

# HOW MINERALS FORM

- **What are the processes by which minerals form?**



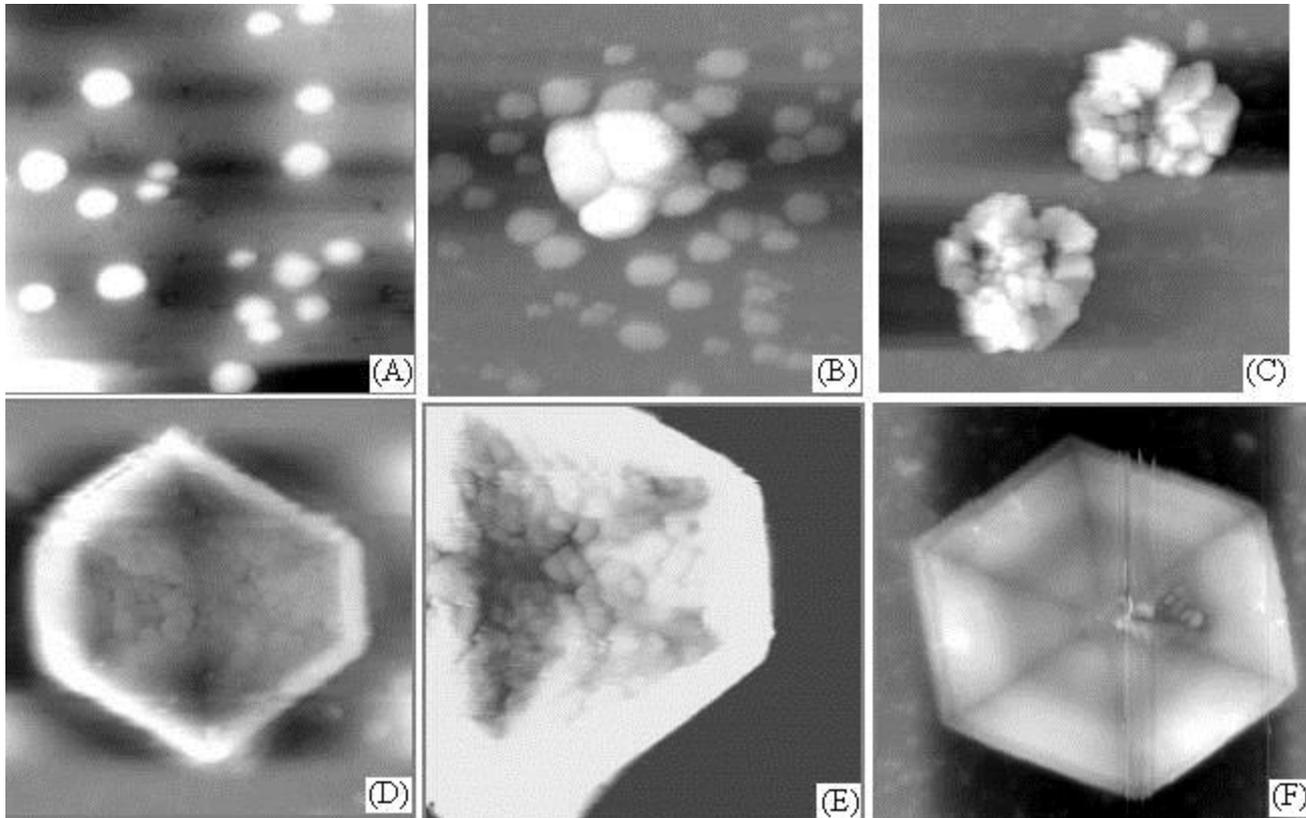
- The minerals that people use today have been forming deep in Earth's crust or on the surface for several billion years.



