
Chapter 5 Pleistocene cave sequences

Introduction

S. Campbell

South-West England contains some of the most important Pleistocene cave sequences in Britain. The Carboniferous Limestone of the Somerset and Avon districts (particularly the Mendips), and the Devonian limestones of south Devon (Figure 2.1) and (Figure 5.1), host numerous caves and cave systems, many of which contain important sediment sequences, faunal remains and artefacts. As a result, the caves have long attracted scientific interest and several locations remain the subject of intensive modern research. This chapter reviews evidence from four of the stratigraphically most significant localities — Kent's Cavern (Torquay), Tornewton Cave (Torbryan), Chudleigh Caves and Joint Mitnor Cave (Buckfastleigh).

The importance of the region for Pleistocene cave studies stems from a number of circumstances. First, the region was situated overwhelmingly, if not entirely, beyond the southern limits of Pleistocene glaciation (Figure 2.3), and lay centrally in a zone across which a whole range of Pleistocene mammal species would have migrated in response to climatic and environmental changes (Sutcliffe, 1969; Cullingford, 1982).

Second, the Devonian and Carboniferous limestones of the region exhibit significant karst development, providing a profusion of suitable caves, fissures and shafts where sediments, faunal remains and artefacts have accumulated by a variety of agencies. In some locations, animals fell into caves via open shafts and became trapped (e.g. Joint Mitnor Cave and Banwell Bone Caves; Cullingford, 1953; Sutcliffe, 1960; Macfadyen, 1970); other locations were used as natural refuges or dens, for example by bears or hyaenas, in which the animals died, leaving their own remains as well as those of their prey (e.g. Tornewton Cave; Sutcliffe and Zeuner, 1962; Sutcliffe, 1974). Occasionally, fossil bones are preserved in cave stream deposits (e.g. Eastern Torrs Quarry Cave, near Plymouth; Sutcliffe, 1969, 1974). Particularly significant are the remains of rodents, which evolve more quickly than the larger mammals and which can provide important palaeoenvironmental evidence (Sutcliffe, 1974; Sutcliffe and Kowalski, 1976). Bone preservation, even of microfaunal remains, has been aided in many circumstances by alkaline conditions. Thirdly, the South-West, and Devon in particular, was the scene for much of the pioneering work carried out in the nineteenth century.

Geological Conservation Review site selection

The large numbers of caves and fissures in South-West England where sediments, faunal remains and artefacts have been described, provide significant difficulties with respect to selecting the 'best' or most appropriate sites for conservation. Following the guidelines outlined in Chapter 2 (Ellis *et al.*, 1996), four sites believed to contain the most important stratigraphical and palaeoenvironmental evidence (and with some of the most extensive histories of research) were selected, and are described in this volume (this chapter). A further five sites in Somerset and Avon (Sun Hole (Cheddar Complex); Bridged Pot and Savory's Hole (Ebbor Gorge); Badger Hole and Rhinoceros Hole (Wookey Hole); Picken's Hole and Beeche's Hole (Crook Peak–Shute Shelve Hill); Banwell Bone Caves) are to be described in a separate volume of the GCR Series — *Fossil Mammals and Birds* (in prep.) — in the *Pleistocene Vertebrata* section. Tornewton Cave and Joint Mitnor Cave (this volume; Chapter 5) and Brean Down (this volume; Chapter 9) are described again in the latter volume by virtue of their palaeontological importance, which was assessed independently.

The caves of south Devon

The south Devon caves have been studied for nearly 200 years (e.g. Polwhele, 1797). In fact, the first bone cave to be studied scientifically in Britain was excavated by Joseph Whidbey at Oreston, near Plymouth, in 1816 (Sutcliffe, 1969; Cullingford, 1982). In 1825, the Reverend J. MacEnery began his excavations at Kent's Cavern, later to be continued by William Pengelly (e.g. Pengelly, 1868b, 1869, 1871, 1878, 1884). William Buckland also visited many of the Devon caves during the 1820s, including Kent's Cavern, Pixie's Hole (Chudleigh), Oreston and Anstey's Cove Cave among others

((Figure 5.1); Sutcliffe, 1969). Importantly, Pengelly's excavations in the Brixham Cave in 1859 provided the first published account to demonstrate that humans had occupied the region before the extinction of the cave mammals, a fact later to be reinforced by his work in Kent's Cavern (note also the work of MacEnery; this chapter) (Sutcliffe, 1969).

