THE GEOLOGY OF MIDDLE-EARTH

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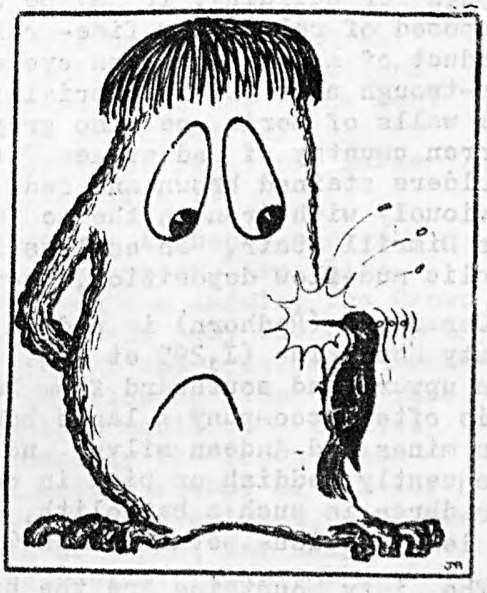
The geology of Middle-Earth, like everything else in that storied and haunting world, is logical, consistent, and only partly described. In this rather incomplete study I have made two basic assumptions. One is that the topographical descroptions are accurate indications of the terrain; in fact, this and the use of words like "wold" and "down" are a large part of the evidence. The other is that rock types and their properties are the same as those we know here, with the one exception of mithril-ore. This seems reasonable enough, since change in these properties would require change in the weathering cycle to account for it, with consequences clear back to the basic physical laws of the universe. As a corollary to this, I have assumed a geological history for Middle-Earth. This is open to argument on several counts, but is not strictly crucial to the study.

The descriptions given cover three main regions. It is a little like constructing a landscape from someone else's field nots, except that most of the notes are concerned with more important matters. We begin with the Shire.

The Shire is a clay vale between chalk downs, east and west. The scenery, with its small fields and settlements, trees and coppices and many small streams resembles that of the Weald or the Oxford Clay districts; there are few large rivers but some marshy places (such as the Marish istelf) and brick and wood are preferred for building in most areas. The rock succession is probably one of clays and soft sandstones, with occasional bands of harder sandstone and limestone forming ridges. To the west are the White Downs, to the east, the Barrow Downs. The treeless hilltop in the Old Forest (I,124) may well be an outlier of the chalk-- that is, a relic of the days when the chalk extended over the Shire. Below the Barrow-Downs there is a spring-line (I,133) and the outcrop of more durable stone, perhaps resenbling the Greensand of the Weald of which Tom Bombadil's house is built. The path leading to the house is chalky.



Beyond Bombadil's house the downs form a north-south ridge, diminishing northward into a wide pale land; eastward they rise "ridge behind ridge into the morning", treeless, without surface drainage, covered in short springy turf (I,146-7). This is typical chalk down scenerey. The westward faces of the hills are steeper, which suggests an eastward inclination (dip) of the layer of chalk;it must therefore lie over the clay-and-sandstone vale of the Shire. If the White and Far Downs are also chalk, (as seems likely) they are probably the

other end of an arch whose centre has been eroded away to leave the older rocks of the Shire exposed beneath.

The Barrow-downs are apparently bounded east or northeast by a fault: the land falls away at the edge of the downs (I,157) and the landscape of Bree suggests its rocks are older. Building-stone is plentiful; Bree hill itself is brown (I, 193) and is probably a reddish or brown sandstone. Eastwards, the marshy area of Midgewater could be an igneous intrusion like the Cornish granites (igneous rocks do not always form hills; it depends on the relative hardness of the surrounding rocks) or perhaps an area of very old crystalline rocks, like those of the Northwest Highlands. Whatever it is, it must be impermeable to water. Eastwards again, Weathertop and the Weatherhills are of a light-coloured stone (I,199) on which grows grass rather than heather (I,212). This is generally a sign of calcium in the soil since heather will not grow on limy soil; the Weather hills are probably an outcrop of sandy sedimentary rocks with a proportion of calcium carbonate; calcerous sandstones, which are often light in colour.