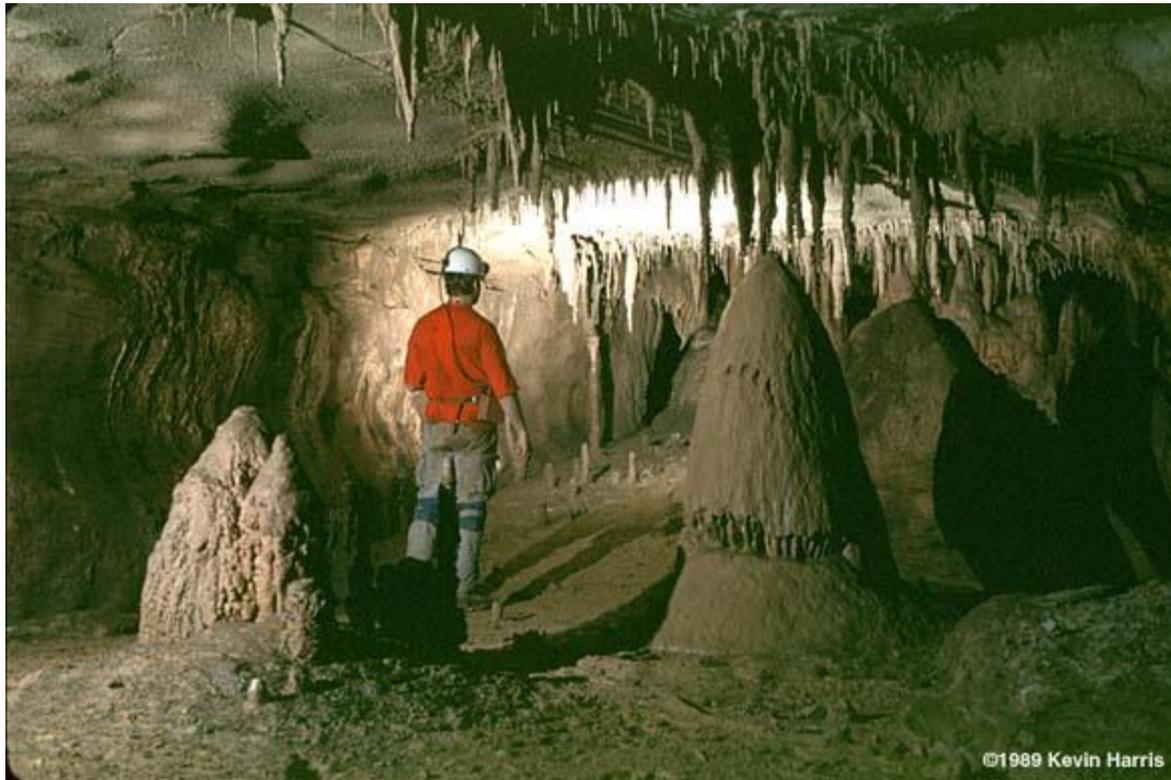
- In general, minerals can form in two ways: through **crystallization of melted materials**, and through **crystallization of materials dissolved in water**.



- Crystallization is the process by which atoms are arranged to form a material with a crystal shape.



- Minerals can form as hot magma cools deep inside the crust, or as lava hardens on the surface.
- When these liquids cool to the solid state, they form mineral crystals.



- The size of these crystals depends on several factors.
- **The rate at which magma cools, the amount of gas magma contains, and the chemical composition of magma all affect crystal size.**



- Slow cooling leads to the formation of minerals with large crystals.
- If the crystals remain undisturbed while cooling deep below the surface, they grow according to a regular pattern.



- Magma closer to the surface loses heat energy much faster than magma that hardens deep below ground.
- With rapid cooling, there is no time for magma to form large crystals.



- If magma erupts to the surface, the lava will also cool quickly and form minerals with small crystals.



- Sometimes, the elements that form a mineral dissolve in hot water.
- These dissolved minerals form solutions.



- A **solution** is a mixture in which one substance dissolves in another.