Of the early excavations, J.L. Widger's in the Torbryan Caves from about 1865 to 1880, are particularly notable. From the 1920s until the beginning of World War Two, the Torquay Natural History Society excavated in Cow Cave (Chudleigh), Kent's Cavern, Tornewton Cave and Joint Mitnor Cave. Since the War, excavations have been carried out by Almy, Cheesman, Neale, Rosenfeld, Sutcliffe, Zeuner and others in Tornewton, Three Holes and Levaton caves (Torbryan); Joint Mitnor Cave; Eastern Torrs Quarry Cave, Yealmpton (discovered by quarrying in 1954); and Neale's Cave, Paignton (discovered in 1958) (Sutcliffe, 1969, 1974, 1977).

The principal localities where remains of Pleistocene mammals have been found in south Devon are shown in (Figure 5.1). With the exception of the Honiton hippopotamus site, where a peat deposit with an Ipswichian fauna was excavated during roadworks in 1964 (Turner, 1975), the caves are all located in Devonian limestone below c. 100 m OD (Sutcliffe, 1969, 1974, 1977).

Kent's Cavern, Tornewton Cave and Joint Mitnor Cave have long been regarded as the most important sites, both stratigraphically (in terms of length and detail of palaeoenvironmental record) and palaeontologically. However, Chudleigh Caves also contain significant sediment sequences, fossils and artefacts which have been investigated systematically by Collcutt (1984, 1986); Pixie's Hole is particularly notable in containing the greatest demonstrable extent of Later Upper Palaeolithic deposits surviving in any known British cave site (Collcutt, 1996). Recent Uranium-series work on speleothem in the Berry Head Caves (Figure 5.1) confirms their potential for calibrating marine Pleistocene events (Proctor and Smart, 1991; Baker, 1993; Proctor, 1994; Baker and Proctor, 1996) and necessitates their future assessment for GCR status.

Kent's Cavern is a site of considerable historical importance in British Pleistocene studies (e.g. Pengelly, 1884; Campbell and Sampson, 1971; Proctor and Smart, 1989; Proctor, 1994). It contains a sequence of sediments, with fossil fauna and artefacts, which extends well back into the Middle Pleistocene. The interpretation of the sequence has been hampered both by Pengelly's removal of most of the cave sediments and by an inability, until recently, to date the earliest deposits in the cave: the latter have appeared to most workers to be significantly older than deposits in the upper part of the sequence. Some have speculated that the controversial Breccia, with its *Ursus deningeri* von Reichenau fauna (with *Homotherium latidens* Owen), could date from the Cromerian Complex (e.g. Hinton, 1926; Campbell and Sampson, 1971; Sutcliffe and Kowalski, 1976; Straw, 1983), but recent Uranium-series and Electron Spin Resonance (ESR) dates associated with the breccia (Proctor, 1994, 1996) suggest an age of c. 300–400 ka BP for the deposit, and a possible correlation with Oxygen Isotope Stages 9 or 11 of the marine record. Proctor's work, however, confirms earlier views that the Crystalline Stalagmite represents a lengthy hiatus between deposition of the Breccia and the overlying Cave Earth. Controversially, Straw (1995, 1996) has suggested that the Crystalline Stalagmite was broken up by an earthquake. The traditional interpretation of the Cave Earth as a Devensian deposit is upheld by U-series dates which invite a correlation with Oxygen Isotope Stages 4 to 2: the deposit contains a typical and diverse Devensian mammal fauna dominated by spotted hyaena, which evidently used the cave as a den (Proctor, 1994, 1996).

