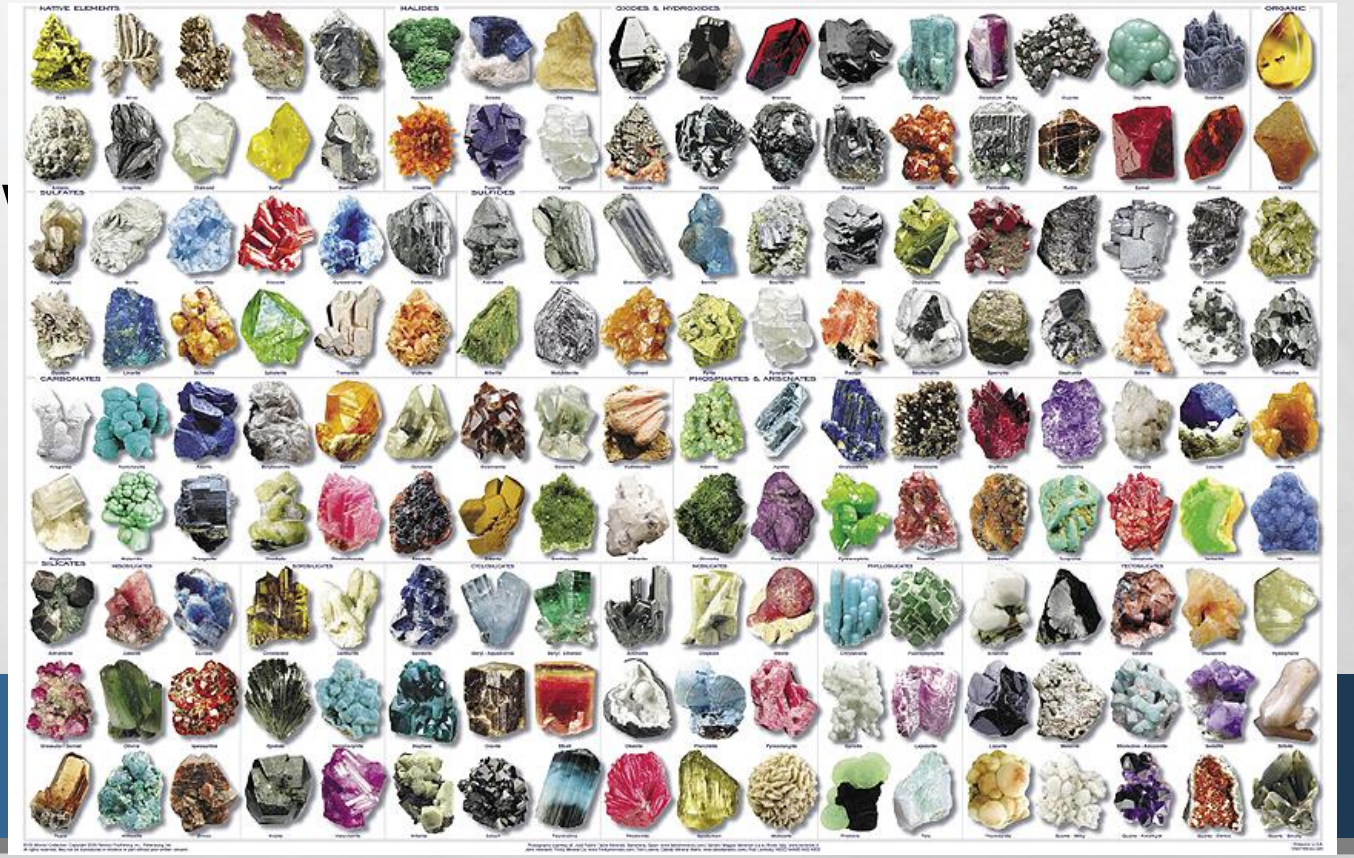
MINERALS & ROCKS

UNIT TOPICS

- TOPIC 1: MINERALS
- TOPIC 2: IGNEOUS ROCKS
- TOPIC 3: SEDIMENTARY ROCKS
- TOPIC 4: METAMORPHIC ROCKS
- TOPIC 5: THE ROCK CYCLE

TOPIC 1: MINERALS

- **ESSENTIAL QUESTION: W**
  WE CLASSIFY THEM?



TOPIC 1: MINERALS

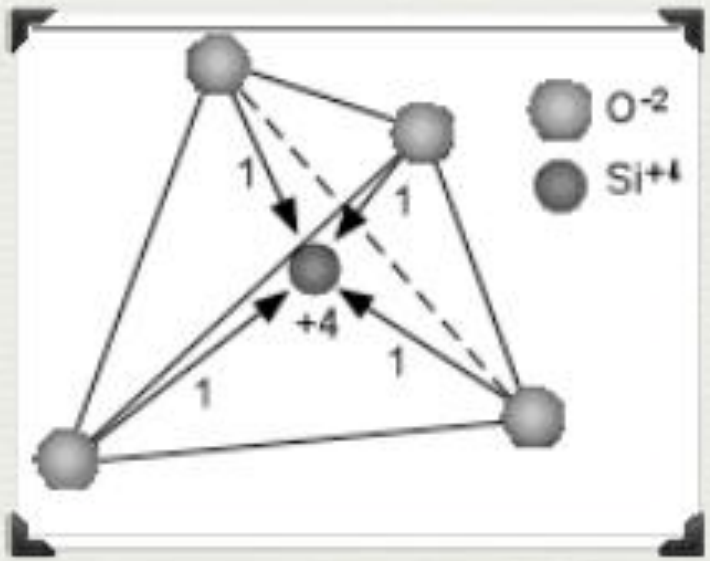
- MINERALS ARE THE INGREDIENTS NEEDED TO FORM THE DIFFERENT TYPES OF ROCKS
- ROCK: **ANY NATURALLY-FORMED SOLID THAT IS PART OF EARTH**
- MINERAL: **NATURALLY-OCCURRING, INORGANIC SOLID WITH A DEFINITE STRUCTURE, COMPOSITION, & CRYSTALLINE STRUCTURE**
- INORGANIC: **NOT MADE BY OR COMPOSED OF LIVING THINGS**
- CRYSTALLINE: **ATOMS ARE ARRANGED IN A REPEATING PATTERN**

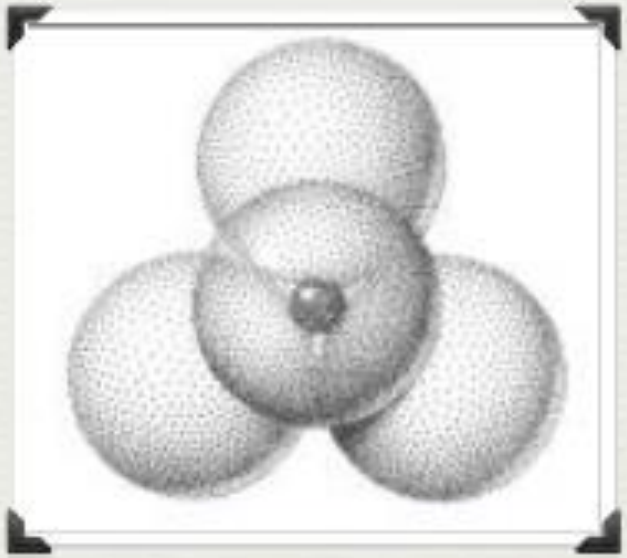
TOPIC 1: MINERALS

- MINERALS FORM BY THREE METHODS:
  - CRYSTALLIZATION: A PROCESS OF ORGANIZING **ATOMS** TO FORM CRYSTALLINE SOLIDS
  - RECRYSTALLIZATION: THE COOLING AND HARDENING OF **LAVA** OR MAGMA INTO MINERALS
  - REARRANGEMENT: THE REALIGNMENT OF ATOMS IN MINERALS UNDER HIGH **TEMPERATURE** AND **PRESSURE**

TOPIC 1: MINERALS

- MOST ROCK-FORMING MINERALS ARE ***SILICATES*** THAT RESULT IN A TETRAHEDRON SHAPE
  - FOUR-SIDED UNITS OF 4 **OXYGENS** AND 1 **SILICON**





TOPIC 1: MINERALS

- CRYSTAL STRUCTURE OR "**INTERNAL ARRANGEMENT OF ATOMS**" ARE RESPONSIBLE FOR THE PHYSICAL AND CHEMICAL PROPERTIES A MINERAL POSSESSES
- EACH MINERAL HAS A SET OF PHYSICAL AND CHEMICAL PROPERTIES THAT CAN BE USED TO IDENTIFY THE SAMPLE

