



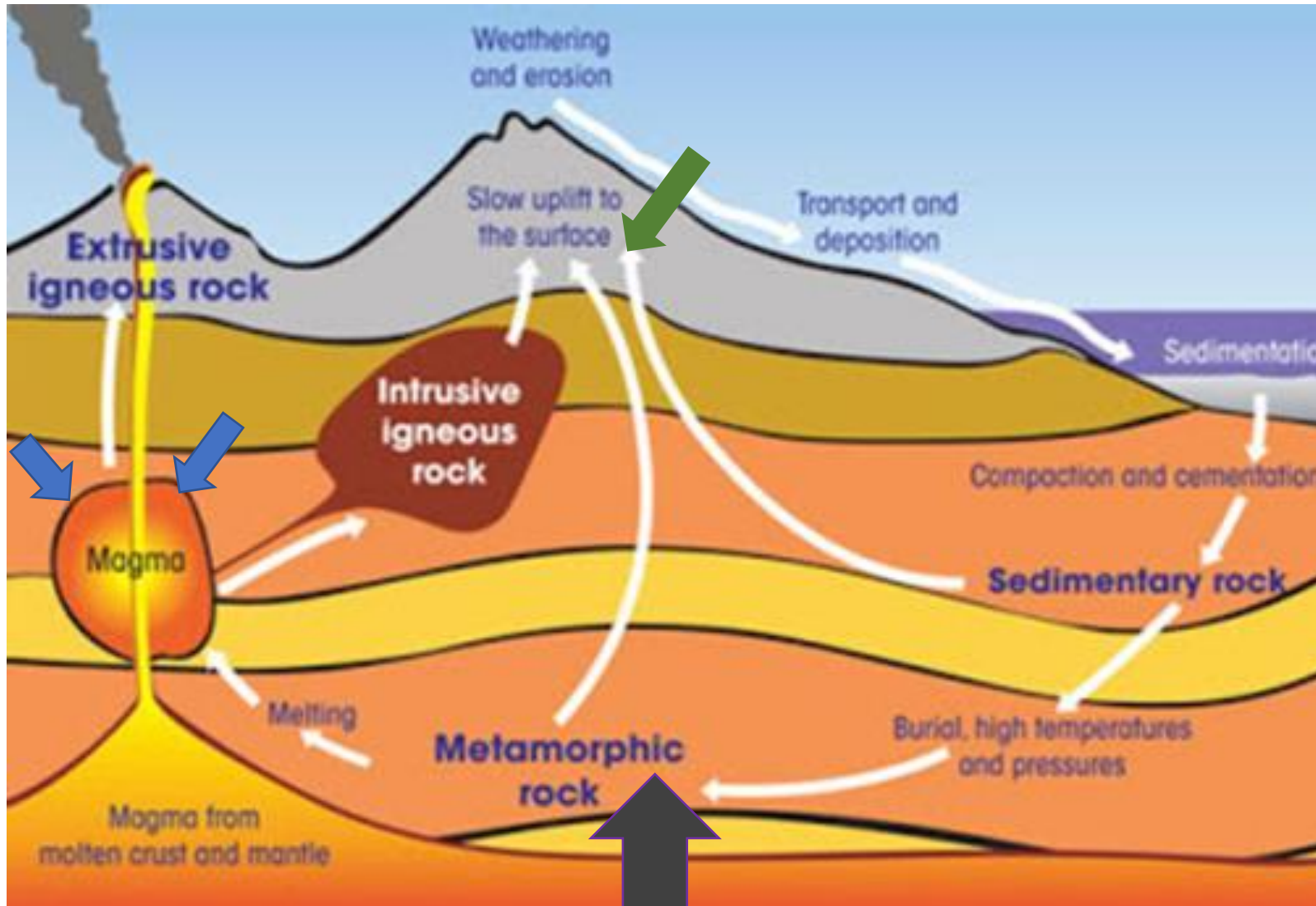
Metamorphic Rocks





What are Metamorphic Rocks?

- Metamorphism is the process where rocks are altered due to **pressure** and/or **heat**, changing their appearance entirely.
 - Metamorphism means "**change in form**"
 - Any type of rock - igneous, sedimentary or metamorphic - can become a metamorphic rock.
 - Does **NOT** involve complete melting of the original rock.
 - Parent rock = **original rock** (aka protolith)

