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# TRANSACTIONS OF THE LEICESTER LITERARY & PHILOSOPHICAL SOCIETY

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Cover picture: The Hermitage in Oadby in 1901 (Goddard and Callow)

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LEICESTER CITY MUSEUM SERVICE
Events & Exhibitions 1998

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Exhibitions

From 8th August
Saturday Shambles; 700 Years and More of Leicester’s Market Place

This exhibition focuses on Leicester’s Market Place and celebrates the 700th anniversary of the first reference to the Saturday Market. This permanent exhibition will be based at Newark Houses Museum which is situated in the Castle Park area of the city.

5th September - 31st October
Handmade in India

Based at New Walk Museum and the City Gallery, ‘Handmade in India’ embraces an extensive range of crafts ranging from textiles, wood, jewellery, furniture and ceramics to objects of everyday use. For details of workshops and activities, contact The City Gallery on 0116 254 0595. Handmade in India is a Crafts Council touring exhibition.

28th September - 4th October
“New Works”

The promotion of the visual and performing arts including exhibitions, installations and multi-media projects. These will take place at various sites - please contact the festival office on 0116 255 6507 for further details.

Contact Details

Abbey Pumping Station, Corporation Road, Leicester. Telephone 0116 299 5111
New Walk Museum, New Walk, Leicester. Telephone 0116 255 4100
Newarke Houses Museum, The Newarke, Leicester. Telephone 0116 247 3222
Jewry Wall Museum, St. Nicholas Circle, Leicester. Telephone 0116 247 3021
Belgrave Hall, Church Road, Belgrave, Leicester. Telephone 0116 266 6590

For events at the Magazine, please contact Newarke Houses Museum.
DESIRABLE LOCATIONS:  
LEICESTER'S MIDDLE CLASS SUBURBS 1880-1920

Grant Pitches M.A. A.R.I.B.A.  
Presidential Address delivered on 6th October 1997

Before I introduce the theme of my Address I would like to thank the Past Presidents and the Council for the honour of electing me as President for the 156th season. I am fully aware of the status of the persons who have held this office in the past, including distinguished businessmen, academics, and architects, and I therefore approach my role with trepidation.

The theme of my Address is the evaluation and celebration of the rich heritage of Late-Victorian and Edwardian domestic architecture of Leicester’s middle class suburbs.

The embodiment of this architecture is the suburban villa. Built for the rising middle classes from the profits of industry, commerce, and the professions, its varied variety of form and detail symbolised the values of status, space and security.

Status can be seen as a measure of the ‘social honour’ accorded to an individual, an affirmation of his or her place in the hierarchy of society, expressed in the scale and design of the family home.

Space, both inside the house and in its external setting, was testimony not only to, personal success, but to the distance which the middle classes strove to put between themselves and the lower orders of society - in terms of lifestyles as well as their physical retreat from ‘contagion of the masses’, represented by death, disease, disaster and the overcrowding of the Victorian city.

Security relates to one of the Victorians’ prime social elements: the family and its key role in society. The family was the sanctuary, embracing a feeling of security and protection from the outside world, but the villa also testified to the bourgeois roles of the family, especially women, children, and the domestic servants.

In the view of some historians, the middle classes can be defined essentially as the ‘servant keeping class’, and the house was planned to reflect this hierarchy, with designated areas for the family, and the ‘domestic offices’ often located in a separate wing.

The setting of the house was a further dimension of social success. “The status of the area was confirmed to visitors by the space designed to secure privacy from onlookers” (Long 1993).

The classic examples of houses in large-scale settings are in Oadby in Stoughton Drive South, where a series of ‘miniature estates’ was designed by Stockdale Harrison (1846-1914). “Middleman’s” (1904) now Beaumont Hall is a supreme example of a luxurious Edwardian house in a large well-screened garden.

In further analysing this topic it is useful to pose the following questions:

1. What were the key factors involved in their development?
2. Who were the ‘shakers and movers’ of this period who lived in these areas?
3. What were the roots of the ‘Old English’ style of architecture, and why was it frequently adopted by the fashionable local architects?

The factors involved in the development of these suburbs were complex but three factors emerge as significant: Transport systems; landownership and geology.

I will explore the first two, the third was examined by Dr Helen Boynton, who was my co-researcher in our three-year study of this subject (Boynton 1996).

Transport systems: One facet of the expanding rail network in the later 19th century was the opportunity to develop low density housing for businessmen in the suburbs, although it is interesting that Oadby, where there was a concentration of this group, did not have a railway station. The main London to Leicester line bypassed it to the west, but this proved of no great obstacle. Its wealthy inhabitants owned horse-drawn carriages and were independent travellers.

In the outer areas of Leicester, stations were opened at South Wigston (1840), Wigston Magna (1854), Kirby Muxloe (1859), Thurnby (1883) and Belgrave, Birstall and Rothley (1899)

Horse-drawn trams were introduced in Leicester in 1874, and the electric trams which replaced them 30 years later, also contributed to the development of the urban fringes. However, the role of transport in the evolution of the suburbs is not clear. As one historian has suggested, “passenger networks required passengers to generate adequate revenue to operate”. Consequently they followed rather than preceded residential development” (Rodger 1989).

Land ownership is one of the most important factors in the development of the suburbs, and the two systems of land tenure - leasehold and freehold - had a crucial impact on the creation of hierarchies of housing. In the case of leasehold land, the landowner could impose restrictions relating to the pattern and layout of the streets, and the uses to which buildings could be put. Or he or she often commissioned architects who would determine the design policy. Freehold land offered a greater degree of freedom in planning and design, but here too might be constraints, such as restricted covenants imposed as a condition of sale.

There are major regional differences in terms of land tenure. Birmingham, for instance, was predominantly leasehold, but Leicester’s pattern of land ownership was more complex. The south east areas were largely freehold, and they generally offer a great variety of housing styles within each suburb. Accordingly they demonstrate variations of wealth and status within this middle class itself, reflected not only in the scale and quality of individual villas, but by the structure and character of their
gardens and small estates. Along with the private archives of the Goddard family of architects, sales catalogues produced in the 1920s and 1930s by the former estate agents, Warner Sheppard and Wade have been particularly valuable sources, providing a fascinating insight into the social priorities of prospective middle class property owners.

What was the nature of Leicester's industries, and who were the 'shakers and movers', the middle class businessmen and professionals?

Apart from iron founding, hosiery was the only industry of any substance in Leicester until the mid 19th century. From the 1880s, however, footwear manufacture became established in the town, giving a boost in turn to hosiery by stimulating demand for elastic webbing. In the second half of the century the engineering industry also expanded, initially supplying hosiery and footwear machinery, but later producing such goods as clocks, lifts and optical instruments.

Food and drink, printing, silver polish manufacture, and cigar and umbrella making were among a host of smaller industries which were established by the end of the 19th century. This was one of the most prosperous periods in Leicester's history, and as industrial expansion continued and the economy became more complex, there was a parallel expansion in the service sector, notably in professional occupations. The ranks of the middle classes embraced solicitors, architects, doctors, and while they might not accumulate wealth on the scale of the large industrialists, many enjoyed a very comfortable lifestyle.

Many 19th century businesses in Leicester were family firms built up from modest beginnings over two or three generations. Freer (1975) points out that their founders liked to describe themselves as "self-made" men, most had some previous business experience, and many came from families already engaged in commerce or industry.

Harry Peach (1874-1936), a past President of the Leicester Literary and Philosophical Society 1920-1921, was a bookseller in Belvoir Street before founding the Dryad Company in 1907 to produce cane furniture. His friend and mentor Benjamin J. Fletcher, head of the Leicester School of Art, designed the early products while Peach provided the finance. Five years later Peach moved into the field of metalwork, and went into partnership with William Pick of Collins and Co. (Kirkham 1986). Peach lived at Chapel Lane, Stoneygate.

J. Wallis Goddard (1851-1927) was among those businessmen who inherited wealth from earlier generations of the family. His grandfather was a banker, and his father Joseph a chemist who founded an international business on the manufacture of non-mercurial silver plate polish.

A factor which J. Wallis Goddard had in common with many of his middle class contemporaries in Leicester was religious nonconformity, which was often allied politically to the Liberal cause. Goddard contributed to the building of Stoneygate Baptist Church on London Road. He lived at Avenue Road in Stoneygate.

John Adams Bolton (1869-1945), founder of Chilpience and son of a doctor, is an interesting example of a man whose relations with his employees were formed by his own religious beliefs. Although he had no formal scientific education, he invented a new process for woolen garments from which 'Chilprufe' company derived its name. A staunch Methodist, John Bolton worshipped at Melbourne Hall. He lived at 'Tetuan' at Manor Road, Oadby.

George Creswell Turner (1858-1940) was chairman of W. and E. Turner's wholesale Boot and Shoe business. He was President of the Leicester Literary and Philosophical Society in 1915-1916. A keen botanist, he helped with encouragement and money to get The Flora of Leicestershire and Rutland published in 1933. He lived at The Gables, Elmfield Avenue, Stoneygate. The house, in the 'Old English style,' was designed by Draper and Walter in 1901.

What were the roots of the "Old English" style frequently adopted by local fashionable architects? Alan Howkins (1986), rural historian, points out that the values expressed in this style were essentially the outward symbols of a powerful underlying change of culture, which was clearly evident in literature and music as well as architecture during this period.

This cultural sea change focused on the notion of "Englishness" in which life in the country house was symbolic of the ideal values of "English" culture. Howkins quotes John Galsworthy's The Country House which reinforces the mystical values of Old England, and E.M. Forster's Howard's End (1910) which has been described as "the symbolic representation of civilised England".

In music during the late 19th century there was a resurgence of interest in the works of Tudor composers. In parallel, the folk songs of southern England were also being researched and collected.

During this period a group of architects were turning to vernacular architecture as a cultural reference. The leading national figure was Norman Shaw (1821-1912) who evolved an architectural language which became known as the "Old English" style.

Leicester's leading architects, Stockdale Harrison and Son, and the Goddards were strongly influenced for a period by this return to Elizabethan imagery. Leicester's suburbs which were developing over the period 1880-1920 exhibited an interesting range of physical patterns, and their domestic architecture a remarkable range of styles.

In Oadby, for example, many areas were characterised by low-density housing, wide pavements, and a generally quiet ambience. A number of roads were tree-lined, and the sites varied from a minimum of quarter of an acre to up to four acres in Stoughton Drive South. The most sort-after suburbs in Leicester at this time were Oadby and Stoneygate. Both included some of the finest domestic architecture of this period.

Oadby

Approximately three and half miles south east of Leicester its population in 1881 was 1,731 rising to 3,279 in 1921 (Elliot 1992).

The main Leicester-London road passed through the village, and although it had no railway station its growth was encouraged after 1874 by the advent of horse-drawn trams, with termini at the city boundary and the Black Dog in Oadby. The was one main landowner, the Powys-Keck estate, whose Oadby lands were sold off and developed over a period around 20 years from the turn of the century.

Significant business people who lived there included Duncan Henderson, Footwear (Chinambo), Miss W.L. Fox, Confectionery (The Knoll) and Ernest Lillie, Elastic Webbing (Manorcroft).
There were four major road developments at the turn of the century which featured some of the finest houses: Manor Road, which included 'Sorrento' (1906) in the Arts and Crafts style for footwear manufacturer Robert Hislop; Glebe Road, with a Voysey-influenced house ‘Chumbeag’ ('little field') by Walter Bedingfield; Meadowcourt Road laid down by the architects A.E. and T. Sawday; and Stoughton Drive South which included some of Stockdale Harrison and Son's most dramatic neo-Elizabethan houses: Nether Close (1902) for W.H. Stevens, hosiercy, and Middlemeade (1904) for F.F. Brice, also in hosiercy.