Tornewton Cave, in the Torbryan Valley (Figure 5.1), is of considerable importance for a sequence of richly fossiliferous deposits spanning the entire Late Pleistocene and extending well back into the Middle Pleistocene (Roberts, 1996). Sutcliffe and Zeuner (1962) interpreted the sequence as an Ipswichian interglacial layer (Hyaena Stratum) sandwiched between Saalian (Glutton Stratum) and Devensian (Reindeer Stratum) cold-climate deposits, and this view has since been reiterated in a number of publications and wider correlations (e.g. Sutcliffe, 1969, 1974, 1977; Stephens, 1973). Recent multi-disciplinary work, sponsored by the British Museum between 1989 and 1992 at Torbryan, has confirmed the palaeoenvironmental value of the caves, especially Three Holes Cave, Broken Cavern and Tornewton Cave, and led to considerable re-evaluation and elaboration of the sequences (e.g. Proctor, 1994; Barton, 1996; Berridge, 1996; Cartwright, 1996; Caseldine and Hatton, 1996; Currant, 1996; Debenham, 1996; Gleed-Owen, 1996, 1997; Irving, 1996; Price, 1996; Proctor and Smart, 1996; Seddon, 1996; Stewart, 1996). Although the full results of the Torbryan Caves Research Project await publication (Roberts *et al.*, in prep.), it is likely that the sequence at Tornewton Cave spans from Oxygen Isotope Stage 7 (Otter Stratum), through Stage 6 (minor debris flow), to the warmest parts of Stage 5 (Bear

Stratum, Hyaena Stratum and 'Dark Earth') to Stage 4 (isolated deposits with a *Rangifer* and *Bison* fauna) and Stage 3 (material at the cave mouth) to Stage 2 (Glutton Stratum — a huge mass-flow deposit), thus providing one of the most complete Pleistocene cave sequences known in Britain.

