Targets:

Understanding Geology, Mineral and Environment in our society

Lecture:

1.General lecture

2.Showing geological material

Rocks and minerals

Geological maps

3.Giving small subjects through newspapers' opinions

Communication:

Discussion in the lecture and/or google classroom

Geology, Mineral resources, and Natural environment in our society

Chapter 1　Introduction

Distribution of mineral resources depends on geology.

Material characteristics can be understood from the periodic table.

The rocks are roughly classified into sedimentary rocks, igneous rocks, and metamorphic rocks.

Porphyry copper deposits distribution in the world

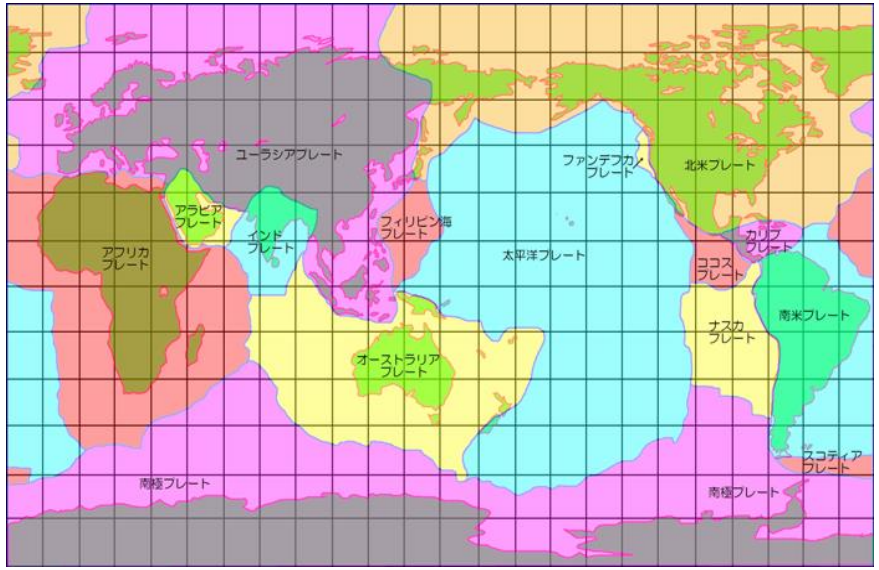
Porphyry copper deposits distribute along western coast of North America and South America.

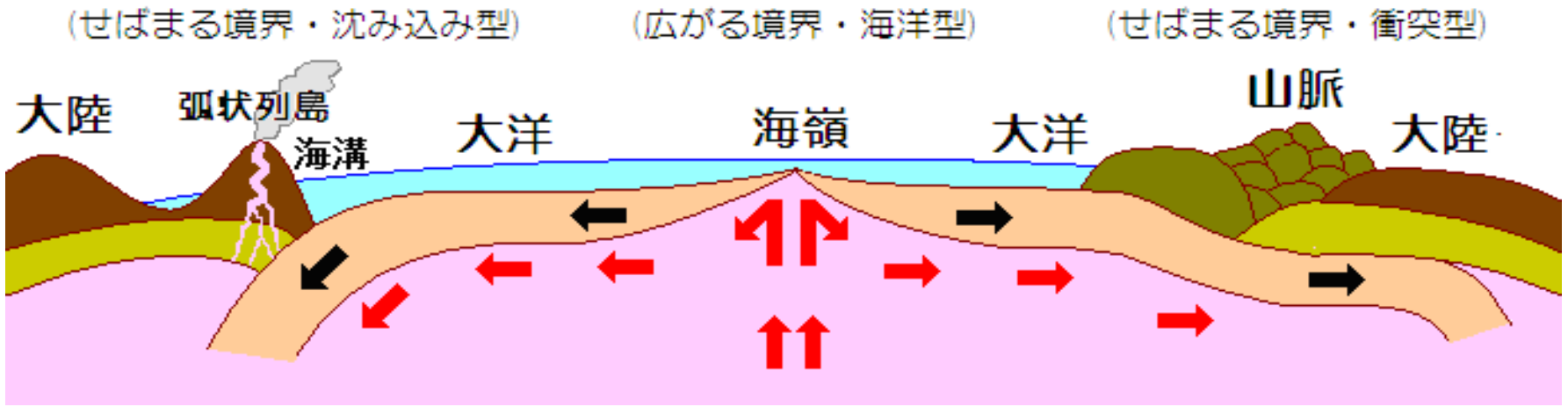
Geologically, the plates subduct under these two continents from the Pacific Ocean to the continents.

