REVIEWS

Delving ever deeper: the Ecton mines through time by John Barnatt, 2013. Peak District National Park Authority, 382 pages, 160 illustrations, 978-0-901428-26-4, £21 at Matlock Mining Museum.

This beautifully produced A4-size paperback volume is the culmination of many years of painstaking and detailed archaeological research and physical survey work by John Barnatt and co-workers around the Ecton copper mine complex in the Manifold valley of north Staffordshire. It is copiously illustrated with many superb colour underground photographs by Paul Deakin complemented by numerous surface views and historic black and white images. There are also many clearly drawn sketches of mine levels and detailed section of workings as well as reproductions of the few remaining historic mine plans and sections.

The Ecton area is unusual from many aspects. It has dated Bronze Age workings. It was one of the first English mines to have the recorded use of gunpowder for mining. It was at its peak during the late 18th Century when it was amongst the deepest mines in Britain working an unusual (unique for the Peak District) semi-vertical pipe-like and very rich calcite-chalcopyrite orebody. It combined many unusual mining techniques, including the use of large underground water and steam engines for pumping and an underground canal for ore transport. It had an early Boulton and Watt steam winding engine housed in what is now the oldest remaining purpose-built engine house, which is in the process of stabilisation and conservation by the National Trust. This employed an early use of tapered ropes due to the great depth of the shaft. It also contains some excellent and accessible examples of the strongly folded and faulted Carboniferous limestone host-rock, though not of the high-grade mineralisation which sadly has all been removed by generations of miners. The area is now a centre for education and industrial archaeology.

The book is divided into a number of sections; each of these describes features associated with the individual mines, especially the two main mines, Deep Ecton and Clayton. The sections deal with the current surface and accessible underground features of the area and then describe the major phases of activity, such as Prehistoric mining, the main productive period under the Dukes of Devonshire and the latter stages of the area from the 1820s to the 1880s under several very hopeful companies. There are also sections on the mining and processing methods through the ages, the Boulton and Watt engine and decay and development since final closure in the late 1880s. The archaeological surveys could only cover the accessible parts of the mines above river level. Much remains hidden in the flooded depths of Deep Ecton and Clayton mines which extend to 300 m below river level. These were pumped out several times up to the end of their lives in

the 1880s; perhaps we may see this done again and be able to explore the undoubted treasures concealed in their extensive workings.

There is a comprehensive bibliography and references to the numerous published and unpublished sources used in the project including the Chatsworth and Birmingham City Archives, county record offices and Mining Journal extracts. There is also a glossary of mining terms and reference to the large numbers of unpublished papers deposited by the project team in the Ecton Mines Project Archive at Bakewell.

This is not a book for a quick read, though the stunning underground photographs encourage page turning. It deserves careful study and every page has interesting facts and opinions. The numerous headings, separating details of each mine or section of mine, make navigation simple. It places on record an enormous amount of information gleaned from years of careful survey and observation by the author and his co-workers (Simon Timberlake, Bill Whitehead and Rhodri Thomas) at Ecton and in the archives noted above. It does not describe the social history of the mine workers or their families or delve into the details of the geology of the ores (Porter, 2004; Ford, 2000). I would have liked a fuller explanation, perhaps with diagrams, of how the Boulton and Watt engine worked and transferred its motion to the vertical shaft. There is also little on the calcining and smelting of ores, though most of the smelting was done elsewhere; the lack of surface and written evidence may be the reason. Overall this is a very comprehensive study of this fascinating area.

Porter, L., 2004. *The Ecton Copper Mines Under the Dukes of Devonshire, 1760-1790*. Ashbourne: Landmark.

Ford, T D., 2000. Geology of the Ecton and other northeast Staffordshire mines. *Bull. Peak Dist. Mines Hist. Soc*., 14 (4), 1-22.

Tim Colman

The Goldilocks Planet; the four billion year story of Earth's climate by Jan Zalasiewicz and Mark Williams, 2012. Oxford University Press, 303 pages, 29 illustrations, 978-0-19-959357-6, £16.99 (hardback).