East of the Weathertop range there are few notes. The scenery remains much the same as far as the Hoarwell or Mitheithel; beyond there we find darker rock, massive enough for building (I,213,216), with trees growing. Between Mitheithel and Bruinen there is a region of hills with woods and heather-covered slopes, bilbery, brush, and hazel thickets (I,220-1),and the Road runs down to the Fords of Bruinen in a cutting with steep moist walls of red stone (I,225). The rocks are probably mixed sandstones and other sedimentary types, perhaps of the same age as those around Bree. The Rivendell valley is steep-walled and stony (I,252,294) but the rock type is not described. A tentative explanation of the structure of the region is shown in Fig.1. Weathertop is capped by a harder, more resistant rock that protects it from weathering, and the Midgewater marshes are interpreted as an igneous intrusion, probably granite. The section is probably grossly over-simplified, but without extensive field work, the simplest explanation is the best.

The Misty Mountains can probably be taken as a unit, although the notes we have are scattered and refer mainly to the part south of the Moria region. Hollin is a region of grey stone (I,295), some massive enough for building. It may be what is called greywacke, that is rock composed of relatively fine-grained unsorted sediments, a typical product of a rapid erosion cycle with dumping of the sediments in a sea-trough near to their origin; it can build up to great thicknesses. The walls of Moria are also grey but the Moria-gate region is "a barren country of red stones" (I,313) and the Sirannon runs through boulders stained brown and red. This is a different part of the sequence obviously with iron in the sediments. On the east side of the Mountains the Dimrill Stair, "an endless ladder of short falls" (I,347) suggests cyclic mud-flow deposition, another product of a rapid erosion cycle.

Caradhras (Redhorn) is red in colour and the highest peak of the Misty Mountains (I,295 et seq.) According to Gimli lodes of mithril run upward and southward from Redhorn (I,331). Mineral veins such as this often accompany a large body (batholith) of granite: the Cornish tin mines and Andean silver and gold mines are examples. Granite is frequently reddish or pink in colour. It does seem likely that Caradhras is such a batholith, and if so there are undoubtedly veins of less precious metals which Gimli did not mention.

The Misty Mountains are the highest, and therefore probably the youngest mountains of Middle-Earth. They appear to be composed, like the Alps in this Age, of great thicknesses of sedimentary rock, laid

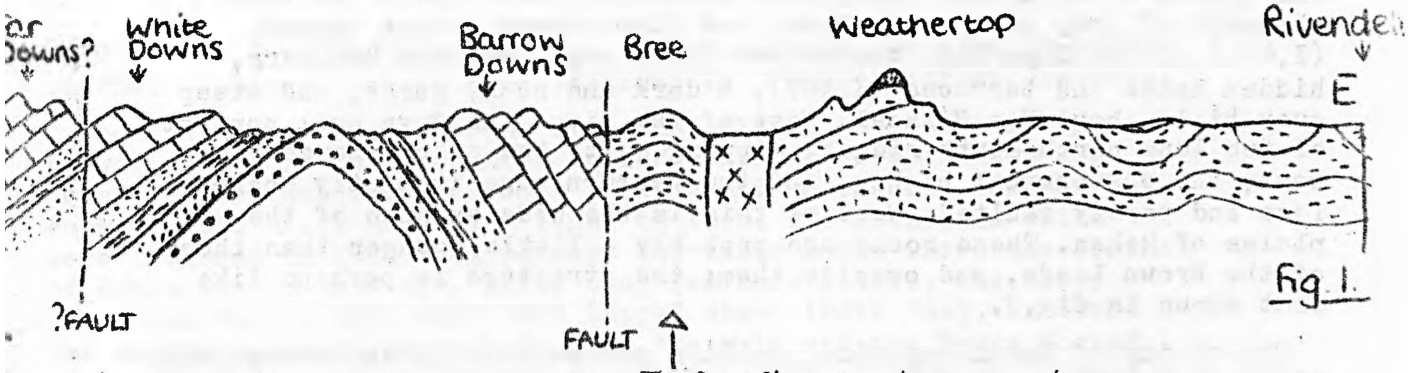


Fig 1.

