2 The Magnesian Limestone

2.1 Composition

The recognition, by the early 1800s, that some of the rocks exposed on the Durham Coast and the inland plateau contain magnesium led to the general use of the name 'Magnesian Limestone' to describe them, even though not all of the rocks contain magnesium nor are all limestones.

Limestone is one type of carbonate rock, a class of sedimentary rocks composed primarily of minerals that contain the carbonate ion, CO_3^{2-}, as the basic structural and compositional unit. The carbonates are among the most widely distributed minerals in the Earth's crust. In general terms a limestone is a rock composed predominantly of calcium carbonate ($CaCO_3$). Some limestones contain an appreciable quantity of magnesium, most commonly as the mineral dolomite ($CaMg(CO_3)_2$), and are known as magnesian limestones. The term 'dolomite' is applied to both the mineral dolomite and to a carbonate rock containing between 90 and 100% of this mineral. The strata that are exposed on the Durham coast and underlie the plateau consist of a variety of rock types; mainly carbonate rocks of different compositions including magnesian limestone and dolomite. The Magnesian Limestone is itself restricted to a narrow belt between Nottingham and Durham.

2.2 Age

The rocks of the Durham Limestone Plateau were laid down during the Permian Period of geological history, which dates from about 299 to 251 million years ago. The Permian rocks of the plateau are underlain by coal-bearing rocks of Carboniferous age (310 my). Earth movements towards the end of the Carboniferous raised and tilted the land which was subsequently eroded for several million years before the deposition of the earliest Permian rocks, as desert sands.

Most of the Magnesian Limestone (above the Yellow Sands) was deposited in the late Permian. The superficial deposits that overlie the Magnesian Limestone date from the Quaternary Period, which commenced about two million years ago. Little is known with any certainty about the geological history of the area in the intervening time. Fissure fills in the Magnesian Limestone coastal cliffs at Warren House Gill, north of Easington, predate the Devensian glaciation and are the oldest Quaternary deposits in the area.

2.3 Naming and division

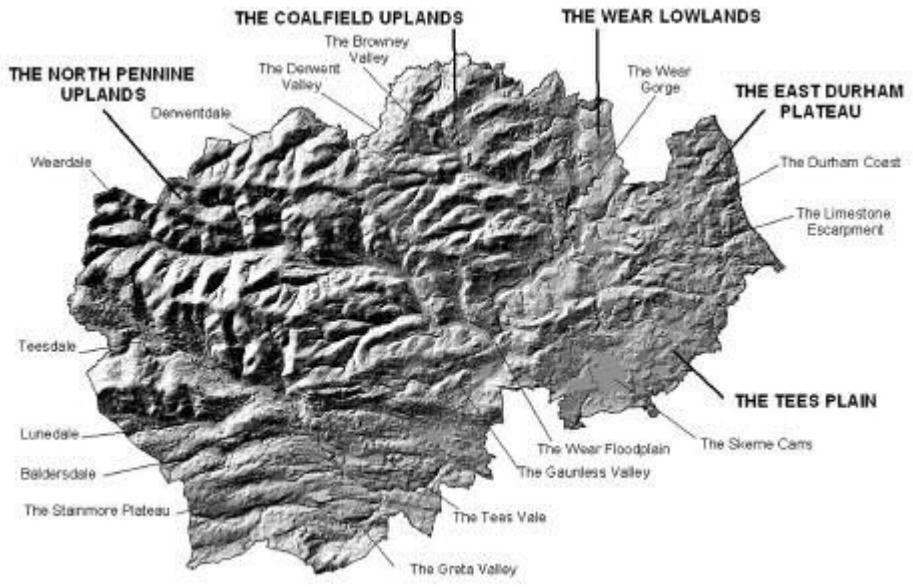
The naturalist John Winch used the term Magnesian Limestone to describe the rocks along the coast from 'Shield to Hartlepool' in his observations of the geology of Northumberland and Durham presented to the Geological Society in March 1814 (published 1816), although the name was probably in use before then. The eminent geologist Adam Sedgwick described the primary divisions of the Magnesian Limestone in a comprehensive scientific paper of 1829. The classifi cation of the rock sequence then evolved gradually as successive discoveries enabled later workers to refine the pioneer work. The Magnesian Limestone has traditionally been divided into Lower, Middle and Upper units. Although describing it within his Magnesian Limestone unit, Sedgwick recognised that the sand at the base might be more appropriately considered separately, as is now the case. However, the importance of this lowest unit, the Yellow Sand, in the development of the Limestone Plateau makes its inclusion essential in discussion of the Magnesian Limestone.