The deposits within the continents distribute along the plate subduction zones in ancient time.

Plate tectonics

- A movement of plates on surface of the Earth causes magmatism and earthquake.
- A plate is produced at the ridge and sinks at the margin of the continent. Magmatism is active and some elements are concentrated at this subduction zone.



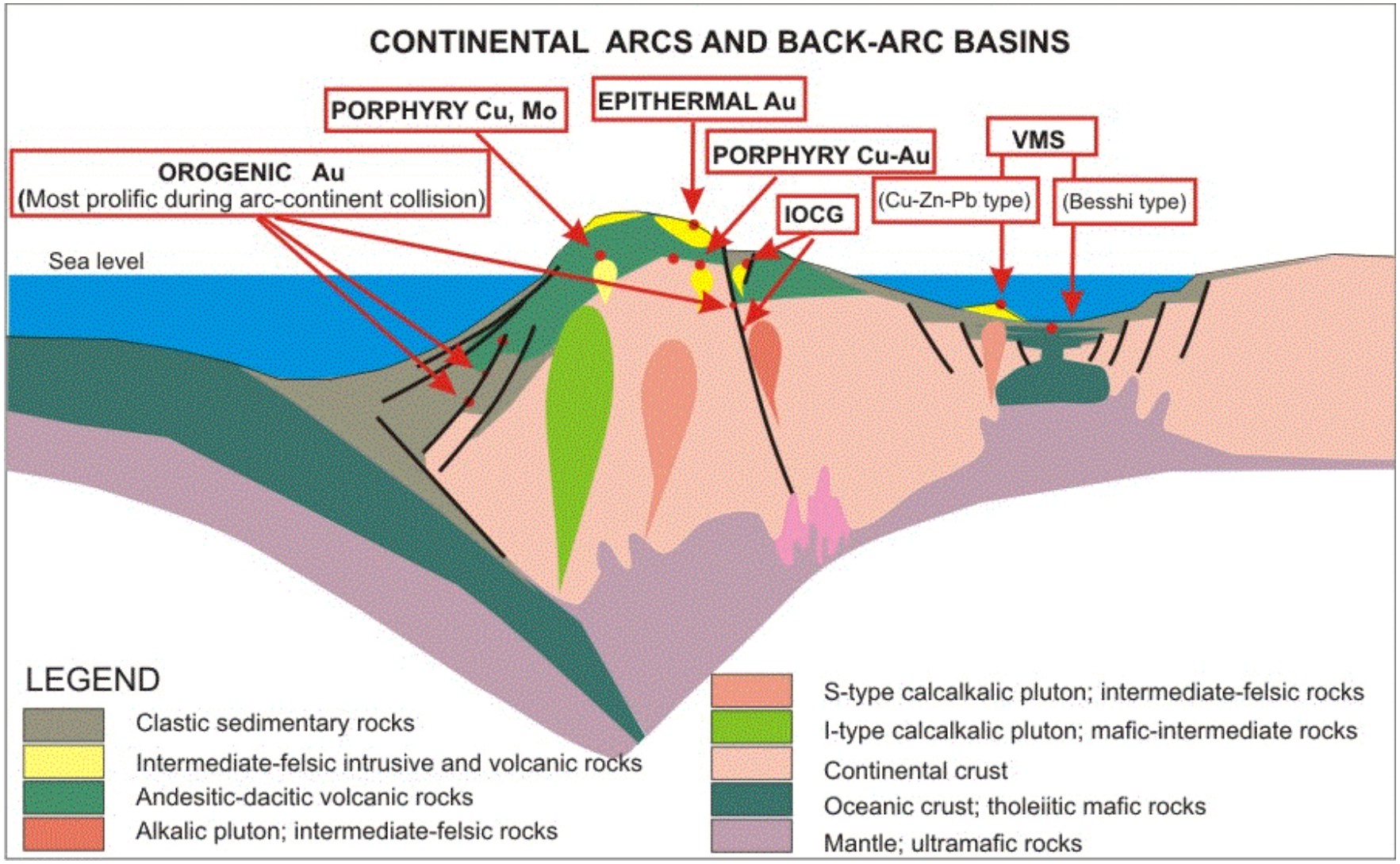


Mineral deposits model

Porphyry type
Continental arcs and Continental margins
Commodity Cu, Mo, Au

Volcano massive sulfide type
Back-arc basins
Commodity
- Cu-Zn-Pb (Kuroko)
- Cu (Besshi type)

Mineral deposits are defined by geological settings.



Review of elements
Mineral Resources can be considered with chemistry of the elements.

