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Geology of road-forming materials as applied to Tasmania

A mineral is a natural substance e composed of one or more elements, combined in definite proportions, whereas a rock is composed of minerals and is of no definite composition. Silicon (SiO_2) is a mineral of definite formation, composed of silica (Si) and oxygen (O) whereas quartzite is a rock composed mainly of silicon but with small impurities such as iron. Calcite ($CaCO_3$) is a mineral composed of calcium, carbon and oxygen and limestone is a rock composed mainly of $CaCO_3$ but with varying amounts of silicon, magnesia, etc.

Rocks may be divided into three main categories, igneous, sedimentary and metamorphic.

Igneous rocks are believed to have formed from the cooling of large masses of molten matter, often well below the surface of the Earth but also, as can be seen today in Hawaii or Japan, from molten lava flows. They are usually composed of many small interlocking crystals. These igneous rocks are often again divided into three groups.

Plutonic are those rocks that have crystallised from large masses well below the Earth's surface and are therefore composed of comparatively large crystals. The granites of the northeast, northwest and west of Tasmania are composed of masses of quartz (glassy) and pink and white feldspar crystals with small amounts of black mica or hornblende. These rocks crystallised nearly 400 million years ago and a lot of covering rocks have since been removed by erosion to allow the granite to outcrop.

The second group, called *hypabyssal*, crystallised in smaller masses closer to the then surface so that crystal size is smaller. The great dolerite masses of Tasmania were injected 150 million years ago into beds of sandstone and mudstone, sometimes in the form of sills parallel to the bedding of the rocks, sometimes in narrow dykes (near Osterley is a dyke of dolerite in sandstone, about as wide as a main road running in a straight line for several miles), but often as large irregular masses. As dolerite cooled fairly quickly, cooling cracks (joints) developed mainly at right angles to the cooling surface so dolerite often has the appearance of a thinly bedded material. Good examples of small irregular dolerite intrusions may be seen in road cuttings between Melton Mowbray and Jericho, and on the Tasman Highway on the hill before Runnymede.

The third group of igneous rocks is the *volcanic*. Nearly 15 million years ago there was widespread volcanic activity in Tasmania and basalt flowed over much of the country, particularly in the northwest, northeast and Derwent Valley. This basalt is very finely crystalline and often glassy. Sometimes it emerged from vents in the ground but often from necks or plugs like The Nut at Stanley. Basalt cooled rapidly and well developed cooling joints formed in two main directions, often giving the well known columnar appearance at Burnie.

Sedimentary or bedded rocks have been formed, usually under the sea, by the accumulation and composition of masses of material; often mud, silt, sand or shingle. These materials have been laid down usually by water in flat sheets or beds which sometimes are slightly disrupted by slumping or wave action. Later earth movements have disrupted them, sometimes by folding the flat beds, sometimes by warping or tilting them, or often by violently moving one part up or down or sideways and forming breaks or faults. In the southeastern part of Tasmania are large areas of flat-lying Permian–Triassic rocks, sandstone, mudstone, limestone and conglomerate (formed from the accumulation of pebbles), which have not been folded

but have been tilted or faulted so that, except near faults, the dip of the beds rarely exceeds 5 to 10°.

In the western part of the State are Ordovician rocks (conglomerate, sandstone and limestone) which have been folded and faulted so that sometimes the beds appear to stand on end. Similarly in the northeast are sandstone and siltstone which are well folded. These beds can be seen in road cuttings over The Sideling and between Avoca and Fingal.

Metamorphic rocks are sedimentary rocks that have been subjected to stresses and strains so that their appearance and mineral composition have been altered. As well as bedding and jointing they have other divisions called cleavage, as in slate. Some of the rocks in northeast Tasmania have suffered this alteration, as at the slate quarry at Bangor, but most of the metamorphic rocks, most commonly slate, schist and quartzite, occur in the west of Tasmania in the Cambrian and Precambrian rocks.

Materials

Solid rocks break down to fragments ('gravel') by two main processes.

1. Ordinary weathering or the breaking up of the rock by water, ice or glaciers; and
2. Fracturing of rock by earth movements, faults.

Ordinary weathering is going on continuously and the products of this breakdown are widely spread, although most of the material finds its way to seas and lakes where the sedimentary rock forming process starts all over again. Soft, non-coherent rocks (sandstone and siltstone) weather more easily but the product is usually too fine for good road materials.

Permian siltstone, as at Tunnel Hill and East Risdon, is often well jointed and bedded and breaks into angular fragments an inch or so in size. This material is very poor for roads as it finally breaks down, under traffic, into its original grainsize which is very small.

In the *Ordovician* are massive conglomerates formed of hard siliceous pebbles. These rocks are very hard and often form mountains in the north and west. Weathering takes place more rapidly in high mountains and often the slopes are covered with an accumulation of pebbles, called talus, which although often very coarse is used as gravel, as at the Dial Range and St Valentines Peak.

The pieces of broken rock are often rounded and collected by water or glaciers into widespread but often shallow accumulations. In the Launceston area, notably at Beaconsfield, Deviot and Perth, sand and gravel has accumulated in beds among clay in what was once a large lake.

Everyone is familiar with the sand and gravel along present stream beds. Raised beaches, near the sea, often provide gravel as near Leith, although they are normally composed of fine sand. Glacial moraines on the Central Plateau provide accumulations of rounded and broken fragments. Nearly all of these alluvial deposits are not well sorted and will vary greatly in grain size over quite small lateral extents and depths.

Dolerite and basalt, because of their many joints, weather fairly rapidly on steep slopes and the talus or scree from these rocks is widely used as road material.

The rate of weathering of *granite* varies widely but in the northeast it is sometimes weathered for many feet in depth and provided there is not too much mica in the original rock provides a good surfacing material.

Precambrian rocks in western Tasmania often contain large stringers and blebs of quartz which is more resistant than the rock and after prolonged weathering is left as a layer, often under button grass as at Parrawe and on the Waratah–Corinna road.

When rocks that contain a lot of iron (notably dolerite and basalt) weather the iron often goes into solution and is then precipitated as iron oxide or laterite. If sufficient quantities of this can be found it is the best surface material of all. Part of the Iron Cliffs Road near Penguin is formed of iron oxide.

All of the above materials have been formed from slow weathering, break up and accumulation, often far from the source of rock fragments. There is another class of material that is often used for road making — broken rock fault breccia. This is usually formed many millions of years ago when violent earthquakes and earth movements broke the rock and ground and shattered the edges of the breaks. These zones are not wide and may be concealed by soil and vegetation so that they are difficult to find. The best way of locating fault zones, when hidden, is to try and find two different rock types close together, when the junction may be a faulted one.

Solid materials

If rocks have to be broken mechanically for road material the types most used are the igneous rocks, and of these in Tasmania dolerite is the favourite. Dolerite, or bluestone or simply road metal, is widely used especially around Hobart, Launceston and Devonport. Basalt, which closely resembles dolerite in appearance, is used at Burnie and Weily's quarry near Brighton. Granite is normally too hard but limestone is occasionally broken for road material. Tin and wolfram are extracted from quartz veins in Silurian slates and quartzite at the Aberfoyle mine. The mixture of broken quartz (white) and rock (black) is widely used on northern roads.

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