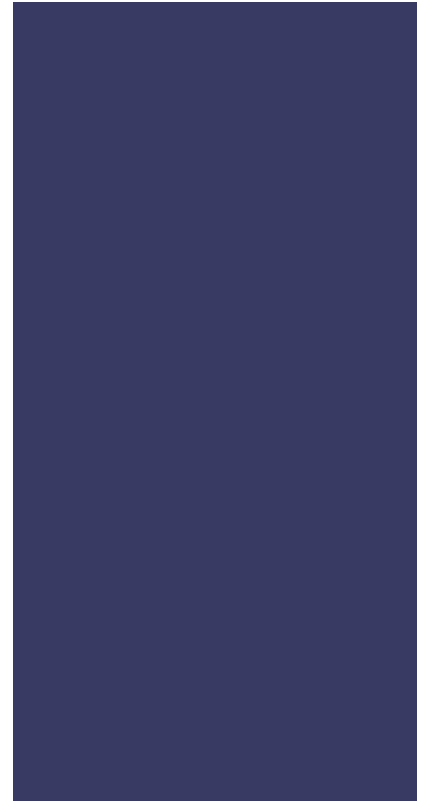
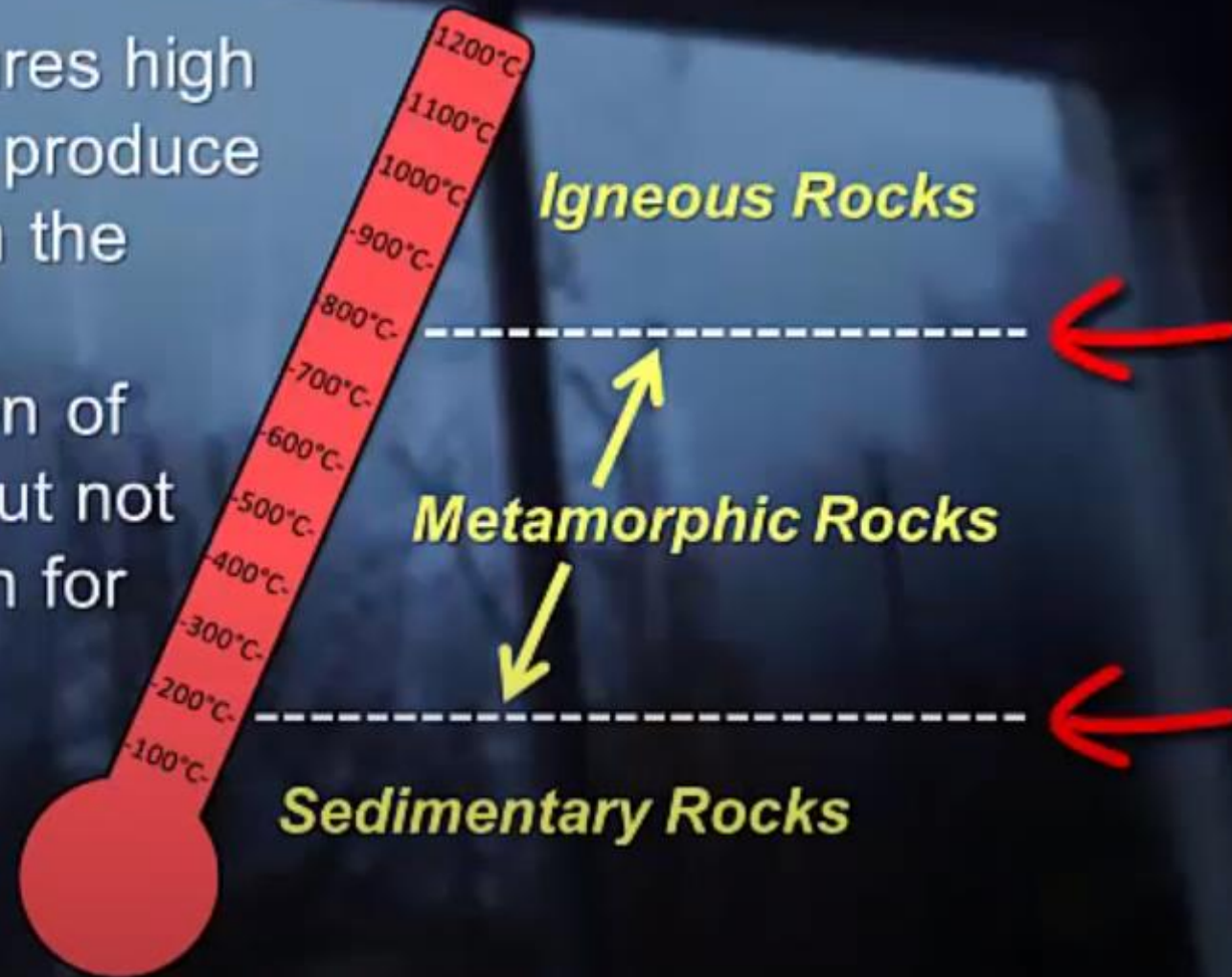