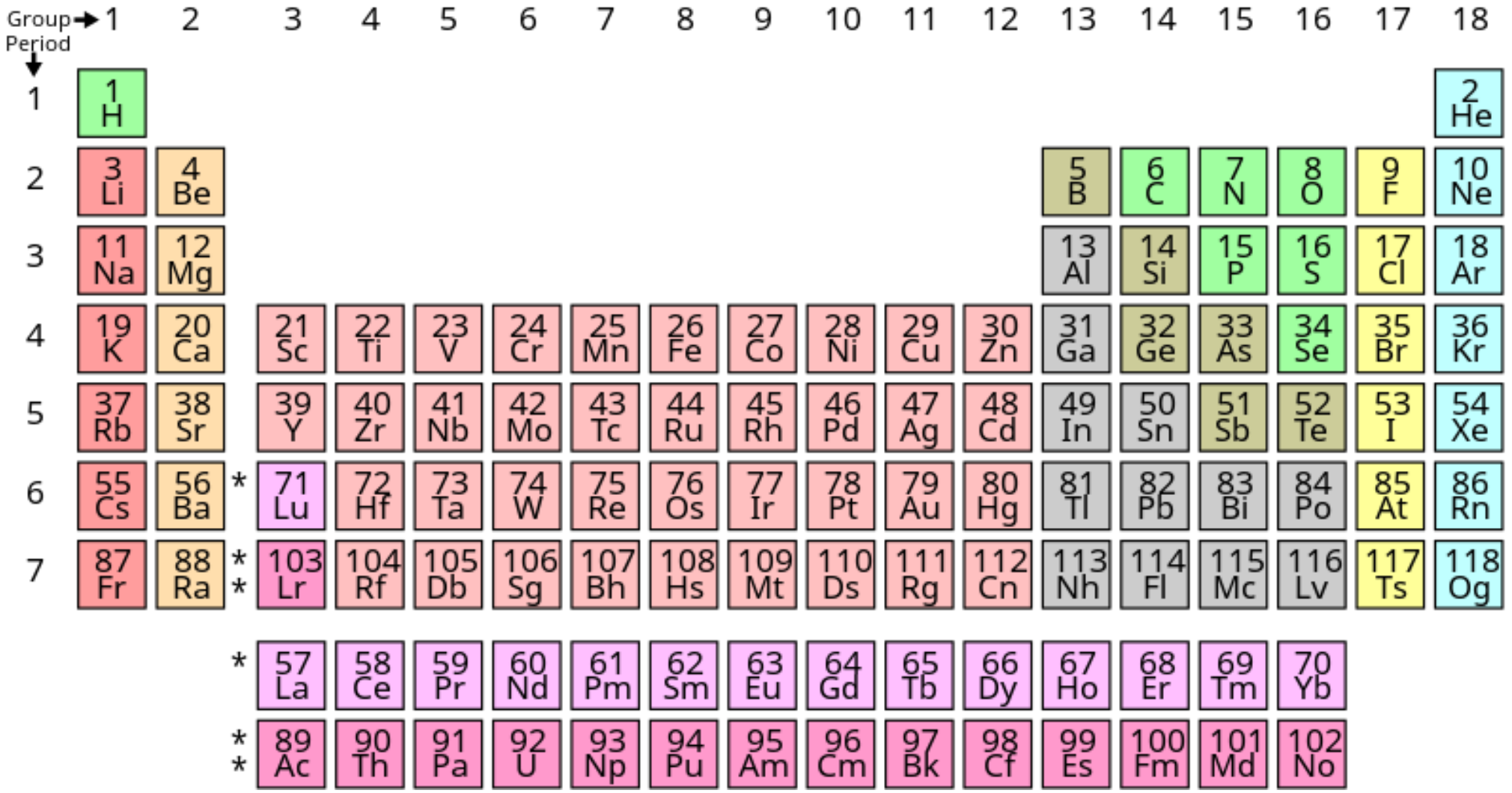
Periodic table

- The periodic table is a tabular display of the chemical elements, which are arranged by atomic number.
- The rows are called periods, and they are numbered from 1 to 7.
- The columns are called groups, numbered from 1 to 18.

Question

What are the symbols for the following metals?
(Gold, Copper, Lead, Zinc, Nickel)

Periodic Table From Wikipedia (Atomic number and Element symbol)



Elements in daily life

Cu (Copper)

Electric wire

Pipe laying

Industrial machinery

Al (Aluminum)

One yen coin

Aluminum foil

Airplane

C (Carbon)

Pencil lead

Diamond

Coke

Introduction to geology

Rock classification

Igneous rocks : The rocks which have congealed from a molten mass (magma). Ex. Basalt, Andesite, Granite

Sedimentary rocks : The rocks which are formed by consolidated sediment deposited in layers. Ex. Sandstone, Mudstone, Limestone

Metamorphic rocks : The rocks which are formed from preexisting solid rocks by mineralogical, structural, and chemical changes, in response to extreme changes in temperature and pressure. Ex. Schist, Gneiss, Hornfels

Ex Rock name is Granite. This is composed of some minerals such as quartz, feldspar, and biotite.

Classification of Igneous rocks

	Ultramafic	Mafic	Intermediate	Felsic
SiO_2 wt.%	40 ～ 45	45 ～ 52	52 ～ 63	63 ～ 75
Volcanic rocks		Basalt	Andesite	Rhyolite
Plutonic rocks	Peridotite	Gabbro	Diorite	Granite

	Gabbro	Diorite	Granite
