

Explain the formation of metamorphic rocks, with reference to examples from Ireland

(30m)

Metamorphic rocks are formed when igneous rock or sedimentary rock are changed by great heat and/or pressure. There are three types of metamorphic rock, which are thermal, dynamic and regional.

Thermal metamorphism is when rocks are changed as a result of great heat. Thermal metamorphism occurs when heat from volcanic activity changes the rock. In Ireland, quartzite in the Sugar Loaf, Co. Wicklow was formed as a result of this thermal metamorphism. Here magma came in contact with the surrounding sandstone rock as the magma upwelled into a fold mountain. The heat from this magma body within the fold mountain changed the sandstone to quartzite. As a result of weathering on the peaks of this fold mountain, the quartzite was revealed. Marble is another example of a metamorphic rock, this time as a result of the thermal metamorphism of limestone.

Dynamic metamorphism occurs when convection currents cause plates to slide past each other at passive plate boundaries or collide with each other. Along fault lines at passive plate boundaries, the fault line itself can be changed into a 'fault gouge' (fine, sticky powder). Shale is a sedimentary rock which can be put under huge dynamic pressure at destructive plate boundaries. As a result of this pressure the shale is compressed forming slate which can be used for roof tiling.

Regional metamorphism is caused when heat and pressure occur over a large area at, for example, subduction zones. The majority of Ireland's metamorphic rocks were formed in this way 450 million years ago during the Caledonian orogenic (see fold mt. answer) period when the North American and European plates collided. The collision of the plates caused the rocks to fold and magma rose into the buckled rock. This was at the same time that the Leinster Batholith was forming. Mudstone in County Wicklow was changed to schist in this way.

Finally, as a result of metamorphism, mineral crystals within the original rock can be rearranged to form foliated metamorphic rocks such as slate. Here, the minerals are flattened into parallel layers.