Sheer sides of slate at Apsley Gorge near Walcha.

associated dikes. The granites present greater resistance to water erosion than do the sediments, hence the boulder-strewn floors of the V-shaped valleys now incised into the Tablelands.

Bakers Creek Gorge near Hillgrove. The gently rolling surface of the Tablelands is incised by Bakers Creek Gorge. At source, depth is 20 m, increasing to 600 m at confluence with Metz Gorge.

Ebor and Dorrigo

Ebor and Dorrigo localities were settled to take advantage of the local fertile basaltic soils. The basaltic magma escaped from several volcanic vents, notably the Ebor Shield Volcano in the present-day New England National Park.

At Ebor Falls there are clearly four flows of lava displaying spectacular columnar jointing which formed as the lava slowly cooled. There is a an important difference in the chemical compositions of the magma between Ebor and Dorrigo areas.

The Dorrigo soils are spectacularly red in colour with high aluminium, iron and manganese contents combined with high acidity; ideal for potato production. At Ebor the black soils are close to neutral in acidity and high in calcium, phosphates and trace elements. These fertile soils yield pasture crops well suited to the prime beef industry.

Ebor Falls. Note the sequence of columnar-jointed basalt flows.

Australia has drifted northwards in the last 20 million years at a rate of close to 7 cm a year, travelling over a “hot spot” of molten magma deep within the earth, which has thrown up a chain of volcanoes on all sides of the New England Tablelands (Tweed/Byron in the north, then Ebor/Dorrigo at Point Lookout, Comboyne behind Port Macquarie, and inland, Mt Kaputar near Narrabri and the Warrumbungles further south). This “hot spot” is currently under Bass Strait, north of Tasmania.

The movement north into more arid lower latitudes has had consequences for the flora and fauna. Antarctic Beech forest remnants survive only at the highest altitudes; most remaining flora has adapted or vanished. The mega-fauna, the giant mammals that replaced the dinosaurs, retreated into the more temperate climate of New England. After the coming of humans ~50,000 years ago, they largely disappeared though leaving accretions of bones, notably around Glen Innes.

Present geological studies examine not only the origins of New England, but an ever-changing interactive environment that is our inheritance and our future.

Geological Highlights of New England

Deeply weathered sediments of the Armidale Beds near University of New England, Armidale.

ARMIDALE

new england high country

Any reasonably accurate description of the geological phenomena seen today around the New England region must necessarily include some technical terms. As far as possible these will be explained within the text.

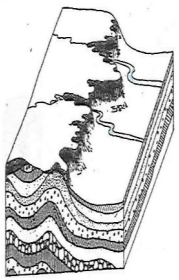
Geomorphology

The New England Tablelands began as marine sedimentary deposits laid down in Paleozoic times, around 400 million years ago. These sediments, composed of a mixture of volcanic debris, fine shales and cherts, were folded and uplifted, then eroded, then uplifted again as the Eastern Highlands were formed. The resulting undulating plateau, the Tablelands, slopes gently to the west (see "Sandon Beds" below).

Later, but still 250-350 million years ago, plutons of hot granitic rock were intruded into the already deformed metamorphosed sediments. Persistent erosion finally exposed these intrusions among which are the easily recognized Mt Duval just north of Armidale, the Carrai Plateau east of Walcha and the Bald Rock/ Girraween complex north of Tenterfield. It was around these intrusions that gold, tin, other metals and precious gemstones were deposited/crystallized; these are still being harvested today.

Final uplift, though of close to 800 m, in fact occurred quite slowly and allowed eastern-flowing streams to cut into the hard, but fractured, rocks to form the deeply dissected landscape of today (see Apsley and Wollomombi Gorges).

