HISTORICAL CHANGES IN RIVER PATTERNS NEAR HOLFORD, SOMERSET

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Close to the exit of Holford Combe, at the edge of the Quantock Hills, several problems are presented to the keen observer of the countryside and local maps. Firstly, why does the river or stream issuing from the Combe make such a sharp left turn at Holford immediately after leaving the Combe? Why in addition is there a large gorge at this same point, and are these two phenomena connected in any way? Finally, and perhaps less obvious, why is the valley occupied by Lower Hill Farm, midway between the Quantock Hills and the Bristol Channel, so large, yet the stream flowing through this valley now so small? These and other problems can only be solved by reference to historical changes in the stream and river patterns of the area, the causes of which are uncertain but the effects of which remain clearly visible in the landscape to this day.

The present pattern of stream and river channel is seen as the last of three distinct stages. Fig. 1 shows these three stages, the evidence for which is discussed below. Firstly the original path of the river follows route 'A', flowing straight out of the Combe over the coastal plain past Stogursey to reach the Bristol Channel near Stolford Farm. Secondly, the river subsequently flowed through the valley now occupied by Lower Hill Farm (route 'B') to reach the Bristol Channel as at present near Kilve. Finally the river was again diverted to its present path (route 'C') making the sharp and significant left turn at the exit of Holford Combe. This process of diversion is rare and is known as *river capture.*[1] It occurs when the source of a stream migrates with head-ward erosion, crossing the path of another stream and thereby capturing its head-waters, leaving an abrupt change of direction at the point of capture.

Taking the historical river patterns identified in reverse order, the present stage 'C' is clearly anomalous. Firstly, the gorge at Holford is a feature most uncommonly found in normal river valleys except in special cases such as Cheddar Gorge where the solution of the limestone rock has led to chemical excavation of the gorge. Secondly, the profile of the river between the Combe exit and Kilve shows not only the abrupt change of altitude at the gorge (Fig. 2) but also a distinct change in the overall stream slope. Fig. 3 shows the same profile plotted on a logarithmic scale; usually the profile of a river will be a straight line on such a plot (Hack, 1957). This is certainly true of the upper portions of both the Holford and the Hodder Combes but the gradient and curvature of the stream's profile change abruptly at Holford. The equations for the straight lines approximating to the logarithmic plots are given below and the differences in slopes are evident:

$$A_L = 1185 - 637 \text{ (log 10d)} \qquad \text{(Hodder Combe)}$$

$$A_L = 1505 - 1117 \text{ (log 10d)} \qquad \text{(Holford – Kilve profile)}$$

(Where A_L is altitude and d is the distance from the source in miles).

The slope factor of the latter equation (1117) is nearly twice as great as that for the former equation (637); clearly the two portions of the present stream are in contrast to each other. A third anomaly is the sharp left turn of the present river at the Combe exit. This type of change in direction is unusual in normal rivers, but is common where river capture has occurred.

The evidence for the two former routes of the river is partly to be found in the field and partly to be found on specialised maps of the area. Examination in the field of the valley now occupied by Lower Hill Farm indicates that it is considerably larger than could have been eroded by the stream now flowing through it. The conclusion that this valley was once occupied by the larger stream issuing from Holford and Hodder Combes and following route 'B' is supported by the fact that this large valley at Lower Hill Farm passes right

