Millington Pastures

[SE 84 43]–[SE 85 55]

Highlights

The dry valley system of Millington Pastures may qualify as the finest dry valley system on the Chalk of Britain. With its deeply incised, dendritic form and well developed head deposits, it is an excellent representative of this important and ubiquitous karst landform.

Introduction

The Yorkshire Wolds form the crest of a wide chalk escarpment with a gentle dip to the east (Figure 7.1). Many dry valley networks are cut into both the scarp face and the dip slope. Millington Pastures is the finest and deepest of these, incised in the steep scarp face. It consists of a superb dendritic valley network with eight separate branches, all converging into Millington Bottom, east of Pocklington village. The thick head deposits in the valley floor are well preserved. The dry valleys of the Yorkshire Wolds have been poorly documented in comparison with the chalk valleys of southern Britain. Their origins have been discussed by Cole (1879, 1887), Mortimer (1885), Lewin (1969) and De Boer (1974), and many of the arguments put forward to explain the dry chalk valleys of southern England apply equally well.

Description

Millington Pastures has a dendritic system of eight converging dry valleys entrenched by up to 100 m into the chalk wolds (Figure 7.14). They cut through the entire surviving Chalk sequence in the western flank of the Yorkshire Wolds escarpment; the dip is a few degrees to the east, but the chalk is cambered along the scarp edge and valley sides. The chalk locally lies unconformably on Liassic clays, which are exposed in the floor of Millington Bottom, where three powerful springs are fed by groundwater from the chalk to feed Millington Beck. Upstream of the springs, which are all now capped, the valleys are completely dry except after extreme rainfall events (Cole, 1887). Several sections through weathered chalk and the overlying combe rock are exposed in old quarries and pits, but there are no natural chalk outcrops.

The valley floors are gently graded, but steepen rapidly up into their headwalls. Many of the valley sides have very uniform gradients for most of their height, with a short convex section at the top. The valley cross-sections show a flattening where the thicker head deposits occupy the valley floors (Figure 7.15). The dry valley systems of both Millington Pastures and Warter Wold are among the largest of the scarp face systems. Their headward retreat has been so extensive that they have shifted the topographic divide of the Wolds escarpment towards the dip slope (Figure 7.14); the trendline of high points along the interfluves passes through Coldwold.

Interpretation

As with the many other chalk dry valleys in southern England, many different hypotheses have been proposed to explain the origin of the dry valleys of the Yorkshire Wolds. Mortimer (1885) suggested that they were formed by periods of crustal upheaval creating fractures in the crust, subsequently rounded by denudation. Cole preferred a more realistic explanation (1879, 1887) after noting the effects of a prolonged sharp frost followed by a rapid thaw. He witnessed surface flow occurring in many normally dry valleys causing extensive erosion and commented that 'nothing could more plainly show what rapid denudation of the chalk dry valleys might be carried out under glacial conditions'. However, he still maintained that chemical denudation was the primary cause for their origin. Lewin (1969) provided a comprehensive review of the dry valleys of the Yorkshire Wolds. He noted that there were at least three generations of valley which can be identified: old wide valleys which continued as wind gaps through the interfluves; younger dendritic valleys such as Millington Pastures; and the Devensian glacial meltwater channels. He reviewed the several hypotheses for their origins:

by meltwater erosion of frozen ground, by subsurface solution and collapse, and by dissection resulting from scarp retreat and climatic change. He concluded that the dendritic valleys such as Millington Pastures formed by headward erosion by surface streams and were later abandoned due to climate change. These valley systems are clearly distinct from the glacial meltwater channels which cross parts of the Wolds without gathering tributaries and commonly with neither upstream nor downstream continuations.