This book is truly spectacular – not visually, but in the wealth of its data and the perspectives in which it places such a long and complex geological story. It takes a succession of geological events with which we are all familiar and relates each to climate changes, and ultimately leads to implications, debate and questions about the current phase of global warming.

Archaean banded iron formations, the Great Oxygenation Event, Snowball Earth and the role of limestones. The grey or black of Welsh slates related to Ordovician glaciations. The evolution of Pangaea followed by the Carboniferous coal-forming forests and glaciations related to carbon burial. The Permian impact of Siberian flood basalts, and the roles of carbon, methane and Whitby jet through the hyper-warm climatic interlude of the Lower Jurassic. And then the Oligocene growth of the Antarctic ice sheet related to carbon dioxide lost from the atmosphere as it was used in rock weathering. Suggestions and questions abound, there is too much to review, and the evidence for all these geo-events is massively diverse; the book is highly thought-provoking, and it just has to be read.

The quality and breadth of the research in this volume are exemplified by the treatment (occupying half the book's pages) given to the Pliocene epoch onwards, a crucial period that is of direct relevance to today's climate debate. The authors chart the subsequent climatic deterioration following the early Pliocene warmth by drawing attention to chemical variations in organisms from the layers encountered in deep-sea cores, and this evidence is evaluated in conjunction with other factors, such as the rise of mountain belts and the opening or closure of major oceanic gateways. In their typically objective assessment, the authors acknowledge the bewildering array of possibilities that may influence the geologically abrupt changes in the Earth's climate, but draw attention to the Pacific snowgun effect, where warm summer oceanic waters cause an increase in atmospheric moisture which then falls as snow in Polar regions, triggering the expansion of ice caps.

Moving into the glacial world, borehole evidence is again given prominence in relation to the astronomically-induced Milankovitch cycles. The authors are to be congratulated for painstakingly explaining these complex patterns, while at the same time enlivening their account be interleaving biographical details of the principal scientists involved. Arguably the most tantalizing aspect is the graph of temperature against time of Lisicki and Raymo, showing that just over a million years ago the frequency of climatic fluctuations changed, from 40,000-year cycles to 100,000-year cycles. This also marks the start of the current Ice Age, but the authors note that it is also a complete mystery.

The final sections present a state-of-the-science discussion of the highly complex data used to chart the planet's most recent climates – for example, the message imprinted in snowfall layers at the ice caps, which gives the Dansgaard-Oeschger pattern and Heinrich events; if explanations are not always forthcoming then the various alternative possibilities are expertly evaluated. Biological evolution is emphasised here, as it is throughout the book, and justifiably so since hominid evolution was directly influenced by Pliocene-Holocene climatic changes. Some remarkably abrupt climate triggers are discussed, such as the emptying of Lake Agassiz 8200 years ago, which caused a virtually instantaneous global sea-level rise of 1 m.

An assessment of Holocene climate patterns is also vital to the on-going debate about human influences, and the book succinctly discusses all available evidence, even down to studies of long-lasting nests made by packrats in the USA! The last 50 pages of the book deal with the last 1000 years of climate change

and the various complementary influences that may be in play, such as the sun's fluctuating output, the El Niño effect, and others. And so to the latest culprits – ourselves and how our burgeoning need for power generation may be influencing the climate of the newly-named Anthropocene Period (see G*eobrowser* for 2011). Highlighted here is the progressive carbon rise, dramatically demonstrated by the Keeling curve for the last 50 years.

The authors do not hold back on their prognosis for the future for, as the 'hockey stick' global temperature curve of Michael Mann shows, it is now possible to assign many recent changes (for example sea-level rise) to atmospheric warming. The debate about extrapolating these effects into the future is still controversial, but the book concludes that it is "...likely....indeed very likely that climate has already started to change towards greater global warmth", with carbon dioxide levels possibly tripling, and methane levels doubling, within the next 100 years. Reliance on previous climatic events to chart our future may be problematic, however, since our present climate regime is, uniquely, influenced by artificial (human) factors rather than by the natural checks and balances that existed in the geological past. The authors quote the oceanographer Wallace Broecker, who suggested that "climate is an angry beast", to which he cautioned that we are currently poking it with a stick. The book concludes with evidence-based assessments of how the planet is increasingly likely to be affected by our activities. Our planet is a 'Goldilocks world', perhaps unique in the Universe in being just right for human habitation. But constrained as human societies now are within rigid and jealously-guarded borders, how can we as a species adequately respond to the major environmental changes that we are blithely perpetrating?