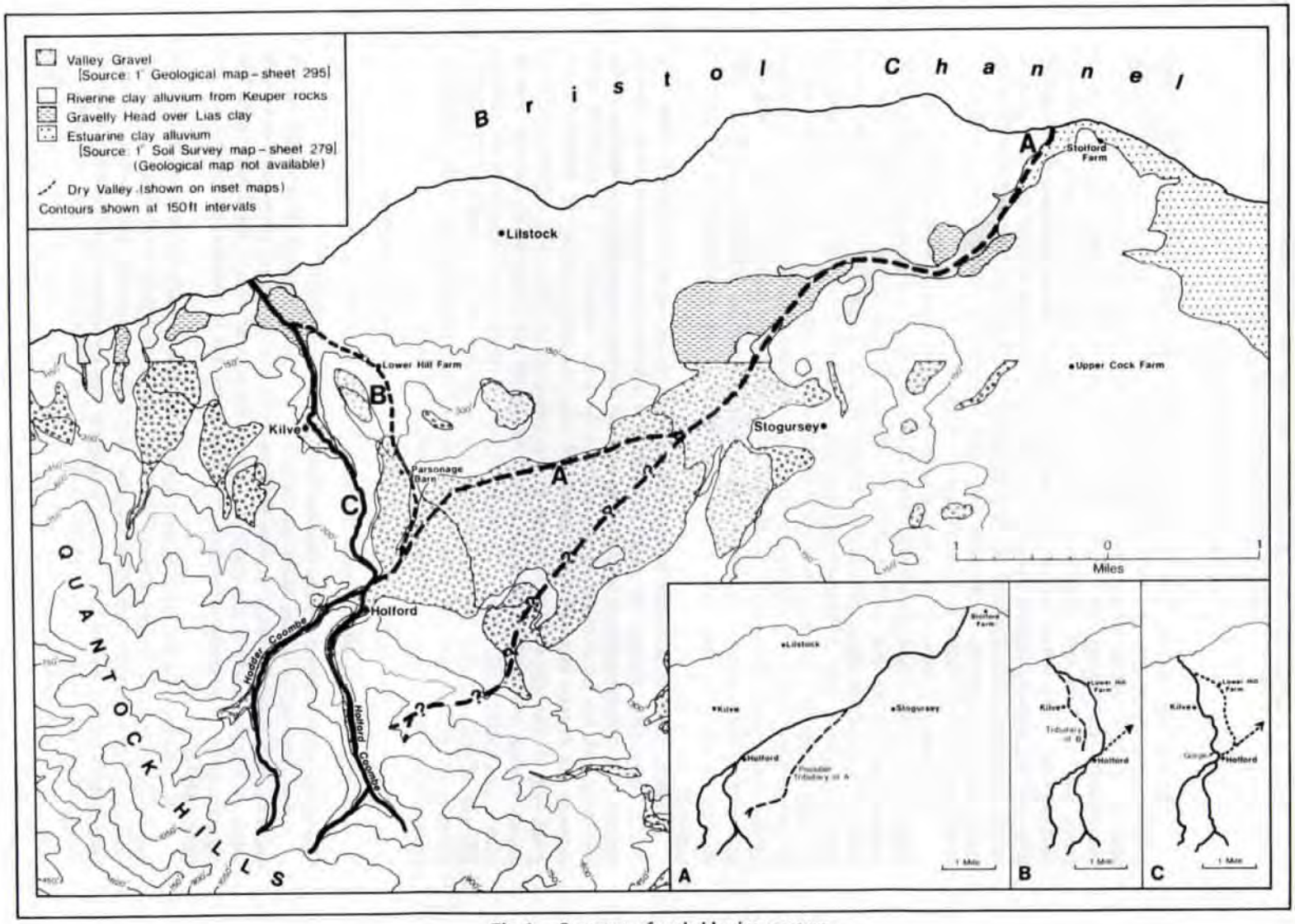

Fig. 1 Sequence of probable river capture.