Although a comparable reappraisal of the sequence at Joint Mitnor Cave at Buckfastleigh is not available, the site remains one of the most important localities for Ipswichian mammal remains in Britain (Stuart, 1982b), and is included in this volume on that basis.

The caves of Somerset and Avon

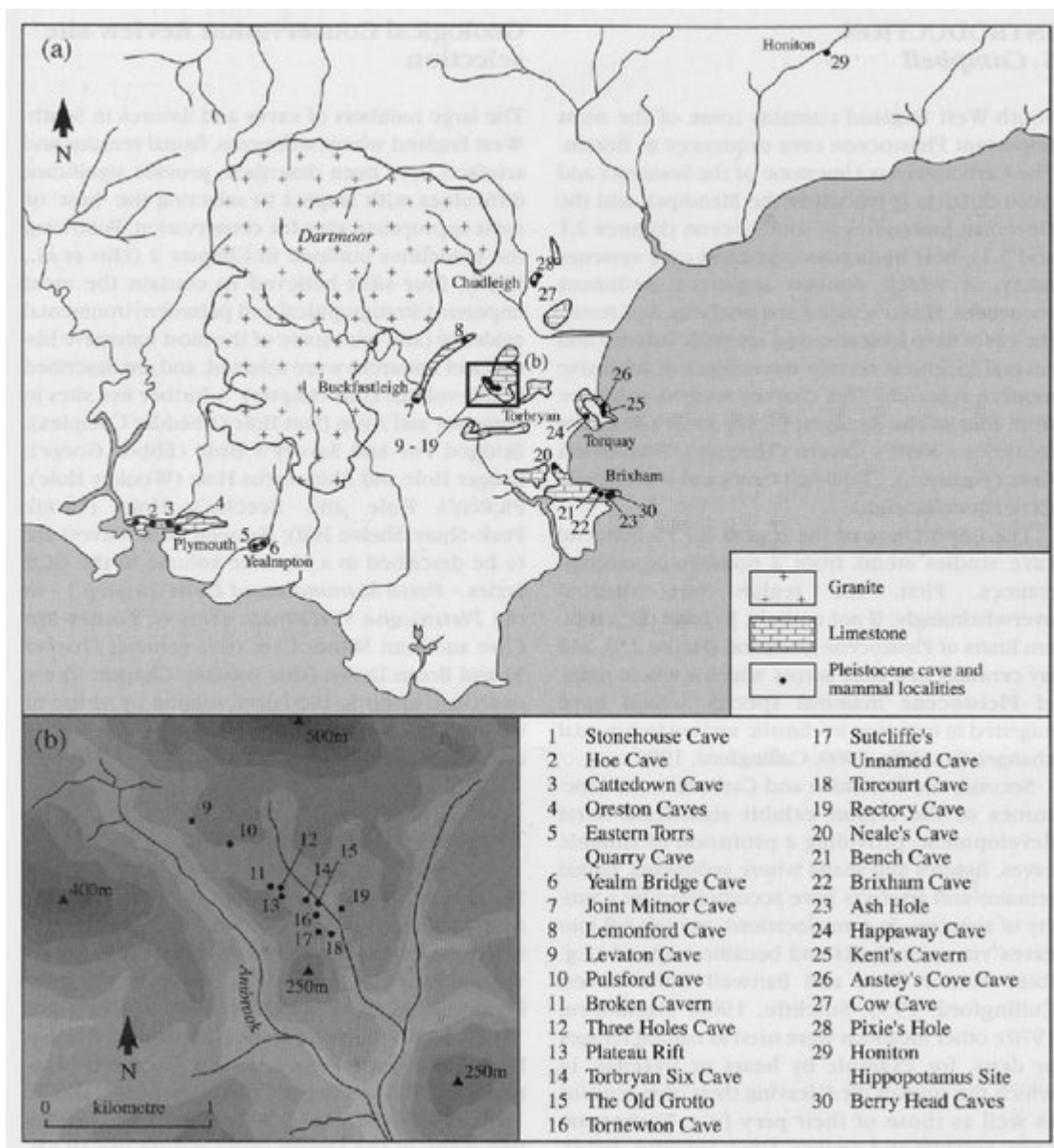
The Carboniferous Limestone of the Bristol, Bath and Mendip areas hosts a significant number of caves, fissures and shafts which contain Pleistocene sediments, fossils and artefacts (e.g. Balch, 1947, 1948; Donovan, 1954, 1964; Ford, 1968; Macfadyen, 1970; Drew, 1975; Campbell, 1977; HaWkins and Tratman, 1977; Irwin and Knibbs, 1987; Waltham *et al.*, 1996). The caves have long been the subject of scientific study, but overwhelmingly (with the notable exception of Westbury-sub-Mendip) the evidence dates largely from the Devensian Stage, particularly Oxygen Isotope Stages 4 and 2, and does not provide a sufficient length or detail of palaeoenvironmental record to have merited selection within the subject 'blocks' of the GCR described in this volume (Chapter 2). However, a number of the Somerset and Avon cave sites are of considerable palaeontological significance, and are thus described elsewhere in the GCR Series of volumes (see above; Geological Conservation Review site selection). Excellent reviews, with comprehensive bibliographies, of the cave and fissure deposits of these areas are provided by Donovan (1954, 1964), Macfadyen (1970) and Hawkins and Tratman (1977), and only brief background comments are provided here on the more significant localities for Pleistocene studies.