John Carney

Lead mining in Derbyshire: history, development and drainage by J H Rieuwerts; **v1 Castleton to the River Wye,** Landmark, 2007, 192pp, 978-1-84306-343-8; **v2 Millers Dale to Alport and Dovedale,** Horizon**,** 2008, 142pp, 978-1-84306-344-5; **v3 Elton to the Via Gellia,** Horizon, **2**010, 208pp, 978-1-84306-345-2; **v4 The area south of the Via Gellia**, PDMHS, 150pp, 978-0-904334-02-09; £25 each from Matlock Mining Museum.

A difficulty in any mining is water flowing into the workings, and the lead miners of Derbyshire were no exception to this problem; their many drainage levels are known as soughs. In 1987 Dr Rieuwerts privately published a limited-edition compilation bringing together some 30 years of research into widely distributed archives. His review covered the 200 soughs then known, and is difficult to obtain today. A further 25 years of research in the Derbyshire Record Office, Sheffield Archives (formerly the Reference Library), in the Duke of Devonshire's archives in Chatsworth House, the Duchy of Lancaster Archives at Chatsworth and in London, the Rutland Archives at Haddon Hall and in the National Archives (Public Record Office) at Kew and several other collections, has uncovered much more material. In particular the number of known soughs has increased to well over 300; thus Dr Rieuwerts has found it necessary to expand his 1987 book into a four volume set. A great quantity of data on the history of mining, investment and drainage is now accessible and Jim Rieuwerts has done us a service in analyzing the numerous and often vague or conflicting references. Many of the historical details have been revealed by frequent disputes between mine owners and sough-driving companies, resulting in court cases with consequent legal records.

Jim Rieuwerts has taken the opportunity to describe the industry as a whole, with accounts of who worked which mines and when, and how much lead ore was produced, where figures survive. Much of the history discussed relates to the 17th and 18th centuries when production was at its peak and demonstrates that the miners knew about the geological relationships of the Carboniferous Limestone, the inter-layered toadstones and the overlying shales long before geology as a science was born. Indeed their observations provided John Whitehurst with his early concept of Derbyshire stratigraphy in 1778. The miners knew that the interleaved lavas (toadstones) rarely yielded much lead ore and they could often predict where they might be met. However, their knowledge had its limitations and these books show that they still ran into many problems, particularly where the lavas extended further or were thicker than expected. The miners also found what appear to be volcanic vents and feeders where the toadstone could not be bottomed. Thus some soughs were abandoned or diverted when they met toadstone.

The traditional categorization of the mineral deposits into rakes, scrins, pipes and flats has been followed. Rakes and scrins are more or less vertical fracture fillings, whereas pipes and flats were largely controlled by favourable beds or, more widely, by bedding planes. It is noted that the pipes were mineral-lined caves where roof beds locally collapsed into the voids, and some later filled with sediments containing detached lumps of ore, referred to by the miners as gravel ore. He also includes comments on the 'plumbs' and 'hadings' of Longstone Edge where the fissure veins are in steeply dipping limestone beds on the south side of the Longstone Edge monocline.

Several important mines are discussed in detail, e.g. Magpie Mine at Sheldon, the Hillocks and Knotlow Mines near Monyash, Golconda Mine near Brassington, and Millclose Mine at Darley Dale. Many other mines are currently inaccessible, e.g. Hubbadale Mines at Flagg where it is to be hoped that mine explorers will soon gain access. The last major lead and zinc mine at Mill Close is covered in volume 3 (not in volume 4 as implied by the map on the title page). The lead and

baryte Golconda Mine is covered in volume 4, as are the mines of the Ashover and Crich inliers.

The books are illustrated with sections of the Old Series 6-inch and 25-inch Ordnance Survey maps with mining details superimposed. There are scattered references in the text to plans and diagrams in archives but few of these have been reproduced: they would have made it easier to follow the historical details and would have helped future studies.

