Geology of the Tidbinbilla Nature Reserve

Geological history of the reserve

The earth is about 4500 million years old, 10 times as old as the oldest rocks in the Tidbinbilla Nature Reserve. About 450 to 500 million years ago (the Ordovician period), the Tidbinbilla area was covered by shallow seas; sand and other sediments were washed in from adjacent land and deposited on the sea floor. Volcanoes were active nearby at the time and fragments of volcanic ash became mixed with the sediments. The area was still covered by the sea during the Silurian period (400-450 million years ago) but it was now shallower and the sediments were coarser. The Tidbinbilla area was then lifted above sea level to form land. About the same time a massive, hot body of granite was injected into the sediments. This probably took place thousands of feet below the ground surface.

Prominent granite tor on Turkey Hill with the Tidbinbilla Valley in the background

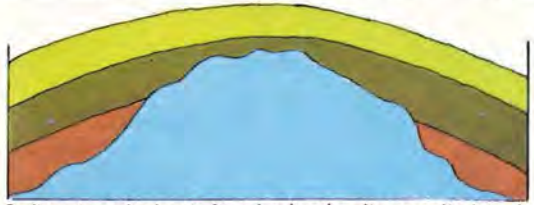
Rocks in the Tidbinbilla Reserve give no clues to what happened in the next 400 million years but evidence from other parts of the ACT and neighbouring parts of NSW show that during this interval volcanoes erupted, the sea invaded the area several times, glaciers came and went, and earthquakes cracked the ground. It is possible that throughout much of this time the Tidbinbilla area was above sea level and that it was continually being worn down.

Eventually, the sediments that formed the "roof" to the granite were largely removed and the granite itself was exposed at the surface. Once exposed the granite weathered quickly partly because cracks in it, known as joints, allowed the weathering to penetrate deeply into the rocks and thick soils were formed. The Tidbinbilla Valley started to develop some tens of million years ago and it was then that the rounded granite boulders (tors) started to form within the soil (this process is explained in a Tidbinbilla pamphlet dealing with the Turkey Hill Trail). At some time during the last few million years the processes of erosion increased; gradually much of the deep soil was washed away and the granite tors exposed. The valley was cut down still further until the floor of the valley was 3000ft below the surrounding ridges, giving the Tidbinbilla Valley its present-day form.

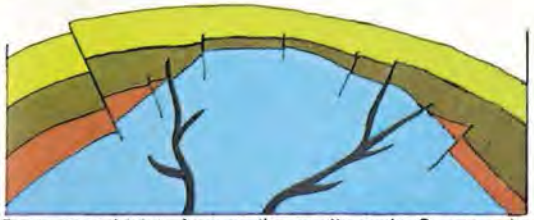
A prominent group of granite corestones

Stages in the geological history

1 Sediments laid down on the sea bed 400 to 500 million years ago



2 Sediments arched up to form land and molten granite intruded into them 400 million years ago



3 Fractures and joints form as the granite cools. Quartz and aplite veins injected along some of them

4 Exposure of the granite at the surface by the removal of the sediment cover about 30 million years ago

5 Rapid weathering of the granite to form tors and the present Tidbinbilla Valley

Places of geological interest in the reserve

Places of geological interest illustrating the development of the Tidbinbilla Reserve are described below. Please do not hammer or disturb these rocks, so that the outcrops will remain unspoilt for future visitors.

Turkey Hill. Several groups of granite boulders (tors) are well developed here. Their origin is described in the pamphlet, "The Turkey Hill Trail".

Perched blocks of granite on Turkey Hill. The Tidbinbilla Range in the background is composed of sedimentary rocks 400 to 450 million years old

Bald Hill. The rocks on this hill project as sharp, angular outcrops in contrast to the more rounded form of most other outcrops of the area. This scenic point illustrates the way in which the rock type influences the landform. Most hills in the reserve have distinctive rounded peaks and are underlain by granite. This peak, however, is underlain by vein quartz and consequently the summit is a sharp angular ridge. The vein quartz is much more resistant to weathering than granite and produces poorer shallower soils. The quartz here is strongly jointed. It is part of a thick vein which runs northeast-southwest across the reserve, cutting through the granite. Along the

Vein of aplite (fine-grained granite) cutting through normal granite

line of the quartz vein there are numerous springs, showing the influence of rock structure on the groundwater in this area.

Ashbrook Creek Crossing. The coarse gravels of this locality illustrate the great power of rivers and streams to erode and change the landscape. On the west side of the ford there are large flat areas composed of gravels, with boulders up to a foot in diameter, indicating the moving power of the streams. Even more significant is the fact that most of the boulders are not composed of the nearby granite, but of Ordovician and Silurian sediments which occur four or five miles away.

Hanging Rock. The granite forming huge rocks in this part of the Reserve has an age of about 400 million years. As explained in the Turkey Hill pamphlet the rounded boulders formed in the soil and were later exposed when erosion removed the soil. Most of the granite is the normal coarse-grained variety, but some veins of finer material (aplite) cut across it. Some of the flat surfaces in the Hanging Rock are joint planes which developed as shrinkage cracks as the

Weathered granite forming a well-rounded tor near Hanging Rock

granite cooled down, or were possibly caused by later earth movements. Some of the granite corestones are now being weathered and gradually worn away. This can be seen in the flaking off of sheets, and the development of small caverns. The resulting debris is incorporated into the soil or washed down the slope and into the streams.

Large rounded granite corestone

Rocks of the reserve

There are rocks of three ages in the Tidbinbilla Reserve. The oldest are the Ordovician rocks forming the higher part of the Tidbinbilla Range in the north-west corner of the Reserve. They are 450 to 500 million years old and consist of sedimentary rocks such as sandstone, shale, limestone, and chert (a hard splintery rock composed predominantly of quartz).