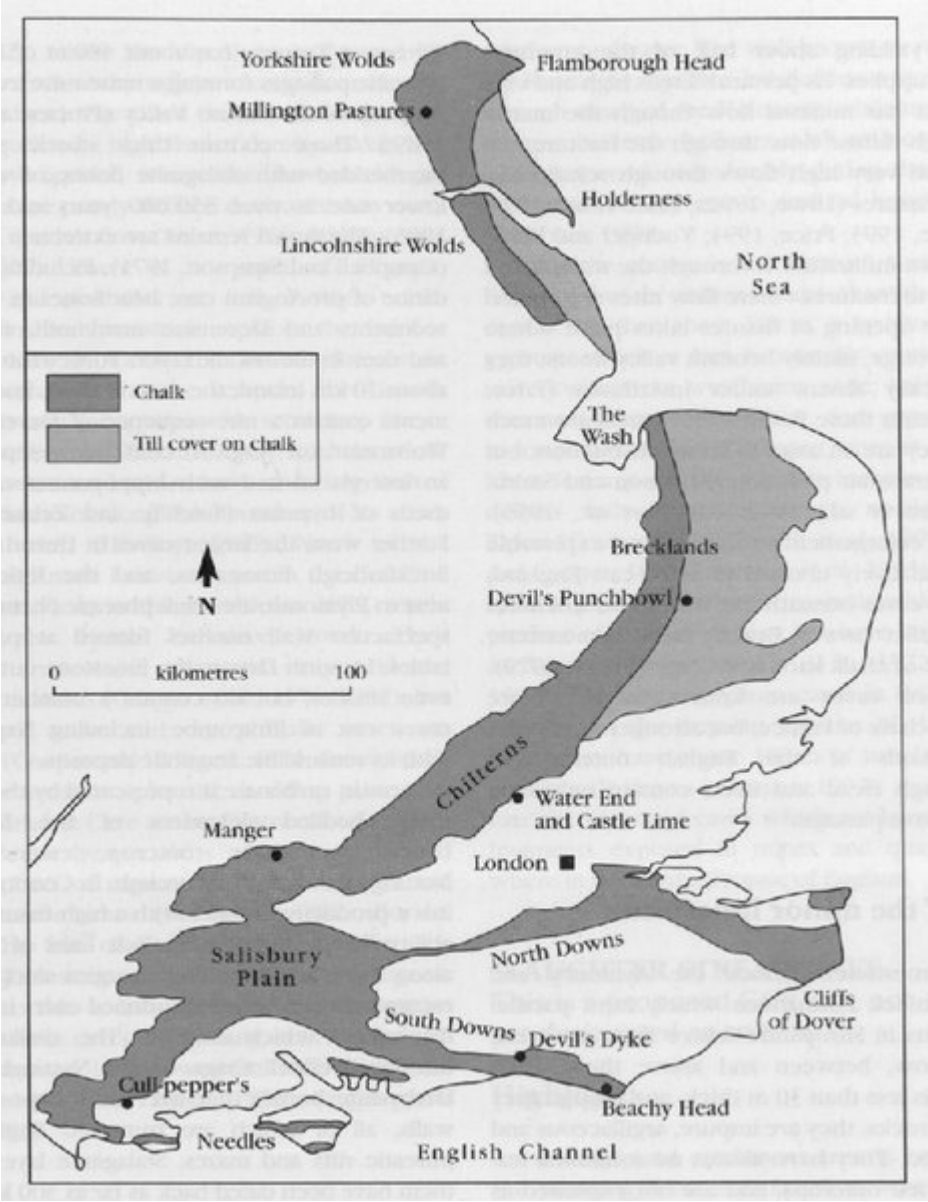
By analogy with similar valleys in the Chalk of southern England such as the Manger (Paterson, 1977), and the Devil's Dyke (Small, 1962), it is clear that the dry valleys were excavated by a combination of solifluction and subaerial fluvial action under periglacial conditions. Ice sheets covered the Wolds in the earlier Pleistocene glaciations, but they were not covered by Devensian ice. During a long period of Devensian periglacial conditions, extensive and recurrent solifluction flows moved frost-shattered and saturated chalk debris into and down the growing valleys. Sediment removal and valley incision were further aided by snow meltwater flowing over the permafrost each summer.

The valleys subsequently became dry relict features when the climate ameliorated and all precipitation could percolate into groundwater systems. The chalk is a very permeable aquifer, with extensive diffuse flow. Beneath Millington Pastures the groundwater appears to converge on some form of conduit systems; though the springs are all close to the impermeable base of the chalk, they are in the valley sides where fissures dictate their sites, and not simply at the lowest exit points.