TOPIC 1: MINERALS

- THE METHODS WE USE TO CLASSIFY MINERALS ARE:
  - 1. COLOR: A VISUAL ATTRIBUTE OF AN OBJECT BASED ON PERCEPTION
    - ONE OF THE MOST OBVIOUS, BUT NOT THE MOST RELIABLE
    - MANY OF THE 4000 KNOWN MINERALS SHARE SIMILAR COLORS

TOPIC 1: MINERALS

- 2. STREAK: **THE COLOR OF A FINELY-CRUSHED POWDER WHEN A MINERAL IS DRAGGED ACROSS A STREAK PLATE**
  - WEATHERING CHANGES THE OUTSIDE COLOR, BUT STREAK GIVES THE TRUE COLOR

TOPIC 1: MINERALS

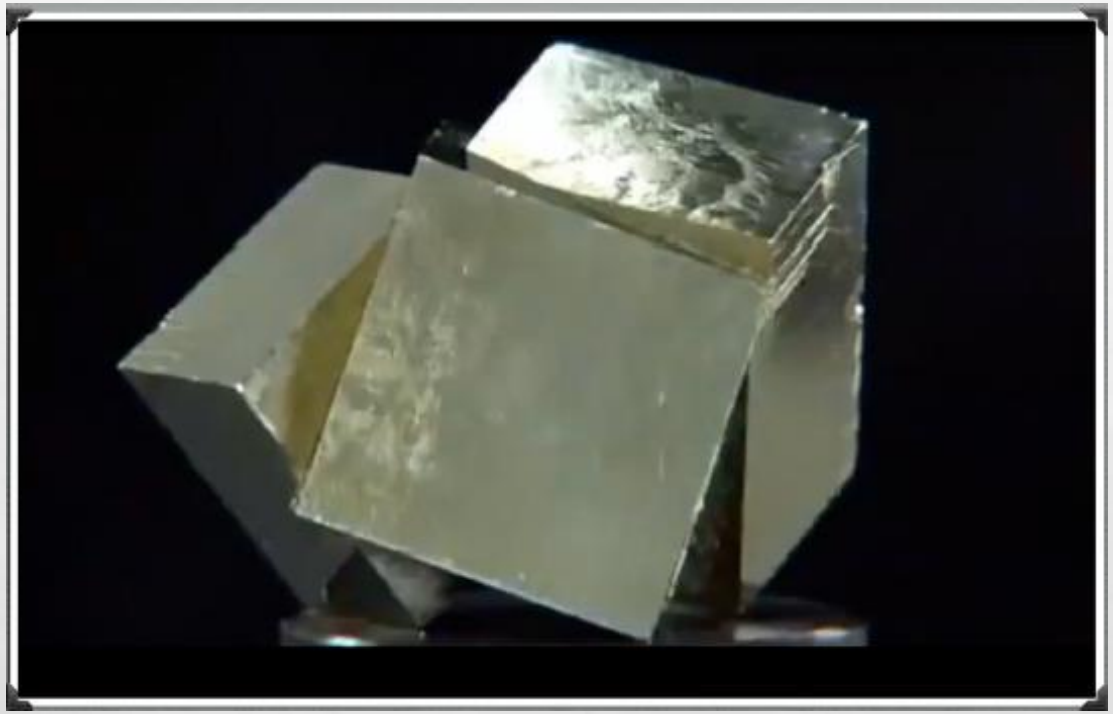
- 3. LUSTER: **THE SHINE OF AN UNWEATHERED MINERAL; THE WAY IT LOOKS REFLECTED IN LIGHT**
  - TWO TYPES OF LUSTER:
    - METALLIC LUSTER: SHINES LIKE STAINLESS STEEL (METAL)
    - NONMETALLIC LUSTER: EARTHY OR DULL SHINE

Metallic

Nonmetallic

TOPIC 1: MINERALS

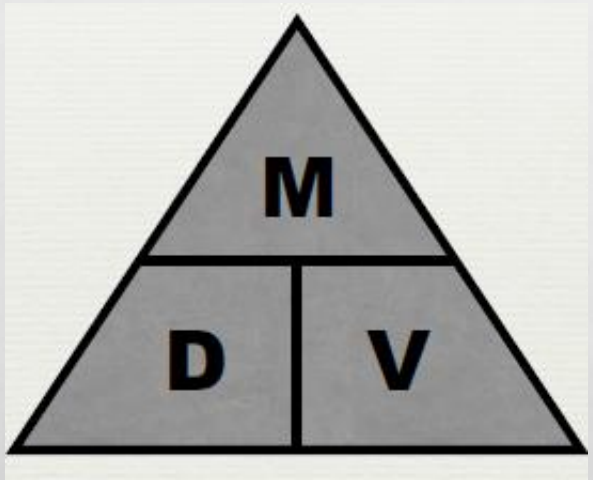
- DOES THIS MINERAL HAVE A METALLIC OR NON-METALLIC LUSTER?



METALLIC

TOPIC 1: MINERALS

- 4. DENSITY: **THE RATIO OF MASS TO VOLUME OF AN OBJECT**
  - SAMPLE PROBLEM: A STUDENT MEASURES THE MASS OF A MINERAL TO BE **350** G AND CALCULATES THE VOLUME TO BE **35** ML. WHAT IS THE DENSITY?



WRITE THE FORMULA: **D = M / V**

SHOW ALL WORK: **D = 350 G / 35 ML**

ANSWER: **D = 10 G/ML**

TOPIC 1: MINERALS

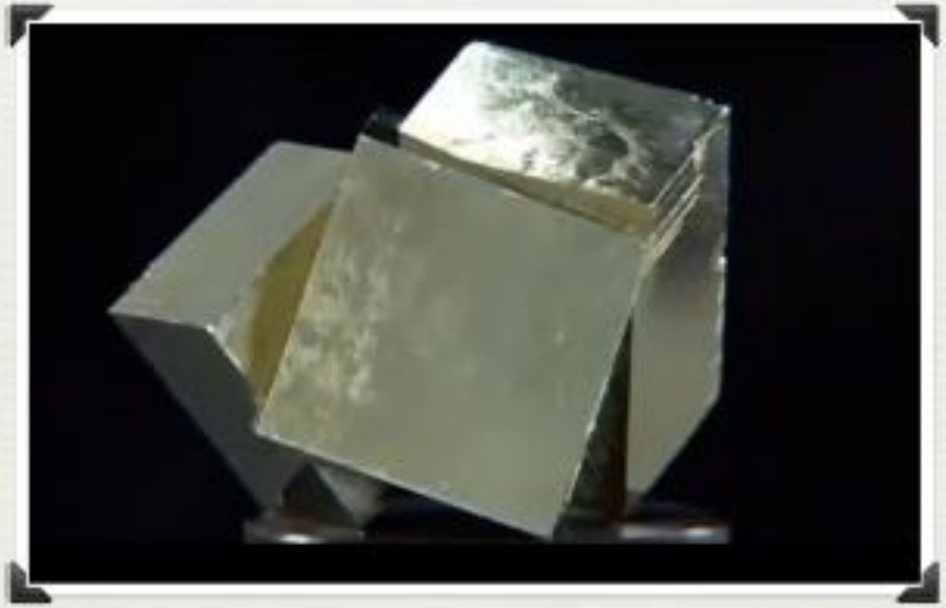
- 5. HARDNESS: **RESISTANCE OF A MINERAL TO BEING SCRATCHED**
  - MOHS HARDNESS SCALE IS USED TO CLASSIFY HARDNESS

Hardness	Mineral	Test
1	Talc	Finger nail scratches easily
2	Gypsum	Finger nail scratches
3	Calcite	Copper penny scratches
4	Fluorite	Steel knife scratches easily
5	Apatite	Steel knife scratches
6	Feldspar	Steel knife will not scratches
7	Quartz	Will scratch glass and steel
8	Topaz	Harder then any common mineral
9	Corundum	Scratches topaz
10	Diamond	Hardest mineral

TOPIC 1: MINERALS

- 6. CLEAVAGE: **THE TENDENCY OF A MINERAL TO BREAK ALONG WEAK AREAS & FORM SEMI-SMOOTH OR PARALLEL SURFACES**
  - CAN BREAK IN ONE DIRECTION OR 3 DIRECTIONS (90° ANGLES)

One direction



Three directions at 90°

TOPIC 1: MINERALS

- <u>WHICH TYPE OF CLEAVAGE IS SHOWN IN YOUR CLASS NOTES?</u>

3 DIRECTIONS (90° ANGLES)

TOPIC 1: MINERALS

- 7. FRACTURE: **AN IRREGULAR OR UNEVEN BREAK**
  - TENDS TO LACK PREFERRED ZONES OF WEAKNESS
  - FOR EXAMPLE: FIBROUS; CONCHOIDAL

