THE EVOLUTION OF THE RIVERS OF EAST DEVON AND SOUTH SOMERSET, UK

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With the exception of the River Tone, which appears to have been separated at an early stage from its neighbours to the south by a major fault, the rivers of south Somerset and east Devon were initiated on a southward dipping Tertiary planation surface. The evolutionary histories of the present-day catchments of the rivers Exe and Otter are complex and inter-related. Those of the adjacent Axe and Teign appear to be less complex and may have evolved relatively independently from the Exe-Otter system. The differences in the histories of the catchments are most clearly demonstrated by their terrace systems. The Exe-Otter catchment has 10 or more terrace levels at heights of up to 140 m above the modern floodplain. In contrast, the Axe, Teign and Tone catchments contain only one or two terrace levels all of which are less than 20 m above the present-day valley floor. The explanation suggested here for the difference involves a sequence of river captures that changed the forerunner of the present-day Otter from a major river capable of producing a 3-km wide gravelly braidplain into a minor stream.

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INTRODUCTION

The middle and lower reaches of the River Exe and the adjacent catchments of the Axe, Otter, Teign and Tone drain an area with a complex topographical relief that ranges from over 300 m above Ordnance Datum (O.D.) in the Blackdown Hills to a few metres above O.D. on the Devon coast (Figure 1). Geological resurveys of the Exeter, Newton Abbot, Sidmouth and Taunton districts during the past 20 years have confirmed the 19th century observations of Ussher and others (Ussher, 1902; 1906; 1908; 1913; Woodward and Ussher, 1911) that the terrace sequences of the Exe and Otter catchments are markedly different from those of the Axe, Sid, Teign and Tone. Eight terrace levels, ranging in height from just above, to 60 m above, the modern floodplain, have been recognised along the Exe and its tributaries with patches of 'undifferentiated' terrace at higher levels (Edwards and Scrivener, 1999). An even greater range is preserved in the lower reaches of the Otter Valley where a staircase of ten terrace levels range up to 100 m above the modern floodplain and 'undifferentiated' terrace deposits range up to 150 m above (Edwards and Gallois, 2004). In contrast, Edmonds and Williams (1985) recorded only two terrace levels in the Tone catchment, one mostly *c.* 5 m above the modern floodplain and the other "just above the alluvial flats". Selwood *et al.* (1984) recorded only one terrace level in the Teign catchment, up to a few metres above the alluvium, and no terrace deposit was recorded in the Sid catchment (Edwards and Gallois, 2004).

Extensive terrace deposits crop out on the lower slopes of the Axe Valley at heights up to 20 m above the valley floor between Kilmington (SY 270 980) and Chard Junction (ST 342 047). In contrast to the terrace deposits of the Exe and Otter, those of the Axe are unusually thick (locally up to 15 m). They were worked in Victorian times for road and railway ballast, and continue to be worked at Chard Junction for aggregate. The former workings at Broom (ST 326 024) have yielded a greater number of Palaeolithic implements than any other site in southern England (Wymer, 1999) and the succession there is, in consequence, the most studied terrace deposit in south-west England.

There are too few age data to determine the period of time during which the terrace sequences in south-west England evolved, but comparison with the denudation chronology of southern England as a whole suggests that all the terraces referred to in this account formed during the middle and late Pleistocene. Throughout this period the region experienced alternations of cold and temperate climates, but there is no evidence to indicate that the area was ever glaciated. The climate experienced by the Exe and Otter catchments was not, therefore, sufficiently different from that of the adjacent catchments to explain the differences in the terrace successions. These must relate to the underlying geology.

GEOLOGICAL SETTING

The present-day outcrop geology of the region can be divided into four principal types (Figure 2). In the west and north west the complexly folded and faulted Carboniferous deposits (mostly Crackington and Bude formations) are strongly lithified rocks. They give rise to a high-relief topography in which their predominantly E-W Variscan structural fabric is reflected in the drainage patterns. The Carboniferous rocks are overlain with marked unconformity by a gently dipping, fining-upward succession of Permian breccias, sandstones and mudstones (Exeter Group to Littleham Mudstone Formation) that was deposited in E-W trending extensional basins during the denudation phase of the Variscan mountains, most conspicuously in the Crediton and Tiverton troughs. The Permian deposits are disconformably overlain by early to middle Triassic pebble beds and sandstones (Budleigh Salterton Pebble Beds and Otter Sandstone formations). These and the Permian rocks give rise to generally low-relief, low-lying land, in which the Budleigh Salterton Pebble Beds form a prominent ridge that separates the present-day catchments of the rivers Exe and Otter (Figure 1).

The eastern part of the region is underlain by mid Triassic to early Jurassic rocks (Mercia Mudstone to Lias groups) that are almost wholly weakly lithified mudstones that give rise to a