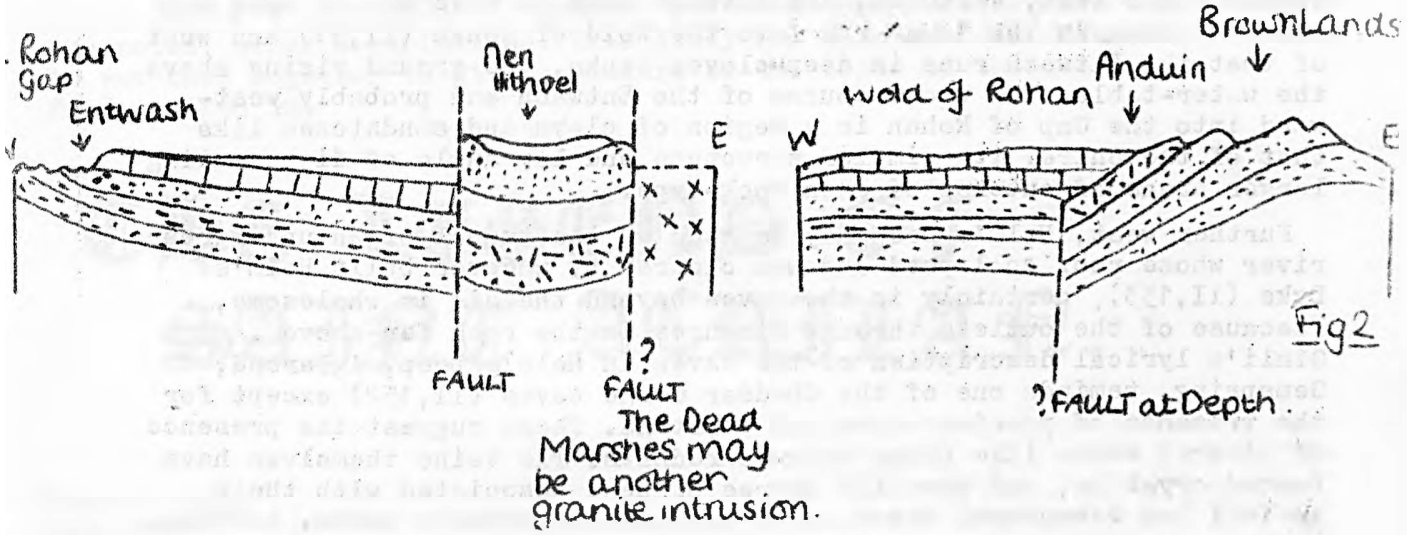


Fig 2

down in an ancient sea between Eriador and Rhovanion. These two landmasses, moving together in the long slow process of continental drift, squeezed the younger sedimentary rocks between them. Great complex fold structures developed, with sliding of whole sections over each other; since there was nowhere else to go the rocks went upwards. Under the pressures developed, by a complex melting process the rocks turned to granite and formed at least one large batholith, with lodes of precious ore running from it.

There is no surface rock in lothlorien, there the only stones mentioned, in the road and at the hythe on the river, are white. The next notes are for points further south on the Anduin; the Brown Lands are "long formless slopes stretching up and away toward the sky" and here the land west of Anduin is green, flat and treeless, marshy in places (I,396). The River here is plainly flowing along the line of contact between two rock types; the contact could be a faulted one but there is no indication of this. Possibly the Brown Lands are a region of sandstones and other sedimentary rocks, of similar age to the Bree hill-Weathertop sequence, dipping westward, with the much younger sedimentary rocks of the Wold of Rohan, including clays where the marshy places occur, lying west of the river and lapping like the sea which deposited them over the older sediments. (See Fig.2.)