Fibrous

Conchodial

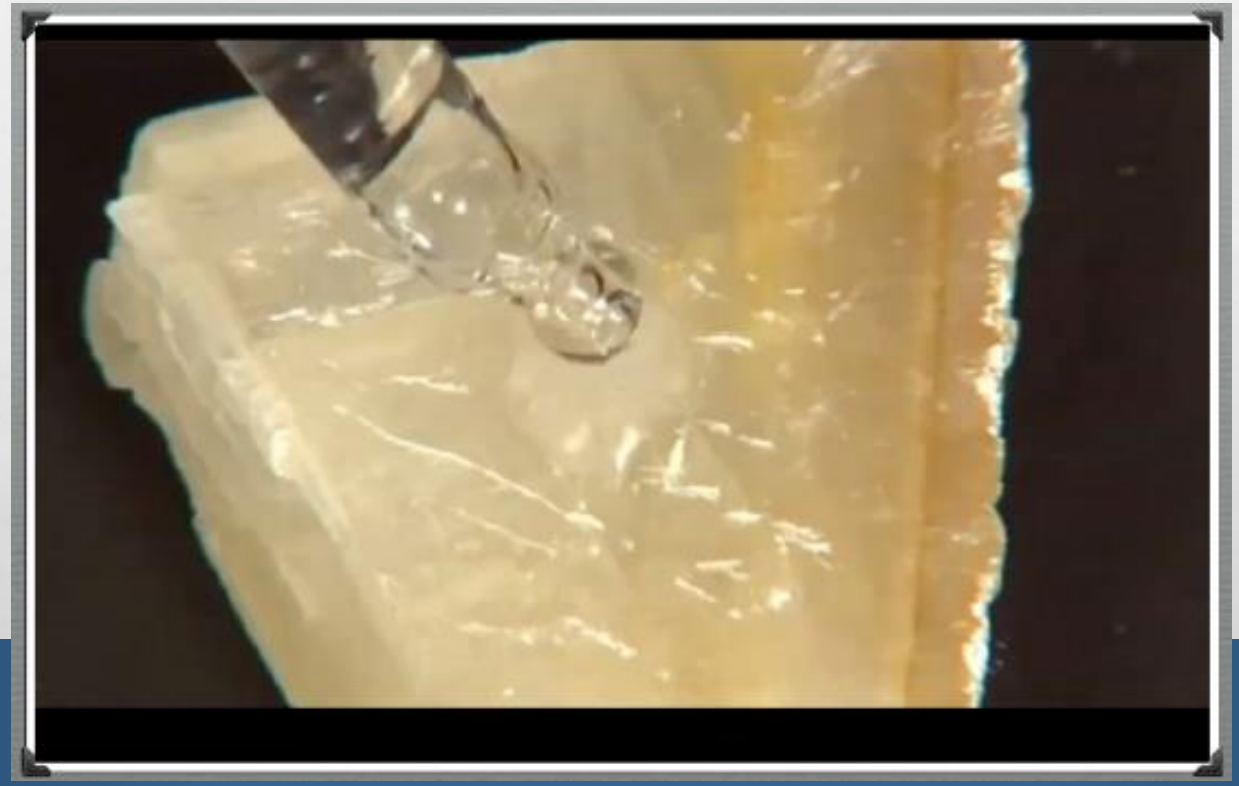
TOPIC 1: MINERALS

- WHICH TYPE OF FRACTURE IS SHOWN IN YOUR CLASS NOTES?

CONCHOIDAL

TOPIC 1: MINERALS

- 8. ACID TEST: **A TEST SHOWING WHEN DILUTE ACID (HCL) IS PLACED ON A MINERAL, IT MAY BUBBLE**
  - CALCITE AND DOLOMITE BOTH REACT WITH ACID



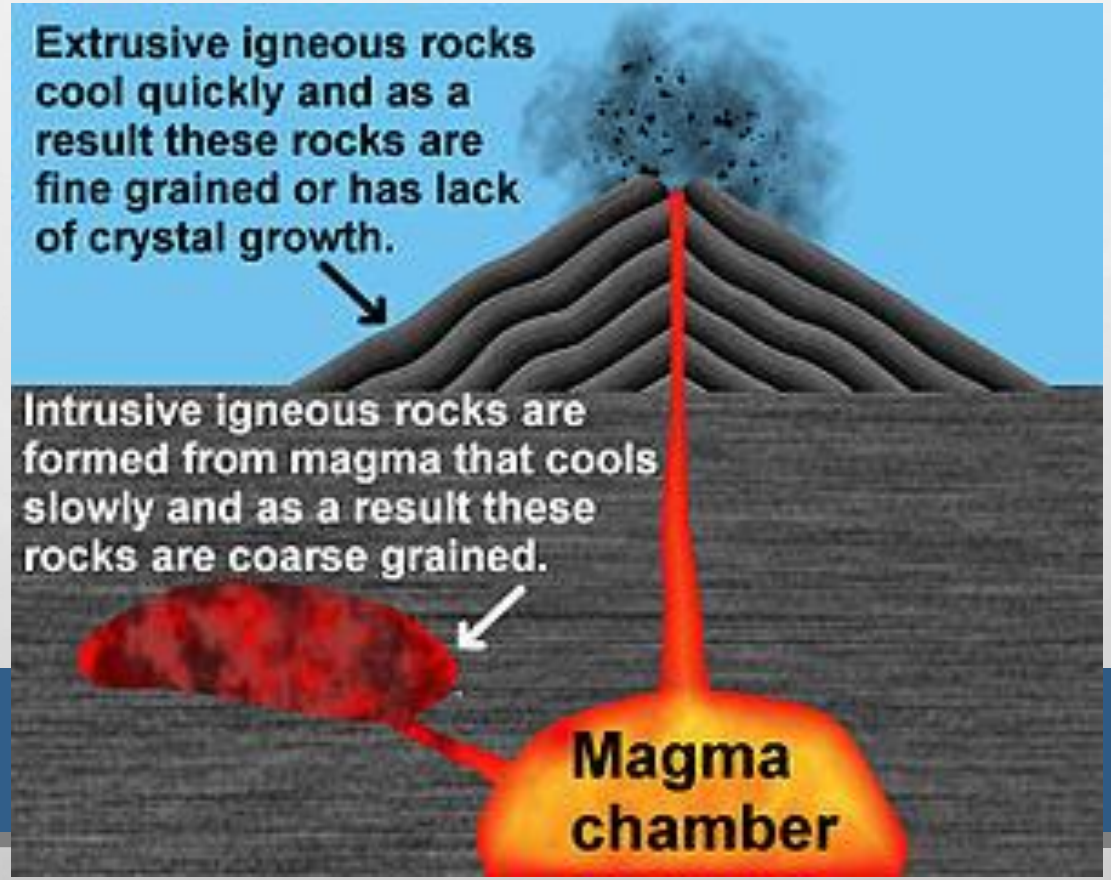
QUESTIONS?