Stoneygate

The northern boundary is approximately two miles from the clocktower. It is an area which stretches form Victoria Park in the north, to the City/Oadby boundary to the south. It is divided by the ‘spine road’ (the old Turnpike) called London Road into two areas: East and West Stoneygate. On the east side the land was largely owned by the Powys-Keck estate, however another significant landowner was Wallis Goddard (1851-1927).

Compared to Oadby, Stoneygate has generally a higher density of housing. It is characterised by a mixture of terraced three-storey villas in the eastern area and larger detached houses in gardens of one to four acres in the western sector.

Stoneygate Road typifies Stoneygate East with its three-storey late-Victorian villas including a large group by local architect Isaac Barradale (1845-1892) who is known in particular for his pioneering use of the 'Old English' style.

Two roads in Stoneygate West encompass some of the most spectacular houses of this period: Elms Road which includes 'Knights Lodge' (1891) by Joseph Goddard, and Katoliffe Road with 'Knighton Hayes' (1881) by Edward Burgess, set in a 'miniature estate of eighteen acres including eight acres of gardens'.

Postscript

During the 1960s and 1970s a significant number of Victorian and Edwardian buildings were demolished nationally and locally in the development of commercial and housing schemes.

After 1945 one of the few guardians of the large late-Victorian and Edwardian houses in Leicester was Leicester University whose enlightened policy on student accommodation ensured that they were retained and sensitively converted and extended. A similar policy has been pursued by the new De Montfort University. However, while listing of historic buildings has been largely carried out, I believe that there is now a need to give more priority to identifying gardens of the Victorian, Edwardian and post-Edwardian periods which have retained their structure and features.

Finally, therefore, in examining future conservation policies, I feel that it is essential that houses and gardens, both individually and in group or area contexts, should be perceived as entities and not isolates.

Let us, the vigilant general public, through the agencies of local authorities, and voluntary organisations such as the Victorian Society and the Leicestershire and Rutland Gardens Trust, ensure that they remain protected from insensitive development for future generations.

REFERENCES


Kirkham, P. 1986 Harry Peach: Dryad and the DIA


Grant Pitchess.

85 The Fairway, Oadby, Leicester. LE2 2HP.
LIFE, TIMES AND LEGACY OF MARY ANNING (1799-1847) FOSSILIST

H.S. Torrens

Summary of the Lecture delivered on 20th October 1997 to a Joint Meeting of the Geology Section and the Parent Society

Mary ANNING junior, fossil hunter, preparator and dealer, was born on 21 May 1799, in a seaside house in Lyme Regis, Dorset, the only surviving daughter of Richard Anning (c1766-1810), carpenter, and his wife Mary (senior) née Moore (c1764-1842). Mary, and her brother Joseph (1796-1849), were the only survivors of the, probably at least ten, children born to this couple. Both had been taken out on youthful fossil-hunting expeditions by their father, who discovered a ready, slightly remunerative, sale for such 'curiosities' to the middle class visitors starting to flock to Lyme in the summers.

Richard died, from the combined effects of falling over a Lyme cliff and consumption, in October 1810. Mary was eleven. His departure left the family in receipt of parish poor relief. She, meanwhile, had become the stuff of legend, being named after an elder sister, who had been burnt to death in a house fire in 1798, and soon the only survivor of a lightning strike which killed three in 1800. Mary's later history has accordingly been much 'fabricated' to live up to such legendary beginnings.

Mary developed a fine eye for fossils, and with her brother (who found the skull in 1811), she found the remainder of a remarkably complete fossil 'crocodile' in 1812. Such fossils were already well known at Lyme, but this one was sold to the Lord of the Manor at Lyme and through him, and William Bullock (1773-1849)'s famous Museum in London, was brought to the attention of London scientists; one of whom, Sir Everard Home bart (1756-1832), named it *Ichthyosaurus* in 1814. It was more appropriately called *Ichthyosaurus* in 1817. This brought the Annings further notoriety and the two children, with their mother, set about finding more and more palaeontological treasures in the Lower Liassic rocks exposed in the cliffs and foreshore at Lyme Regis. Until about 1825 this was a triangular business, overseen by Mary Anning senior.

In 1820 Lt. Col. Thomas James Birch, later Bosvile (1768-1829), organised a London sale which attracted buyers from all over Europe of specimens he had bought from the Annings. Birch generously donated the proceeds (up to £400) to the Anning family, whom he had found on the "point of selling their furniture to pay their rent" in 1819. With this publicity coup, Mary junior's reputation could be sealed. Now followed her truly remarkable career as an adult hunter, extractor and developer of Lyme fossils.

A series of new, ever more complete, *Ichthyosaurus* was followed by her discovery of the first ever *Plesiosaurus* on 10 December 1823. This created a further sensation in London but brought accusations of fraud from Baron Georges Cuvier (1769-1832) in Paris which were soon laid to rest. Her achievement in 'defeating' the world's foremost foreign anatomist, established her credibility amongst London scientists. Further *Plesiosaur* finds, for the purchase of which there was considerable, and international, competition, were followed by her discovery that the ink of fossilised squid-like animals had survived fossilisation. This ink could be macerated to allow drawings to be made of the other Lyme fossils, in an ink contemporary to those same fossils. Mary was also involved with William Buckland (1784-1856)'s work on coprolites (fossil faeces), which stimulated much coarse humour and some critical evidence in the debate over whether fossils had evolved or been created.

The winter of 1828 yielded her the first British example of 'a flying dragon', the fossil reptile *Pterodactylus*. This caught the public's imagination more than any other of her finds. *Squaloraja*, a fossil fish then intermediary between sharks and rays, followed in the winter of 1829. In mid 1830 the famous, blood-thirsty,
reconstruction of *Dorita antiquior* (Ancient Dorset) in illustration of many of her discoveries, was prepared for her financial benefit by Henry De la Beche (1796-1855). Her own, fifth, major discovery followed in the winter of 1830. This was a new large *Plesiosaurus*, which conveniently curled itself up pre-mortally to better fit a gentleman's cabinet, and was purchased for 200 guineas by Lord Cole, William Willoughby (1807-1886), to demonstrate the money that was to be made from such novel finds.

Mary had become as much a curiosity as the fossils she had become so adept at extracting, and which she continued to bring to the attention of an astonished public. People regularly came to Lyme Regis to accompany her on her fossil-hunting expeditions. In 1842, her mother died and by 1845, Mary Anning was suffering from the breast cancer which killed her, aged 47, on 9 March 1847. The laudanum, that she took in hopes of relieving the pain, led to rumours, from an ignorant Lyme population, that she had taken 'to the bottle'. They thought of her only as a vital part of the local tourist trade.

Mary had been awarded an annuity in 1838, by members of the British Association for the Advancement of Science augmented by a Parliamentary donation from the Prime Minister. This was supplemented by a subscription in 1846 amongst members of the Geological Society of London. Mary also became the first honorary Member of the new Dorset County Museum in Dorchester in 1846. She was posthumously honoured with a window unveiled in her honour in Lyme Regis church in 1850. It shows the six corporate Acts of Mercy being given to her townspeople, in clear, if unstated, reference to her philanthropy towards the working poor of her home town.

For such a working class, provincial, female, of dissenting origin, forced to work every winter - when the best discoveries were inevitably made - hers had been a truly remarkable career. She has proved an inspiration ever since, especially to other women similarly trapped in a world of men, earning the important epithets of 'first woman geologist' and 'first professional fossil collector'.

Many problems face the biographer of such a person. Because Mary achieved unusual, and above all childish, celebrity there has been much myth-making and fictionalised biography about her. Historians pay too much attention to the creators of printed pages and of manuscripts. They have paid too little attention to the creators of *manufact* that Mary Anning made her short life’s work. The history of such people is of equal importance.

Hugh Torrens,
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THE CHANGING ROLE AND FUNCTIONS OF THE BANK OF ENGLAND

Andrew J. Bailey

Summary of the lecture delivered on 7th November 1997

The Bank of England began life in 1694 as a private company created by Act of Parliament and by Royal Charter. Two closely related factors explain the origin of the Bank, namely the inability of the seventeenth century Crown to repay its debts and its tendency to fight costly wars. The idea behind the Bank was simple: £1.2mm was raised from a public subscription among City of London merchants which was lent to the Crown in return for interest and privileges which meant that the Bank had a monopoly position as the only joint stock bank allowed in England and Wales (all other banks were private concerns - or partnerships without limited liability - with the maximum number of partners allowed in law fixed at six). The proposal met opposition in a number of quarters, including from supporters of the ousted Stuarts who saw the Bank as designed to prop up William of Orange - and it is this opposition which led the Bank in the first half of the eighteenth century to be labelled as a Whig institution. The Bank's position was subject to frequent challenges, which were generally met by raising further loans for the Crown in return for subsequent renewals of the Charter and consolidation of its privileges.

For the Bank the eighteenth century was a period dominated by government debt demands for finance (still often linked to wars), as the National Debt grew from £12mm in 1700 to £850mm in 1815. The Bank continued to use these demands as an opportunity to consolidate its position, and alongside that it developed another of the core functions that remains today, issuing Bank notes, which were then partly backed by the gold holdings of the Bank but partly backed by loans to the Government and the private sector. Since its notes were redeemable in gold coin, it was subject to the risk of loss of confidence; for instance, it only just survived in 1745 at the time of the Jacobite rebellion. But out of this fear of runs came the first manifestation of the modern central banker's concern with the pursuit of monetary stability. The Bank knew that the amount of credit that it created (in the form of notes) had to bear a relationship to its holding of gold so that it could stem a run as people returned their notes to be redeemed in gold. And because of its position as the largest bank, the Bank's behaviour in creating credit came to influence the state of the economy, in other words the beginnings of the Bank's role in monetary policy.

The war with France which began in 1793 placed a huge strain on government finances. By the end of 1796 almost a quarter of the private banks had collapsed, and in February 1797 the Bank was forced to suspend the right to convert its notes into gold. The suspension lasted until 1821 and, during the wartime period, there was the first experience of prolonged inflation during the Bank's history. In the aftermath there was a fierce debate on the causes of the problem and a Parliamentary Committee attributed much of the responsibility to the Bank's over-issue of paper currency. The Committee argued that a paper currency which had ceased to be convertible into gold could only be kept in its proper value by limiting its quantity. This was not the first statement that inflation is in essence a monetary phenomenon (put simply, monetarism) but it was the most coherent up to that time.

One of the features of the wartime and post-war period was a heavy rate of failure among the private banks. One consequence of the Bank's privileges was that other banks - which could issue notes - were very small and restricted to local areas (and hence subject to the fortunes of the local economy). Moreover, the Bank of England had not seen fit to establish a branch network around the country or to encourage the nationwide circulation of its notes. In other words, it had not taken steps to remedy the problems that would lead to pressure for an end to its privilege. These problems came to a head in 1825, and in the following year Parliament allowed the formation of joint stock banks with more than six partners, but not within a radius of 65 miles of London - a privilege the Bank retained until 1833. This encouraged the Bank to establish branches outside London and thus widen the scope of its note issue. The Bank opened eight branches between 1826 and 1834. After that only one further branch was opened, in 1844 in Leicester. Unfortunately very little business was ever done, and in 1872 Leicester became the only town in the nineteenth century to have a Bank of England branch close.