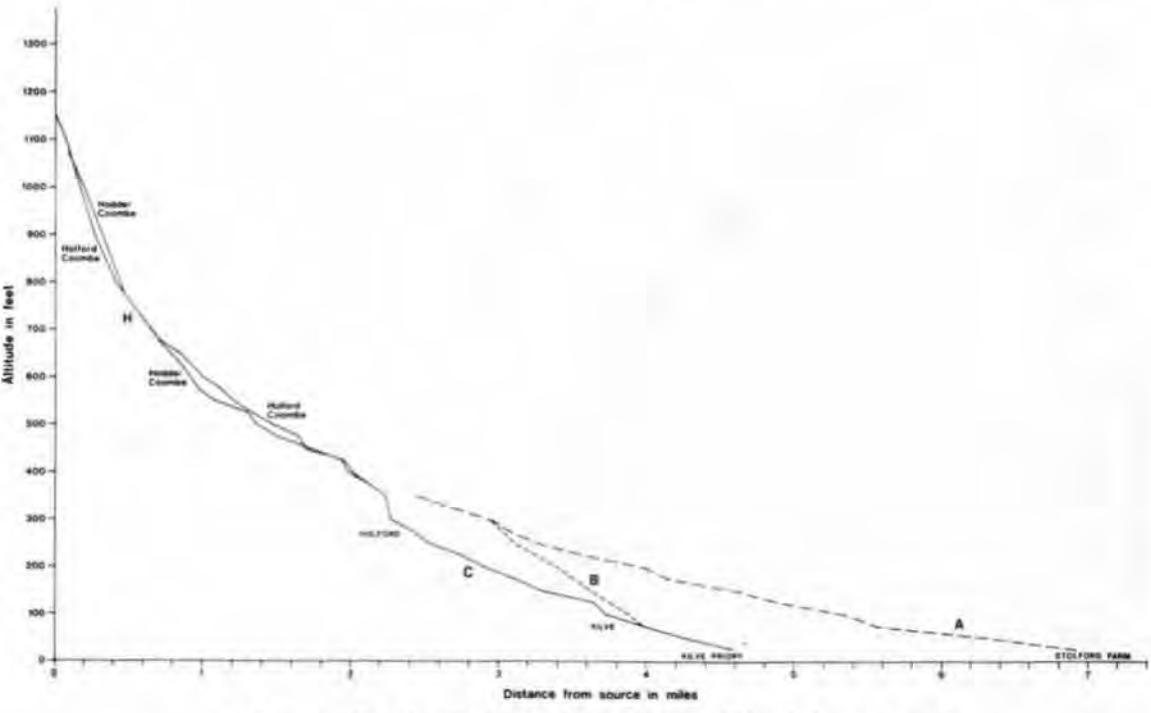

Fig. 2 Profiles of Holford and Hodder Combes and historical stream routes.

through the low coastal hills rather than being a valley of a stream flowing off these hills. Such a valley passing through the hills can only have been cut by a large river, almost inevitably flowing from the two Combes cut in the Quantock Hills.

The stream following route 'B' must have been captured by one of its tributaries flowing along the line of the current route 'C', indicated on the inset to Fig. 1. Because this latter route 'C' involves a shorter distance between Holford and the coast the overall gradient of the tributary would have been steeper than that of the main channel. This could have caused the tributary to have a faster rate of erosion, leading it to cut back through time to intersect route 'B' at Holford. Owing to a higher rate of erosion it could have been at a lower level than the previous route 'B' so that when capture occurred the stream flowed into a gorge dug by the headward erosion of the tributary now constituting route 'C'. Naturally much of this is speculative but no other explanation can account satisfactorily for the present morphological anomalies to be seen in the landscape today, in particular the valley at Lower Hill Farm.

The evidence for route 'A' is contained on the geological and soil maps of the area as well as in the profiles of Figs. 2 and 3. Between the exit of the two Combes and the coast at Stolford Farm the 1-inch geological map shows a spread of 'valley gravels' also shown on Fig. 1. This is material eroded from the Quantock Hills and laid down by a river or series of rivers. To the north of Stogursey no comparable geological map exists but the gravels are shown indirectly by the soil map of the area, on which soils developed from river gravels are shown (see Fig. 1). It seems impossible that these gravels can have been deposited by any other agency than a stream flowing out of the two Combes towards the coast at Stolford Farm. This conjecture is substantiated by profile A in Figs. 2 and 3 which is the profile of this Holford-Stolford Farm route. Fig. 3 shows that this route can be interpreted as a direct continuation of the upper sections of Hodder Combe, which itself is almost identical in