TOPIC 2: IGNEOUS ROCKS

- **ESSENTIAL QUESTION: HOW DO WE CLASSIFY IGNEOUS ROCKS?**

TOPIC 2: IGNEOUS ROCKS

- IGNEOUS ROCKS: **ROCK TYPE THAT FORMS WHEN MOLTEN MATERIAL (LAVA OR MAGMA) SOLIDIFIES**

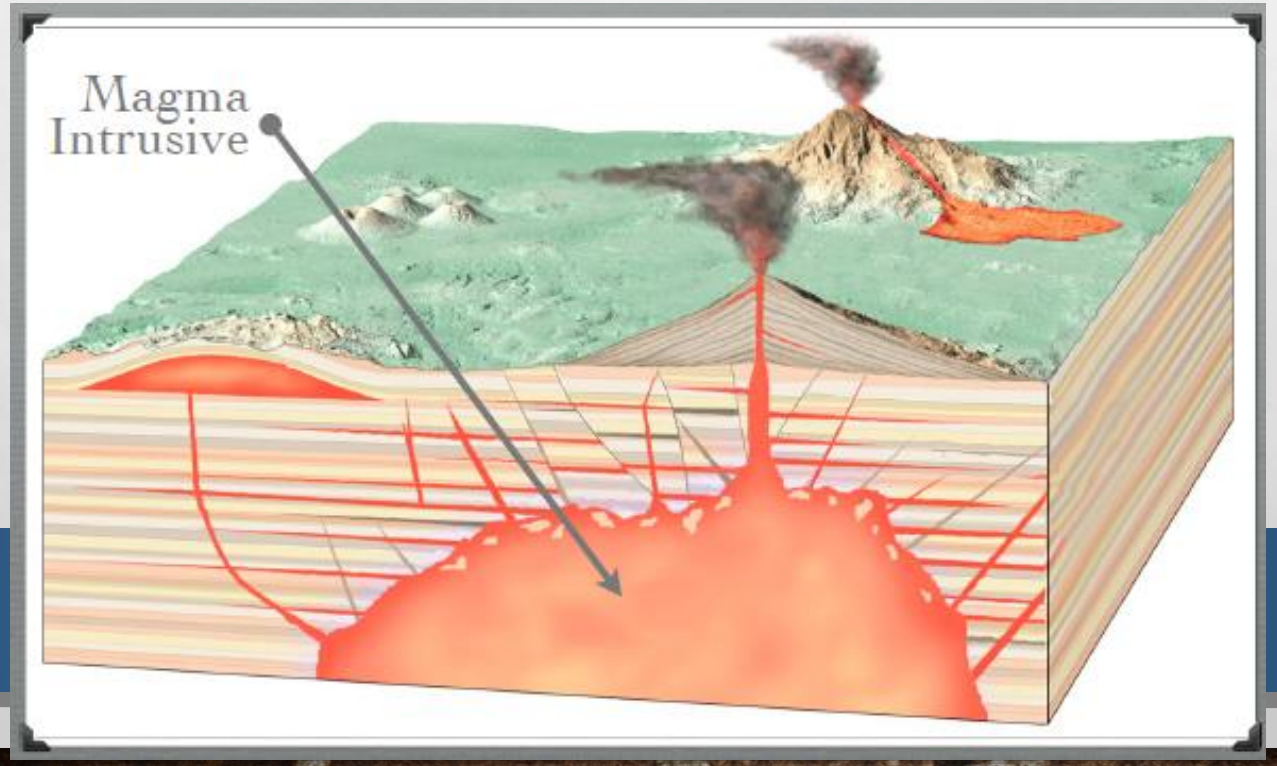


TOPIC 2: IGNEOUS ROCKS

- METHODS TO CLASSIFY IGNEOUS ROCKS:
  - 1. ENVIRONMENT OF FORMATION: **LOCATION WHERE LIQUID ROCK SOLIDIFIES INTO SOLID ROCK**

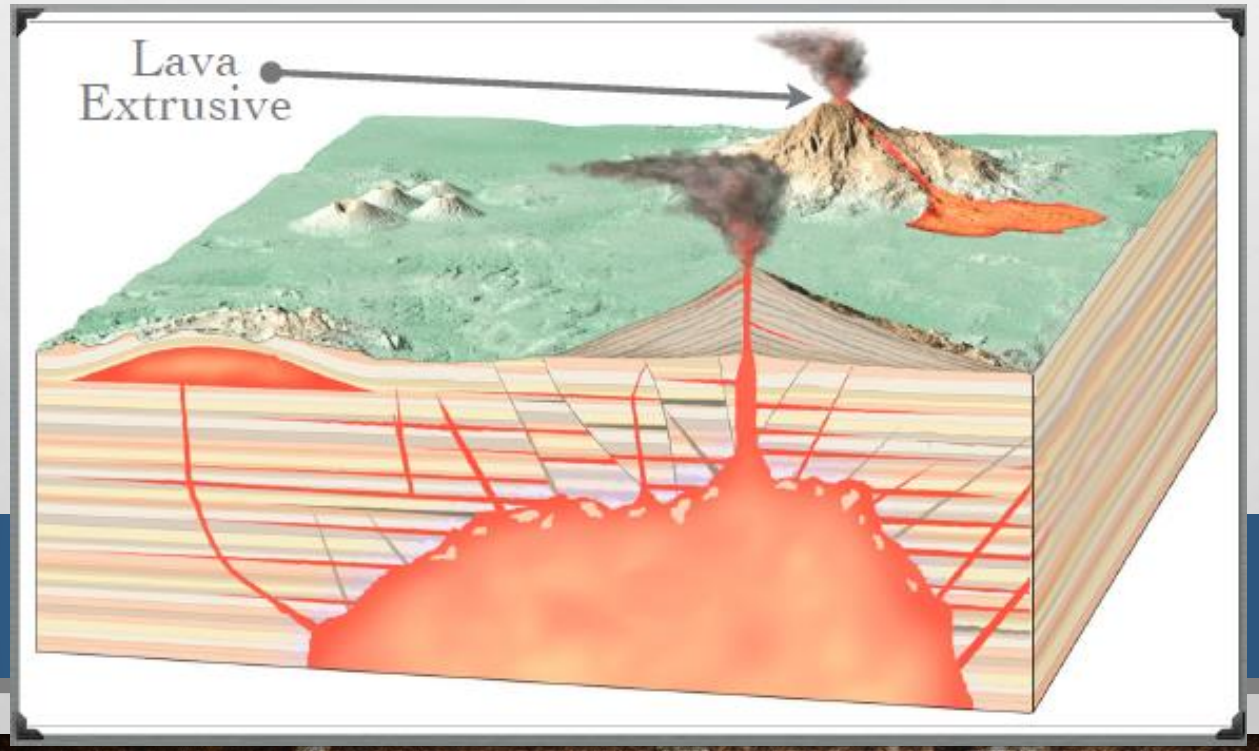
TOPIC 2: IGNEOUS ROCKS

- 1. ENVIRONMENT OF FORMATION:
  - MAGMA: **MOLTEN ROCK INSIDE THE EARTH**
  - PLUTONIC: **ROCK THAT FORMED DEEP WITHIN THE EARTH**
  - INTRUSIVE: **BELOW EARTH'S CRUST**



TOPIC 2: IGNEOUS ROCKS

- 1. ENVIRONMENT OF FORMATION:
  - LAVA: **MOLTEN ROCK OUTSIDE THE EARTH**
  - VOLCANIC: **ROCK THAT FORMED ON EARTH'S SURFACE**
  - EXTRUSIVE: **ABOVE EARTH'S CRUST**

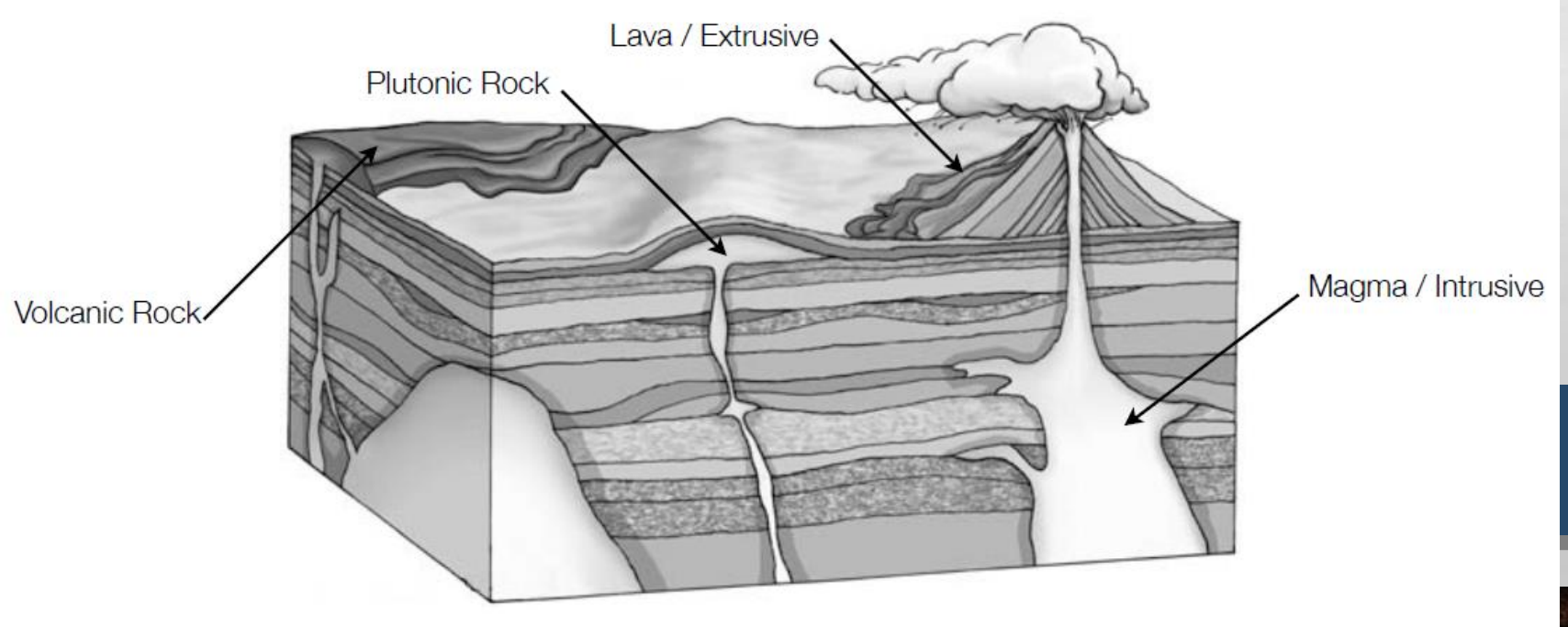


TOPIC 2: IGNEOUS ROCKS

- **REVIEW:** 1. ENVIRONMENT OF FORMATION:
  - IS PLUTONIC ROCK INTRUSIVE OR EXTRUSIVE?