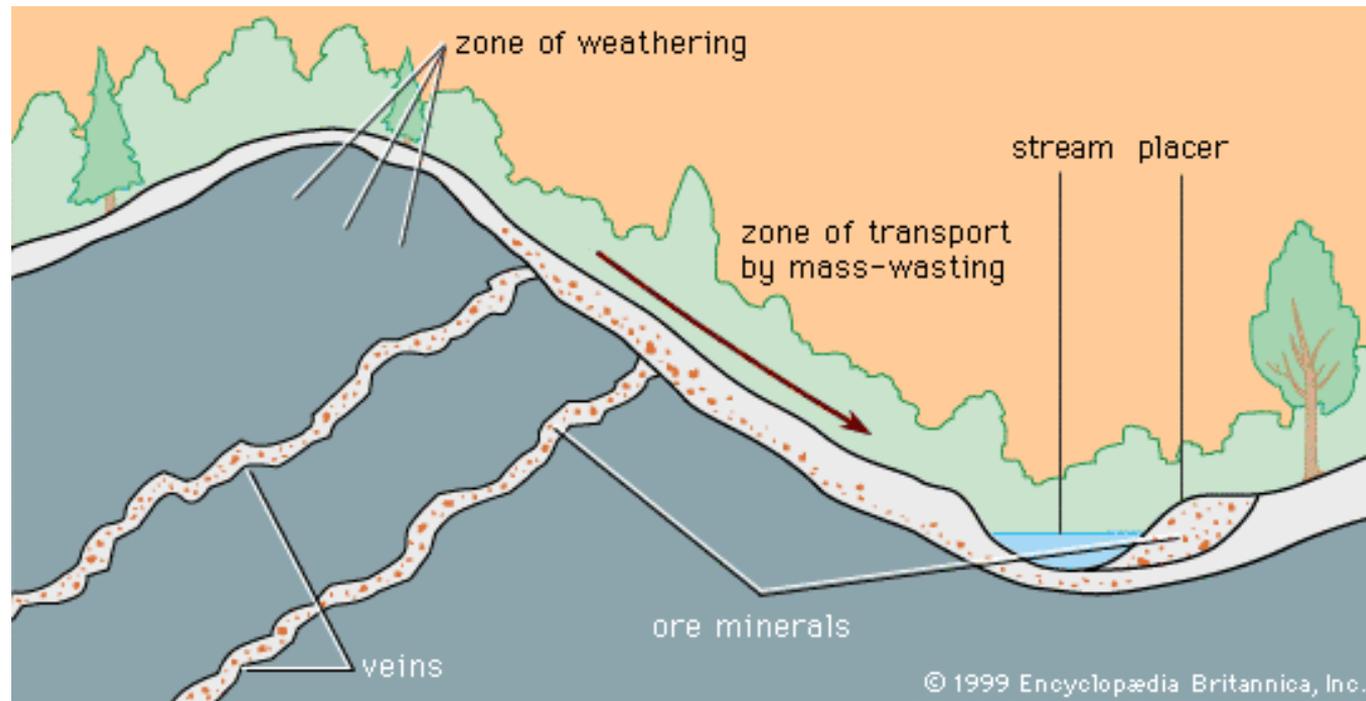
- When a hot water solution begins to cool, the elements and compounds leave the solution and crystallize as minerals.



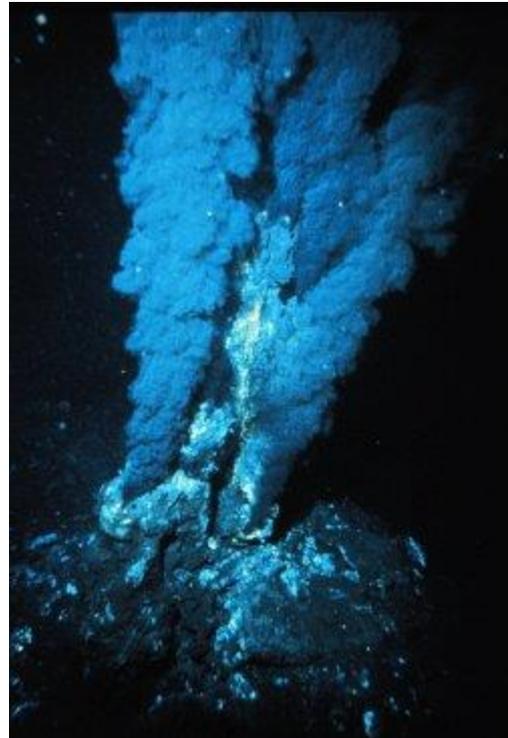
- Pure metals that crystallize underground from hot water solutions often form veins.
- A **vein** is a narrow channel or slab of a mineral that is sharply different from the surrounding rock.



