

The final section, Part 8, pursues the implications of all this speleogenetic knowledge for our understanding of aquifers in the wider context of hydrogeology. It takes a determinedly conduit-centred view, one essay maintaining that virtually all flow through all unconfined carbonate aquifers occurs through channel networks. While this could be true if one includes fissures of ~1 mm aperture as “channels”, it is tendentious to include such small voids as being karstic in their hydrogeological function, or to maintain that where larger fissures occur they necessarily dominate all flow through the aquifer. Simple calculation shows that if lesser voids are plentiful then large ones can only dominate the average permeability if they are plentiful also, which is frequently not the case even in strongly karstified aquifers. Flow in ~1 mm fissures is usually laminar and therefore does not possess the turbulence which is the hydraulic signature of karstic *hydrological* behaviour. We should distinguish between the origin of such fissures (which is relevant to speleogenesis, since many may be solutionally enlarged and a few will become the forerunners of future caves) and their present hydrological function as pathways for laminar or Darcian flow. By making this distinction we can see that there is indeed a spectrum between conduit-dominated and diffuse-dominated flow among different aquifers, and even among different parts of the same aquifer. The point that conduits and large fissures are nevertheless more important than some hydrogeologists think they are is not helped by insisting that all aquifers are “channel”-dominated, especially if one neglects to define “channels” in terms of size, connectivity and spacing. The issue is easily resolved by invoking the concept of heterogeneity which is common parlance in mainstream hydrogeology. To the extent that the speleological community tends to be inward looking, speleologists may now have only themselves to blame if their contribution to the science of hydrogeology as a whole is misunderstood or overlooked. A future meeting of minds is unlikely to be promoted quickly by the following, from the book’s third paragraph: “The advances in cave science are poorly appreciated in ... ‘mainstream hydrology’ which retains a childlike faith in flow models developed in the sand box.” The subsidiary clause may have contained some truth twenty years ago, but today it is rubbish, and an opportunity is being lost by saying it so tauntingly.

“So many caves; so little time left in which to find them.” This fatalistic thought of my advancing years is tempered now by a brighter prospect. I shall return, again and again, to this rich and fascinating book, not just as a *vade mecum* for finding the varieties of caves I may never see, but as a companion and stimulus to further thought about caves, speleogenesis and how real aquifers work. The editors modestly dissemble when they write, “This book does not pretend to be a definitive text on speleogenesis”. It need not pretend, as from now on no serious discussion can fail to refer to it.

Tim Atkinson

Secret underground cities. An account of some of Britain’s subterranean defence, factory and storage sites in the Second World War by N. J. McCamley. Leo Cooper, 1998. Paperback 1999, 273 pp., £14.95. ISBN 0 85052 733 3.

The pioneer spelaeologist E. A. Baker and his friends, frustrated by the lack of caves in the London area, explored Chiselhurst ‘caves’, dene holes and even the Fleet Sewer in about 1906. Chiselhurst ‘caves’ are chalk mines with an irregular plan of galleries and pillars similar to those of some of the Bath Stone mines. Legends involving the Druids were assiduously nurtured by the owners. Baker, perhaps unwisely, got into a dispute with local ‘antiquaries’ unwilling to relinquish romantic beliefs about subterranean rituals at Chiselhurst.

On the whole, however, cavers do not seem to have taken much interest in stone mines until after the last war.

Some underground storage, including Chiselhurst and Ridge quarry near Corsham, was already used by the War Department during World War I, but developments during WW II were much more extensive and for a long time, of course, highly secret. The records have now emerged into the public domain and McCamley has made very good use of them.

Although coverage of this book is nationwide, the greater part of it is concerned with the Bath stone mines of the Box-Corsham area east of Bath. As is well known, the existence of workable freestone here was discovered during the driving of Box Tunnel for the GWR in 1838, and mining started soon afterwards, with a connection to the main line railway at the eastern portal of Box Tunnel which was to prove important a century later.

The author recognises two phases of War Department use. The first was the provision of underground ammunition storage depots, which was started about 1934, and which he reckons to have been a successful operation. The second phase was the provision of underground factories, started much later. The first ones did not come into operation until 1942 or even 1943, by which time the menace of the Luftwaffe was over. McCamley regards these as having been a disaster. The present writer, posted to Anti-Aircraft Command in East Anglia early in 1943, remembers waiting for the enemy aircraft which never came.

