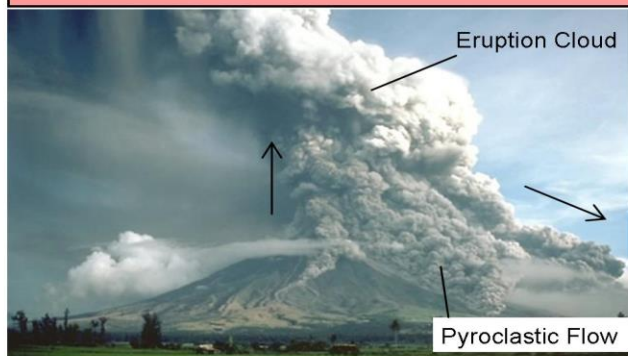


# GEOLOGY OF VOLCANIC SHORES - PORT STEPHENS COAST



Explosive eruption from volcano, Mt Mayon, Philippines.

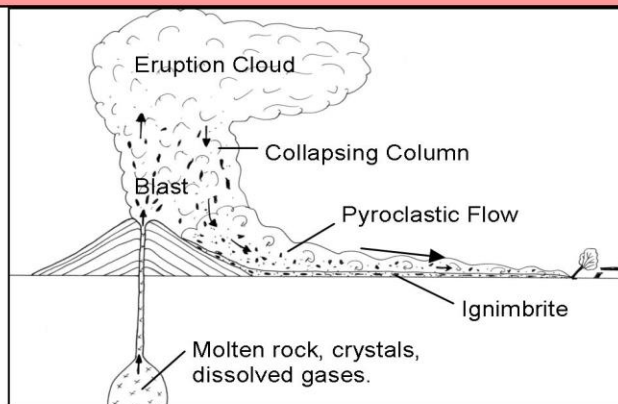
## VOLCANIC BLASTS OF THE PAST

The rocky coast of Port Stephens is made of volcanic rocks. Spectacular, loud, explosive eruptions from a nearby volcano, about 330 million years ago, gave birth to most of these rocks. Violent volcanic blasts produced hot, glowing avalanches of broken volcanic material and expanding gases called **pyroclastic flows**. These deadly, fiery flows travelled down the side of the volcano as a heavy 'fluid' at speeds of over 100 km/hour. Plants and animals in their path were annihilated.

As the pyroclastic flows spread out over the countryside, they dropped their load of volcanic fragments, forming thick blankets extending up to many tens of kilometres from the volcano. The pyroclastic flow deposits cooled and compacted to form the volcanic rock called **ignimbrite**.

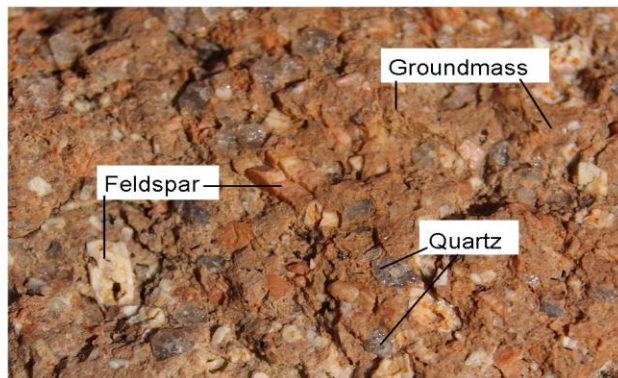
## VOLCANIC ROCKS UP CLOSE

The ignimbrites are pink, light brown or light grey in colour. If you look closely at the rock, you will see it is speckled with crystals. The squarish pink and white crystals are feldspar minerals and the glassy, colourless hexagonal ones are quartz.



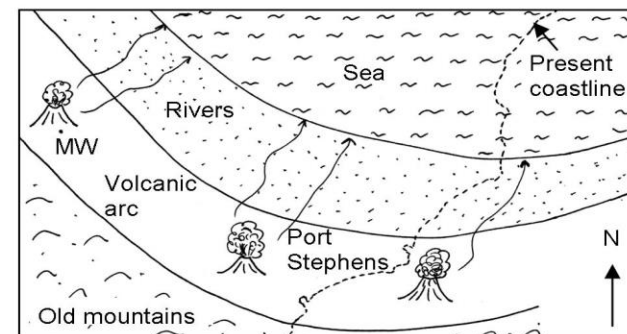
Explosive volcanic eruption producing a pyroclastic flow by collapse of the eruption column.