    INTRUSIVE
  - DOES LAVA FORM VOLCANIC OR PLUTONIC ROCK?

    VOLCANIC ROCK



TOPIC 2: IGNEOUS ROCKS

- 2. COLOR: **IGNEOUS ROCKS HAVE 2 COLOR CATEGORIES (LIGHT OR DARK)**

TOPIC 2: IGNEOUS ROCKS

- 3. COMPOSITION: A MIXTURE OF MATERIALS THAT MAKE UP AN IGNEOUS ROCK

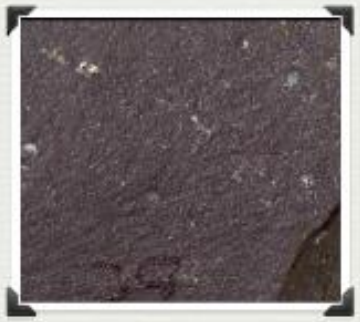
TOPIC 2: IGNEOUS ROCKS

- FELSIC: **LIGHT-COLORED ROCKS WITH HIGH ALUMINUM (AL) AND SILICON (SI) CONTENT (EX: GRANITE, RHYOLITE)**

Granite

Rhyolite

- MAFIC: **DARK-COLORED ROCKS WITH HIGH IRON (FE) OR MAGNESIUM (MG) CONTENT (EX: BASALT, SCORIA)**



Basalt

Scoria

TOPIC 2: IGNEOUS ROCKS

- 4. TEXTURE: **THE APPEARANCE OR "LOOK" OF A ROCK**
  - VESICULAR: **APPEARS TO HAVE HOLES; CREATED BY GAS POCKETS**
  - PORPHYRITIC: **APPEARS TO HAVE A MIX OF SMALL & LARGE CRYSTALS**

Vesicular

Porphyritic

TOPIC 2: IGNEOUS ROCKS

- 5. CRYSTAL SIZE: **THE ACTUAL MEASUREMENT OF INDIVIDUAL CRYSTALS OR TOTAL AMOUNT OF CRYSTALS IN A ROCK**

Obsidian

Granite

TOPIC 2: IGNEOUS ROCKS

- CRYSTAL SIZE IS AN IMPORTANT FACTOR TO DETERMINE THE ENVIRONMENT OF FORMATION
- THE **LONGER** THE COOLING TIME, THE **LARGER** THE CRYSTAL SIZE (COARSE OR VERY COARSE)
- THE **SHORTER** THE COOLING TIME, THE **SMALLER** THE CRYSTAL SIZE (GLASSY OR FINE)

Coarse Texture
Long Cooling

Fine Texture
Short Cooling

TOPIC 2: IGNEOUS ROCKS

- 5. CRYSTAL SIZE:

WHICH ROCK TOOK LONGER TO COOL, OBSIDIAN OR GRANITE?

GRANITE

QUESTIONS?

TOPIC 3: SEDIMENTARY ROCKS

- **ESSENTIAL QUESTION: HOW DO WE CLASSIFY SEDIMENTARY ROCKS?**

TOPIC 3: SEDIMENTARY ROCKS

- SEDIMENTARY ROCKS: **ROCK TYPE THAT FORMS FROM AN ACCUMULATION (BUILD UP) OF SEDIMENT FROM PRE-EXISTING ROCKS AND/OR ORGANIC MATERIALS**
- LITHIFICATION: **HOW SEDIMENTARY ROCKS FORM**

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:

1. TEXTURE: **THE SIZE, FORM, & POSITIONS OF THE PIECES (CLASTS) IN A ROCK**

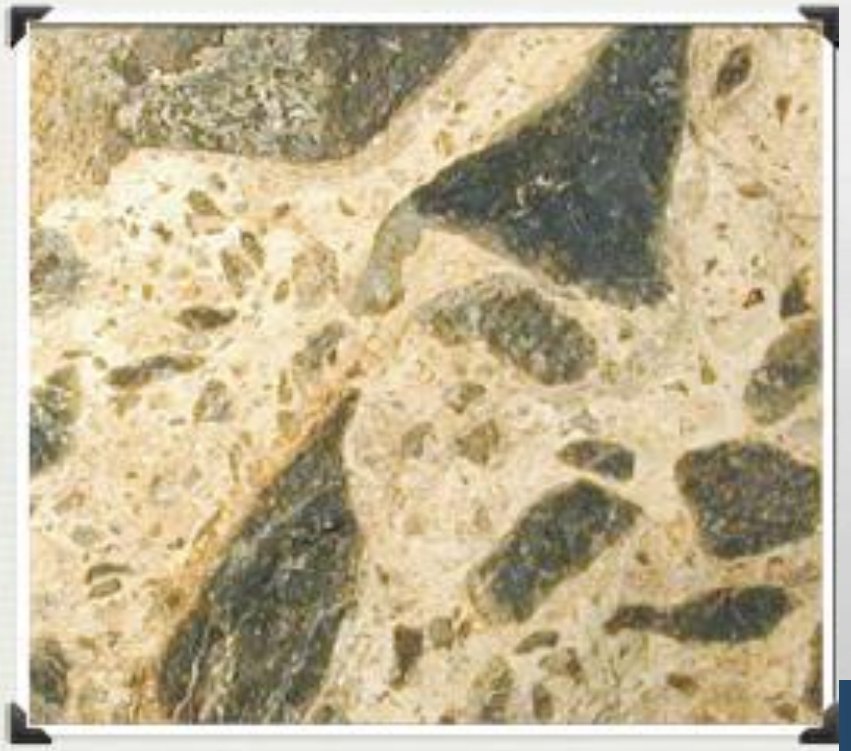
  - **TEXTURE IS THE MAIN FACTOR** IN SEDIMENTARY ROCK IDENTIFICATION

    - CLASTIC: **ROCK FORMED FROM PIECES OF OTHER ROCKS; CAN BE IDENTIFIED BY THE SIZE & SHAPE OF THE PIECES**

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:
  - **FOR EXAMPLE: ROUNDED PIECES = CONGLOMERATE; ANGULAR PIECES = BRECCIA**

Conglomerate
Rounded Fragments



Breccia
Angular Fragments

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:
  - CRYSTALLINE: **ROCK FORMED FROM MINERAL GRAINS THAT "FALL OUT" OF A SOLUTION BECAUSE OF EVAPORATION**

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:
  - BIOCLASTIC: **ROCK FORMED FROM PLANT AND/OR ANIMAL REMAINS**
    - **REMEMBER: "BIO" = LIVING (ONCE-LIVING)**

Coal

Limestone

TOPIC 3: SEDIMENTARY ROCKS

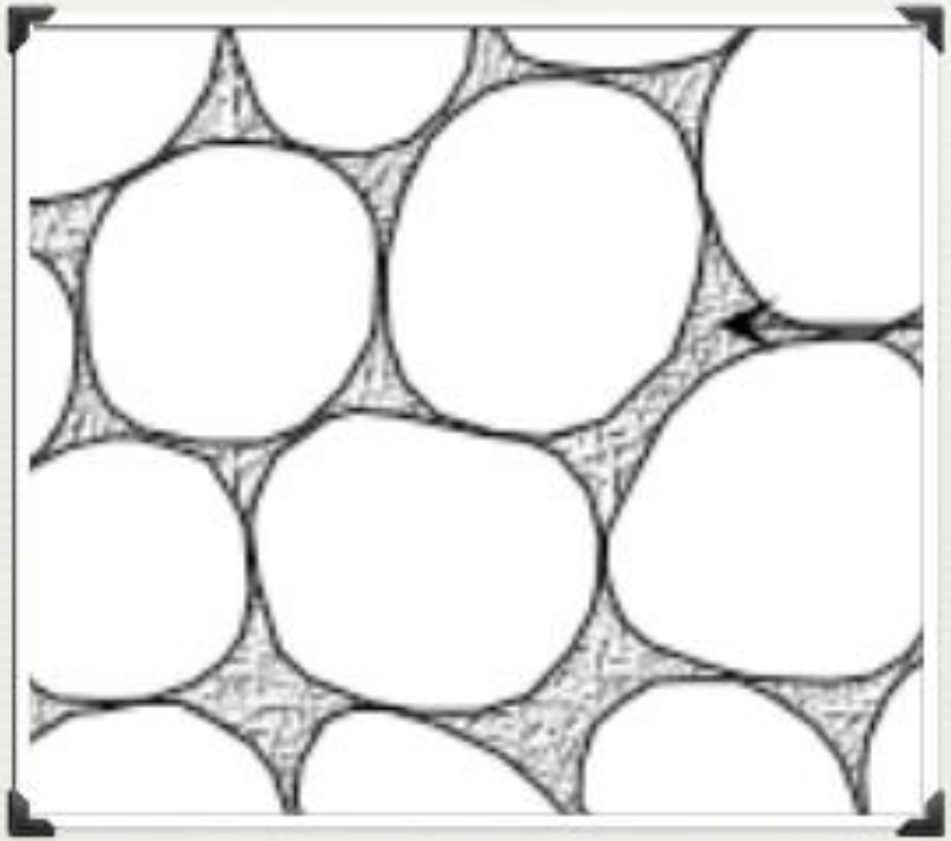
- METHODS TO CLASSIFY SEDIMENTARY ROCKS:

2. FORMATION: **HOW THE CLASTS (PIECES) OF SEDIMENTARY ROCKS ARE HELD TOGETHER**

  - MOST SEDIMENTARY ROCKS FORM UNDER LARGE BODIES OF WATER BY THE FOLLOWING:
    - CEMENTATION: **WHEN CLASTS (EX., PIECES OF CLAY, SAND, & SILT) ARE GLUED TOGETHER**
      - OCCURS AS WATER BETWEEN SEDIMENTS DISSOLVES AND THE REMAINING MATERIALS HOLD THE CLASTS TOGETHER

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:



Cemented Fragments

Cemented Fragments

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:
- <u>COMPACTION</u>: **WHEN THERE'S LESS VOLUME (SPACE) BETWEEN SEDIMENTARY LAYERS DUE TO INCREASING WEIGHT OF THE OVERLYING SEDIMENT**
  - USUALLY RESULTS IN A DECREASE IN PORE SPACE AND SEDIMENTS BECOME MORE TIGHTLY PACKED

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:
- CHEMICAL ACTION: **WHEN DISSOLVED MINERALS IN WATER FORM A MASS OF MINERAL CRYSTALS AFTER EVAPORATING**

Salt Flats, Utah

Rock Salt

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:

3. CHARACTERISTICS: **THE PROPERTIES & TRAITS THAT MAY HELP IDENTIFY A SEDIMENTARY ROCK**

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:
  - FORM AT OR NEAR EARTH'S SURFACE WHERE WEATHERING CAN BREAK ROCK DOWN INTO PIECES

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:
  - FORMS IN HORIZONTAL LAYERS

TOPIC 3: SEDIMENTARY ROCKS

- METHODS TO CLASSIFY SEDIMENTARY ROCKS:
  - MAY CONTAIN FOSSILS

QUESTIONS?

TOPIC 4: METAMORPHIC ROCKS

- **ESSENTIAL QUESTION: HOW DO WE CLASSIFY METAMORPHIC ROCKS?**

TOPIC 4: METAMORPHIC ROCKS

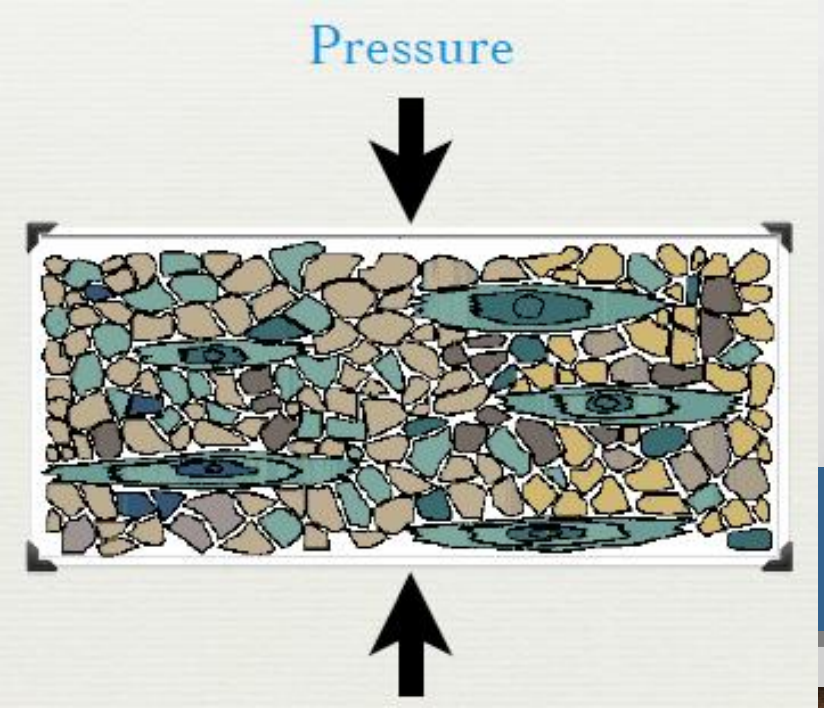
- METAMORPHIC ROCKS: **PARENT ROCKS THAT HAVE BEEN CHANGED BY INCREASES IN TEMPERATURE AND/OR PRESSURE**
- PARENT ROCK: **PRE-EXISTING ROCK FROM WHICH METAMORPHIC ROCKS ARE FORMED**

TOPIC 4: METAMORPHIC ROCKS

- HEAT:
  - ROCK EXPANDS WHEN HEATED, CAUSING THE ATOMS TO BREAK APART AND MOVE FREELY
  - AS TEMPERATURE DECREASES, ATOMS JOIN WITH OTHER ATOMS TO FORM DIFFERENT COMPOUNDS
  - THE RESULT IS A STRUCTURAL AND CHEMICAL CHANGE

TOPIC 4: METAMORPHIC ROCKS

- <u>PRESSURE:</u>
  - UNDER EXTREME PRESSURE AT GREAT DEPTHS INSIDE THE EARTH, ATOMS' BONDS ARE BROKEN AND RE-ARRANGED INTO A DENSER AND MORE COMPACT (AKA TIGHT) STRUCTURE



TOPIC 4: METAMORPHIC ROCKS

- METHODS TO CLASSIFY METAMORPHIC ROCKS:
  1. TEXTURE: THE GENERAL APPEARANCE OF THE ROCK
     - FOLIATION: **WHEN MINERALS RE-ARRANGE INTO FLAT LAYERS DUE TO EXTREME PRESSURE**
     - BANDING: **TYPE OF FOLIATION; WHEN PRESSURE SEPARATES MINERALS INTO ALTERNATING LIGHT & DARK LAYERS**

Foliation
Slate

Foliation with Banding
Gneiss

TOPIC 4: METAMORPHIC ROCKS

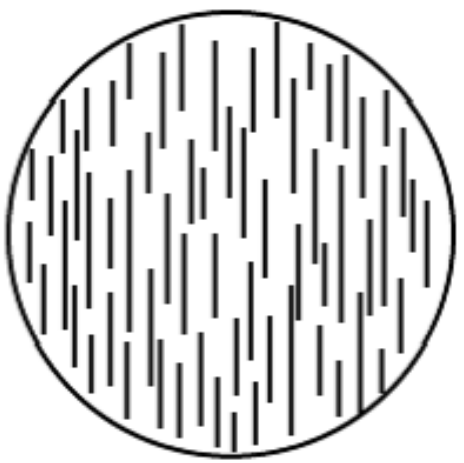
- METHODS TO CLASSIFY METAMORPHIC ROCKS:
  - NON-FOLIATED: **WHEN MINERALS RE-ARRANGE & CHANGE FORM, BUT DO NOT FORM LAYERS**

Non-foliated
Marble

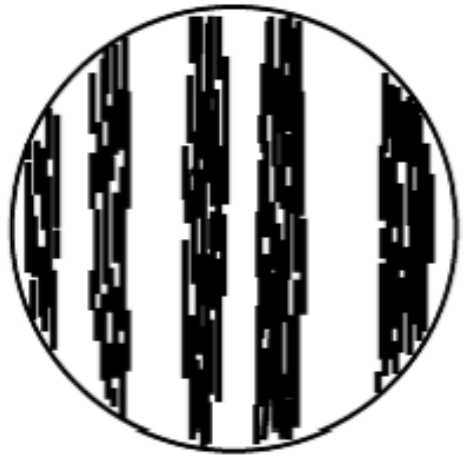
Non-foliated
Quartzite

TOPIC 4: METAMORPHIC ROCKS

- METHODS TO CLASSIFY METAMORPHIC ROCKS:



Foliated



Banding

Non-foliated

TOPIC 4: METAMORPHIC ROCKS

- METHODS TO CLASSIFY METAMORPHIC ROCKS:

  2. GRAIN SIZE: **SIZE OF THE INDIVIDUAL GRAINS IN THE ROCK**

Medium Grained
Schist

Coarse Grained
Metaconglomerate

TOPIC 4: METAMORPHIC ROCKS

- METHODS TO CLASSIFY METAMORPHIC ROCKS:

  3. COMPOSITION: **THE MINERALS THAT MAKE UP THE ROCK**

Composition: Calcite
Rock: Marble

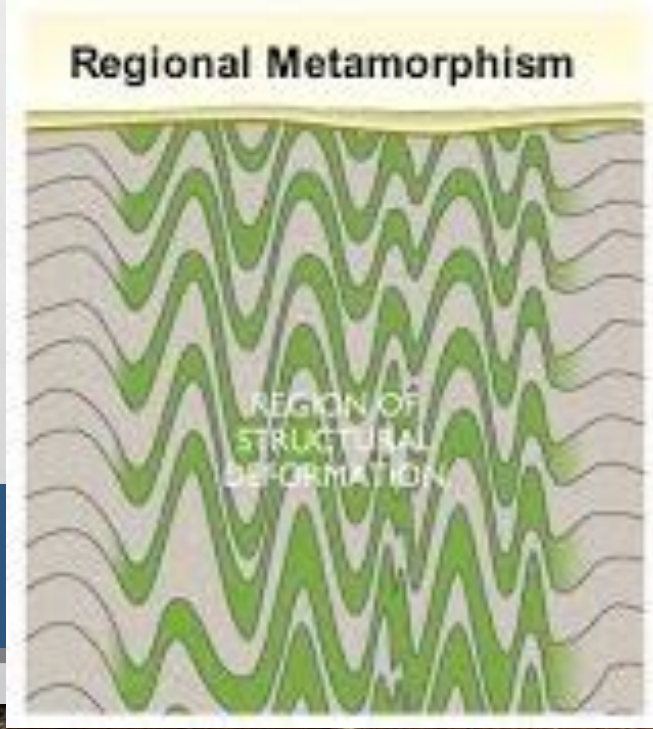
Composition: Mica
Rock: Slate

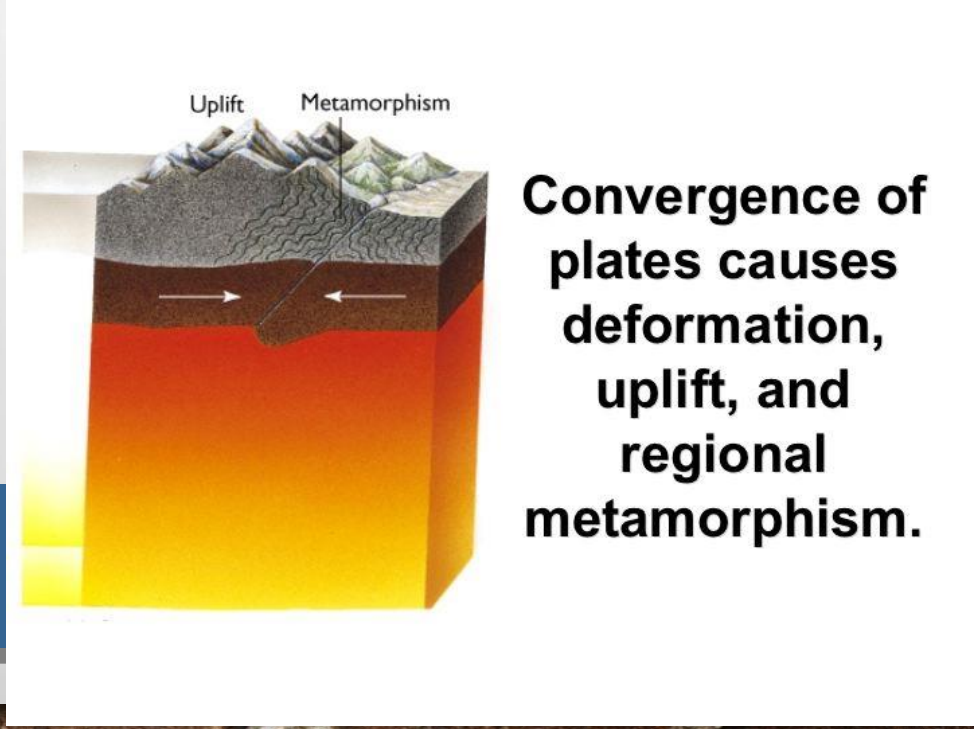
TOPIC 4: METAMORPHIC ROCKS

- METHODS TO CLASSIFY METAMORPHIC ROCKS:

4. TYPE OF METAMORPHISM:

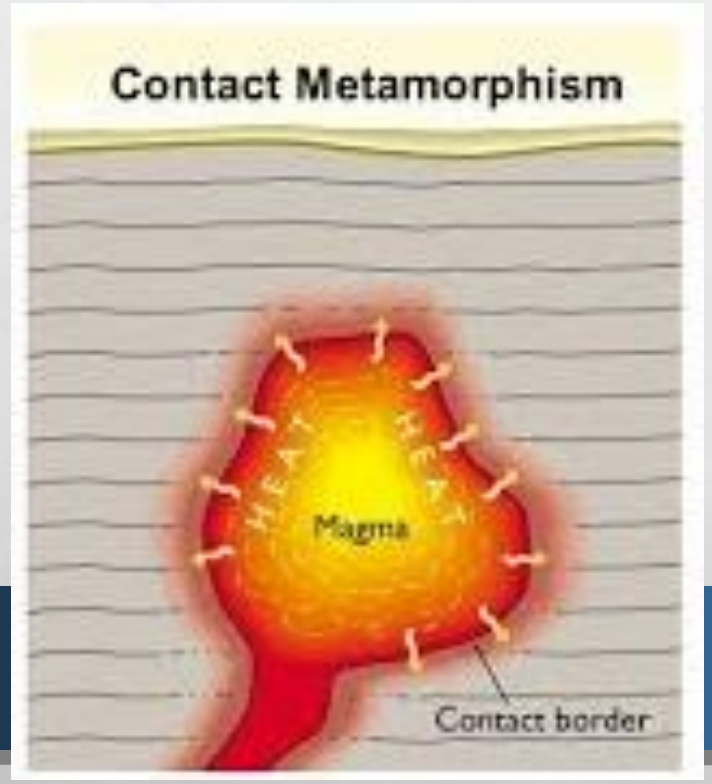
- REGIONAL METAMORPHISM: **PROCESS CAUSING METAMORPHIC ROCKS TO FORM OVER LARGE AREAS DUE TO INCREASING TEMPERATURE AND PRESSURE**
  - MOST METAMORPHIC ROCKS FORM REGIONALLY UNDER A MOUNTAIN OR DEEP INSIDE THE EARTH

