# Marble: Castle Lecture Theatres

Site 1: Campus Geosites@ Otago

Location: Enter the Castle Lecture Theatres from the west entrance. The entrance hall has marble pavers and wall tiles. The photo in Figure 2 shows the southern wall of the main entrance hall. 170.5129°E   45.8665°S

Learning outcome: Understand and describe the key characteristics of marble, a common metamorphic rock.

Keywords: Metamorphic; Marble
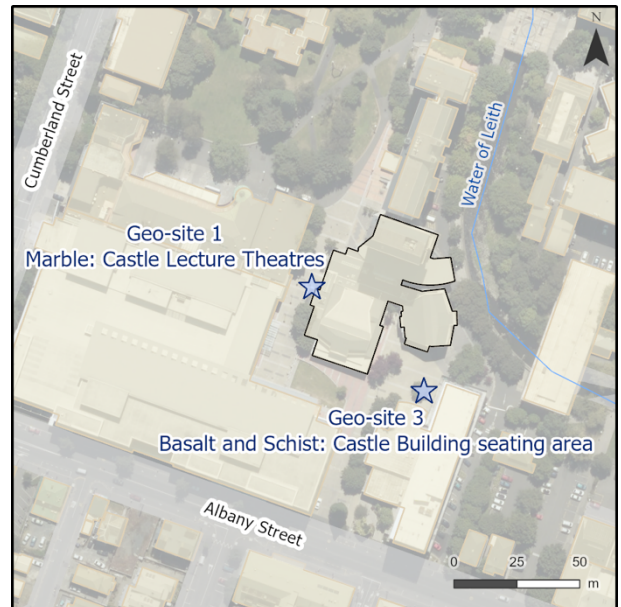
Metamorphic rocks arise from the transformation of existing rock types during a process called metamorphism, which means "change in form". The original rock ("protolith") is subjected to heat and pressure, causing significant physical and/or chemical changes. The protolith can be a pre-existing sedimentary, igneous, or metamorphic rock.

Marble is a metamorphic rock that is commonly used as a building material and ornamental stone. Some of the most famous sculptures in the world are made out of marble, including Michelangelo's "*David*" that can be seen in Figure 1. The marble used in this sculpture comes from the small village of Carrara in Italy, where huge quantities of marble have been quarried since at least the 5th Century BC.

- What properties of marble make it a highly prized building (e.g. kitchen benchtops) and sculptural material?

Figure 1. Michelangelo's "David" (1501-1504), sculpted from Carrara marble quarried from the village of Carrara in Italy.

Figure 2: Marble wall tiles inside main entrance (west) to the Castle Lecture Theatres.

Figure 3: Detail of wall tile to be used in exercises 5 and 6.

Figure 4: Detail of wall tile to be used in exercises 5 and 6.

Exercises

1) Describe the range of colors that can be seen in the marble wall tiles.

2) Are the color variations randomly arranged or organized? Describe any patterns of color that you can see (e.g. striped, banded, layered, folded, patchy).

3) Based on the highly simplified cartoons and descriptions of crystalline and granular rock textures below, what is the correct textural term to describe marble (and most metamorphic rocks)?
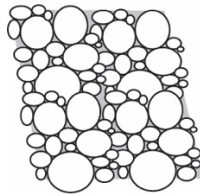
Granular   Crystalline

A *granular rock* contains grains that were deposited. Most sedimentary and volcaniclastic rocks are granular. The areas between grains can either be empty (pore space) or filled. A very wide variety of granular textures occurs.

A *crystalline rock* is composed entirely of crystals that formed during cooling and crystallization of magma/lava, or by recrystallization during metamorphism. The crystals are often tightly-packed. A very wide variety of crystalline textures occurs.

4) Can you think about what the mineral composition of the grains in the marble might be? Most marbles are composed mainly of this mineral (*Hint*: if you were to drop some weak acid on the marble, it would fizz).

5) Now look carefully at the lighter colored layers in the tiles shown in Figures 3 and 4. Use a magnifier or hand lens to look at the tiles closely. Describe the size and shape of the individual grains, and sketch them if you can. Do you see any space (porosity) between the grains or are they tightly interlocked? Are there variations in grain size or shape?

6) Now look carefully at the darker grey layers and compare them to the lighter layers. Focus on the tile shown in Figure 4. Do you notice any differences in grain size in the darker and lighter layers?

7) What do you think might be causing the different colors and grain sizes in the marble?

8) In Figure 5 on the next page, a black mineral can be seen in one of the layers. Use your hand lens and examine the mineral carefully, then answer the following questions.

- In which layers can you find this black mineral (i.e., the lighter or darker layers)?

- What crystal shape does it have?

- What is the name of this black mineral?

Figure 5

9) Based on what you have described above, list the key characteristics of a metamorphic marble (e.g. texture, grain size, visible structures, color, composition).