Temperature and Pressure

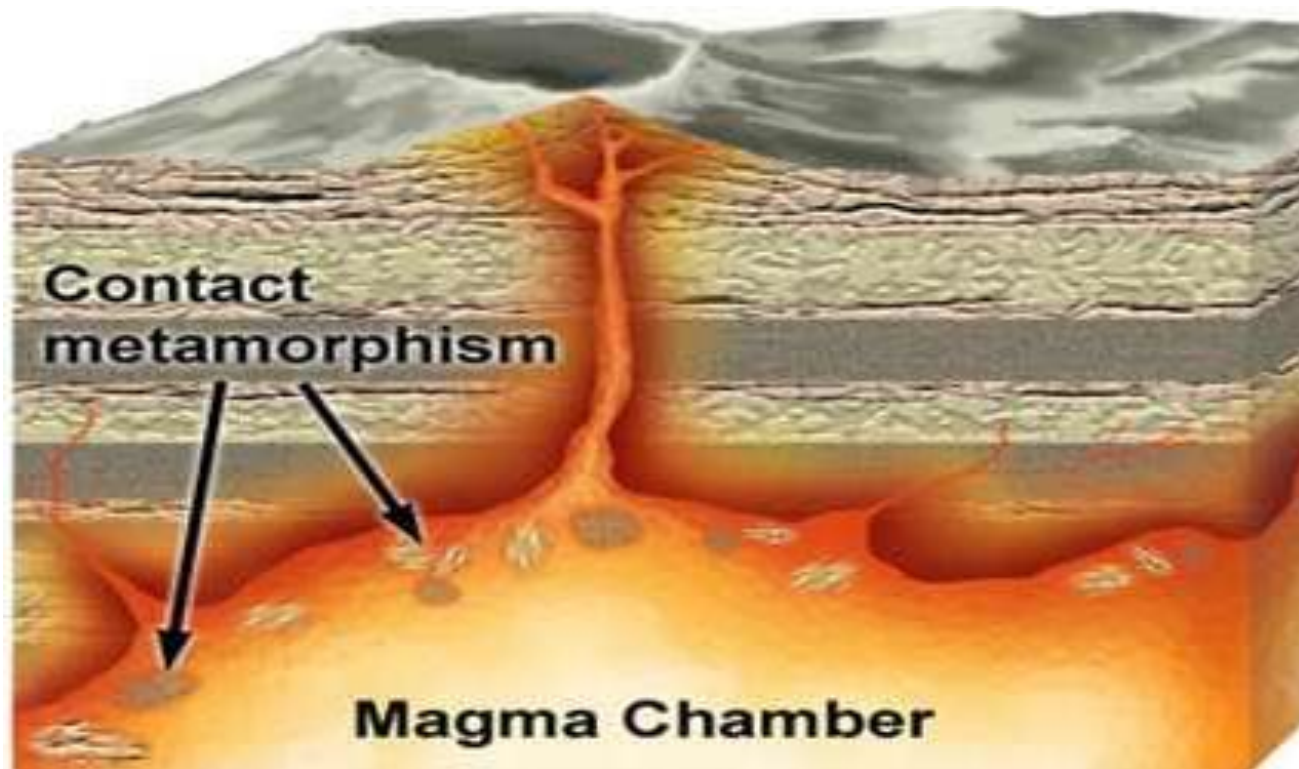
- High Temperatures near **magma**
- High Pressures around tectonic plate boundaries
- High Temperatures and pressure **deep in the Earth**

Metamorphic Temperature “Window”

- Temperatures high enough to produce changes in the texture or composition of minerals but not hot enough for melting

