

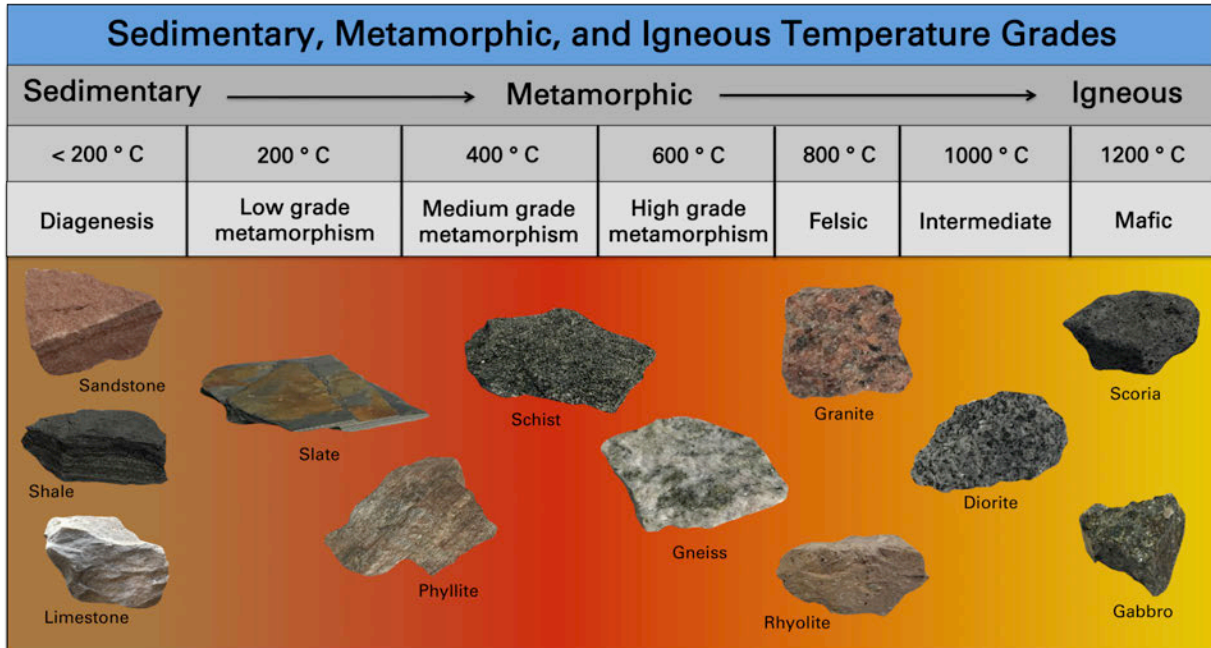
4.5

MAKING METAMORPHIC ROCK INFERENCES

How do geologists identify metamorphic rocks?

INFER THE PARENT ROCK

Metamorphism (to change form) is a process in which a parent rock undergoes changes in the mineralogy, texture, and sometimes modifies the parent rocks chemical composition. Every metamorphic rock forms from a pre-existing rock, be it a metamorphic, igneous, or sedimentary rock, called the parent rock. Every metamorphic rock has a parent rock, called a "Protolith".



1. Pull out samples 4B, 13B, 17B, 19B, and 22B. These are all possible Protoliths "Parent Rocks" (sedimentary/ Igneous rocks) to a few of your metamorphic samples found in your kits. Keep these out in front of you.
2. Pull out rock samples 23B, 28B, 29B, and 30B. These are all metamorphic rocks that have undergone metamorphism. Lay the rocks out on the table in front of you.
3. Using dilute hydrochloric acid (HCl) or vinegar put a drop on sample 29B; it should effervesce or "fizz". That means that the Protolith "parent rock" you choose should also effervesce or "fizz". If it doesn't then you will need to go back and try again until you find the correct Protolith.
4. Match the metamorphic rock with its Protolith "parent rock" below:

Metamorphic rock	23B	27B	28B	29B	30B
Protolith "Parent rock"					

REFLECTION

Name two primary environmental changes a protolith rock must undergo to transition from its protolith to a metamorphic rock.