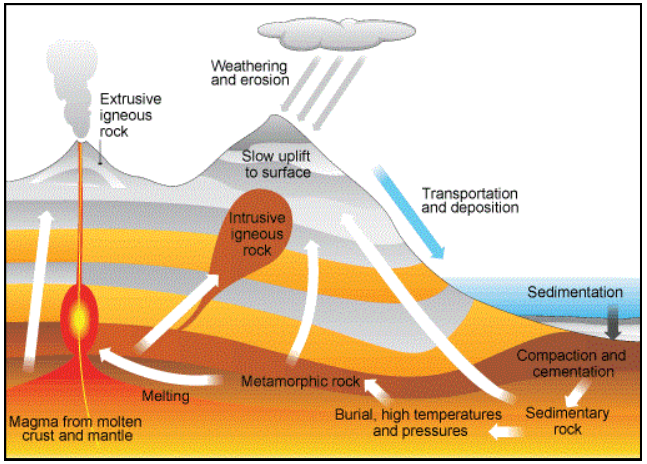
Episodes of uplift occurred at 100 million and 50 million years ago, associated with the detachment of Australia from the ancient mega-continent of Gondwana. This led to rifting that opened the Tasman Sea where previously there had been land. This rift, similar to the Rift Valley in Africa, formed into the Great Escarpment, a 3000 km line of cliffs and steep country that runs from North Queensland to Gippsland, and is at its highest in New England in places such as the almost 1600 m high Point Lookout line of cliffs. The Great Escarpment has been eroding eastward for the last 50 million years. The gorges that cut westward (inland) into it have been eroding even more rapidly.



The Escarpment. Note stream erosion of the uplifted eastern Tablelands.

The *Great Dividing Range* is a term commonly misused. The *Great Divide*, in reality, denotes the separation of eastern and inland drainage. Locally the New England Highway mostly follows the crest of the Divide, though many spurs and smaller ranges contribute to the whole. In the broader New England it is 50 to 100 km west of the escarpment, and it includes some of the flattest land in the region, often containing swampy lagoons with indeterminate drainage that are rich in wildlife.

More recent contributions to the landscape are the basaltic lava flows from many volcanic orifices. Notable remnants of these are the Dangarsleigh vents (four can be seen from the local Hall looking north), the Ebor and Round Mountain volcanoes and the sources (for example, Chandler's Peak) of rich soils around Guyra. Details of Round Mountain can be found in the Cathedral Rock leaflet.



Schematic diagram of igneous activity.

The volcanic outpourings of lava cooled to form extensive layers of basalt which lay like an icing some metres thick over the older rocks of metasediment and granite. Lava flowed to fill the lowest places first, especially the old river beds, thus sealing the gold and other heavy metals in the deep "leads" so prized by the early gold diggers. Madgwick Drive cutting, east of the University of New England campus, exposes an example of a typical deep lead made up of old river gravels from re-worked Armidale Beds.

Alluvial gold continues to present fossicking opportunities due to continued erosion of Tertiary sediments.

Sandon Beds

In the immediate Armidale district, the oldest rocks are collectively known as the Sandon Beds. The Beds stretch at least from Mihi in the south-east to Black Mountain in the north and west towards Yarrowyck. The total extent of the Sandon Beds is about 2,500 sq km. They are tightly folded beds of sedimentary rocks, metamorphosed in places. These rocks are the source of the so-called 'trap-rock" soils of New England. "Trap" soils vary greatly in composition and fertility and are by no means a single entity.

Iron saturated Tertiary sediments overlying deformed Armidale Beds, Madgwick Drive, near University of New England.

Apsley and Wollomombi Gorges

These two gorges east of Walcha and Armidale respectively demonstrate the extreme forces applied to the once sub-marine sediments during the periods of uplift. The cherts, mudstones and greywacke have been heated, compressed to slate, then uplifted to near vertical. Rock-climbers have frequently found the easily fractured slate to be perilous in the extreme.

Slate at Wollomombi Gorge. Also see picture of Apsley Gorge overleaf.

Hillgrove, Bakers Creek and Metz Gorges

These gorges are distinctly less sheer than those at Apsley and Wollomombi. This is due largely to meta-sediments being intruded and deformed by granite masses (plutons) and