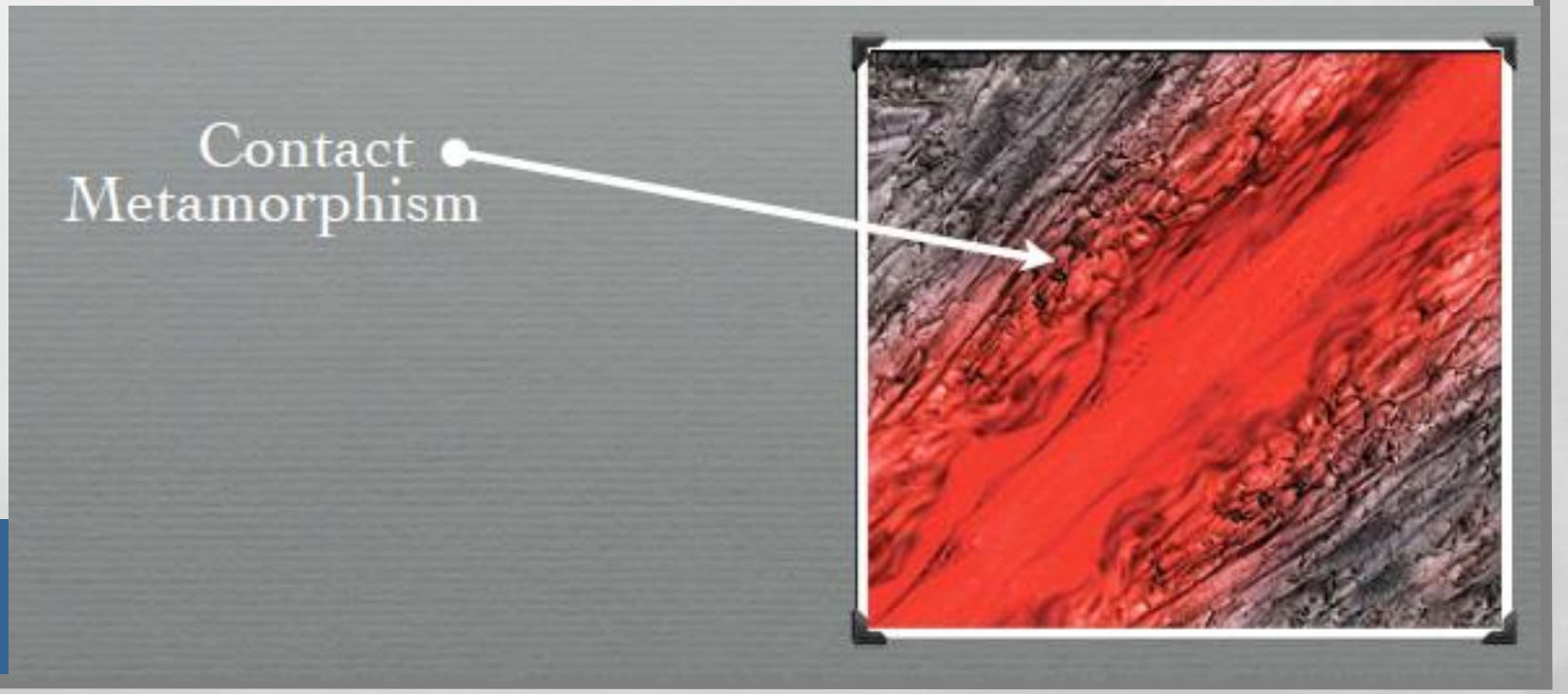




TOPIC 4: METAMORPHIC ROCKS

- METHODS TO CLASSIFY METAMORPHIC ROCKS:
  - CONTACT METAMORPHISM: **PROCESS WHEN PRE-EXISTING ROCKS CHANGE WHEN HEAT FROM MAGMA OR LAVA RE-ARRANGES THE MINERALS**

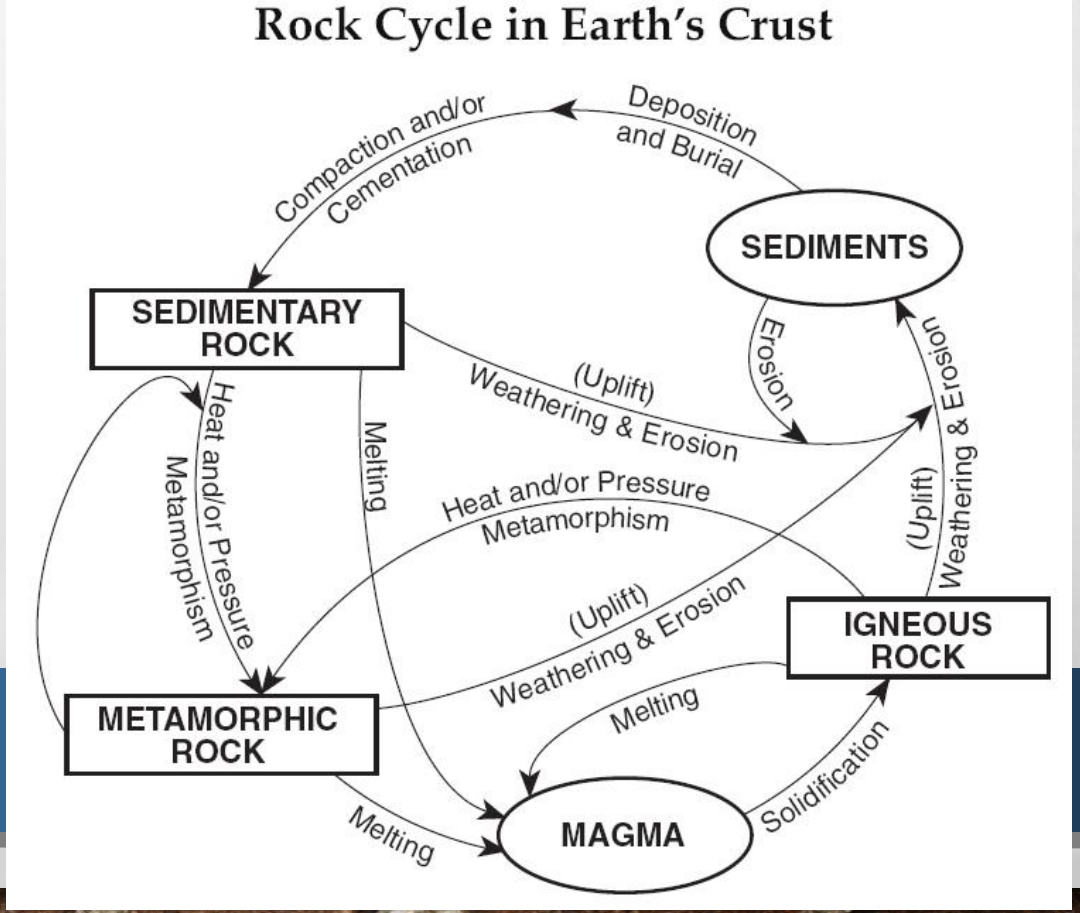




QUESTIONS?

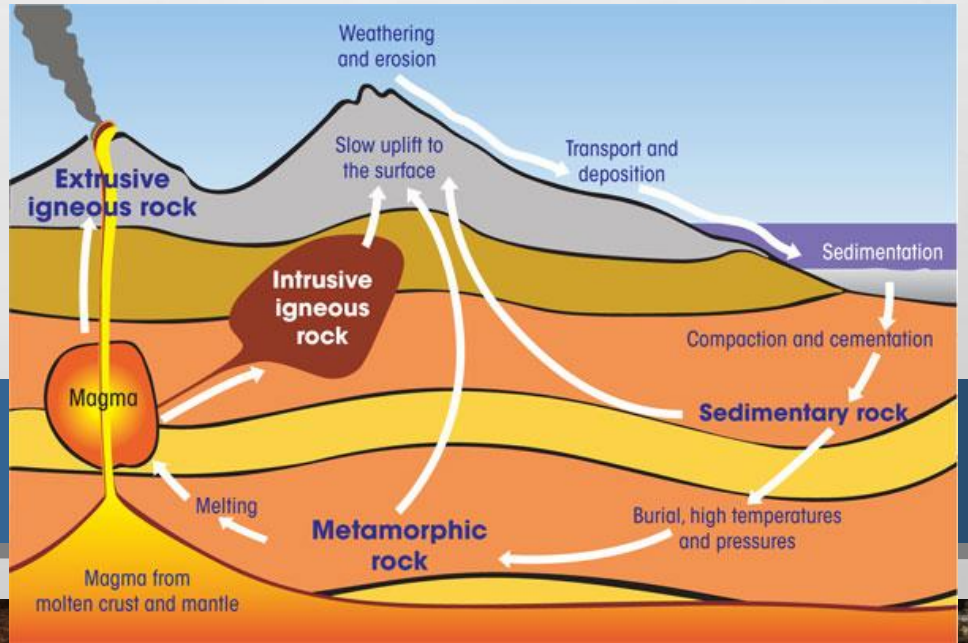
TOPIC 5: ROCK CYCLE

- **ESSENTIAL QUESTION: WHAT IS THE ROCK CYCLE & HOW ARE ROCKS INTERRELATED?**



TOPIC 5: ROCK CYCLE

- ROCK CYCLE: **SCIENTIFIC MODEL USED TO SHOW HOW DIFFERENT ROCK TYPES ARE INTERRELATED (CONNECTED) & THE PROCESSES THAT CREATE THEM**
  - ANY ROCK TYPE CAN CHANGE INTO ANOTHER ROCK TYPE
  - THEREFORE ANY ROCK COULD CONTAIN MATERIALS THAT WERE ONCE PART OF ANOTHER ROCK



TOPIC 5: ROCK CYCLE

- IGNEOUS ROCK: **FORMED FROM MELTING & SOLIDIFICATION**
- SEDIMENTARY ROCK: **FORMED FROM CLASTS (PIECES) HELD TOGETHER BY CEMENTATION, COMPACTION, OR CHEMICAL ACTION**
- METAMORPHIC ROCK: **FORMED FROM HEAT AND/OR PRESSURE**

TOPIC 5: ROCK CYCLE

- DRIVING FORCES: THE PROCESSES THAT CREATE UPLIFT, WEATHERING, EROSION, PRESSURE, AND MELTING TO FORM THE DIFFERENT ROCK TYPES
  - **EARTH'S INTERIOR**
  - **INSOLATION FROM THE SUN**
  - **GRAVITY**

QUESTIONS?