Far more important in 1844 was the passage of the Bank Charter Act. After that, no banks were allowed to issue notes anew, and those banks whose issue subsequently lapsed, or who were taken over, forfeited the right to issue. It also provided that the Bank's notes were (broadly) to be backed by gold. This, together with a fixed price for standard gold, laid the foundation for the gold standard which during the nineteenth century spread worldwide, and created a long period of price stability with monetary policy in effect on autopilot.

The Bank was on its way to becoming a central bank in the modern sense of the term, even though it remained in private ownership. In the nineteenth century three factors helped the Bank to achieve this status. First, the Bank's special role as Government Banker, a role that it retains today. Second, the importance of Bank of England banknotes, reinforced by the monopoly that gradually took effect after 1844, and the stability that ensued from the gold standard. And third, the size of the Bank at the time - it was around 1880 before any of the major joint stock banks overtook the Bank in terms of balance sheet size.

Under the gold standard the Bank had to pay close attention to the size of its gold reserves in order to maintain full convertibility. By the end of the century the Bank had settled on a regime which involved an active interest rate policy (Bank Rate as it was known), raising rates when demands on its reserves were high and
lowering them when they were low, and so-called open market operations involving the purchase and sale of bills of exchange which were used to keep market rates in line through either supplying liquidity to the money markets against the purchase of bills or mopping up surplus liquidity through the reverse operations. In this role the Bank was acting as ultimate provider of liquidity to the banking system, and this is in many ways the real core of central banking.

This role is sometimes described as acting as lender of last resort. But this can be confusing. Central banks can also act as lender of last resort when rescuing banks. To understand this role it is necessary to consider why banks are different from other businesses. Banking involves maturity transformation - taking deposits which are often repayable on demand and lending them out at longer maturities. This makes banks susceptible to loss of confidence among depositors - the classic run on the bank. At worst, the problem can become systemic - in other words a loss of confidence in the banking system or, more likely, some part of it. The trick then is to restore that confidence, but this should not involve the central bank bailing out any bank in trouble - that leads to what economists call a moral hazard problem, in other words there is no discipline on banks to conduct their business responsibly because they know that they will be bailed out. From the middle of the nineteenth century the Bank increasingly took on the role of crisis lender of last resort in the interest of not upsetting its objective of maintaining the convertibility of the currency - which depended in good measure on stable economic conditions. But crisis lender of last resort does not always have to involve the central bank putting up its own money, and towards the end of the century, as the major clearing banks began to evolve, the Bank started to act as the co-ordinator of the banking system to orchestrate its own rescues. Most famous of all, in 1890 it orchestrated a rescue of Baring's. This demonstrated another of the Bank's more modern central banking roles, as orchestrator of collective action among the banks and the City of London more generally.

By the end of the century, the Bank had established its role in the two key elements of central banking - monetary and financial stability. But with the outbreak of the 1st World War the gold standard was suspended - once again it was a war that disrupted the system. In 1925 Britain returned to the gold standard for the last time, and the price of gold was fixed at its pre-war level, even though the value of sterling had depreciated in the meantime. The effect was to make British goods uncompetitive at a time when the world economy was in any case moving into recession. It was during this time that Montagu Norman was Governor of the Bank. Norman was Governor for 24 years from 1920 - up to then Governors had generally served two year terms only, and since Norman no Governor has served for more than ten years. Views on Norman differ markedly. On one hand he is credited with playing a decisive part in rebuilding a number of continental European financial systems, building a relationship which the United States through the newly created Federal Reserve system, and at home launching a series of initiatives to encourage industrial investment in response to criticism of the clearing banks for failing to take a leading role during the 1930s. But Norman's reputation could never escape his support for the return to the gold standard.

In 1931 Britain was forced to abandon the gold standard for the last time and sterling was put onto a managed float against the dollar. Thus monetary policy was no longer on autopilot, and the Government became far more involved as a result of this discretion. Moreover, this highlighted the anomaly of a private sector institution undertaking monetary policy. In 1946 the Bank was nationalised, although this did relatively little to change the nature of the Bank as an institution because the role had been evolving anyway to reflect the change in monetary policy arrangements.

For the next twenty five years or so monetary policy operated under the Bretton Woods system of fixed exchange rates. After that broke down in the mid-1970s the UK followed a number of approaches, including targeting the money supply, targeting the Deutschmark, membership of the ERM, and for the last five years or so an explicit inflation target. Until last year the Bank's role was in essence twofold - advising the Chancellor of the Exchequer on monetary policy decisions and implementing those decisions through market operations.

A major change in the Bank's role during this period was the growth of formal supervision of banks. The Bank's formal statutory role only dates back to 1979, although the origins of the role are much older, in part due to the Bank's role in lender of last resort described earlier. From 1979 onwards the growing complexity of the task of monitoring the banking system meant that formal supervision was preferred. This was also prompted by a number of well-publicised problems, notably the Secondary Banking crisis of 1973/74, the failure of Johnson Matthey Bankers, BCCI, and most recently Baring's. The trend throughout this period was towards more extensive and complex supervision - a trend that was mirrored across the world.

To reflect these changes, and the longer evolution of its role as the central bank, the Bank has three core purposes:

Maintaining the integrity and value of the currency;

Maintaining the stability of the financial system, both domestic and international;

Seeking to ensure the effectiveness of the UK's financial services.

In recent years there has been a growing consensus around the world that price stability is desirable in its own right as a necessary condition of sustainable economic growth; that inflation reduces growth and has other social costs - including higher unemployment; and that inflation is a monetary phenomenon, and needs to be controlled by monetary measures. Alongside this has been the rise of the idea that the way to secure this price stability is to give central banks the role of securing it, and thereby remove this role from politicians who, inter alia, are assumed to have a temptation to dash for growth with a bit of inflation, particularly in the run-up to elections. Independence in respect of monetary policy is not however a new feature; for instance, it has a longer tradition in the United States and Germany.

In May of last year the Bank of England was given independent responsibility for the operation of monetary policy. The changes announced last May mean that:

the Bank will have a statutory objective to pursue price stability as defined by the Government - currently defined as an inflation target of 2% per annum.
the task of meeting this objective has been given to a Monetary Policy Committee consisting of nine members - with four appointed from outside the Bank, and the other five from inside; the role and composition of the Bank’s Court of Directors will change - the first such changes since 1694;

responsibility for banking supervision will be transferred to a new supervisory authority responsible for supervising all financial services;

the Bank will remain responsible for the stability of the financial system as a whole, including its responsibility for lender of last resort support;

responsibility for government debt management will be transferred to a new Debt Management Agency;

changes will be made to the arrangements by which the Bank is financed.

These are in many ways the biggest changes to the Bank since its foundation in 1694, but interestingly they leave the three core purposes mentioned earlier almost unchanged, which is a reflection of the well-established understanding on the basic role of central banks.

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WORLD PROJECTS

K.O. Shuttleworth

Lecture delivered on 17th November 1997
Sponsored by de Montfort University

The architectural partnership of Sir Norman Foster and Partners was founded in 1967 and now employs several hundred architects involved in many projects world wide. Dr Shuttleworth explained some of the factors involved in producing a building which met the client's requirements. The practical matters of access, power and other service supplies, heating, ventilation and waste disposal were important but so was the client's view of their corporate image. Knowledge of local planning and political constraints was another significant factor in the architect's approach. It was thus his task to produce designs which satisfied all these criteria, to assess costs and, if approved, to supervise the construction keeping within any budget set by the client.

Dr. Shuttleworth then showed about a hundred slides of the projects his company has been involved in, such as the new airport terminal buildings at Hong Kong. Other completed or ongoing projects included the Imperial War Museum "hangar" at Duxford; extensions at the British Museum; the new German parliament building in Berlin; a congress centre in Valencia, Spain; an exhibition centre in Glasgow; the Hong Kong and Shanghai Bank headquarters tower at Hong Kong; the Millennium Tower in Tokyo; Willis Faber Dumas head office in Ipswich; the Centre for Visual Arts at the University of East Anglia in Norwich; the Sackler Galleries at the Royal Academy of Arts in London; the ITN Building in London; the headquarters of the Commerz Bank in Frankfurt; an extension to the Joslyn Art Museum in Omaha, Nebraska and the terminal at Stanstead airport. Future projects included a new terminal at Luton Airport, shown in the illustration below.

The Foster Partnership is renowned for its innovative designs and had won many awards and citations for excellence. The accompanying photographs provide some examples of the Partnership's work.

Dr. K.O. Shuttleworth.
Sir Norman Foster Partners, Riverside Three,
22 Hester Road, London SW11 4AN.

(above) Bilbao Metro, Spain
(below) Joslyn Art Museum, Omaha, Nebraska

(below) Proposed new terminal for Luton Airport. (bottom right) London Millennium Tower
ANSWERING THE CALLS OF NATURE: HUMAN MIMICRY OF THE AVIAN VOICE

Jeffrey Boswall

Joint lecture with the Natural History Section on 12th January 1998

HUMAN IMITATION OF BIRD SOUNDS: For a number of reasons and by a variety of means. Perhaps the commonest form is onomatopoeia, when we speak bird names that are intended to sound like the sounds of the birds, e.g. Cuckoo Cuculus canorus, Chiffchaff Phylloscopus collybita, Killdeer Charadrius vociferus and Bobwhite Colinus virginianus. The human vocal chords can be employed to copy, for example the song of the male Cuckoo. Imitation may be otherwise effected by whistling through the lips, "spishing" through the teeth or "squeaking" by sucking in air between lips held against the back of the hand. By cupping the lips together and blowing between the thumbs held parallel and between the lips, calls such as those of the Tawney Owl Strix aluco and the cuckoo can be reproduced.

Among the various "bird calls" the commonest is the whistle or pipe. The simplest design is a tube with a mouth aperture and a single outlet hole. Some whistles may have a "pet" inside or may incorporate a reed. The pipe known as the "Nightingale" (and used in the music of Scarlatti and Haydn) involves blowing through a container partly filled with water: direct imitation by human composers dates from the 13th century. The small thin circular instruments used, for example, to copy the distinctive 'whoowoo' of the drake Widgeon Anas penelope are sucked rather than blown. Diaphragm callers (e.g. for Wild Turkey Meleagris gallopavo) are held inside the mouth against the palate. A few whistles have bellows (e.g. the French Quail Coturnix coturnix pipe) or a compressible bulb (e.g. the British Quail pipe) both of which are operated with the hands. In the case of a large bellows (as in the American 'Scotch' make of Mallard Anas platyrhynchos call) a foot may be used (thus leaving two hands free for a gun).

Quite different instruments are those which rely on friction for the creation of sound. An Irish Cornetake Crex crex caller comprises two mammalian rib bones; one has saw-teeth, across which the other bone is rhythmically drawn to reproduce the rasping 'song'. The 'Audubon' bird call consists of a small cylindrical piece of birch wood into which is inserted (and then turned) a reamed small pewter plug; its high-pitched squeaks are reputed to attract song birds. A common design of Wild Turkey call involves scraping a piece of wood across a slate. Box-calls are operated by hand; one side of the box is pivoted at one end and elongated at the other to form a handle and its flat side is drawn across an upright edge, the box acting as a resonator. These are used mainly for Wild Turkeys and wild geese. One French company sells 25 different bird calls, a Brazilian one, 40. Although 'electronic' callers are not strictly relevant they do represent the reproduction of bird sounds by human agency and they have come to replace earlier manual callers. These consist of recordings of real birds reproduced from a disc or tape on a portable battery-operated gramophone or player. The use of this method for hunting is now illegal in the USA and Britain.