4.5 MAKING METAMORPHIC ROCK INFERENCES CONTINUED

INFER THE GRADE

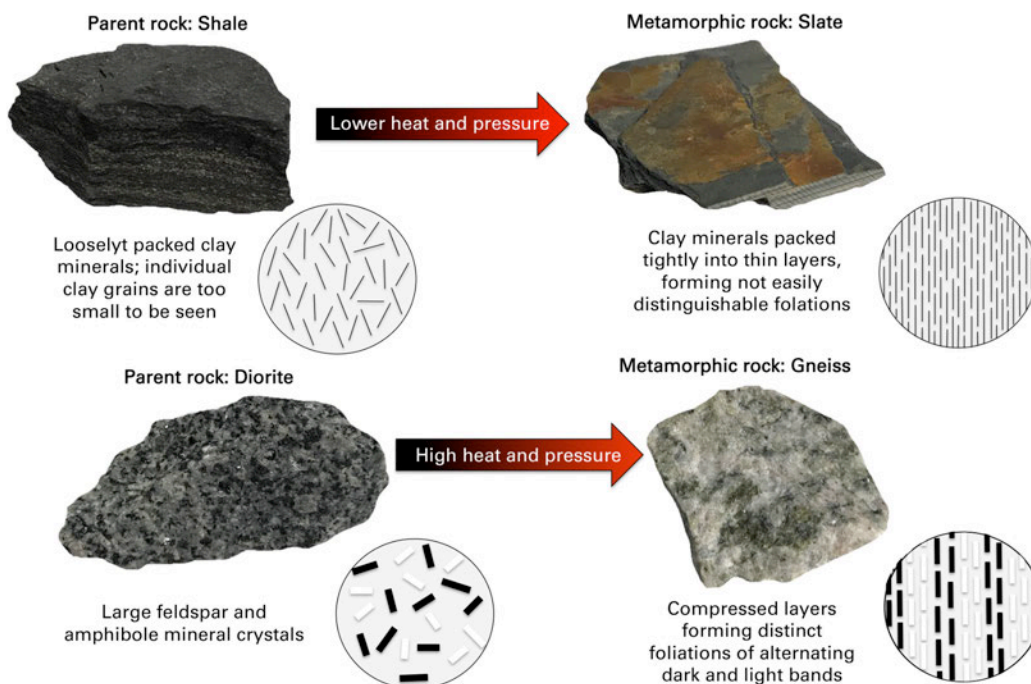
Sometimes the protoliths “parent rocks” are a metamorphic rock and that parent rock is metamorphosed into a new metamorphic rock that has experienced a different grade (intensity) of metamorphism. Here, we will look at how the intensity of metamorphism affects the mineral crystallization and alignment. As you increase the intensity of metamorphism by either increasing the temperature, pressure, or both temperature and pressure at the same time. Remember the metamorphic rocks never melt.

Different grades of metamorphism can produce characteristic changes in texture and mineralogy of the rock.

Low grade: no visible crystals, flat and platy, foliated (layered)

Intermediate grade: foliated (layered), crystals start to enlarge and align themselves in a needle like pattern, then becoming more organized with larger crystals as the intensity of the metamorphism increases.

High grade: foliated (layered), crystals become more organized possibly in alternating bands of crystals.



1. For this exercise you will need samples 13B, 23B, 24B, 25B and 27B.
2. Sample 13B is a sedimentary rock called “Shale”; sample 13B is the protolith “parent rock” to the remaining metamorphic samples you pulled out.
3. Organize samples 23B, 24B, 25B and 27B based on their grade (intensity) of metamorphism:

Protolith “Parent rock”	Low grade	Intermediate grade	Intermediate/ high grade	High grade
13B				

REFLECTION







What environmental changes are responsible for the changes a metamorphic rock undergoes as grade increases from low to high?

4.5 MAKING METAMORPHIC ROCK INFERENCES CONTINUED

INFER THE TEXTURE

Texture of a metamorphic rock is a description of its structure and their sizes, shapes, and arrangements. There are two main types of metamorphic rocks which are distinguished on the basis of their textures, foliated and nonfoliated.

Foliated textures exhibit foliations, layering and parallel alignment of platy (flat) mineral crystals, such as micas. This usually occurs as a result of pressure (shearing and smearing of crystals) and recrystallization. All metamorphic rocks with a layered appearance are foliated. Nonfoliated metamorphic rocks exhibit no layering.

Metamorphic Rock	Texture	Composition	Parent Rock
 Slate	Foliated	Low grade metamorphic rock; minerals and foliations are not easily identified.	Shale, mudstone, or siltstone
 Phyllite		Low-to medium grade metamorphic rock; glossy sheen from fine grained micas; breaks along wavy surface	Shale, mudstone, or siltstone
 Schist		Moderate- to high grade metamorphic rock; large distinct alignment of mica minerals.	Shale, mudstone, or siltstone
 Gneiss		High grade metamorphic rock; distinctive foliations are composed of alternating light and dark layers.	Shale, granite, or volcanic rocks
 Quartzite	Crystalline	Composed of large, hard crystals of quartz. Color may vary from sample to sample.	Quartz or sandstone
 Marble		Composed of large crystals of calcite or dolomite; bubbles with hydrochloric acid.	Limestone or dolostone

1. For this exercise you will need samples 23B, 24B, 25B, 26B, 27B, 28B, and 29B.
2. Match the specific foliated / nonfoliated texture with each of the foliated rock samples below:

Sample	23B	24B	25B	26B	27B	28B	29B
Texture (foliated/ nonfoliated)							
Metamorphic rock name							

REFLECTION

1. What mineral does the metamorphic rock and Protolith "parent rock" share in common that makes them both fizz?
2. How do the temperature and pressure influence the metamorphic grade change from the protolithic rock?
3. What are the primary differences between a foliated and nonfoliated metamorphic rock?