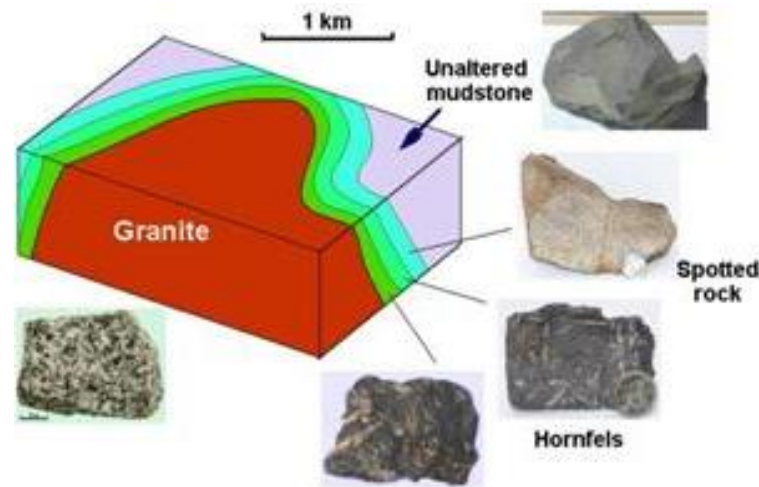


Contact Metamorphism

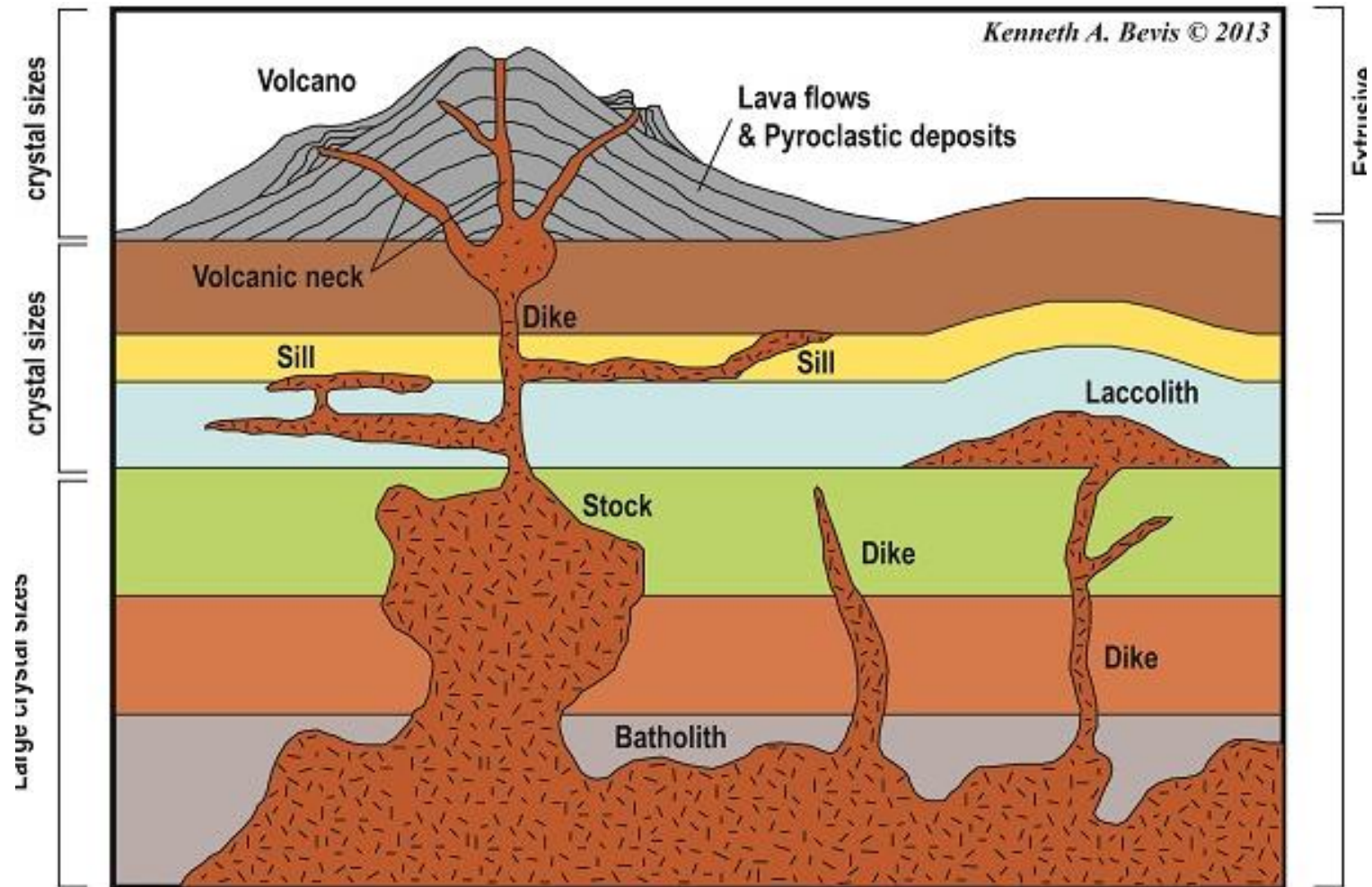


- Metamorphism produced by intrusion of **magma**
- Changes in a rock result from temperature increases due to contact with the magma body
- Usually occur at **relatively shallow depths (low pressure)** in the Earth where there is a bigger difference in temperature between the intruding magma and the surrounding rock.

Contact Metamorphism



- (Thermal metamorphism)
- Contact Metamorphism can occur on scales from a few millimeters either side of a small intrusion, to several hundred meters around a large igneous body such as a batholith.



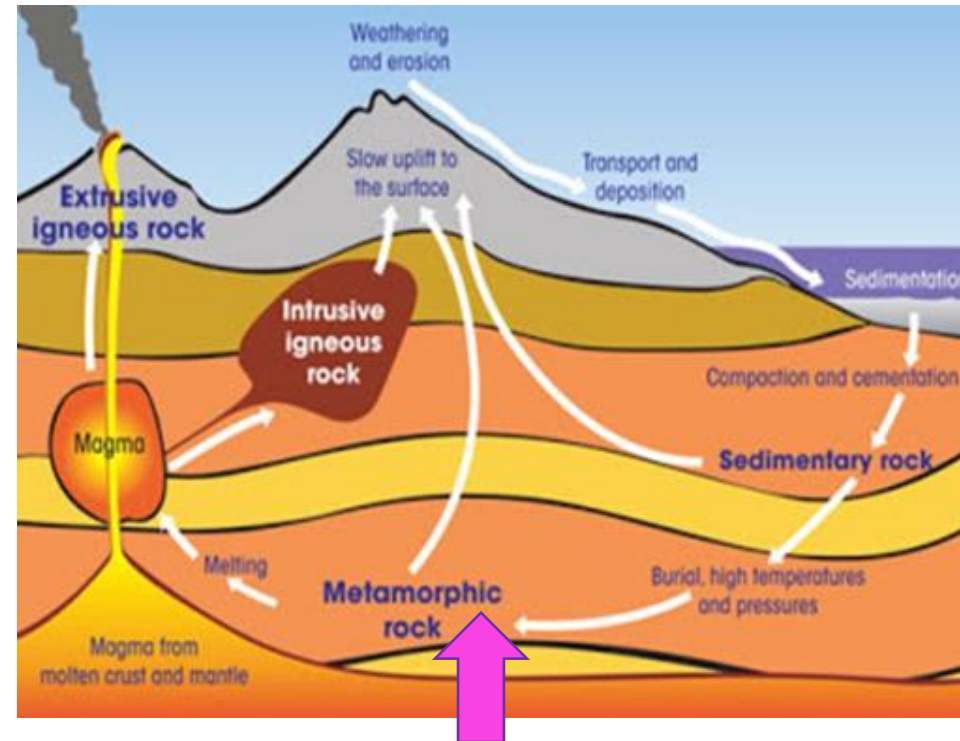
Types of Intrusive Bodies of Rock

Regional Metamorphism

- Changes in rock that occur because of high temperature and pressure over a **large area**.