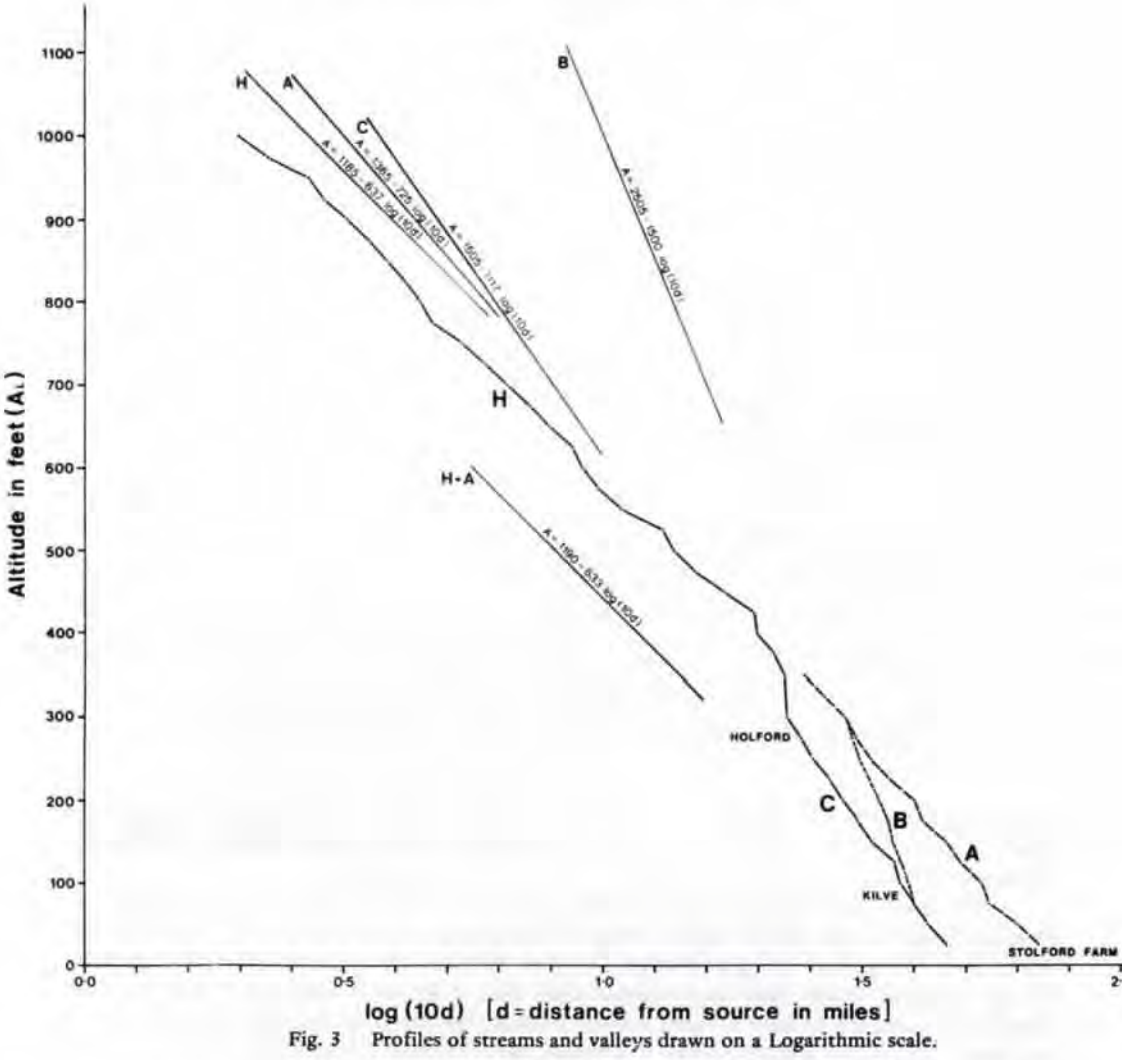

Fig. 3 Profiles of streams and valleys drawn on a Logarithmic scale.

profile to Holford Combe. The equations of the two sections are given below and their similarity will be noticed.

$A_L = 1185 - 637 \text{ (log 10d)}$ (Hodder Combe)

$A_L = 1365 - 725 \text{ (log 10d)}$ (Holford – Stolford Farm profile)

Consequently we have here a case of double capture. First the direct and straight route 'A' was captured by the Lower Hill Farm valley route 'B', leaving behind the valley gravels eroded from the excavation of Holford and Hodder Combes perhaps immediately after the last glaciers left the north of England. Secondly this route was captured by the present route leaving the almost dry valley at Lower Hill Farm. The reason or reasons for the captures are not clear but the fact that at each successive capture the overall length of the river was shortened and therefore the gradient steepened means that with these changes through time the efficiency and power of the river increased.

Nevertheless several problems remain unanswered. Firstly, it is not totally clear why

route 'B' was abandoned for the present route 'C'; the overall gradient of the latter is steeper but, as Fig. 3 shows, locally the gradient of route 'B' is considerably greater. It is not common for a stream to be captured by one of its own tributaries, however, unless that tributary is eroding weaker rock, or rock weakened by faulting or other shattering. Secondly, the area around Parsonage Barn is almost flat and the point of capture of route 'A' by route 'B' is obscure. This is unfortunate since this initial capture is critical to the re-orientation of the whole drainage pattern. It is likely that capture took place many thousands of years ago and all trace of the point of capture has been removed by subsequent erosion and deposition. The only evidence remaining is the channel cut through the valley gravels (Fig. 1), leading to the top of the Lower Hill Farm valley, showing that this route was adopted after route 'A' had been abandoned.

Despite these problems of interpretation it is clear that the present landscape cannot be explained in terms of the present stream patterns. Satisfactory explanation can only be made with reference to routes 'A' and 'B' and their subsequent capture by the present route – only the precise mechanism and timing are unknown.

1. A fuller account and explanation of the process of river capture can be found in G. H. Dury's *The Face of the Earth* (Penguin, 1959).

REFERENCES

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