2.49	MgO	1.06
L.O. I	10.83	Na <sub>2</sub> O	1.82
Graphite carbon			11.26





## Definition

It is the very soft industrial mineral that consists of hydrated magnesium silicate and the pure minerals contains 63.34%SiO<sub>2</sub>,31.91%MgO and 4.75% H<sub>2</sub>O. It also called soapstone.

- Density:2.58 g/cm<sup>3</sup>.
- Bulk density: 2.4 t/m<sup>3</sup>.
- Hardness: 1 on moho scale.
- Color: white to gray to light green.
- surface feel: soapy feel.
- Pearly luster.
- High Oil absorption:.35%.

## Physical properties



## Characteristics

- Great reserves.
- High MgO content: >31%
- Easy of accessible and exploitation by surface and open bit mining.

- Plastic and rubber industry.
- Ceramic industry.
- Paints and paper manufacturing.
- Cosmetics (Talcum powder).
- Many other industrial uses (Potteries, Electrically insulating porcelain, Insecticide ...ect).

## Applications

## Chemical Composition(%)

SiO <sub>2</sub>	29.90-57.00	FeO	5.41
TiO <sub>2</sub>	0.35	K <sub>2</sub> O	0.03
Al <sub>2</sub> O <sub>3</sub>	0.12-14.64	CaO	4.03
F <sub>2</sub> O <sub>3</sub>	0.05-13.00	MgO	14.28-49.10
L.O.I	13.64	Na <sub>2</sub> O	1.89
H <sub>2</sub> O+	7.4	H <sub>2</sub> O-	0.09



# Nepheline Syenite

## نفلين سيانيت

Yemen Geological Survey and Mineral Resources Board

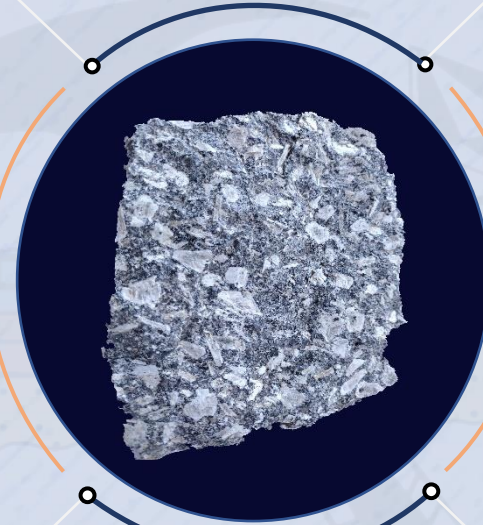


### Definition

It is plutonic igneous rocks which has mafic chemical composition and medium to coarse grains. It is characterized by quartz ratio ranges from 0.0 to < 5% and also Known as nepheline rich- syenite rock.

### Physical properties

- Density: 2.5-2.7 g/cm<sup>3</sup>.
- Hardness: 5.5-6 on moho scale.
- High Oil absorption: .28%
- Low melting point of nepheline.
- Glassy luster.
- Sub-concoidal fracture.



### Characteristics

- Medium reserves.
- High Al<sub>2</sub>O<sub>3</sub> content: >18%
- High nepheline content: average 26.41%
- Easy of accessible and exploitation by surface and open bit mining.

### Applications

- Glass and ceramic industry.
- Filler in paints, rubber and plastic.
- Source for aluminum (Al) metal.
- Building and ornamental stones.
- Many other uses field.

Chemical Composition(%)

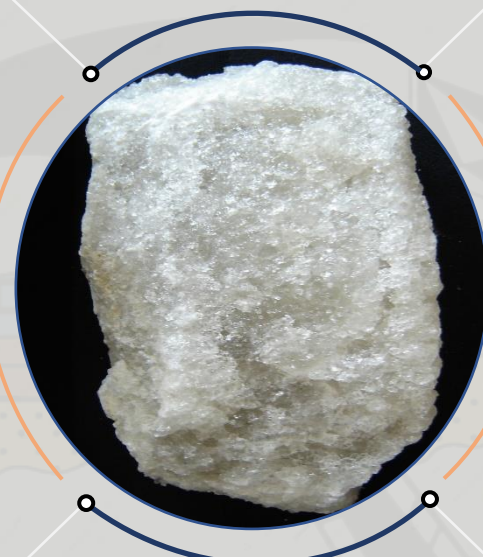
SiO <sub>2</sub>	49.78	K <sub>2</sub> O	3.94
Al <sub>2</sub> O <sub>3</sub>	18.9	CaO	2.41
F <sub>2</sub> O <sub>3</sub>	6.97	MgO	1.12
L.O.I	2.33	Na <sub>2</sub> O	12.14
Nepheline		26.41%	