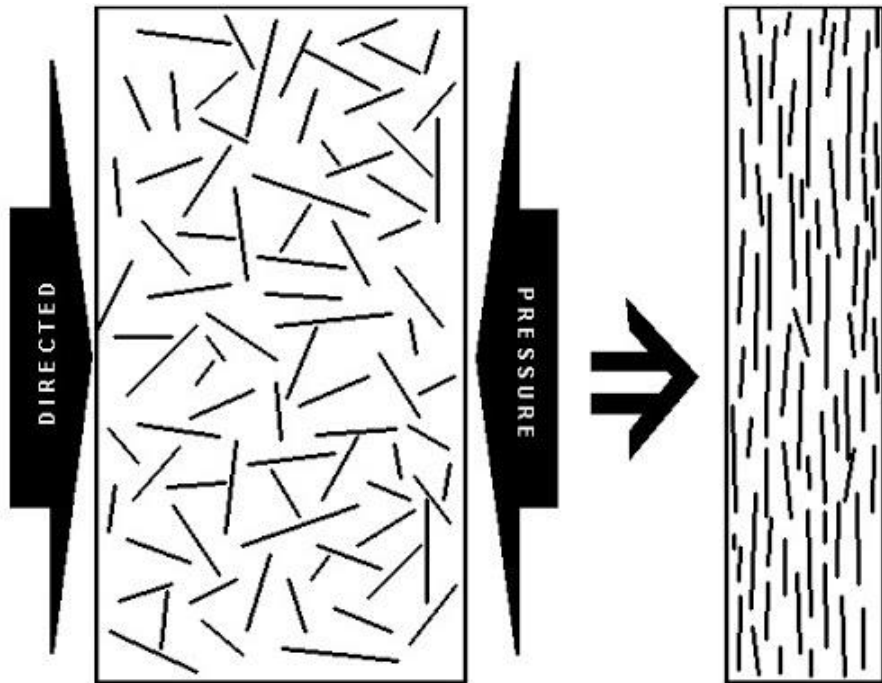


This was once a series of both igneous and sedimentary rocks, which were deeply buried, folded by huge forces, and completely recrystallized at high temperature and pressure to form this beautifully banded and folded rock.