The present work is historical rather than descriptive, although there is much incidental mention of roof failures, flooding and geological faults, some of the problems encountered in adapting stone mines for wartime purposes. Difficulties were enormous. Freestone quarrying generates a high proportion of waste which is normally backfilled. Use for defence purposes entailed removing large amounts of backfill, frequently revealing roof pillars which were in a poor state and had to be strengthened or replaced by concrete supports. Unsurprisingly estimates of cost were usually greatly exceeded, causing apoplexy at the Treasury. Hazards like these were not the end of the problems. Factories using precision machine tools, and stores for museum treasures, needed air conditioning, difficult to provide as natural humidity was usually near 100%.

It is comical to read of the difficulties encountered in obtaining basic equipment. At Spring Quarry, Corsham, where state-of-the-art aircraft engines were being manufactured, steam was supplied by second-hand boilers, and the ancillary gear for fuelling and controlling them was almost useless. At Westwood quarry, Bradford-on-Avon, a museum store, a generating set was so old that spares had to be specially manufactured. Alas! on its first test run the engine exploded and was never used again.

The book is not a guide to would-be explorers, but the author's researches have been extremely thorough and are commendably up-to-date, so that anyone wanting to investigate these places can find information about their fates after abandonment by government. In the case of Monkton Farleigh Quarry, for example, he records that installations were "virtually destroyed by vandals" between 1980 and 1984, followed by opening to the public as a tourist attraction, closed in turn in 1990 after purchase by a property company which went bust. Finally it was acquired in 1996 by Wansdyke Security as a secure store.

Four plans are included of Corsham quarries, but only two of these (Monkton Farleigh and Eastlays) are detailed plans showing the roof-supporting pillars, and they are not referenced to surface features or the national grid.

I have never visited any of the Corsham stores but a few years ago I was taken round the RAF stores in the Chilmark stone mines west of Salisbury, one of the first underground ammunition stores to be authorised in the 1930s. We passed endless stacks of damp, rusting bombs which

would never be used. Chilmark in turn has now closed, and I suppose that a chapter in the history of British defence has come to an end.

Desmond Donovan

REFERENCE

E. A. BAKER. 1932. *Caving. Episodes of underground exploration*. London. Chapman & Hall.

Westbury Cave: The Natural History Museum Excavations 1976–1984. edited by Peter Andrews, Jill Cook, Andrew Currant and Christopher Stringer. 1999. Western Academic & Specialist Press Ltd. Bristol. HB 309pp Price £55 ISBN 0 9535418 0 0.

Westbury Cave first really captured the attention of the archaeological world in 1975, when Michael Bishop published details of stone artefacts in association with a Cromerian-type fauna. At that time Westbury represented the best, although certainly not the first, claim for pre-Anglian occupation of the British Isles. It was, as such, fairly revolutionary; only a year earlier Wymer (1974) had reviewed the British evidence and concluded that Britain had not been colonised until the late Anglian at the earliest. On the strength of Bishop's work, the Natural History Museum began a nine-year research project at the site, starting in 1976. It is the results of this project that are presented in the current report.

Twenty-five years later pre-Anglian occupation in Britain is far less of a conceptual hurdle. Britain now has, in Boxgrove (Roberts and Parfitt, 1999), the best excavated and most well preserved Cromerian archaeological site in Europe; as well as a number of other less perfectly preserved locales such as High Lodge and Warren Hill. Nevertheless, Westbury is still regarded as a highly important member of the corpus of Cromerian archaeological sites. The current report, though, makes one seriously wonder whether this is really the case.

Typically for a site report this is a reference volume rather than a riveting read, but the quantity and quality of detailed information it contains clearly makes it a major contribution to the British Quaternary. The book is divided into eleven chapters, with two appendices. These can be grouped into three related blocks: 1) history and geology; 2) palaeontology and ecology and; 3) archaeology.

The first block opens with an introduction by Stringer, Andrews and Current that provides the fundamental details and also outlines the early research history of the site. The important message to take away from this chapter is that the Westbury site represents the truncated remnants of two partly linked chambers of an ancient cave system, exposed in modern times at the edge of a major and often dangerous quarry 28 km from Bristol, each filled with a complex sequence of various sediments over an extensive period of time. The second chapter, by Stanton, picks up some of these themes, describing the initial research on the site by Bishop and Stanton and detailing the early development of the cave sequence; while chapter three by Andrews and Cook describes in detail the highly complex stratigraphy of the site. This can be summarised as a lower siliceous member and an upper, heavily sub-divided, calcareous member; the latter forming the focus of the palaeontological and archaeological research at the site. The fourth chapter, by McPhail and Goldberg, describes the micromorphology of the main Westbury sediments, suggesting that while the soils testify to climatic variation and diverse faunal activity, there is no evidence for hearths or burning in the cave that might highlight human presence. McPhail and Goldberg suggest that post-depositional alterations make preservation of such evidence unlikely at Westbury, leading one to wonder just how far this, rather