Definition

It is one of the natural and industrial minerals that consist of two elements as 60.67% Cl and 39.33%Na. It is chemically known as sodium chloride (NaCl) or halite and naturally occur as form crystal and massive or grains.



Physical properties

- Cubic crystal.
- White color and transparent to semitransparent.
- Specific gravity: 2.1-2.6.
- Hardness: 2-2.5 on moho scale.
- High Oil absorption: 28%
- Melting point: 800°C.
- Glassy luster.
- Well dissolved in water.
- Reduced the freezing point and defrost.

Characteristics

- Great reserves.
- High purity and few impurities.
- Easy of accessible and exploitation by surface and open bit mining.

Applications

- Various chemical industry.
- Table salt, cattle feed and production.
- Oil drilling well.
- Reduced the freezing point and defrost
- Preservation material and leather industry.
- Medical solution industry.
- Source for sodium and chlorine.
- Many other uses fields (up to 14,000 uses).

Chemical Composition (%)

Na <sup>+</sup>	39.04-38.6	SO <sub>4</sub> <sup>-</sup>	1.44-0.35
Cl <sup>-</sup>	60.06-58.67	NaCl	99.01-96.20
K <sup>+</sup>	0.04-0.01	Mg	0.87-0.001
Ca <sup>++</sup>	0.72-0.006	-	-



# Gypsum

## الجبس

Yemen Geological Survey and Mineral Resources Board



### Definition

It is one of the natural evaporate sediments as industrial mineral or rock (rock gypsum) that consist of hydrated calcium sulphate ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) and it's often associated with anhydrite ( $\text{CaSO}_4$ ).

### Physical properties

- Specific gravity: 2.3-2.4.
- Hardness: 2 on moho scale.



### Characteristics

- Great reserves.
- High purity.
- Suitable for many applications.
- Easy of accessible and exploitation by surface and open bit mining.

### Applications

- Cement industry.
- Soil fertilizer.
- Glass industry.
- Plaster production.
- Gypsum board industry.
- Additive in medicine and cosmetics.
- Broken bone treatment.
- Many other uses field.

Chemical Composition (%)

$\text{SiO}_2$	8.70	0.14	$\text{Na}_2\text{O}$	0.20	0.03
$\text{Al}_2\text{O}_3$	4.86	0.08	$\text{K}_2\text{O}$	0.22	0.05
$\text{CaO}$	50.12	29.01	$\text{SO}_3$	52.55	15.18
$\text{MgO}$	16.5	0.07	$\text{P}_2\text{O}_5$	-	-
$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	96.5	36.8	L.O.I	20.19	17.23



# Dolomite

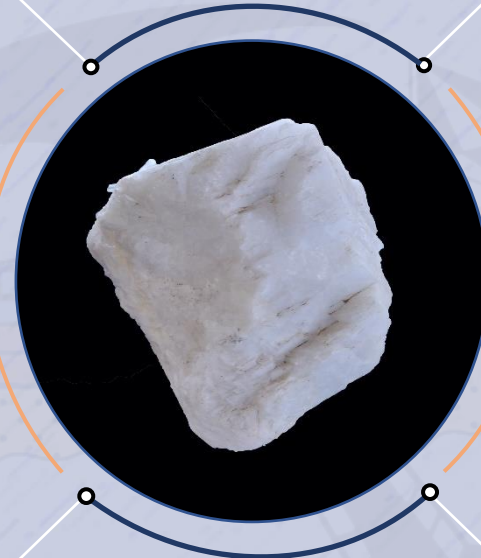
## الدولوميت

Yemen Geological Survey and Mineral Resources Board



### Definition

Dolomite is one sedimentary carbonate rocks which mainly consists of dolomite mineral that contains 45.7%  $MgCO_3$  and 54.3%  $CaCO_3$  (21.87%  $MgO$ , 30.41%  $CaO$ ), so it is known as bi-mineralic rock (Magnesite and calcite).