Siffleurs use a siffer - a 'song whistle' with a movable 'plunger' - to give generalised impressions of bird songs accompanying music. The copying of birds in human music is done with conventional instruments, or, recently, with synthesizers for radiophonic music. One recent and highly original example of human imitation of bird voice combines the simplest with the most sophisticated technique: human vocal mimicry recorded on tape and then electronically enhanced to increase its verisimilitude before being published on disc and cassette as an identification aid to birdwatchers (Ward et al 1980).

Primitive peoples imitate birds, either in their ceremonies, or to locate or decoy them. For example, the American Indians of the north-west Pacific coast have a dance in which they imitate the voice and the action of the Raven Corvus corax. The Cree Indians use callers to decoy Canada Geese Branta canadensis. The Esquima of the Canadian Belcher Islands attract them vocally. There is a published recording of the Kayabi tribe of the Parantina River in the Matto Grosso of Brazil mimicking four species of bird. Tribespeople in Laos use a bird-call fashioned from bamboo to attract the Bamboo Partridge Bambusicola fytchii within range of a weapon. Whistles made from bone and found in a few prehistoric sites in Europe and, more commonly, across North America, may well have been used for the purpose of attracting birds. Indeed, whistles similar to those found by archaeologists in New Mexico were still being used by the Pueblos to lure Wild Turkeys in the early twentieth century.

Present-day hunters use a variety of means to decoy their quarry, but nowhere more elaborately than in North America, where the sales of duck and goose calls and, most of all, of Wild Turkey calls must be considerable. Schorger (1966) gives a detailed account of Turkey calling from prehistoric times to the present day. Not only are the food species decoyed, so too are so-called 'vermin' Hunters may copy the species they are pursuing or they may attract them by mimicking a predator that the birds assemble to mob. Thus plumage hunters of Trinidad used to call up hummingbirds by mimicking the call of the local owl. Human imitations are usually intended to attract the birds but, in the case of dove calling, they may merely cause the bird to answer from its perch and thus give away his location to the hunter. Bird trappers on the south west coast of France and, no doubt elsewhere, lure birds to the catching area of their clap nets with a decoy whistle.

For bird watchers to call-up owls for a better view is comparatively simple and, in North America 'spishing' and 'squeaking' are commonly employed, usually to put wild birds on view for the purpose of identification and occasionally to census (Smith 1975; Tucker 1978). The reproduction in the field of tape recordings is widely used, e.g. for censusing and ringing. For
example, Swallows Hirundo rustica approaching a roost location before sunset can be very effectively drawn in the direction of the ringer and his mist net by playing the "Swallow roost twitter recording. Even more remarkable is the success achieved by reproducing from coastal headlands at night the purring call of the Storm Petrel Hydrobates pelagicus. Although well away from the nesting colonies, three workers in six years mist-netted 16,000 birds (Fowler et al 1982). The use of tape PLAYBACK in the breeding season, particularly with rare species, needs scientific investigation to determine how easily, if at all, harm may be done.

Bird impressionists - notably in mid 20th century Britain, Percy Edwards - provided entertainment on stage, radio and television. Gramophone records of avian imitators have been issued surprisingly often since the earliest one in 1891 (Copeland and Boswall 1983). Mechanical birds that sang from little French enamel boxes appeared in the late 18th century in France and 'automaton' mechanical caged birds were no doubt a familiar sight in Victorian drawing-rooms. Two of the jewelled eggs of Imperial Russia were designed by Faberge to feature birds (a Nightingale Luscinia megarhynchos and a cockerel that appeared by clockwork to offer the world mechanical utterances.

REFERENCES

Becker, A.C. 1972 Game and Bird Calling. South Brunswick.

Boswall, J. and Barton, R. 1983 Human Imitation of Bird Sound. Recorded Sound 83, 57-75.


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OZONE HOLES - FACT OR FICTION?

Paul S. Monks

Lecture delivered on 24 January 1998

"Chicken-licken, the sky is falling down, we must tell the king" (Trav. ) may seem to be the cry in the modern press when it comes to environmental problems. One would hope that all good policy, press and public understanding in the area of environmental issues is based on strong science, as it is the science that underlies and underpins the public awareness of any environmental problem. This lecture is based on a question often posed to myself by the public as an atmospheric scientist, ozone holes do they really exist and do they make any difference? The short answer to the question is "yes". Thus, the aim of this lecture is to describe some of the science and explain the story of ozone and ozone holes and to therefore hopefully leave the reader with a better understanding of the basic science.

Essentially, the starting point must be what is ozone and why is it important? Ozone, or triatomic oxygen, the bulk of which is formed in the upper atmosphere (see figure 1 ) the so-called stratosphere, plays a vital role in absorbing the potentially harmful components of sunlight. In a way the ozone layer can be considered to be the "earth's sunglasses". This, one of the ironies of the role of ozone in the atmosphere, is that high up in the atmosphere (10-50km) ozone is an essential prerequisite to life on earth but lower down in the atmosphere and in particular where we live it is considered to be a harmful pollutant. The so-called "ozone-layer" is responsible for removing much of the solar ultraviolet radiation (UV). This radiation if it penetrates to the surface can have potentially harmful effects on human health, animals, materials, terrestrial and aquatic ecosystems.

From Figure 1, it is quite clear there is an ozone layer but why should this be? A British scientist, Sydney Chapman, suggested the basic ideas of stratospheric ozone in the 1930s, which have become known as the Chapman cycle. Sunlight (UV) can dissociate molecular oxygen and the atomic oxygen fragments produced can react with oxygen molecules to make ozone

\[
\begin{align*}
O_2 + \text{hv} & \rightarrow O + O \\
O + O_2 & \rightarrow O_3
\end{align*}
\]

(1)
(2)

There are some further reactions that complete the picture, which are involved in the interconversion and removal of ozone and atomic oxygen.

\[
\begin{align*}
O_3 + \text{hv} & \rightarrow O + O_2 \\
O + O_3 & \rightarrow O_2 + O_2
\end{align*}
\]

(3)
(4)

Even from this simple chemistry, it is possible to see why there is an ozone layer. For the production of ozone, both ultraviolet radiation and molecular oxygen are required (O₂). High up in the atmosphere there is a plentiful supply of short-wavelength ultra-violet radiation but little oxygen, lower down in the atmosphere the opposite situation pertains. Thus, the point where there is both enough molecular oxygen and ultraviolet light is where the maximum in the ozone concentrations are going to be found. In our atmosphere this point is at a height of about 15 to 40km, as shown in figure 1. When the Chapman oxygen-only mechanism is applied to real atmospheric measurements it is found that about five times as much ozone is predicted as is measured. It therefore follows that there must be some other, faster, way of removing ozone in the stratosphere. One possible scenario is that a catalyst is present which is speeding up the destruction of ozone. A catalyst is something that can promote a chemical reaction without itself being consumed. In the stratosphere, we can think of a catalytic cycle like

\[
\begin{align*}
X + O_3 & \rightarrow XO + O_2 \\
O + XO & \rightarrow X + O_2
\end{align*}
\]

(5)
(6)

In this case the catalyst is the molecule X, by destroying ozone it is converted into XO, but the XO then reacts with an oxygen reforming X. This so-called chain process can proceed many hundreds of thousands of times. As to the identity of X, it is molecules like chlorine atoms (Cl), nitrogen oxides (NO) and the hydroxyl radical (OH) and therefore the corresponding XO are ClO, NO₂ and HO₂. We now have an apparent contradiction, with

---

Figure 1 (left). A typical ozone profile, showing the different regions of the atmosphere.
only the Chapman cycle we produce too much ozone, whereas the catalytic cycles could destroy all the ozone! At any given time though 99% of active Cl is held in a set of species called reservoirs

\[ \text{Cl + CH}_4 \rightarrow \text{HCl + CH}_3 \]  
\[ \text{ClO + NO}_2 \rightarrow \text{ClONO}_2 \]  

These reservoirs are of great importance to the chemistry of the stratosphere as they act to divert potential catalytic species from active to inactive forms, but they remain available to release the active catalysts again.

Where do these catalytic species come from and what effect does man have in increasing the levels of these catalysts? There are a number of potential sources of pollution that could find their way to the stratosphere. One of the first problems that scientists were worried about was Concorde or stratospheric supersonic transport (SST). Aircraft engines produce large amounts of nitrogen oxides (e.g. NO) on combustion of the fuel. Injection of these nitrogen oxides directly into the atmosphere could be asking for trouble as they can be very long lived at high altitudes. Initial estimates suggested that SST's would lead to substantial losses of ozone. For two reasons it became apparent that this would not be the case. First, the number of aeroplanes required to observe a loss of ozone would be 1,500, flying 7 hours a day, 7 days a week. This number of aeroplanes would be able to transport the population of London to New York, or vice versa in a matter of weeks. Secondly, refinements to the understanding of the fundamental chemistry used to make the initial predictions have shown the impact is likely to be less. A warning note should be interposed at this point because the rise in international air travel and the new generation of aircraft means that this problem is back on the scientific agenda. The potential of subsonic aircraft to pollute the upper atmosphere is now being studied extensively. Other areas of potential stratospheric pollution have been identified such as NASA space shuttle launches and the extensive use of agricultural fertilisers.

A more serious culprit with respect to the depletion of the atmospheric ozone layer was identified from about 1974 onwards. US scientists postulated that some industrial chemical starting to reach the stratosphere might interfere with the mechanisms of ozone formation and destruction. The chemicals were chlorofluorocarbons, or CFC's, and had been introduced by General Motors in the 1930s mainly as coolants for refrigerators and air conditioning systems, aerosol propellants and blowing agents etc. The perceived virtue of these compounds were their physical properties, chemical inertness and lack of toxicity. The potential problem becomes apparent at higher altitudes where the CFC's (e.g. CF₂Cl₂) are not so inert and can be broken down by UV light

\[ \text{CF}_2\text{Cl}_2 + \text{hv} \rightarrow \text{Cl} + \text{CF}_2\text{Cl} \]  

Fortuitously, as described previously, most of the active chlorine, including that provided by CFC degradation is tied up in the reservoir compounds. There are many myths about CFC's and chlorine in the atmosphere, such as if CFC 's are heavier than air how can they make it high up into the atmosphere? The truth is that thousands of measurements have found CFC's high in the atmosphere and though heavier than air the atmosphere is not still and the winds carry and mix gases high into the stratosphere.

Based on predictions of the effect of CFC's on the ozone layer, in 1987 a previously unprecedented step was taken when many countries signed the UN Montreal protocol specifying the control and phase-out of these ozone-depleting chemicals. Since that time in London in 1990, then Copenhagen in 1992 and Vienna in 1995, the protocol has been modified in order to speed up the schedule and extend the range of chemicals covered to further lessen the effect of these chemicals. One of the factors that lead to more rapid world action on CFC's was the discovery of the so-called Antarctic ozone hole.

British scientists from the British Antarctic Survey (BAS) had been making measurements of ozone from their base at Halley Bay (76°S) for many years. They had detected a decline in the springtime ozone since 1977, and by October 1984, they had detected a 30% decline in the total ozone. They published their results in a scientific journal and thus started the ozone hole story. One more worrying feature was that a rather more sophisticated instrument than that used by the British flying on the Nimbus-7 satellite had apparently not detected the same ozone depletion. When NASA went back and looked at the data they realised they had programmed their computers to reject all low values of ozone as obviously erroneous and on investigation of the 'raw' data they too could see the ozone hole. There would seem to be a lesson in this salutary tale. Figure 2 shows a more recent picture of the ozone hole taken from space. Strictly speaking the use of the word "hole" to describe what happens to ozone in the Antarctic is an exaggeration. There is undoubtedly a massive depletion of ozone, particularly at between 14 and 18 km in the Antarctic stratosphere but the total column of ozone is depleted rather than removed altogether. The exact location and size of the hole varies with
meteorological conditions, but the area covered has increased over the last 10 years or so. Currently, in the Austral spring the hole extends over the entire Antarctic continent, occasionally including the tip of South America, covering an area equivalent to the North American continent.