The minerals feldspar and quartz crystallized slowly from the molten rock beneath the Earth's surface, before eruption. During an explosive eruption, escaping hot gases blasted molten rock and crystals into the air, breaking some of the crystals.



Close up view of ignimbrite at Birubi Point. Shows crystals of feldspar and quartz sitting in a groundmass of tiny pumice fragments and glass shards. Feldspar crystals are up to 4 mm. In composition, the rock is a rhyolite.

As the thick, gluey molten rock moved up to the vent, the rapidly expanding gases came bubbling out of the liquid rock, akin to opening a bottle of bubbly. The frothy lava cooled quickly to form pumice, a volcanic glass riddled with holes from the escaping gases. Continuing expansion of trapped hot gases then blew some of the pumice into very small pieces called glass shards.



Early Carboniferous period, 340 - 330 million years ago, an active volcanic arc extended from Port Stephens to Muswellbrook (MW).

## VOLCANO WORDS

**Volcano** - An opening in the Earth's surface through which molten rock and hot gases from deep underground are spewed. Erupted material can build up around the opening to form a hill or mountain.

**Volcanic rock** - A rock that was once hot and molten, erupted onto the Earth's surface where it cooled to become solid.

**Pyroclastic** - (pyro = fire, clast = broken into pieces) A volcanic rock made of fragments produced by an explosive eruption.

**Intrusion** - A body of rock that was once molten which flowed upwards through overlying rocks, solidifying beneath the Earth's surface.

## WAVE SCULPTURES

From Birubi Point to Tomaree Head hard volcanic rocks make up the rocky coastline. They were originally laid down as almost horizontal layers, but later Earth movements have tilted the layers so that they now dip. On the rocky coast wave erosion along these dipping layers produces gently to steeply sloping rock platforms.

Regular sets of criss-crossing cracks (joints) also slice through the rocks. Erosion by the waves along the joint planes gives rise to numerous regularly shaped blocks, pillars, gutters and chasms. Joints can be formed by shrinkage during cooling of hot rocks and by stresses in the Earth's crust.



*Gently sloping wave cut platform eroded along layers in volcanic rock, Fishermans Bay.*



*Chasm formed by wave erosion along vertical joints, Fishermans Bay.*



*Pillar of hard volcanic rock left standing after erosion along steeply tilted layers, Zenith Beach.*

## BASALT DYKES

Numerous basalt dykes intrude the Early Carboniferous volcanic rocks on the coast, with many dykes concentrated along Morna Point. Dykes are wall-like intrusions that have flowed upwards into joints in the older rocks. They are exposed best in the rock platforms where dark grey, fine grained basalt contrasts with pink speckled ignimbrite.

The dykes originated as molten basalt from a depth of about 100 km. Stretching of the Earth's



*Basalt dyke intruded into joints in ignimbrite, showing side-stepping as the intrusion flowed from one joint to another.*

crust allowed molten basalt to squirt upwards from the Earth's mantle, through joints in the overlying rocks. The basalt solidified in joints against the cooler, older ignimbrite. The dykes are probably less than 100 million years old, whereas the ignimbrite is about 330 million years old.



## DROWNED COAST

The prominent hills of the coast, such as Tomaree, Stephens Head and Quarry Hill, consist of volcanic rocks of Early Carboniferous age. However, they are not ancient volcanoes. They are the tops of a partly buried ridge. At the peak of the last glaciation 20,000 years ago, sea level was 120 m lower than it is today. These hills were the peaks of a tall ridge on a coastal plain, where the shoreline lay about 10 km farther east than it does today.

West of the ridge the Myall and Karuah rivers cut down deeply into earlier deposits to flow to the sea. At the end of the glaciation melted ice flowed back into the sea. The subsequent rising sea partly submerged the high ridge and drowned a series of deep river valleys and lower ridges to produce the estuary of Port Stephens.

Prepared by Roz Kerr  
for Port Stephens Council 2007  
Local photography by Shayne & Roz Kerr.

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