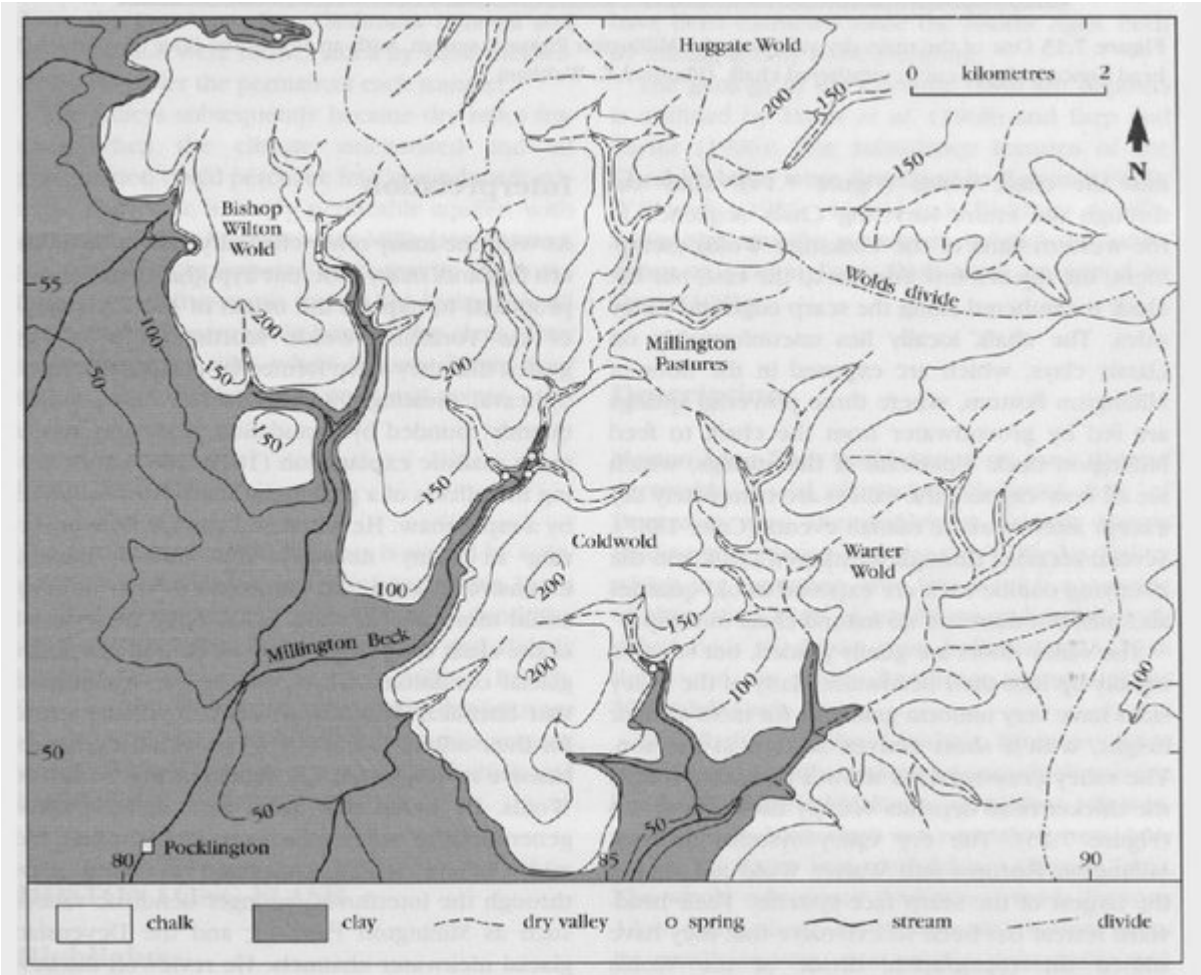
Conclusions

The chalk of Millington Pastures is scored by a singularly well developed system of dry valleys. It is a particularly spectacular example of a dendritic, dry valley network, more compact and deeply incised than any other in the Chalk of Britain. Slope morphologies and solifluction deposits are clearly displayed, and small old quarries expose useful sections through the weathered chalk and head deposits.

References



(Figure 7.1) Outline map of the chalk karst of England, with locations documented in the text. Superficial deposits occur on many parts of the Chalk outcrop; only the large areas of glacial till are distinguished on this map, as they mask most topographic expression of the karst.



(Figure 7.14) Outline map of the dry valley systems of Millington Pastures and its neighbours in the Yorkshire Wolds chalk escarpment. The chalk outcrop includes those of the impure, red Ferriby and Hunstanton Chalks, forming the lowest 25 m. Only the larger springs are marked.

(Figure 7.15) One of the main dry valleys in the Millington Pastures system, with an almost flat floor of soliflucted head beneath slopes cut in weathered chalk. (Photo: A.C. Waltham.)