What happens in Antarctic stratosphere to make it different from many other places? It is colder than the rest of the earth, ozone depletion occurs in the Austral spring when it is particularly cold (-80°C). Also, polar meteorology leads to very strong westerly winds and the formation of a stable vortex, which prevents mixing of air from lower latitudes, i.e. it is very very cold.

In 1986 and 1987 a huge international expedition was mounted to examine the chemistry and meteorology that leads to the polar ozone loss. Many different measurements were made using satellites, aeroplanes and ground-based instruments. The results showed some stark contrasts between the chemistry inside and outside the vortex before and after sunrise in the Austral spring. Within the vortex concentrations of e.g. CIO were a factor of 10 larger than outside. These measurements also showed that the stratosphere within the disturbed region was abnormally dry and highly deficient in nitrogen oxides. The reason for the dehydration and denitrification is the formation of the polar stratospheric clouds, whose special chemistry perturbs the Antarctic stratosphere. The ice crystals on these clouds provide a surface for reactions such as

\[
\text{CINO}_2 + \text{HCl} \rightarrow \text{Cl}_2 + \text{HNO}_3
\]  

that is, the normally inactive reservoir for Cl and CIO is converted into molecular chlorine. This reaction can continue all winter long without light converting inactive chlorine to active chlorine (cf. reactions 7 and 8). When the sun rises in the spring it triggers the depletion chemistry

\[
\text{Cl}_2 + h\nu \rightarrow \text{Cl} + \text{Cl}
\]  

\[
\text{Cl} + \text{O}_3 \rightarrow \text{ClO} + \text{O}_2
\]

But there is one further unforeseen modification as the concentration of oxygen atoms is too low first thing in spring to regenerate Cl via the normal reaction (6) so there is instead a further low temperature reaction that regenerates the chlorine atoms

\[
(\text{ClO})_2 + h\nu \rightarrow \text{Cl} + \text{Cl} + \text{O}_2
\]

that can re-enter the catalytic cycle and destroy large amounts of ozone. In summary, the key features of Antarctic ozone loss are

1. The circulating winds in the polar regions enable the formation of a stable vortex which provides a gigantic "reaction vessel" for depletion to occur
2. The low temperatures encourage the formation of polar stratospheric clouds, which enhance the production of active chlorine species and perturb the chemistry, so that ozone-destroying reactions can take place.

In more recent times, there have been discoveries of ozone depletion in the Arctic that occur by similar mechanisms as the ones described here. Maybe more worryingly, recent measurements have shown a reduction in ozone levels over our own heads here in the UK. Why this happens and the consequences of it still remain an open scientific question. I would hope that this lecture has to some extent illustrated and explained some of the science that underlies the problems of ozone and ozone holes and indeed has somewhat convinced you that ozone holes are indeed fact and not fiction. Finally, there maybe lies a further moral in the traditional tale of chicken licken et al., as all the animals willingly follow the chicken and believe unquestioningly all that is said until they meet a fox and are eaten. I will leave it to the reader as to whether this is a metaphor for modern life and environmental problems.

REFERENCES

For general interest

*The ozone layer*, DoE, Publication Despatch Centre, Blackhorse Rd., London SE59 6TT.


1996 *The potential effects of ozone depletion in the United Kingdom*, DoE, HMSO.

Internet related information

Ozone hole tour on the Internet:
http://www.atm.ch.cam.ac.uk/tour/index.html

A good source of information about ozone in general:
http://www.epa.gov/ozone/index.html

For pictures of the ozone hole and satellite images:
http://jwocky.gsfc.nasa.gov/

The ozone problem from the environmentalist's point of view:
http://www.greenpeace.org/ozone/

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DEVELOPING THE MERCURY TOWARDS 2000

Nick Carter

Summary of the lecture given on 9 February 1998

This talk is entitled Developing the Mercury towards 2000. Of course, time does not stop there. Really it has to be about developing the Mercury for the future - and that is of course an uncertain future. So my job at present is about developing a Mercury that is strong enough to survive into the future, while being responsive and aware enough to adapt to whatever that future holds.

When I arrived in 1993 the newspaper had seen some 30 years of declining sales. It had that in common with every regional newspaper of any size in the country. A whole raft of circumstances were combining to reduce the number of people who simply did not want a local newspaper.

Historically, local newspapers have never been very good at adapting to change.

- Reluctance to spend money to find out what was happening in their market
- Economic circumstances
- TV - and especially sport on TV. - Saturday early evening sports magazine programmes.
- Explosion of alternative sources of information on a whole host of areas - each more precisely tailored to its readers than any mass market newspaper could be.

The list could go on - but you will have spotted that some of the causes are not outside our control.

Back in 1993 I took over a newspaper that, in my view, had begun to lose touch with its traditional readers - firstly because it did not really understand precisely who they were and secondly because it had embarked on a course of development that was pushing basic, local news, out of its columns.

It seemed to me that the Mercury had started to lose credibility and move away from one of the prime roles for any local newspaper - being a provider of essential information on a wide range of topics. It had also started to lose involvement in the communities in which it sought to sell.

Not only was the Mercury not keeping its core readers, it was not doing anything to attract new ones.

It was clear we had to advance on two fronts.
1. Stop those regular readers from drifting away
2. Find out more about those people who were not reading us at all or just occasionally - then find ways of getting occasional readers reading more often and non-readers reading once or twice a week.

Basically, we needed to get more people interested in the Mercury. We needed to get more people feeling the newspaper was for them.

Those two areas embrace everything that has been done to the Mercury in the past four and half years - and just about everything that is still due to happen to it in the foreseeable future.

You will gather from the problem I have been outlining that we needed to get more sophisticated about everything - even the basics.

We started a major and on-going market research programme, probably the most ambitious in the regional industry, designed to find out more about our market, the people of Leicestershire, their likes and dislikes and their lifestyles.

1994/5 objectives:
- Stop decline in regular readers
- Get more younger (under 40) readers

As a result of that we did several things:
1. More local news - primarily Leicester and environs, but also in our county editions. Still a long way to go there.
2. Zoned reporting - not new elsewhere, but new for the Mercury.
3. More letters
4. More Mr Leicester - nostalgia may not be what it used to be, but it is still a powerful area of interest.
5. More sport - several pages every day in fact. Better City and Tigers coverage, plus more amateur coverage. Plus we turned the Green, Blue. Struck a chord with fans and increased the sale.
7. Weekly entertainment guide
8. And, vitally important, we sought more involvements in our local communities.

All that development meant more staff, more pages - more cost. - but it also bore fruit . . .

Feb 97 v. Feb 96

Decline in regular readers has stopped
Total number reading Mercury is up
More of them are infrequent readers
A greater proportion are younger
Sporting Blue and Buff readership up
They think we are good value for money
But . . .
They think we could be more accurate
We could be more entertaining and ‘fun’
More infrequent readers = more ‘disposable’ attitude to the Mercury
IN SUMMARY...

In 1994 we set out to change the readership profile of the Mercury

WE HAVE
We wanted more people reading - THEY ARE
We wanted more younger readers - WE'RE GETTING THEM
But we must tie them in, get more, keep all the others - and build sales! Easier said than done!

But it is worth recording now, that 1997 was the most successful year for Mercury sales performance this decade.

So what happens next? Well, it was clear from that first research project that we would need to know even more if we were to have a real chance of making a long term difference to the sale. So our research has got even more detailed. And in turn, how we look at different areas of the Mercury has got more detailed.

The areas we are working on for the current year include:

- Refreshing the way the Mercury looks - cleaner, brighter, neater, clearer. Trying for a less-cluttered feel.
- We have already moved to change the classified section at the back - clearer and cleaner, easier to use and find your way around.
- More sport from December
- Better indexing.

Better signposting - helping people find your way around the newspaper.

A more campaigning stance. Research feedback told us that however proactive and campaigning we might feel we were, readers thought we could be doing better.

Campaigns, issues, Mercury Active.
Reviewing TV service
The Week
Daily entertainment service - including how the advertising fits with the editorial coverage on entertainment.
Property, Motoring, Jobs Guide - overall, more relevant editorial to help readers.

If that sounds a heavy programme of research and development - it is! Certainly more work going on to improve the Mercury than at any time in its history. This process will continue into the future.

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CHINA IN HOGARTH'S ENGLAND

Lars Tharp

Lecture delivered 2nd February, 1998

When asked some years ago to deliver a talk placing the ceramics of the 18th century into their social context I decided to use the works of William Hogarth whose works, like no other English artist of the 18th century, creates a fully rounded panorama of early Georgian London: from polite palace interiors to a harlots' chamber, from the impoverished poet's garret to the cellar of wealthy drinking companions, from tavern interiors to rowdy town streets, markets and fairs. The whole world of the 1720s through to the 1760s is here and, looking closely, so is its everyday pottery. Furthermore, these images were drawn, painted and engraved during one of the most dynamic periods of English economic, social and technological development. Caught up in this Industrial Revolution was the trade of the potter: greater and greater quantities of Chinese porcelain were being imported from the early 1700s by the Honourable East India Company, challenging the livelihoods of potters throughout Europe.

Some Continental aristocrats reacted by creating exclusive porcelain factories of their own, most notably Augustus the Strong at Meissen in Saxony, whilst in England the native potter, backed not by royal patrons, but by growing numbers of merchants and businessmen, responded with ever-increasing refinement of clays - or "bodies". White stonewares, delftware, creamware, red stonewares, grey/brown stoneware and (eventually) English porcelain - these all supplied not merely to the upper strata of society but also to more modest households as well as the growing numbers of merchant businessmen. Most important of these materials was Creamware, emerging in Staffordshire out of the shortlived salzglazed white stonewares of the 1730s and 1740s and consolidated in the 1760s by Josiah Wedgwood, father of the modern ceramics industry.

CERAMICS IN HOGARTH

Chinese teawares abound in William Hogarth's early group portraits of the 1720s and 30s. In these commissioned works porcelain features merely as part of the naturalistic depiction of contemporary furnishings within recognizable interiors. Most of the "china" glimpsed in these early works shows us not only how tea was taken, but also how important and fashionable were all the tea-taking paraphernalia - the "equipage" - essential for lubricating the wheels of society (e.g. The Assembly at Wanstead Abbey (c1728); and the later Strode Family (1738).

However, once Hogarth establishes his financial independence (through the creation in the 1730s of popular, money-making prints), he paints less for individual patrons, and more for a far wider public. Above all, he paints for himself. His highly constructed images take on a visual complexity foreshadowing the dream-like world of Charles Dickens, many details and objects employed as pointers and clues in the "reading" of the picture. The seemingly innocent, day-to-day artefacts which clutter his human dramas are carefully chosen, placed and posed for theatrical, symbolic effect. In the first of his Modern Moral Subjects, The Harlot's Progress (printed 1733), the rise and drawn-out fall of the heroine (depicted over six scenes) is reinforced by the ominous cascade of genteel porcelain in the second scene, with fragments (quite literally) of the same service recurring alongside other broken pots in subsequent scenes in ever more battered condition, a constant reminder of ruin, of the fall. Running from finest Chinese teawares to coarsest stoneware and common pottery they register a shift from a polite tea-taking world to the rougher wares and brews consumed by the harlot's trade, inevitably ending with the lethal deceptions, potions and salves of the parasitic quack doctors, in scene five seen too busy arguing to notice the death throes of their patient. In the final image, the Harlot's Wake a mask-moulded German stoneware bellarmine bottle grins out of the picture, bottom right, like a ceramic full-stop. Hogarth's contemporaries would instantly have recognized the double entendre: in a last attempt for a cure such commonplace spirit bottles were filled with a patient's nail and hair clippings in a final attempt to draw off evil spirits.