Each volume is illustrated with photographs by Paul Deakin and others, mostly in colour. Volume 4 includes a survey of mining activities and trials outside the orefield at Baslow, Ashley Hay, Whitwell and Whaley Bridge. It also includes 15 pages of appendices to volumes 1 and 2.

I have not seen many of the archives, so I cannot criticize the detail. However, a few improvements could have been made. The mining enterprise using boat haulage in the Speedwell Mine at Castleton gets rather brief treatment in volume 1; boat haulage there has been said to be unique but in fact boats were used at several other mines and soughs. I found it difficult to work out some of the Mining Liberty boundaries: they could have been shown on a separate map or added to the existing maps. The important Stoney Middleton area is split between several maps: an extra map would have been helped, though a map of Morewood Sough at Stoney Middleton is in vol. 4. References cited in the text are not always listed, as in the Ashover chapter in vol. 4 where Stuart Band's articles are not listed.

The volumes have bibliographies and list of archives consulted. I did not notice many spelling or type-setting mistakes, but "Astleton" in the contents list of volume 1 stands out. Also the BSA (British Speleological Association) documents are now in the British Caving Association library at Glutton Bridge near Buxton, not Litchfield as stated in the appendix to volume 1.

Jim Rieuwerts is to be congratulated for bringing together so much information on what is in effect a defunct industry, but one which has left many traces of lead mining activities both on the surface and underground throughout the Peak District. All these volumes should be on the shelves of anyone interested in the lead mining industry in the Peak District.

Trevor Ford

Notes for authors

Guidance notes for authors intending to contribute to the ***Mercian Geologist*** may be seen on, and printed from, the Society website (www.emgs.org.uk). Paper copies may also be requested by mail or by telephone from the editor for anyone without web access. Contributions are welcome from both members of the Society and non-members.

Caves and Karst of the Yorkshire Dales edited by Tony Waltham and David Lowe, 2013. British Cave Research Association: Buxton. 264 pages, 165 maps and graphics, 354 photos, 978-0-900265-46-4, £25 from www.bcra.org.uk/bookshop or BGS shop at Keyworth.

This book offers just about everything you ever wanted to know about the geology, geomorphology and landscape chronology of the Yorkshire Dales, with 16 chapters written by an impressive group of cognoscenti. It replaces a book published in 1974 that has long been essential reading for anyone interested in the Dales and especially in its limestone landscapes, and it has greatly benefited from the huge extent of both scientific techniques and underground discoveries made since then.

Two chapters in particular encompass major scientific strides that have been made in understanding the geomorphology of the Dales. That addressing the chronology of the caves draws on the hundreds of radiometric and other dates that have been published for the region since the late 1970s, enabling them to be placed in the broader context of landscape evolution, which is addressed in the chapter on glaciation and Quaternary evolution. The latter provides an excellent summary of global events through the Quaternary as well as summarising an extensive body of local field evidence amassed particularly in the past two decades. A short chapter examines the palaeoclimate record preserved in just a single stalagmite, little else having been published for the area, and suggests where future developments linking past environments with chronologies may lie, while a chapter on Holocene environments provides a link between the landscape, the flora and the influence of people over the past few thousand years.

For anyone with even a passing interest in the Yorkshire Dales this book is a must, but its value and interest extends far beyond the limits of the region it encompasses and it should prove equally attractive to anyone with an interest in the diverse facets of limestone landscapes. By setting the subject of each chapter in a broader chronological and/or environmental framework, the authors provide us with admirably readable, concise and current summaries of the state of knowledge in their respective fields. The book as a whole is clearly laid out, with the detailed breakdown of subheadings listed on the contents pages making it easy to home in on a particular aspect despite the absence of a comprehensive index (although there is an index to localities). There is a plethora of illustrative material - photographs, maps, diagrams and tables – and at just £25 for the paperback, this beautifully presented and highly informative book represents extremely good value. This is definitely not the sort of book to sit gathering dust on a shelf and I have little doubt that those who purchase a copy will find themselves consulting it frequently for years to come.

Michael Simms