The longest and most significant record from this region comes from Westbury-sub-Mendip, where a fossil mammal fauna (Westbury 1 fauna) may provide evidence of conditions in Cromer-Complex times (Heal, 1970; Bishop, 1974, 1982; Stringer *et al.*, 1996). The later Westbury faunas (Westbury 2 and 3 faunas) appear to be post-Cromerian (cf. West Runton) but pre-Hoxnian *sensu stricto* (Stringer *et al.*, 1996), and thus represent an important part of the Pleistocene record only poorly known elsewhere in the region. Historically, the Westbury deposits have proved difficult to conserve effectively, although the site's adjacent karstic features are included within a GCR site selected for the 'block' *Karst and caves of Great Britain* (Ellis *et al.*, 1996; Waltham *et al.*, 1996). Continuing use of the locality for stratigraphic and palaeontological studies, however, undoubtedly warrants reconsideration of its GCR status for the site 'blocks' — *Quaternary of South-West England* and *Quaternary of Somerset and Avon* described in this volume, and also for the *Pleistocene Vertebrata* section of the GCR.

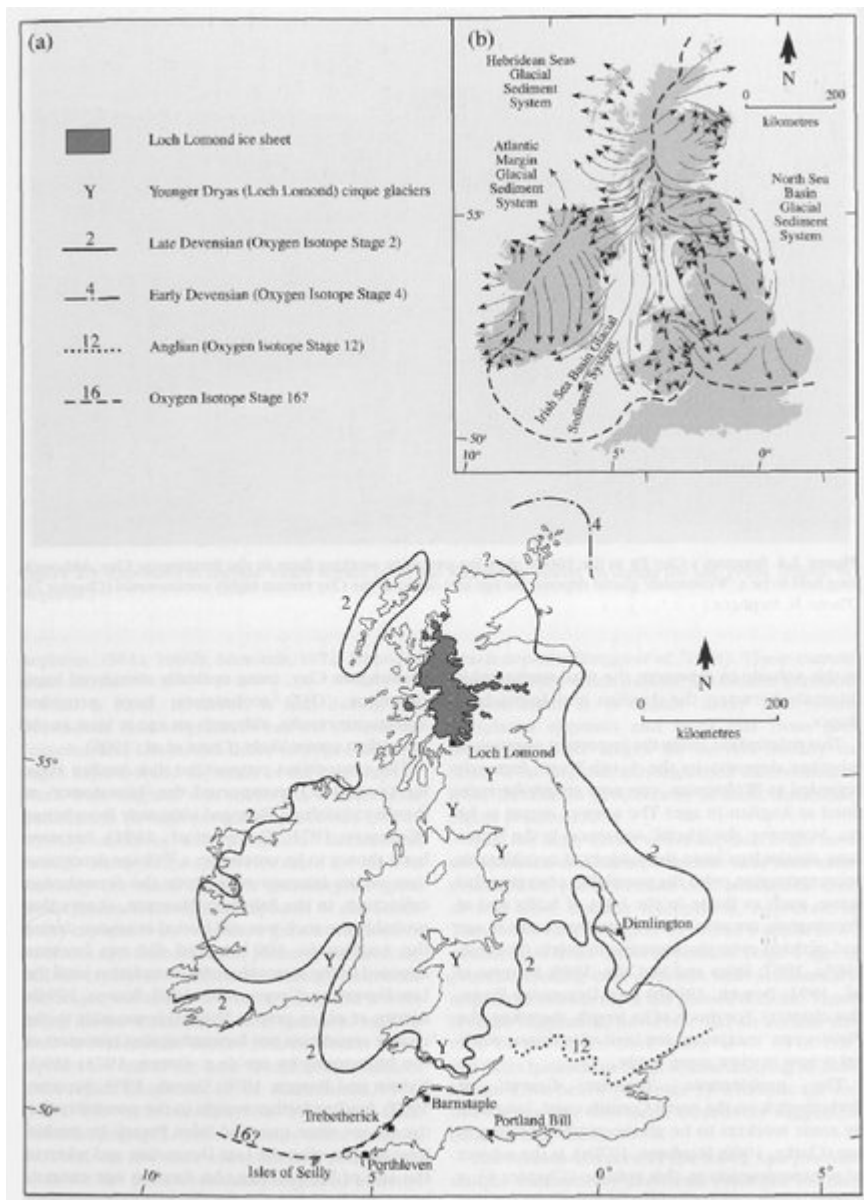
Evidence for conditions in the Ipswichian Stage comes from relatively few cave localities in Somerset and Avon (Chapter 2; Ipswichian Stage). Particularly significant are the sequences at Badger Hole and Rhinoceros Hole (Wookey). The former contains *in situ* deposits which contain mammal remains of Middle and Late Devensian (pre-Devensian late-glacial) age in association with Early Upper Palaeolithic artefacts. Significantly, Rhinoceros Hole contains a sequence of deposits containing a characteristic Ipswichian interglacial fauna including hippopotamus, as well as younger deposits with contained faunas probably dating from the Middle Devensian (Stuart, 1982b).

Banwell Bone Caves are significant for having yielded a rich Pleistocene bone assemblage, mainly bison and reindeer (Balch, 1948; Cullingford, 1953; Macfadyen, 1970; Stuart, 1982b). Like Joint Mitnor Cave in south Devon, the animals here appear to have fallen to their deaths through a large hole in the cave roof. Extensive deposits remain *in situ*, but further work is necessary to establish the age and full composition of the fauna, and the stratigraphical relationships of deposits within the cave (Stuart, 1982b).

Bridged Pot, in the Ebbor Gorge, is notable for one of the best (presumed) Late Devensian small-mammal assemblages in Britain (Stuart, 1982b). The fauna from this small cave includes steppe pika *Ochotona pusilla* Pallas, arctic lemming, Norway lemming, various voles, red deer and reindeer: largely undisturbed deposits at nearby Savory's Hole are likely to yield a similar assemblage (Stuart, 1982b).



(Figure 5.1) (a) The principal localities where remains of Pleistocene mammals have been found in Devon, after Sutcliffe (1969). (b) Excavated caves in the Torbryan Valley, after Roberts (1996). The location of Berry Head 'sea caves' (Proctor, 1994, 1996) is also shown.



(Figure 2.3) (a) Reconstructed Pleistocene maximum ice limits after Bowen (1994a) and Gray and Coxon (1991). (b) British glacial sediment systems. After Charlesworth (1957), and Bowen (1991). (But also see (Figure 8.4).)