In order to accord with modern geological procedures, a new formalised system of names based on geographic locations was introduced in the 1980's and these have been used in this report. (Table 1) indicates the relationship between these new names and those in earlier use. A geological map of the area and schematic cross section are illustrated in (Figure 1)

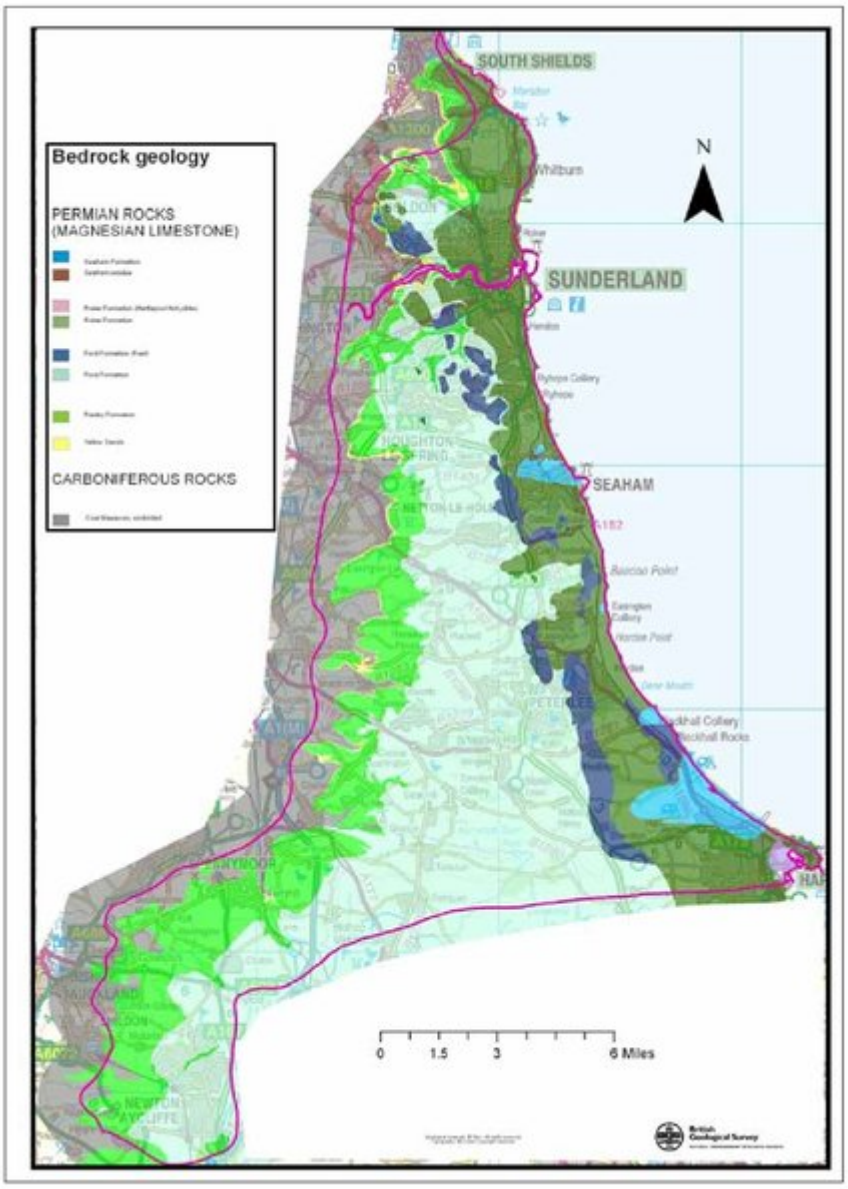
(Figure 2)