- Deep underground, solutions of hot water and metals often follow fractures, or cracks, within the rock.
- Then the metals crystallize into veins.



- Many minerals form from solutions at places where tectonic plates spread apart along the mid-ocean ridge.
- The hot magma heats ocean water that seeps underground.



- The heated water dissolves minerals.
- When the solution billows out of vents called “chimneys,” minerals crystallize in the cold sea.



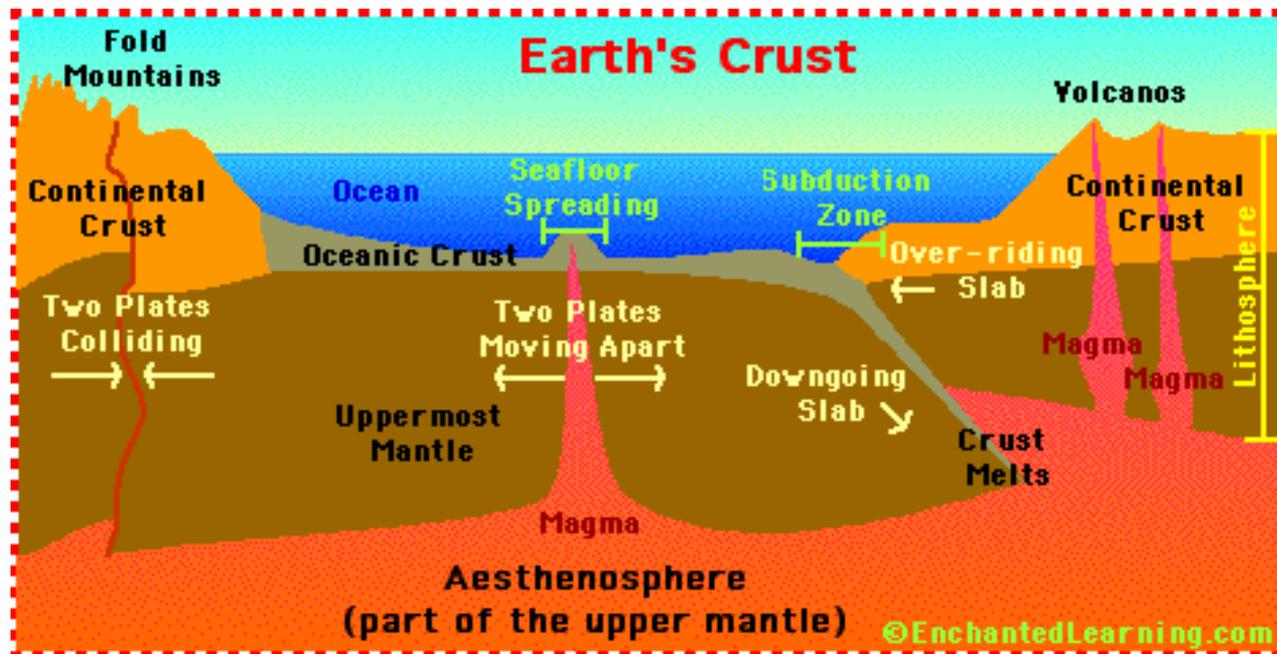
- Minerals can also form when solutions evaporate.
- For example, thick deposits of the mineral halite, or table salt, formed over millions of years when ancient seas slowly evaporated.