Other ceramic pointers to teetearing careers, broken lives and cracked virtue occur throughout many of Hogarth's three hundred or so other images. In addition to their use as a metaphor for cracked and broken reputations he also employs them in frequent swipes at the effeminate victims of "china mania". A term more properly reserved for collectors of the 1860s onwards, the same enthusiasm for ceramic antiquities infected fashionable cops and dilettanti of the 17th and 18th centuries when an interest in foreign porcelain was one of the many badges of the connoisseur. Hogarth hated nothing more than the headlong rush of his contemporaries into all things continental: the Grand Tour filled more and more English houses with Italian and Dutch art - including many fakes - at the expense of homgrown artists such as himself. Eager to display his own English prowess he took up his brush, demonstrating his skills as an artist while lampooning the ridiculous fashions of the day. Taste in High Life (painted in 1742 for a private client and later pirated as a print) freezes the moment (familiar to all fair-goers today) when two elderly figures, dressed to the nines, croon over an absurdly miniscule (probably Chinese) tea bowl and saucer. But his most dramatic send-up of contemporary china accumulators occurs in scenes two and four of his most famous work, Marriage à la Mode (1745).

In the first of these, The Breakfast, he depicts an ill-matched, recently wedded couple, seated in a realistic grand house interior, before a surreal group of white mantelpiece figures. Unmistakably made of porcelain they are modeled with arms stretched wide to signify the chasm which exists between their owners, between new money and impoverished title. Here Hogarth echoes the mocking reception given by literary satirists such as Pope and Swift to "heathen gods" - the epithet actually
used in one early inventory of blanc de chine chimney ornaments. (One ball’d fryor sitting describes a Chinese white Buddha in the 1688 inventory at Burghley House, Stamford). In the second of these two scenes, the Countess is waited upon with chocolate served in fine (Meissen) porcelain while in the foreground her black page boy unwraps the latest auction purchases including a Chinese jar and a piece of polychrome pottery, presumably Italian maiolica.

These, then, are some of the highlights of Hogarth’s own depiction of ceramics. But what of ceramics bearing Hogarth’s own compositions!

HOGARTH IN CERAMICS

Though he certainly owned pottery and porcelain (some minor Chinese pieces still survive, bequeathed through his wife’s cousin down to Aberdeen Museum; his magnificent English Delftware punch bowl can still be seen at the Coram Foundation, London; and his father-in-law painted zodiac designs on a set of twelve delphi plates now in the British Museum. Hogarth was clearly hostile to the prevailing foppery for ceramics and objets de vertu. And as a man of the Rococo, steeped in its scrolls, curves and curls, he inveighed increasingly against the rising tide of straight-lined neo-Classicism. It is doubly ironic, therefore, that his own faithful pug, Trump, should be translated into ceramic form: at first into new-fangled Chelsea porcelain (c.1747, via a terracotta model sculpted by his friend, the great Louis François Roubiliac) and (a decade after Hogarth’s death) in a black basalt version, listed in the 1773 catalogue of that high priest of neo-Classical ceramics, Josiah Wedgwood.

In fact over a dozen of Hogarth’s own images have been translated into a variety of ceramic forms, during and after his lifetime. None in more ceramic versions than his Midnight Modern Conversation (1732/3). It was instantly adopted by: London manufacturers of salt-glazed brown stoneware; by the makers of rarer white stoneware (a mug preserved in the Museum of London, skilfully converts Hogarth’s original landscape format into a more mug-friendly portrait form); by London and Liverpool delftware (tin-glazed earthenware) manufacturers with some fine punch bowls; by Dutch Delft potters (see the blue and white bowl in the Rijksmuseum); by German porcelain factories at Meissen and later at Berlin (the latter incorporating several other Hogarth scenes including the Enraged Musician (1741) and The Idle and Industrious Apprentice (1747); and, thousands of miles away, by the Chinese decorators on a particularly massive bowl showing the dishevelled English revellers juxtaposed on the other side with Chinese gentlemen eating and drinking in an altogether more civilized manner. The Midnight Modern Conversation image has even been revived as a group of figures by a living century American potter, Michelle Erickson, working in the manner of mid-18th century creamware groups.

Other Hogarth images directly translated into clay include: The Gate of Calais (1748/9) (in which Hogarth depicts himself seated at the easel, at the point of being arrested as a spy) and John Wilkes Awaiting Trial (1763), both executed as a Chinese porcelain punch bowl; The Politician, used on small transfer-printed pottery plates from Middleborough, ca. 1830; The Cockpit (1759), issued as a relief-moulded jug, ca. 1810; and the famous portrait of his friend, the celebrated actor, David Garrick as Richard III (1746), rendered one hundred years after Hogarth’s painting/engraving as a Staffordshire flatback pottery group. It has even been suggested that some of Hogarth’s images directly inspired some of J. J. Kaendler’s porcelain lovers’ groups at the Meissen factory.

It should also be noted that, in the case of the already mentioned Quarrel scene (no. 2) from The Harlot’s Progress (1732), a single element, the Negro servant boy, was ‘lifted’ by early transfer artists at the Worcester factory into a wholly different out-of-doors setting, the astonished boy joining a maid taken from Hogarth’s contemporary, Francis Hayman. The resulting composite scene is amongst the earliest of all ceramic transfer prints, produced around the time of Hogarth’s death in 1761, thirty years after the original work.

SUMMARY

Had English porcelain been created at the start of Hogarth’s career - i.e. in the 1720s rather than a whole generation later in the mid 1740s - we would probably have seen yet more instances of his images translated into this magical white clay. We might even have seen the great Rococo artist more in tune with a material regarded by all subsequent commentators as an intrinsically Rococo medium. As it is, however, Hogarth’s China is just one of the many foils with which he parries at human vanities while reminding us of our brittle and imperfect nature. It is a fitting and pleasant irony that for over two hundred years the ceramic traditions throughout the world have seen fit to employ some of the very images through which it has itself been lampooned.

Lars Tharp’s fully colour illustrated book Hogarth’s China is published by Merrell Holberton (ISBN 1-85894-041-9) at £25. Signed copies are available from the author at the address below.

Lars Tharp’s 1998 Exhibition of Hogarth’s China: from Print to Pot is at the Wedgwood Visitor Centre, Barlaston, Stoke-on-Trent from the end of July to October 1998 (contact Wedgwood on 01782 204141 for further information).

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PUZZLES AND CLASSIC FICTION

John Sutherland

Summary of lecture delivered on 9th March 1998
Lecture Sponsored by Leicester University Bookshop

One of the more heartening cultural signs of the times is the boom in classic reprint fiction over the last decade. High Street bookshops are, nowadays, veritable Aladdin’s Caves for lovers of good books. Take, for example, George Eliot’s *The Mill on the Floss*. A moderately well-stocked book shop will have, on display, up to six editions: the World’s Classic (with an introduction by Dinah Birch), the Penguin Classic (with an introduction by A.S. Byatt), the Penguin ‘tie-in’ TV edition, the Everyman paperback edition (with an introduction by Beryl Gray), the hardback Everyman edition (with an introduction by Rosemary Ashton), the stripped-down Wordsworth edition.

It’s a mouthwatering array. And, amazingly, this massive Victorian classic (originally a ‘three-decker’ when it first came out in 1861, costing its first purchasers a guinea-and-a-half) is offered to the 1998 consumer at prices well under £5. Such prices are only possible with modern production methods and most importantly, volume of sale. George Eliot is, in the 1990s, even more of a bestseller than she was in her nineteenth century heyday. Riding on the ‘mania’ triggered by the television adaptation of *Middlemarch*, George Eliot’s masterpiece (a novel, incidentally, that, contemporaries like Trollope thought so difficult as to be almost unreadable) headed the British paperback bestseller list in March 1994.

There are a number of reasons one can put forward for the classic boom of the 1980s and 1990s; some sociological, some attributable to new efficiencies and competitiveness in the book trade. Television and film versions of Austen, Dickens, Eliot and Hardy (particularly) have stimulated interest in the source texts. There are slower, more cumulative factors at work in the education system. The first generation of Britons (my generation), as it happens, to benefit from the 1944 Education Act - which effectively opened higher education to the lower classes - is now in its fifties. Most people save up their serious reading for their leisureed later years. In ‘literate professions’ - notably school teaching - there has been much early retirement.

Sociological, media, and historical explanations for the classic reprint boom do not give us the whole story. Much of the credit must go to the publishers who, over the last thirty years, have gradually built up their lists. Given, as I understand, that in order to stay in print a title has to sell around 3,000 a year, given the fact that the Catalogue’s leading titles (Austen, Dickens, Trollope, Hardy) sell up to five times that number, and given the multiplicity of classic reprints - one can make some interesting deductions. Dickens, as I calculate, must be selling, in the 1990s in Britain, around a million copies of his major works a year. Many times more than the number sold in his own lifetime. Calculations such as this give the lie to gloomy predictions about the ‘decline of the book’. The book - the classic book - has never been in better shape.

All this is, as I say, immensely heartening. If asked what is the most disheartening or depressing feature of our literary culture, I would point to the almost total disconnection of the professional literary critic from the mass of readers. Academics in English departments (particularly, I think, in America) are embroiled in the baffling complexities of deconstruction, New Historicism, Lacanian psycho-analysis, and gender politics. Pick up a cutting-edge academic journal - say *New Literary History* or *Representations* - and prepare yourself for a bamboozling experience.

It was with this disjunction in mind that I wrote *Is Heathcliffe a Murderer?* (1996) and *Can Jane Eyre be Happy* (1997). The aim was (modestly) a kind of Forsterian ‘only connect’ - connect scholarship with the intelligent mass readership, that is. There is, I think, no inherent reason why there should not be a community between those whose profession (lucky them) is to think about literature and the civilized, but non-professional, readers of English classic fiction.

The bridge I chose, was a series of ‘real world’ questions about fiction - particularly the fiction I know best (Victorian). The ‘idea’ of the books is expressed in the blur to the first collection:

Readers of Victorian fiction must often have tripped up on seeming anomalies, enigmas, and mysteries in their favourite, novels. Does Becky kill Jos at the end of *Vanity Fair*? Why does no one notice that Hetty is pregnant in *Adam Bede*? How, exactly, does Victor Frankenstein make his monster? Why does Dracula come to England rather than neighbouring Germany? Why doesn’t the invisible man make himself an invisible suit?

I am fully aware of the nonsensicality of this procedure - the fundamental ‘category error’ in asking factual questions of fiction. But, as I like to say, ‘How many children had Lady Macbeth?’ has always seemed to me a perfectly good question. If only because (1) trying to answer it, forces you to look closely at the text (2) wrong questions can usefully direct you to the ‘right’ questions. There is also, I think, some value in returning criticism to what might be called the ‘Zen’s Paradox’ level of absolutely elementary speculation. Why cannot the hare overtake the tortoise? Literary criticism needs, I believe, to come down to earth from its current stratospheric preoccupations. The kind of question a bright child might ask is one way to bring it down.

John Sutherland.

