

Port Chalmers Breccia: Geology Building

Site 7: Campus Geosites @ Otago

Location: In the quadrangle in front of the Geology Building (west side of building).

Learning outcome: Understand and describe some key features of volcanic breccia. Interpret the formation of fragmented rocks.

Keywords: Breccia; Clasts; Matrix; Volcano

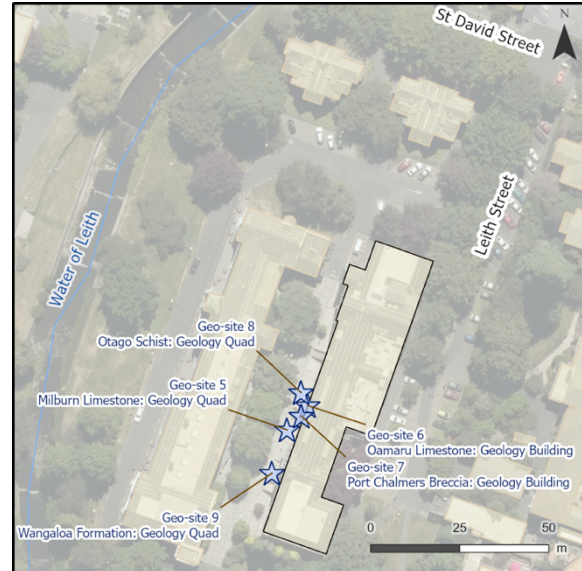


Figure 1: Front façade of the Geology Building showing Port Chalmers breccia that makes up the stairs and the lower part of the front wall (underneath the light colored Oamaru Limestone.). The letters refer to the individual clasts shown in Figure 3.





Breccia is a rock composed of broken fragments (“clasts”) held together by a finer-grained matrix. The Port Chalmers Breccia is a volcanic unit found around the town of Port Chalmers near the centre of the 16–11 million year old Dunedin Volcano. The Port Chalmers Breccia contains fragments of a wide range of rock types, from volcanic rocks (basalt-trachyte) to plutonic rocks (gabbro-syenite), as well as sedimentary and metamorphic rocks. Individual clasts range in size from 1–20 cm. The matrix is mostly composed of similar rock fragments <<1cm in size. The Port Chalmers Breccia was used extensively as a building stone during early settlers times because it is relatively easy to cut and could be extracted locally.

Exercises

- 1) Refer to the Port Chalmers Breccia exposures shown in Figure 1. Would you describe this rock as having a homogenous and uniform texture, or is it made up of different fragments in a matrix? How many different types of fragment can you recognize? (You may need to have both a close look and a wider look to appreciate the textural variety at different scales of observation.)
- 2) What is the shape of the individual clasts? Are they angular or rounded, or something in between?
- 3) Describe the texture and color of the matrix material in between the individual clasts.

Matrix refers to the material that is found between individual clasts. The matrix can contain grains, crystals, fossils etc.

Clasts are small pieces or fragments of broken rock that are embedded in the matrix



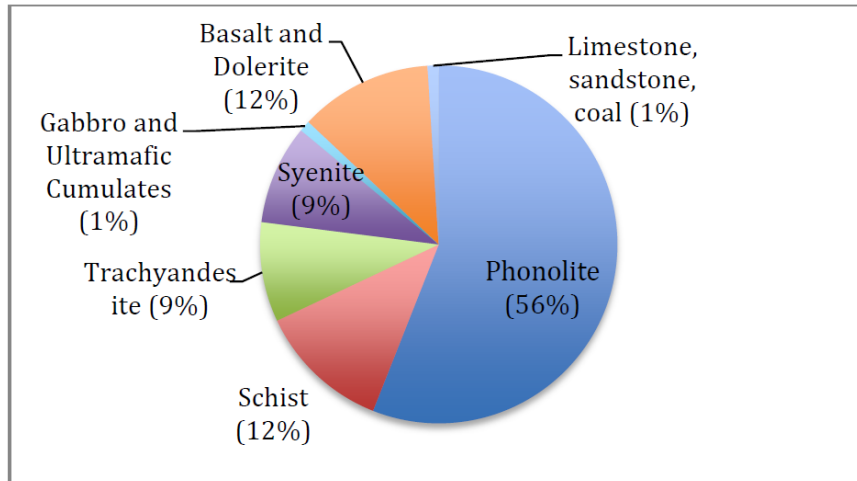


Figure 2: Modal abundance of clasts in the Port Chalmers Breccia.





Figure 3: Examples of different clast types. Use these for reference to answer Question 4, or find your own set of different clasts.

4) Now carefully examine each of the individual clasts shown in Figure 3 (use Figure 1 to locate these clasts). Complete the following table to give a brief description of each clast.

	Color(s) of clast	Size of clast	Internal texture of clast	Name of the rock type (Figure 2 may help)
Figure 3 a				
Figure 3 b				





Figure 3 c				
Figure 3 d				
Figure 3 e				



- 5) Can you interpret the mode of formation of the Port Chalmers Breccia? Consider the range of different clast types (volcanic, plutonic, metamorphic, sedimentary) that occur together within the rock. What process could generate a breccia containing all of these fragments of rocks? Use the diagram in Figure 4 to help illustrate and describe what might have happened to generate the breccia.

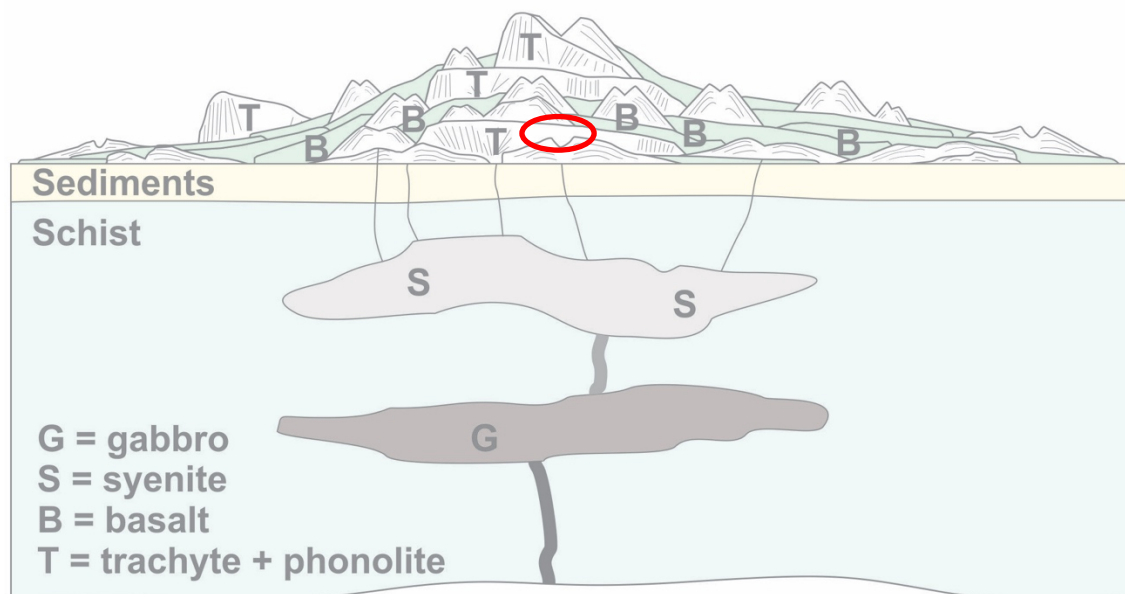


Figure 4: Schematic cross section through the centre of the Dunedin Volcano around 11 million years ago. The current location of the town of Port Chalmers is approximated by the red ellipse.