Minerals	Plagioclase (Ca rich) Pyroxene Hornblende Olivine	Plagioclase Hornblende Pyroxene	Quartz K-feldspar Plagioclase (Na rich) Biotite Hornblende
Color Index (Mafic mineral amounts %)	35 ～ 65	25 ～ 50	5 ～ 20
Density	High	Intermediate	Low
Fe, Mg, Ca	Rich	Intermediate	Rare
Si Na, K	Rare	Intermediate	Rich

Geologic Time (Relative Time)

Geologic time determined by the placing of events in a chronologic order of occurrence, especially time as determined by organic evolution or super position

Era, Time	Period or Era in Precambrian Time	Life
Cenozoic Era	Quaternary Neogene Paleogene	Age of Mammals Age of Flowering Plants
Mesozoic Era	Cretaceous Jurassic Triassic	Age of Reptiles (Dinosaurs) Age of Gymnosperm
Paleozoic Era	Permian/ Carboniferous/ Devonian/ Silurian/ Ordovician/ Cambrian	Age of Amphibians, Fish, Invertebrates
Precambrian Time	Proterozoic/ Archaean/ Hadean	

Radiometric age: Start of Paleozoic 541, Start of Mesozoic 252, Start of Cenozoic 66 (million years ago)

For more study, visit the following sites.

Let's talk Science; Introduction to Periodic table

https://letstalkscience.ca/educational-resources/backgrounders/introduction-periodic-table-elements

Newman (1997) Geologic Time. USGS Publication.

-- Link: https://pubs.usgs.gov/gip/geotime/

Useful Videos

Video, 4min 29sec
Aji Stone, Digging and Manufacturing for a dimension stone
https://japan-stone-center.jp/aji.html

Video, 4min 47sec
Apollo 11 launched Lunar surface, July 24, 1969
https://www.youtube.com/watch?v=BcIRVmK3j6Y