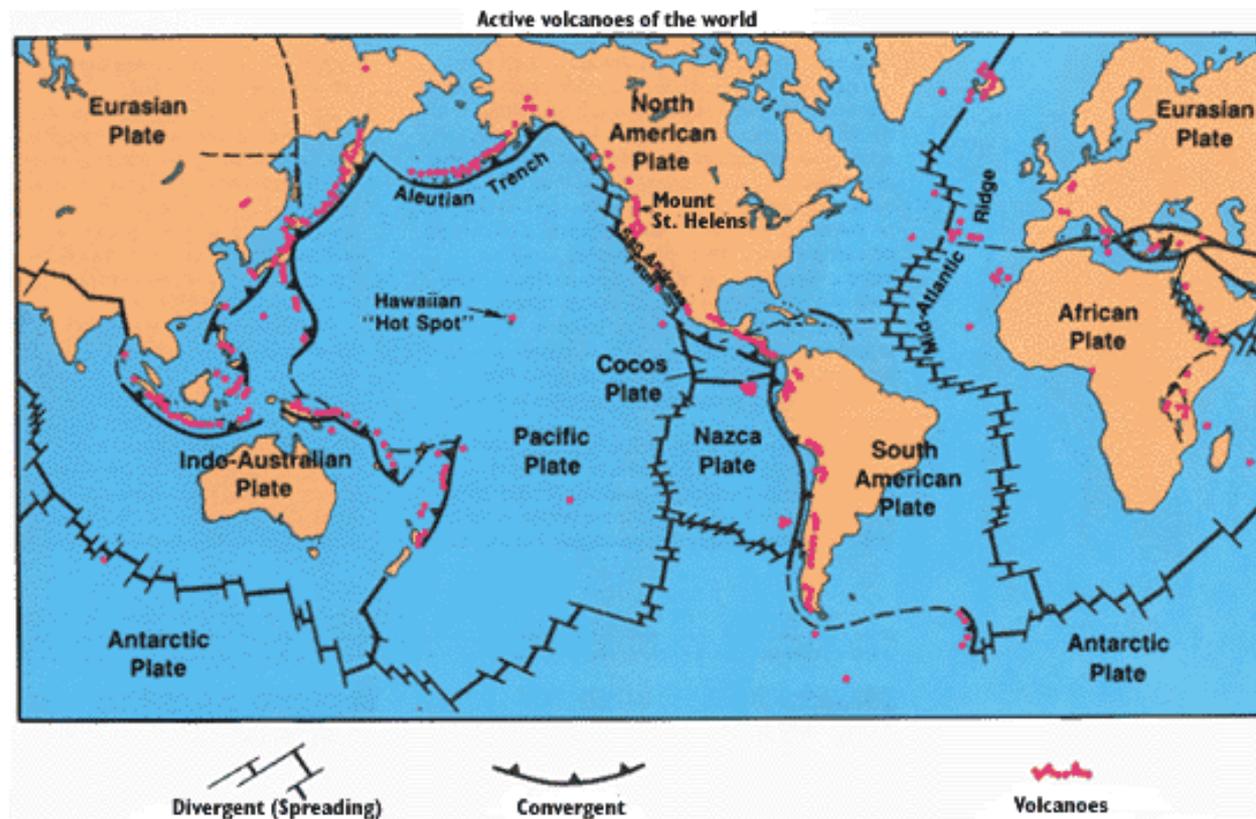
- In addition to halite, other useful minerals form by the evaporation of seawater, including gypsum, calcite crystals, and minerals containing potassium.

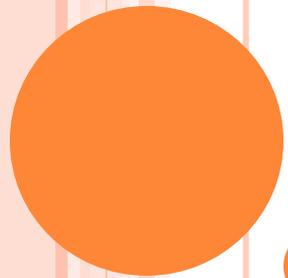


- Earth's crust is made up mostly of the common rock-forming minerals combined in various types of rock.
- Less common and rare minerals, however, are not distributed evenly throughout the crust.



- Instead, there are several processes that concentrate minerals in deposits.
- Many valuable minerals are found in or near areas of volcanic activity and mountain building.





**END**