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THE ILLUSTRATED MAN:
THE ART OF TATTOOING

D. A. Burns

Summary of Lecture delivered on 23rd March 1998

The word tattoo is probably a variation of 'tatau', derived from the Polynesian word 'ta', which means knocking or striking and representing the sound made when tapping the tattooing instrument. It was probably Captain Cook who introduced 'tattoo' into the English language, following his voyages to the Antipodes, where he and his men encountered Maori Moko.

Moko was the traditional Maori method of body decoration, and examples of this art can be seen in the paintings of Gottfried Lindauer in the Auckland City Art Gallery. Maori men had facial and buttock tattoos which were performed using instruments resembling chisels, and the pigment employed was carbon, derived from burning certain types of wood. The pattern of lines, curves and spirals was very complex, and usually individuals with the most complex Moko were high in the social hierarchy of the tribe. In Maori women, Moko was restricted to the chin and lips.

Maoris preserved heads after death by embalming, and this practice was not only common within families, in order to keep alive the memory of the dead, but was also carried out on the heads of vanquished enemies. As more Europeans visited New Zealand, the natives began to trade these preserved heads for firearms. Many of the heads eventually found their way into museum collections around the world, but it is unlikely that any of these will be seen on display nowadays, as Maoris object to their exhibition. Eventually, demand outstripped supply, and the more unscrupulouschieftains began to forcibly tattoo their slaves so that their heads could be used to replenish diminishing stocks. In 1831, an Act was passed which made the trade in preserved heads illegal. By the beginning of the twentieth century very little Maori tattooing was taking place.

England has a rich tattooing history, and one of the best known tattoo artists of this century was George Burchett, 'The King of Tattooists'. He learned to tattoo as a child, by practising on his schoolmates, and later developed his skills in the Royal Navy. George had a tattoo parlour on the Waterloo Road in London, but also engaged in what might be considered 'private practice' in the West End, where he worked in beauty salons tattooing permanent pink blushes on ladies' cheeks, and providing them with tattooed eyebrows and lip rouge. He died in 1953 at the age of eighty-one, and was still working until shortly prior to his death. His memoirs (Memoirs of a Tattooist, George Burchett and Peter Leighton) were published by the Oldbourne Book Co. Ltd., London, in 1958).

Modern tattooing is carried out using an electrical tattooing instrument which has not changed a great deal since it was first developed by Samuel O'Reilly in 1880. The 'business-end' of the machine carries needles soldered to a central rod. A small number of needles are employed for fine work, such as the outline of a design, and a larger number for filling in blocks of colour. Fresh needles and pigment are used for each customer, in order to minimize the risk of cross-infection. Pigments used to be composed of metal salts (e.g. red - mercuric sulphide; blue - cobalt), but in recent years these have been replaced by vegetable pigments, although some still contain traces of metals.

REASONS FOR TATTOOING

The reasons given for acquiring tattoos vary, but the classic 'I was drunk at the time' is rarely the case. Most people are tattooed simply because they want to, and some then go on to have large areas of the body covered in tattoos.

It is considered an art form, then the greatest exponents are undoubtedly the Japanese. The Japanese word for tattooing is irezumi: ire = insert or inject; sumi = charcoal or ink. Their designs are usually symmetrical, and are incredibly intricate. They often include mythical characters, flowers such as peonies and chrysanthemums, and water symbols such as the carp and dragon. Many Western tattooists can also produce extremely artistic work when given the opportunity. Some tattoos are considered to be 'party-pieces', presumably to be unveiled to an inebriated audience when the bearer considers that an appropriate moment has arrived. Perhaps the best known of these is 'the hunt', in which huntsmen and hounds weave their way down the back, chasing a fox whose tail is just visible as it disappears into its lair between the buttocks.

The expression of sentiment is a common reason for tattooing. Protestations of love for parents, spouses and various 'significant others', surrounded by floral tributes, lovebirds and pierced hearts, abound on torsos throughout the land. The sweetest girl I ever kissed was another man's wife - my mother is usually a safe inscription, but using the names of male and female partners is often asking for trouble. Partners frequently change, and those newly acquired tend to take exception to visual reminders of those who have been around previously.

Tattooists have always derived a good income from clients who want a reminder of places visited or special events, and members of the armed forces are frequent customers. It is as well to check the tattooist's ability to spell before having such a motif applied. There is a tale of two squaddies in Aldershot, at the time of the Gulf conflict, who wanted tattoos of a small rat with Desert Rats alongside it. One emerged with the correct spelling, the other with Dessert Rats.

There was a time when the heavily tattooed were such a curiosity that the general public were willing to pay to see them exhibited in circuses and fairground sideshows. Phineas T. Barnum, the
American circus entrepreneur, put on display the extensively tattooed 'Prince Constantine' in his circus. 'The Great Omi' - the so-called zebra man, who was tattooed by George Burchett - made a good living from exhibiting himself in the 1930s and 40s.

The tattooing of women has been episodically fashionable in the civilized world, and is popular today, usually in the form of a butterfly, rose, or other small design on the shoulder, breast, buttocck, thigh or ankle. Whether or not the onlooker finds these alluring is a matter of taste.

A more practical application of tattooing is in recording important medical data such as blood groups and allergies. In the Nazi SS it was the practice to tattoo the blood group of an individual in red Gothic letters in the left armpit. With Teutonic thoroughness, research in casualties showed that the left armpit was the area least likely to be traumatized, hence important data was most secure in this site. Other medical uses have included over-tattooing of port-wine stains with flesh tints, tattooing of vitiligo, the creation of artificial nipples and areolae after breast surgery, and filling in of spaces between hair plugs to improve the cosmetic results after hair transplants.

**TATTOO REMOVAL**

Dermatologists, plastic surgeons and tattooists are often asked to remove unwanted tattoos. Most requests are from individuals who have tattoos on exposed parts of the skin, and they are often poorly executed, self-inflicted designs which they regret having performed. Some consider they are stigmatized by tattoos, and that their presence interferes with job prospects. A change of partner may initiate a request for removal of the names of old acquaintances, and tattooists will often be able to obliterate the names with a suitable decorative overlay. It is important to be aware that any method of tattoo removal will leave scarring.

In ancient times, various bizarre concoctions were proposed to remove tattoos, including the urinary deposits on the inside of chamberpots mixed with strong vinegar, buttercups and caper leaves, and pigeon faeces ground up with vinegar. Other, more effective methods employed strong caustics such as nitric or sulphuric acids and zinc chloride, but these produced severe scarring. A method popular with tattooists was the Variot or 'French Method' -- over-tattooing with tannic acid followed by the application of silver nitrate.

Modern methods leave less scarring. Small tattoos can often be removed by surgical excision, and freezing with liquid nitrogen has been used on tattoos on the fingers. Methods which are used to deal with larger tattoos include removal by electric dermatome (a device resembling a hair-cutting machine, which planes off the superficial part of the skin), dermabrasion (in which a motor-driven instrument carrying small cylinders of wire brush, or a diamond fraise, revolving at high speed, strips the skin down to the tattoo pigment); and lasers. Various laser systems have been used, and it is hoped that advances in laser technology will eventually lead to a system which removes the pigment with minimal damage to the skin. Many forms of expression have been associated with tattooing - art, mystique, sentiment, rebellion and, not least, humour:

*Marry a fat tattooed lady,*  
*And you'll get warmth in the winter,*  
*Shade in the summer,  
And moving pictures all the year round*

Dr. D. A. Burns, MB, BS, FRCP.  
Consultant Dermatologist and Honorary Senior Lecturer in Dermatology, Leicester Royal Infirmary.
FABULOUS FOSSILS: EXAMPLES OF EXCEPTIONAL PRESERVATION

Abstracts of lectures at the Saturday School at Vaughan College, 7th March, 1998

Introduction by Andrew Swift

Exceptionally in the geological record conditions governing the fossilisation of organisms are suitable for the retention of greater detail than is usual. This can include the preservation of soft tissues which normally rot away or are scavenged. Also, entirely soft-bodied organisms may be preserved, as in the famous Burgess Shale, giving a striking window on sections of ancient marine biotas which are normally not seen. Several of these soft-bodied organisms are still little known and take bizarre forms. Lightly articulated body parts, such as feeding structures, are usually dispersed by current and wave action, but these too may be found in life associations in certain exceptional deposits. Original colour is normally lost on fossilisation, but this too may be retained. Interaction between organisms is rarely recorded via fossils, but at certain horizons animals are preserved in associations which give special insights into their lifestyles.

Examples of several of these unique fossils were discussed by distinguished speakers from the world of academia. 440 million year old animals of unknown affinity, ancient carnivorous vertebrates, flying reptiles, early spiders, worms and shrimp-like creatures retaining non-biomineralised detail, colour-banded snails etc. were all on the agenda.

Setting the scene: an overview of exceptional preservation

Derek E.G. Briggs
Department of Geology, University of Bristol

The tissues of animals and plants vary in their susceptibility to decay. The most labile, like muscle, are degraded very rapidly, normally within days. In order to be fossilised they must be replicated by minerals early enough to avoid the loss of morphological detail. This process is finely balanced because some decay is necessary to promote mineralization. In contrast, more decay resistant material, like the skeleton of arthropods, the periderm of graptolites, and the cuticles of plants, may survive and become fossilised as organic material, often with some chemical alteration. Exceptionally preserved fossils are a product of both these processes.

Soft-bodied fossils from a Silurian volcanioclastic deposit

Derek J. Siveter
Oxford University Museums

Fossil deposits preserving lightly sclerotized and soft-bodied organisms are fundamentally important to our understanding of the history of life on earth; they provide a much more complete record of ancient communities than does the normal shelly fossil record. Conditions during the Cambrian may have favoured the preservation of soft-bodied organisms. Burgess Shale-type and Orsten-type faunas are becoming increasingly known from this ca. 40 million year long period, for which we have an increasing body of data on the early metazoan radiation. Soft-bodied organisms are much less well represented in the 100 million years thereafter. The discovery of a new Silurian soft-bodied biota therefore has the potential to fill an important gap in our knowledge. The relatively deep water marine environment represented is dominated by previously undiscovred arthropods and polychaetes. This report of soft-bodied fossils from carbonate concretions within a volcanic ash identifies an important new source of soft-bodied taxa.

Fossil Spiders

Paul Selden
University of Manchester

The fragile, squishable nature of spiders suggests that they would make poor fossils, and indeed it is the case that fossil spiders are rare. Even in beds where insects are common, spiders form only a small percentage of the fauna. For this reason, spiders are good indicators of Fossil Konservat-Lagerstatten deposits which are rightly famed for their exceptional preservation of soft-bodied plants and animals.

A glance at the fossil record of spiders indicates distinct concentrations in such Lagerstatten: Eocene Baltic and Oligocene Dominican amber, and the Coal Measures of Europe and North America, for example. Relatively few spiders have been found in Mesozoic rocks, but recent finds are helping to change this picture.

Tertiary spiders are quite similar to those of today, the exquisitely preserved amber fossils look as though they could have been alive just hours ago. One strange genus, Archaea, was first described from Baltic amber and later found alive in Madagascar! Limestone fossils also occur in the Tertiary, and one spectacular
fossil from the Bembridge Marl of the Isle of Wight shows respiratory organs both book-lungs and tracheae preserved in fine detail in calcite.