### Physical properties

- density: 2.8-2.9  $g/cm^3$ .
- Hardness: 3.5-4 on moho scale.
- High refractory.

### Characteristics

- Great reserves.
- High purity  $MgO$  up to 21%.
- Suitable for many applications.
- Easy of accessible and exploitation by surface and open bit mining.

### Applications

- Glass industry as flux.
- Metallurgical (steel and sponge iron. ect)
- Source of magnesium metal.
- Soil treatment.
- Refractory industry.
- Sorel cement industry.
- Filler in paints, paper, Pharmaceutical ...ect)
- Aggregate production.
- Building and ornamental stones.
- Many other uses field.

### Chemical Composition (%)

$SiO_2$	0.01-4.15	$CaMg(CO_3)_2$	78.58-94.18
$Al_2O_3$	0.09-0.13	$CaO$	30.57-33.70
$F_2O_3$	0.01-2.00	$MgO$	10.50-23.05
L.O.I	44.18-45.77	$Na_2O$	0.0-0.03



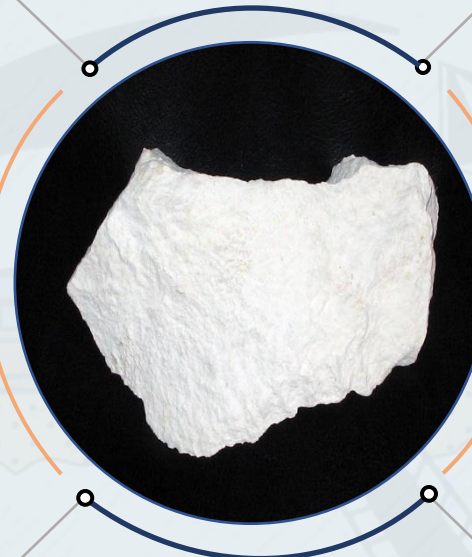


### Definition

Limestone is a sedimentary carbonate rock which mainly consists of calcium carbonate where the pure contains 54% CaO and 44% CO<sub>2</sub> as form calcite mineral and often associated few amounts of dolomite and sandstone or clay as impurities.

### Physical properties

- Density: 2.21-2.88g/cm<sup>3</sup>.
- Whiteness: 81.70-95.20%.
- Source for lime types.



### Characteristics

- Great reserves.
- High purity where CaO up to >50%.
- Suitable for many applications.
- Easy of accessible and exploitation by surface and open bit mining.

### Applications

- Various types of cement industry.
- Glass industry as flux.
- Metallurgical (steel and sponge iron. ect)
- Lime production.
- Soil treatment.
- Filler in paints, paper, Pharmaceutical ...ect)
- Chemical industry (calcium carbide, soda ash ...ect)
- Building and ornamental stones.
- Many other uses field.

Average Chemical Composition (%)

SiO <sub>2</sub>	1.69	CaCO <sub>3</sub>	98.46
Al <sub>2</sub> O <sub>3</sub>	0.38	CaO	55.14
F <sub>2</sub> O <sub>3</sub>	0.17	MgO	0.66
L.O.I	41.82	Av. whiteness	87



# Magnesite

## مجنيزيت

Yemen Geological Survey and Mineral Resources Board

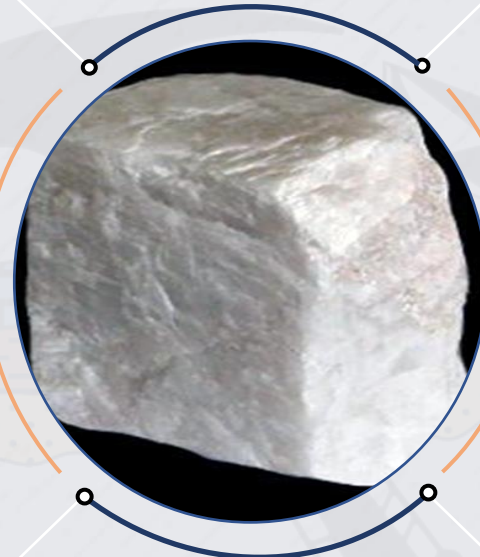


### Definition

Magnesite is a magnesium carbonate industrial mineral which contains 47.81% MgO and 52.19%.