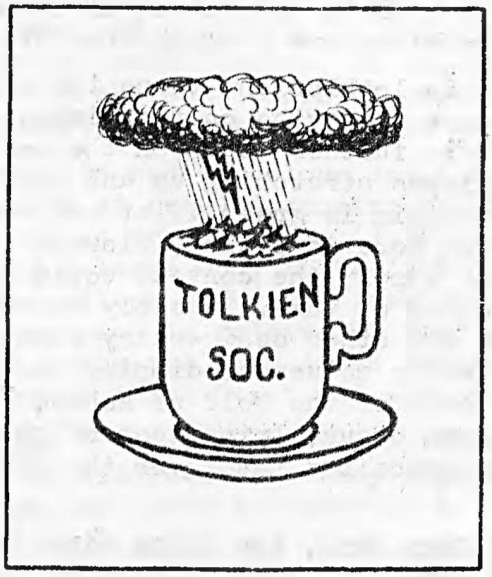
Further south, north of Emyn Muil, the banks rise and grow stony,

the ground is hilly and rocky with crumbling grey cliffs and rock-chimneys of grey weathered stone, and fir-crowned ridges beyond, (I,401). In the Emyn Muil themselves there are limestone boulders, hidden holes and terraces (I,407), a dark and rocky gorge, and steep grey hills about Nan Hithoel. West of the river the Emyn Muil consist of two long north-south ridges, dipping east; the scarp slopes face west, the easternmost higher, and the western edge is partly scarp face and partly faulted. West of this is the wide expanse of the plains of Rohan. These rocks are probably a little younger than those of the Brown Lands, and overlie them; the structure is perhaps like that shown in fig.2.

The plains of Rohan are wide, rolling grass-lands lying between the ridge of the Misty Mountains and the older structures just described. They are not quite flat, but tilt gently eastward; away from the Emyn Muil they rise to "A line of low hump-backed downs" with harder ground and shorter grass (II,29). This land between the Emyn Muil and the downs is a region of clays and young sediments like those of East Anglia, with little exposure; the downs themselves are undoubtedly chalk; and beyond their feet, westward, the Entwash runs in thickets of reed and rush. Northwards the downs run into the Wold of Rohan (II,31) and west of that the Entwash runs in deep-cloven banks, the ground rising above the water-table. The whole course of the Entwash and probably westward into the Gap of Rohan is a region of clays and sandstones like that of the Shire, its simpler structure and low angle of dip creating larger areas of outcrop of each rock-type.

Further west, Helm's Deep may be seen as the tunnel of an underground river whose roof collapsed and was cleared by whoever built Helm's Dyke (II,133), certainly in the caves beyond the air is wholesome, "because of the outlets through fissures in the rock far above". Gimli's lyrical description of the caves in Helm's Deep, Aglarond, Gemspring, reminds one of the Cheddar Gorge caves (II,152) except for the presence of precious ores and crystals. These suggest the presence of mineral veins like those below Caradhras. The veins themslves have formed crystals, and the mild degree of heat associated with their arrival has encouraged crystals to grow in the country rocks, softened them, turned them into pieces of marble.

We have no notes, or not enough, for the White Mountains and the land of Gondor. The White Mountains may be a continuation south and east of the structure of the Misty Mountains, so that the knot south of Edoras is a point of structural weakness like the Anatolian Knot; however, they could equally well be much older. The mountains around



Mordor were deliberately built as a fence around the land of Sauron so their geology, and that of Ithilien is probably rather confused.

There are three main groups of rocks. Oldest are those of the Brown lands-Emyn Muil and Bree Hill-Weathertop group; these had probably been subjected to some folding and weathering before the rocks of the Misty Mountains began to form. The mountains which were levelled to form them perhaps had their roots where the Plains of Rohan lie in this age. After long geological ages, the Misty Mountains were built, and a sea lapped about their feet, eastward and westward, in which the chalk of the Wold and the Downs formed. After the land rose or the sea fell, more earth movements occured in which the fault east of the Barrow-Downs and Possibly the Emyn Muil fault, among others, became as they were when the hobbits found them. Grass grew, beasts ran, men and hobbits came into the world.

As I said at the beginning, the geology of Middle-Earth is not quite complete. The main structures are here; there are other hints and notes, other descriptions. This study may give an idea of how to put them together to give a picture of the bones of the country Frodo walked in.

THE LEGEND OF SAINT ACRILAN.

Young ascetic
Peripatetic
Enthusiastic
Hair-shirt drastic --
Nylon plastic.

Rite ecstatic --
Silk dalmatic....
Too much static !

Scintillation --
Admiration !
Levitation --
Acclamation !
Aerostation --
Jubilation !
Percipitation....
Consternation....

Canonisation.

by Belladonna.