

The Rock Cycle

The different types of rocks that make up the Earth can be grouped according to the way they formed into igneous, metamorphic and sedimentary rocks.

Magma is a general term for hot molten rock that collects in underground chambers within the Earth's crust. Rocks that solidify from magma are called igneous and are broadly divided into extrusive rocks that are formed when the molten magma erupts from the surface as volcanoes or intrusive rocks that form when the magma cools and solidifies beneath the surface.

Granite is an igneous rock that forms by the slow cooling of magma deep within the Earth's crust; it is composed of silica-rich minerals such as quartz, feldspar and mica. The rocks known locally as 'greenstones' are igneous rocks that are basaltic or basic in nature, they contain less silica than granite and are often associated with pillow lavas (formed when basaltic magma erupted beneath the sea).

Sedimentary rocks are formed by the compaction of sediments. For at least the last 3,800 million years weathering, water, wind and glacial movement have worn down the surface of the Earth. The sediments were transported to ancient lakes and seas where they settled layer upon layer. Once laid down sediments may be altered by a variety of processes, water is squeezed out by compaction and further changes transform the soft sediment into hard and brittle layered rocks such as sandstone, limestone and shale.

All rocks can be changed by heat and pressure. Such changes are called metamorphism. Most significant changes take place deep within the Earth but local changes can be produced close to the surface. Strong pressure creates dynamic metamorphism thus mudstones (shales) are converted into slates. Intense heat produces thermal metamorphism; this may be localized around small igneous intrusions or widespread in proximity to major intrusions.

Around four hundred million years ago, near to the equator, lay a sea bounded, to the north and to south by land. This sea filled a depression called the Armorican geosyncline. Over a period of about sixty million years (called the Devonian Period) the landmass to the south was moving steadily northwards uplifting the northern landmass and altering the position and depth of the sea. Thus over millions of years the rising landmasses were worn down by weathering and the material transported to the sea where the particles of rock settled. The coarsest particles settled first in the shallow coastal margins to become sandstones and siltstones whilst the finer particles were carried to deeper waters to eventually become shale. The Devonian Period ended three hundred and fifty million years ago and was followed by the Carboniferous Period. During this time most of the land that will become Cornwall still lay beneath the sea with the southern landmass still moving northwards. The land that will become Devon now lies in an area of swamps and river deltas. Thus over a period of many millions of years a succession of rocks built up that would become the sandstones of Devon and the slates (killas) of Cornwall.

Throughout the Devonian and Carboniferous Periods there were times of volcanic activity. These periods of volcanism produced mainly basic (basalt) lavas, often erupted beneath the sea to form pillow lavas, or as sills and dykes intruded into the surrounding rock. These basic extrusive and intrusive rocks are known locally as 'greenstone' and often formed headlands along the north Cornish coast examples being Botallack Head and Gurnards Head to the west and east of Geevor

By the end of the Carboniferous Period, about three hundred million years ago, the encroaching southern landmass had collided with the northern landmass and uplifted the whole, with consequent folding, thrusting and faulting. The process, known as the Variscan (Armorican) orogeny, created the Variscan Mountains from the seabed rocks that had been lain down over the previous eighty million years

The origin of the Cornish granites is not fully understood. Their composition indicates that they were derived from the melting of marine sediments (or older metamorphic rocks concealed beneath them). At the height of the Variscan (Armorican) orogeny colliding continental landmasses crumpled together to form the Variscan (Armorican) Mountains. This process forced the less dense crust, the mountain 'root' derived from Devonian and Carboniferous sediments, down into the denser mantle where they were melted. Alternatively subduction could have dragged down some crust to a depth where it began to melt.

Whatever the explanation about three hundred million years ago at the end of the Carboniferous Period a reservoir of molten rock (magma) formed beneath the Variscan Mountains. The magma heated the surrounding rock, already altered by pressure generated by the mountain building process, and changed it into metamorphic slates (killas). The magma also contained very small amounts (a few parts per million) of tin, copper and other metals that were present in the original Devonian and Carboniferous sediments and intrusive rocks. As the magma cooled it began to crystallise to form granite.

The granite mass is called a batholith and forms a SW- NE orientated ridge beneath (present day) Cornwall and Devon. It is about two hundred and fifty km in length and is of unknown depth. Projecting from the top of the batholith are dome shaped masses of granite called plutons. These are exposed at the (present) surface as the Isles of Scilly, Land's End, Carnmenellis, St Austell, Bodmin Moor and Dartmoor granites. There are many smaller acidic intrusions like sills, dykes and veins associated with the main granite bodies.

Modern research indicates that the granite formed over a period of approximately thirty million years as a series of pulses. Evidence suggests that the older Dartmoor and Bodmin Moor granites were cooling and being mineralised before the intrusion of the younger Land's End and St Austell granites.

The rock cycle is the name given to the continual and self-perpetuating processes that form the different rock types. Magma is intruded and extruded to form the igneous rocks. At the Earth's surface these and all other surface rocks, are eroded to produce sediments, which after transportation and later burial are transformed into sedimentary rocks. Pressure and heat brings about metamorphism that further changes the rock. Subsequent melting at depth creates fresh magma so that the whole cycle continues.