### Physical properties

- Density: 2.9-3.2g/cm<sup>3</sup>.
- Hardness: 3.5-4.5 on Moho scale.
- Melting of caustic magnesia: 1,560-1760°C.
- High Refractory.



### Characteristics

- Great reserves.
- High purity where MgO up to 47.6 and MgCO<sub>3</sub> up to 99.62%.
- Suitable for many applications.
- Easy of accessible and exploitation by surface and open bit mining.

### Applications

- Magnesia refractory production.
- Caustic magnesia production.
- Sorel (magnesium Oxychloride) cement.
- Electrical insulator.
- Magnesium metal production.
- Filler in rubber, paper, cosmetics...ect)
- Chemical industry.
- Many other uses field.

Chemical Composition(%)

SiO <sub>2</sub>	0.30-7.05	MgCO <sub>3</sub>	81.95-99.62
Al <sub>2</sub> O <sub>3</sub>	0.01-0.01	CaO	0.09-41.4
F <sub>2</sub> O <sub>3</sub>	0.05-0.74	MgO	27.70-47.6
L.O. I	44.60-49.99	Na <sub>2</sub> O	0.01-0.84





## Definition

The term of mica includes a group of hydrated or hydroxyl aluminum silicate minerals with one or more of the K, Na, Fe, Mg and Li oxides, its mineral are muscovite, phlogopite, Biotite, Lepidolite, Paragonite, Zinnwaldite, Lepidomelane and fuchsite.

## Characteristics

- Various types occurrences.
- Easy of accessible and exploitation by artisan mining method.



Chemical Composition(%)

SiO <sub>2</sub>	45.07	MnO	0.03
Al <sub>2</sub> O <sub>3</sub>	31.51	CaO	0.6
F <sub>2</sub> O <sub>3</sub>	4.25	MgO	0.77
L.O. I	4.61	TiO <sub>2</sub>	0.29

## Physical properties

- Specific gravity: 2.8-3.2.
- Hardness: 2-3 on Moho scale.
- Splitting feature.
- Electric, heat and sound insulation.

## Applications

- Manufacture of electronic capacitors and pipes.
- Household electrical appliance.
- Tv. and radio tubes industry.
- Windows glass industry.
- Glass-bonded mica.
- Fire protection boards.
- Oil well drilling.
- Oil emulsion paints.
- Pearlescent pigments.
- Many other uses field.



## Definition

The term of garnet includes a group of nesosilicates which consists of aluminum silicate mineral which are bond with following elements Ca, Mn, Fe and Mg oxides to make up a number of minerals (e.g: pyrope, andradite, almandine, grossularite, spessartite and Uvarovite).

## Physical properties

- Specific gravity: 3.15-4.3.
- Hardness: 6.5-7.5 on Moho scale.
- Multicolor: red, green, yellow. ect.
- Glassy luster.
- Transparent to semitransparent.



## Characteristics

- Grossular composition.
- Easy of accessible and exploitation by artisan mining method.

## Applications

- Abrasive material (coarse and fine polishing).
- Sand blasting.
- Manufacture of lasers, radars and sonar.

Chemical Composition(%)

SiO <sub>2</sub>	32.62-35.24	TiO <sub>2</sub>	0.39-0.58
Al <sub>2</sub> O <sub>3</sub>	15.92-25.24	CaO	37.70-43.63
F <sub>2</sub> O <sub>3</sub>	1.75-3.50	MgO	0.56-0.95
K <sub>2</sub> O	0.00-0.05	MnO	0.0-0.05
L.O. I	0.03-0.10	SO <sub>3</sub>	0.0-0.04