(Table 1) The Classification of the Magnesian Limestone

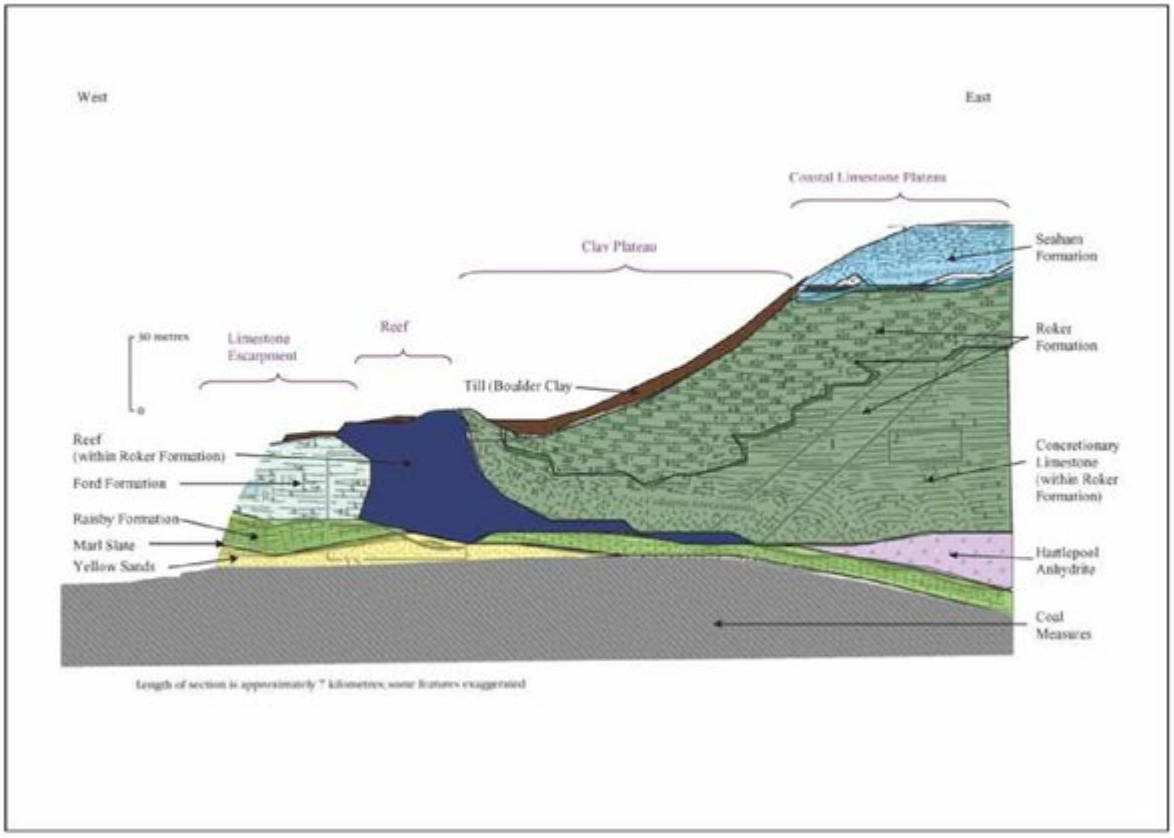
References



(Figure 1) The Topography of County Durham.



(Figure 1) Geological map of the area showing bedrock.



(Figure 2) Schematic diagram to show general relationship of geological units (adapted from Smith 1994).

Geological System	Previous Name	Current Name	Maximum thickness	English Zechstein Cycle
Upper Permian	Rotten Marl	Rotten Marl Formation	10m	EZ3
	Upper Magnesian Limestone	Seaham Formation	33 m	
		Roker Formation (including Concretionary Limestone)	200 m (116 m)	EZ2
	Middle Magnesian Limestone	Hartlepool Anhydrite	As a residue	EZ1
		Ford Formation (including the Reef)	116 m	
	Lower Magnesian Limestone	Raisby Formation	76 m	
	Marl Slate	Marl Slate Formation	6 m	
Lower Permian	Yellow Sands and breccias	Yellow Sands Formation	60 m?	

(Table 1) The Classification of the Magnesian Limestone.