Rhino Rock, a corestone with the remains of a hard shell (right) and soft crumbling centre

The second group of rocks are of the Silurian age (400-450 million years old), and also occur on the higher parts of the Tidbinbilla Range on the western margin of the Reserve. They are known as Tidbinbilla Quartzite, but actually consist of sandstone, breccia (composed of angular rock fragments) and thin limestone and shale.

The third rock is granite which has been intruded into the older sediments and is about 400 million years old. This is the rock exposed all over the Tidbinbilla Valley, particularly in the numerous rocky outcrops or tors. The granite, generally a coarse-grained rock is composed of several minerals, the most common being quartz (colourless glassy crystals), feldspar (pink, buff or white), and black mica (dark and flaky). The granite is cut by veins of two other rock types.

The commonest is aplite, a pale brown very fine-grained granitic rock (examples of this may be seen at Hanging Rock). Quartz veins are also common in places, such as at Bald Hill.

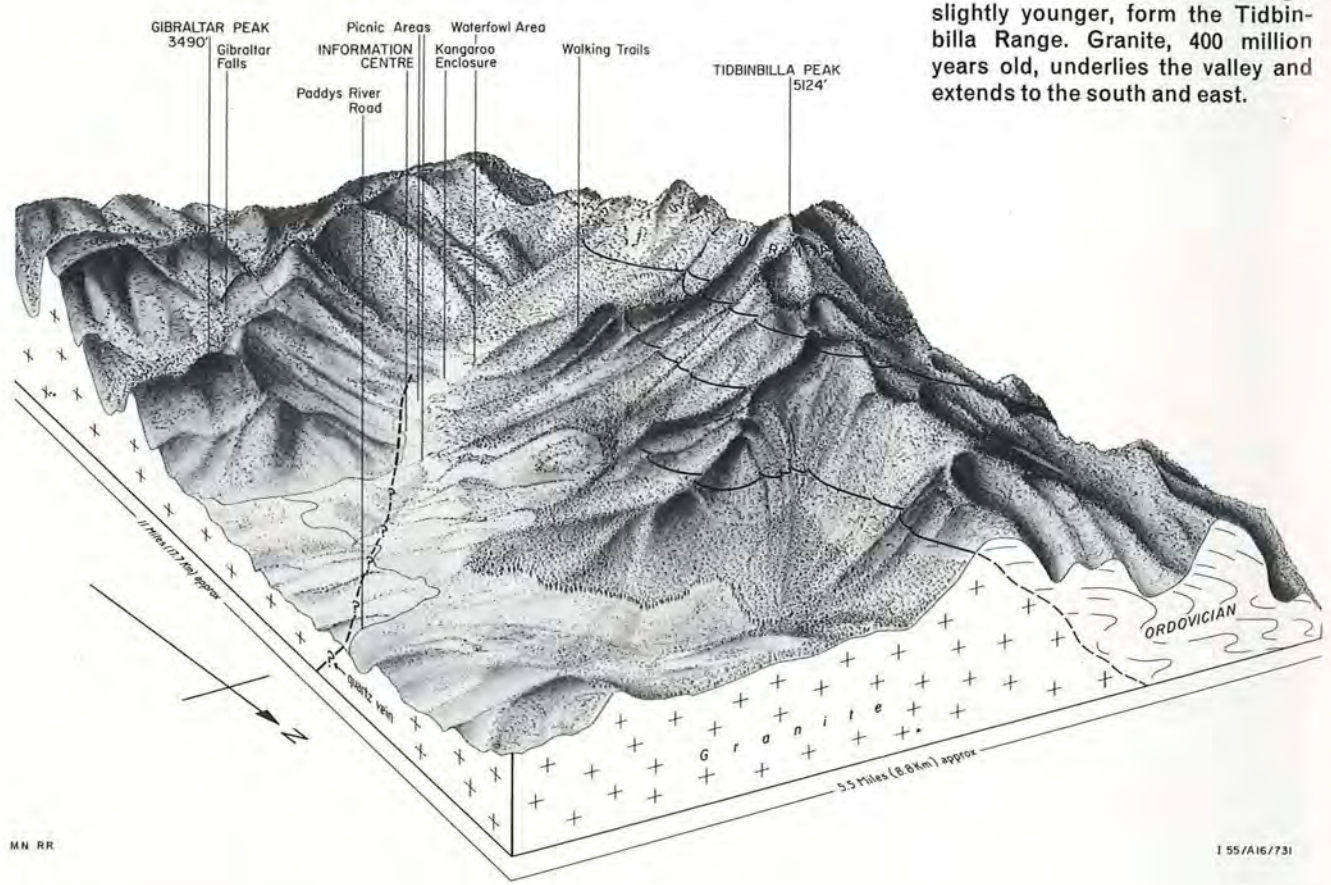
The Department of the Interior expresses its appreciation of the assistance of the Geological Society of Australia in the preparation of the text of this leaflet and the provision of illustrations.

Department of the Interior

Large outcrops of vein quartz showing typically angular weathering in contrast to the rounded weathering of the granite shown in other photographs

Relief Model of the Tidbinbilla Nature Reserve

Block diagram — Relief diagram showing the geology of the Tidbinbilla Valley. There are three main groups of rocks, the oldest, Ordovician, being 450 to 500 million years old. Rocks of the Silurian age, slightly younger, form the Tidbinbilla Range. Granite, 400 million years old, underlies the valley and extends to the south and east.



R71/3415 Printed by Alexander Bros. Pty. Ltd., Mentone, Victoria