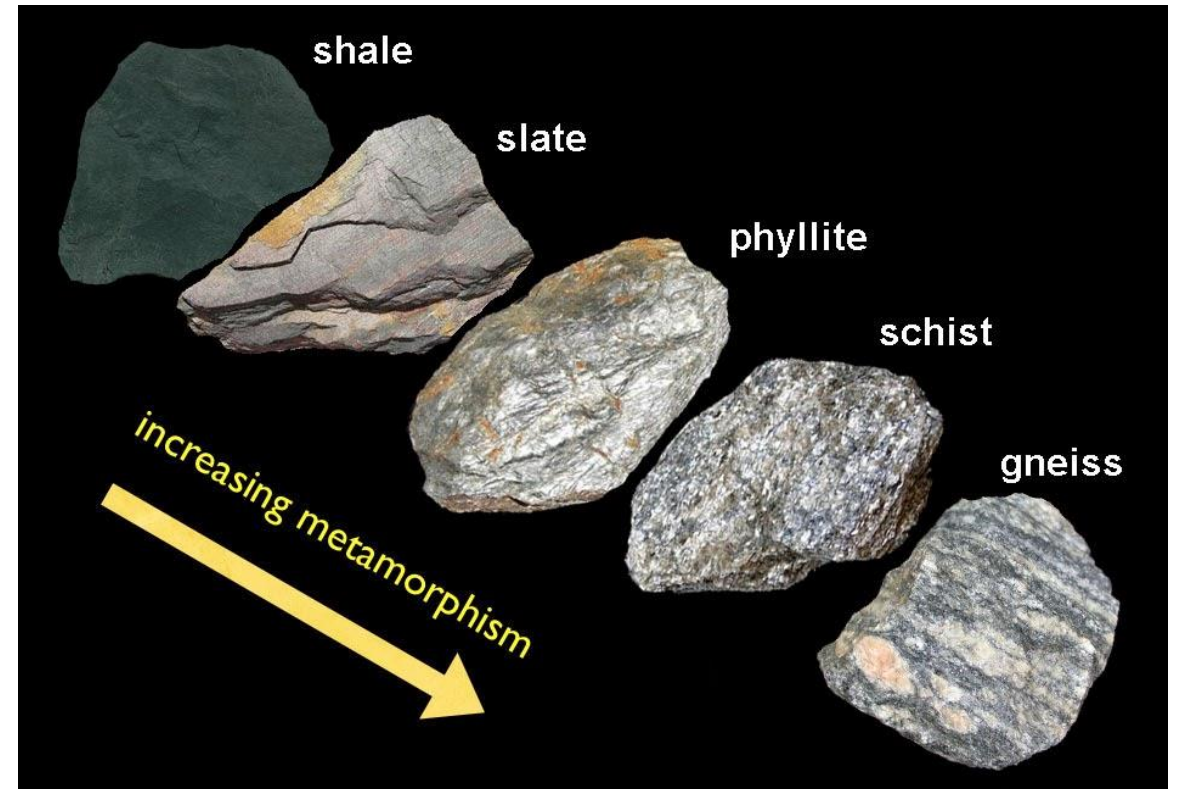
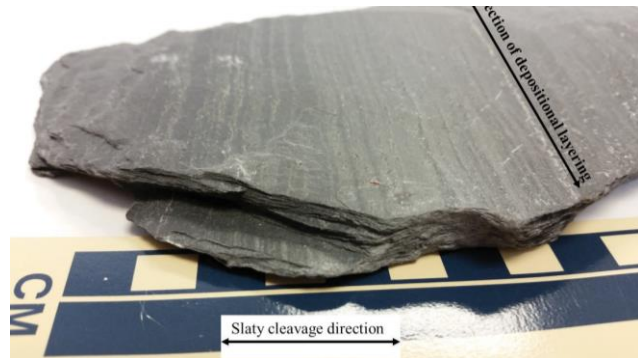
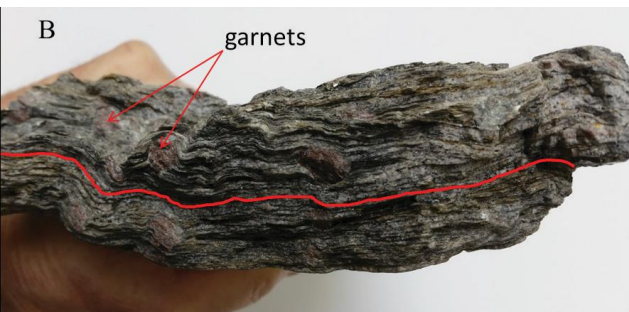
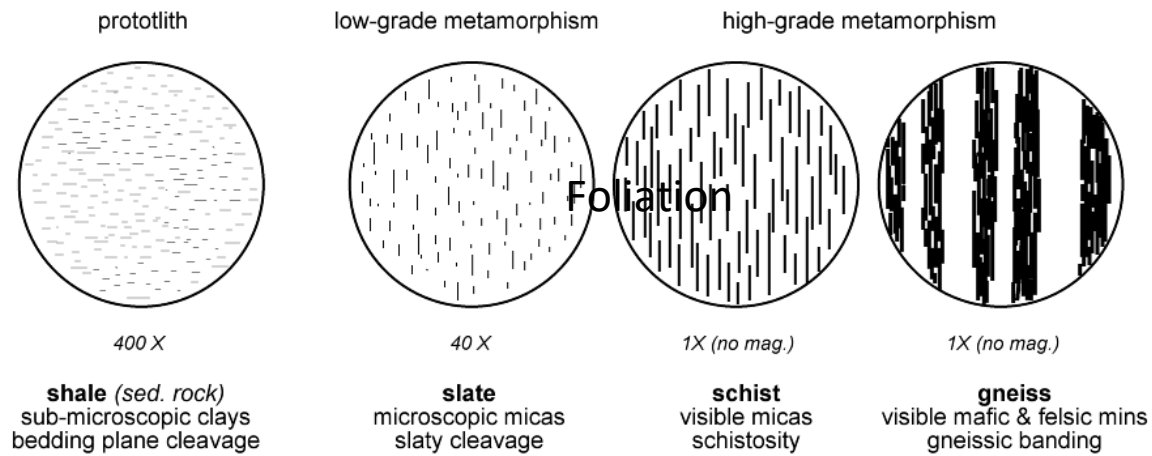
Foliation

Flat layers in rocks due to squeezing by pressure.



Foliation

- Becomes more pronounced with increasing pressure & temperature



Non-Foliated (no layers)

Nonfoliated
Rocks

Limestone



Marble



Heat
&
Pressure



Sandstone

Quartzite

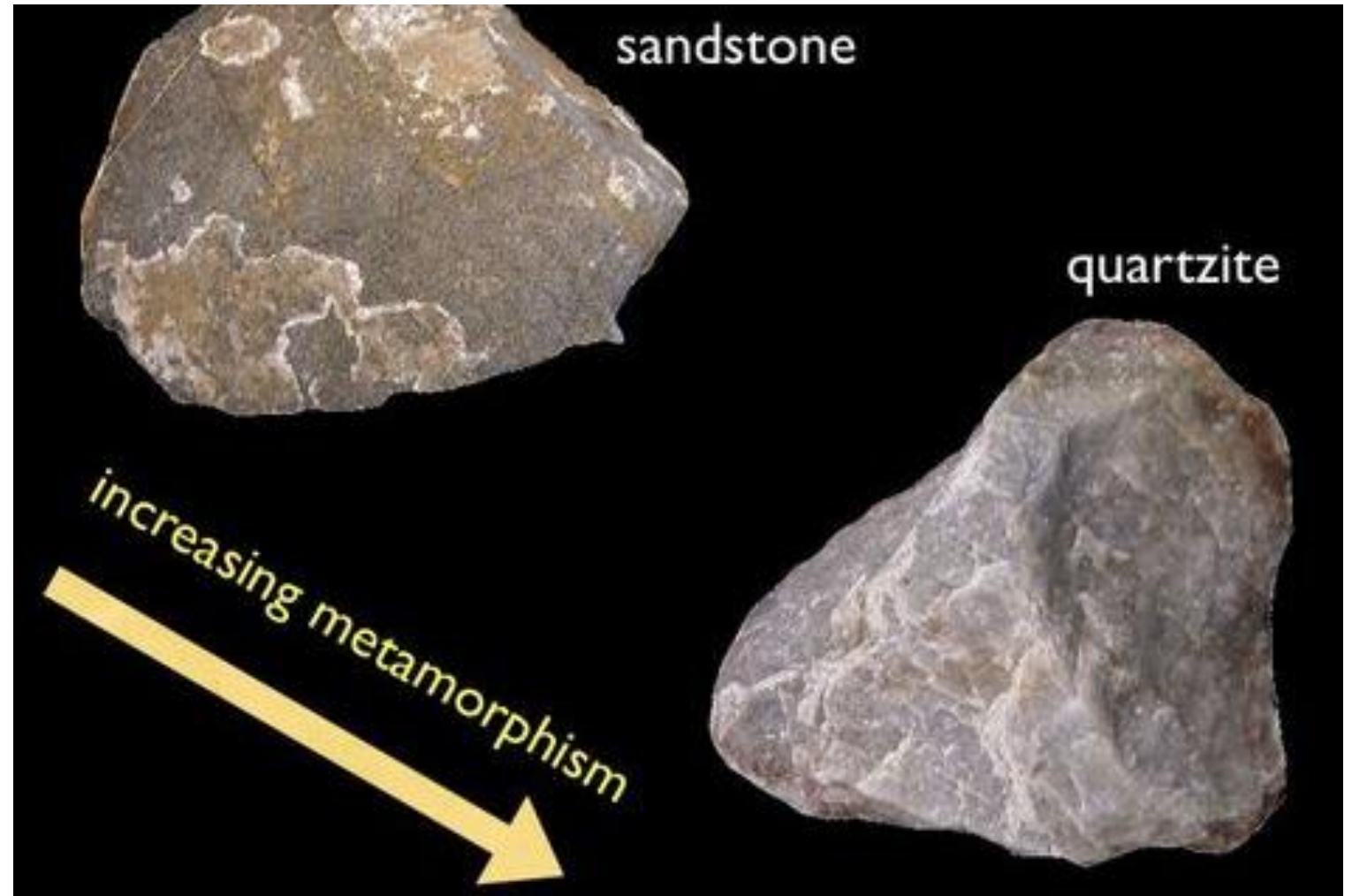


limestone

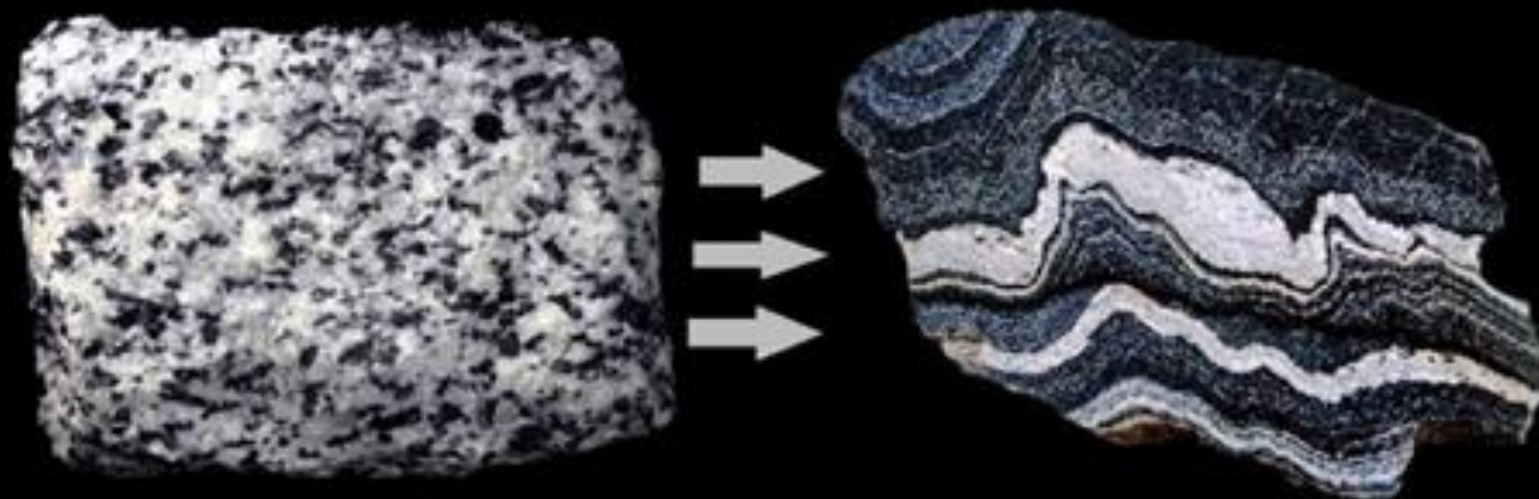
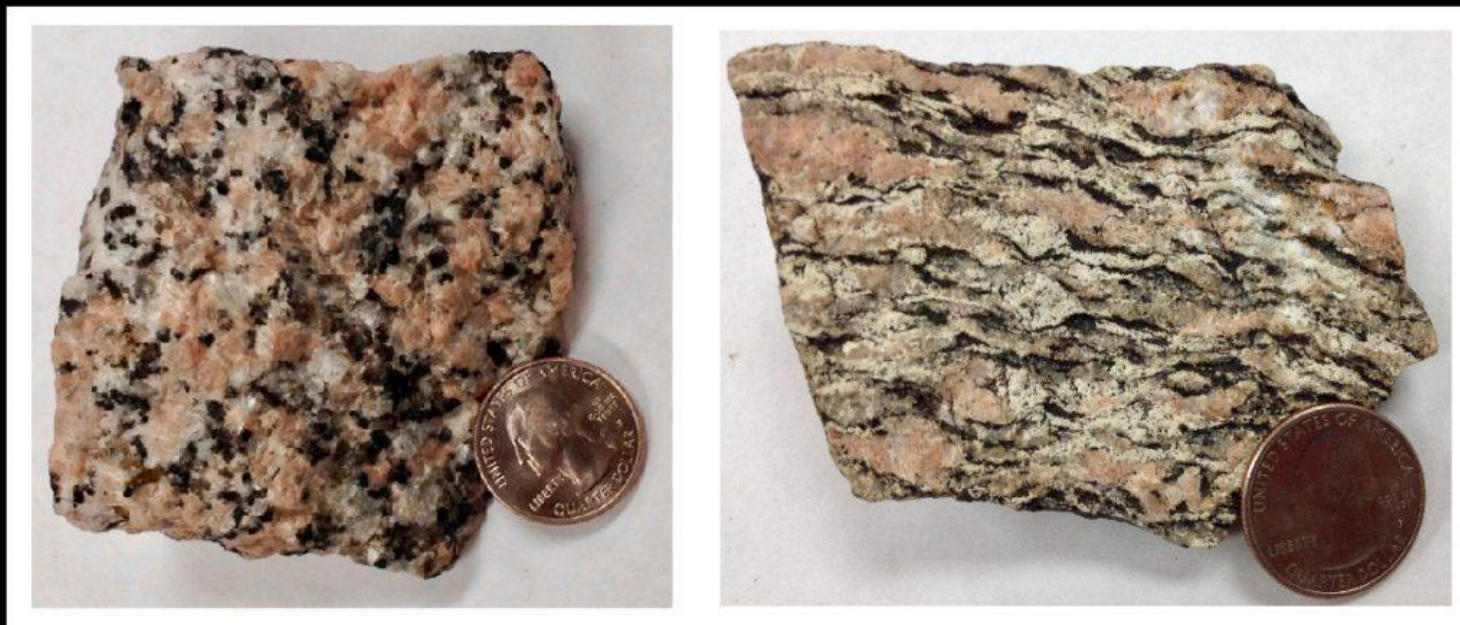
marble

Marble

Sandstone



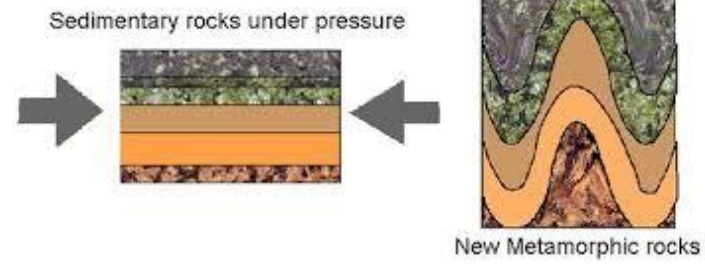
Granitic Rocks



New Minerals

- New (**stable**) minerals form under the new pressure and temperature conditions





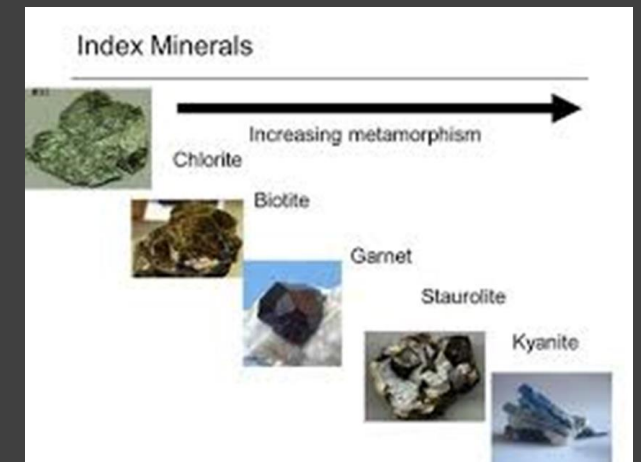
Deformation: the processes by which rocks are folded & faulted.



“Ruby” Mountains

(Garnets are
from
metamorphism)

What can we learn about this rock?



Chlorite = green mica mineral

What can we learn about this rock?