Fine limestones are also responsible for the preservation of spiders from the lowermost Cretaceous of north-east Spain which show remarkable preservation of the foot-claws and spinnerets. These features enabled the specimens to be identified as belonging to modern families of spiders which weave the familiar orb webs seen in gardens today. Imagine dinosaurs brushing past orb webs stretched between cycads! Many spider fossils are now being discovered in Cretaceous rocks of Brazil, but amongst them occur other arachnids such as the solpugid or camel-spiders. This fearsome animal occurs in deserts today and the Brazilian specimen was the first to be found in Mesozoic strata. Only one species of fossil spider has so far been described from Triassic rocks: *Rosamygale*, from the Vosges mountains of France (below). This is the oldest known mygalomorph spider, and belongs in the primitive, present-day family Hexathelidae, which includes the venomous Sydney Funnel-web spider. Mygalomorphs also include bird-eating and tarantula spiders, and are sister-group to the more familiar araneomorphs. The two groups together are sister-group to the most primitive spiders of all, the mesotheles. Newly discovered specimens from the Triassic of South Africa and Virginia, and soon to be published, are the oldest known araneomorphs.

Permian rocks have so far yielded no fossil spiders, and there are, as yet, no proven mygalomorph or araneomorph spiders known from rocks of Palaeozoic age. Indeed, lack of characteristic features such as spinnerets on the large number of generally well-preserved Carboniferous spiders makes one wonder whether they were, indeed, spiders at all. However, in the last few years, a couple of specimens from the Attun coalfield in central France have been discovered which show spinnerets as well as other characteristically primitive features of mesothele spiders, such as two pairs of book-lungs. The most primitive spiders alive today belong in this group and are found in south-east Asia. However, a spider showing even more primitive characters, *Atteropus*, has been described from older, Devonian rocks from the Catskill Mountains, New York. Known only from scraps of cuticle, the tell-tale spinneret revealed its spidery heritage.

Finally, whilst *Atteropus* is the oldest known spider, excavations a few years ago in Silurian rocks in Ludlow, Shropshire, revealed the oldest known terrestrial animals yet discovered. These included various kinds of centipedes and a trigonotarbid. Trigonotarbid are very closely related to spiders but lack spinnerets. It would not be surprising if true spiders were also to be found amongst the earliest animals to have walked on land, some 414 million years ago.

**Colour preservation in the fossil record: new tales from old snails**

Michael J. Barker  
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Actual colour pigment preservation in the fossil record is rare, although retention of degraded pigment and colour pattern can be more common locally. Pigments in modern gastropods are usually melanin or ß-trypaenes (either biliproteins or cyclic porphyrins). Preservation of colour pigment in fossils is aided by early diagenetic cements encrusting the fossil, or, in the case of neritid gastropods, having the original pigment secreted under a diagnostically stable outer shell of calcite. Late Palaeozoic, Mesozoic and Tertiary archaeogastropods with retained colour patterns have been examined. Colour patterns within the thin-shelled pleurotomariids appears not to have changed through time but they have radically changed their mode of life putatively because of the Mesozoic marine revolution and the rise of durophagous molluscivores such as callapid crabs - a case of move or become extinct. Neritid gastropods on the other hand maintained their habitat preferences (shallow marine/intertidal/brackish/freshwater). Marine neritids have thick, globular shells, often with a thick periostracum, and show colour patterns with no change through time. However, in the thin-shelled intertidal and brackish neritids it is a different story. These small gastropods have a thin transparent periostracum and the colour pigment is readily visible. They have evidently adopted a different adaptive strategy which can be documented through time. Early representatives (Late Triassic - Middle Jurassic) have simple colour patterns but subsequently the pattern becomes progressively more complex. Extant representatives such as *Neritina communis* and *Theodorus* (*Clitonia* oovalensis) have complex colour patterns and no two individuals are identical. Such is the complexity of the patterns that only computer generated programmes with a randomised element can mimic the variation. It is believed that this increase in variation is actively selected for and prevents the acquisition of predator search patterns. As such, it documents the progress of reflexive evolution and predator - prey selection pressures.
The Soom Shale: Rough Guide to the sediments and fossils

Richard J. Aldridge
Department of Geology, University of Leicester

Preservation of soft tissues of animals in the fossil record is rare and occurrences are concentrated at particular stratigraphical levels and in a restricted range of sedimentary environments. Cambrian finds, including the celebrated Burgess Shale and Chengjiang biotas, are now widespread, but there is a dearth of similar records from the succeeding Ordovician System. The recent discovery of an exceptionally preserved fossil biota from the Late Ordovician of the Cedarberg Mountains in South Africa has gone some way to filling this gap in our knowledge. The fossils come from the Soom Shale Member of the Cedarberg Formation, which outcrops widely in the mountains north of Cape Town. Exposures of the shale are rare owing to its recessive, deeply-weathered nature, but three localities have produced remarkably well-preserved fossils. The fauna includes eurypterids, brachiopods, orthoccone cephalopods, conodonts; several specimens of these fossils have soft tissues, such as musculature and gills, preserved. There are also animals entirely lacking any biomineralized skeleton, some of which are so strange that they cannot be readily accommodated in any known phylum, extant or extinct.

The Soom Shale is a black, finely laminated deposit, conformably overlying tillites laid down during the Late Ordovician glacial episode. Rare dropstones in the shale attest to continuing ice cover at times during the deposition of the shale, and the fine laminae may well represent seasonal sedimentary episodes related to the melting of ice caps. The presence of orthocones, brachiopods and conodonts in the fauna indicates that conditions were marine. Thus, as well as providing the first known 'Burgess-Shale type' Lagerstatte in the Ordovician, the Soom Shale is a unique example of soft-tissue preservation in a Palaeozoic cold-water, glaciomarine environment.

The mode of preservation of the fossils is also unusual, and perhaps unique. Geochemical analyses of both the hard and soft tissues of different types of animal show a consistent pattern of replication by colloidal clay minerals; these were probably attracted to the decaying organic matter in the anoxic, acidic bottom conditions of the Soom basin. The fidelity of this replacement is sometimes breathtaking, with subcellular ultrastructural details of muscular tissue, for example, being preserved.

Phosphatised soft tissues: wrinkles, sex and parasites

Philip R. Wilby
British Geological Survey, Keyworth

Fossil phosphatised biotas offer a unique opportunity to examine the soft tissue anatomy and ecology of ancient animals. They have provided new and exciting insights into the biology of a variety of extinct organisms including pterosaurs, dinosaurs and belemnites. Unlike many other mechanisms of exceptional fossilisation, soft tissues preserved in apatite (Ca₅[CO₃]₂PO₄)(OH,F) are relatively common and occur throughout the entire Phanerozoic. Indeed, the oldest preserved evidence of multicellular animal life, consisting of embryos in varying states of division, comes from a
Phosphatised cells from the so-called Mushia, an enigmatic animal from the Cogo Formation (Devonian), Australia. The cells are preserved three-dimensionally as internal moulds. The spaces (arrowed) between adjacent cells are their plasma membranes. Scale bar = 8 μm.

pre-Ediacaran phosphatised biota. Recent investigations, primarily of the Cretaceous Santana Formation (NE Brazil), have demonstrated that subcellular details (including cell membranes and nuclei) are routinely preserved in such faunas. Taphonomic artefacts and biases in the mineralisation process have been identified and can be distinguished from genuine anatomical features. Phosphatised soft tissues can therefore be used with some confidence in reconstructing the biology of enigmatic organisms (Fig. 1). Notable examples include a Lower Cambrian problematical Opabinia-like fossils (Briggs and Nedin 1997) and the Carboniferous conodont animal (Briggs et al. 1983). Phosphatised soft tissues have also been used in functional morphology studies. Examples include a pterosaur wing membrane (Martill herein), the tails of ichthyosaurs (Lingham, Solar and Reif, 1998), the copulatory organs of ostracodes (Batte, 1972), and the appendages of parasites (Andres 1989).

The process of phosphatisation and the controls acting on it are now relatively well understood. Decay experiments have demonstrated phosphatisation to be extremely rapid; occurring within days or weeks of the animal's death. Mineralisation is strictly tissue- and taxa-specific, and is controlled at the microscopic level by subtle variations in the chemistry of the decaying carcass. Phosphatised biotas are most commonly preserved in mudstones and slates. These sediments offered the correct redox conditions for phosphatisation, and an abundant source of phosphorus. In many cases, mineralisation appears to have been initiated by catastrophic burial, or by the overgrowth of the carcasses by an "algae mat".

REFERENCES


Soft tissues in pterosaurs

David M. Martill
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Pterosaurs, extinct flying reptiles of the Mesozoic, are exceptionally rare fossils and pterosaurs with soft tissues preserved are rarer than hen's teeth. Four sites have yielded important specimens with preserved soft tissues, including two in the Jurassic in Germany (Solnhofen and Holzmaden), Kazakhstan (Kara Tag, Jurassic) and the Ararap Basin in Brazil (Lower Cretaceous), where two distinctive horizons yield pterosaurs with soft tissues. Early studies of pterosaur flight membranes depended on material from the Solnhofen Limestone of Bavaria where high fidelity external moulds of wing membranes are preserved in micritic limestones, and on specimens from the Posidonia Shales of Holzmaden where membranes are preserved as somewhat amorphous, kerogenised material lacking detail. These early studies concluded that the pterosaur wing membrane was a

A newly discovered specimen of Pterodactylus kochi with soft tissues preserved in the region of the body, throat, back of the neck and limb. From the Upper Jurassic Solnhofen Limestone of Bavaria, Germany.
pleated structure, at least in its distal portions, that could be easily folded when the wings were not in use. Later studies, however, suggested that an internal system of so-called 'structural fibres' was present and that these were responsible for providing internal elasticity, or in some authors' opinions, for stiffening the flight membranes. The argument could not be resolved with Solnhofen fossils. In the 1970s Professor Sharov described a remarkable pterosaur from the Jurassic of Kazakhstan in which the body appeared to be covered with hair-like structures. Unwin and Bakhurina (1996) re-examined this material and hinted that the hair-like material was more likely a structural fibre released from a decomposing integument during the burial process. In 1989 Martill and Unwin described a portion of pterosaur wing from the Santana Formation of Brazil in which the wing membrane was phosphatised and showed detail of the epidermi, dermis, musculature and internal fibres. Such remarkable preservation sparked controversy. Kellner (1996) suggested that the membrane described by Martill and Unwin was not from the wing membrane but from the body.

The fossilised soft tissues have resolved some, but not all of these controversies. A model for the construction for flight membrane has emerged and the contrasting preservational styles have permitted the testing of competing models. It is clear that the flight membrane contained internal fibres. Further analysis may reveal their fine anatomy, composition and function.

REFERENCES


TOWNS AS A SANCTUARIES FOR BIRDS IN LEICESTERSHIRE: A PRELIMINARY STUDY

D. A. C. McNeil

Abstract: Using the concept of "islands" of habitats within urban and suburban areas, the tolerances of various species of bird in Leicestershire to the proximity of man were examined by comparing densities in rural habitats and urban open spaces. Eight species shunned the close proximity of man, but inhabited open spaces in reduced densities. Most of these cases could be explained by the stricter cultivation and pruning of trees in the urban area. Twelve species were shown to tolerate man, several of which have shown population crashes in recent years. It is suggested that reasons other than agricultural chemicals should be explored for explanations for these crashes.

INTRODUCTION

The idea of Island Biogeography (MacArthur et al. 1967) may be applied to the bird populations of cities and the surrounding countryside in two extreme formats. In the first, various species may find the rural surround totally hostile and are confined to built-up areas. At the other extreme, rural species may find cities and the proximity of man hostile, but may occur in the more open parkland 'islands' within city boundaries. Those species which are totally excluded from cities do not lend themselves to the analyses of this theory.

Between these two extremes lies a number of intermediate cases which are more or less tolerant of the presence of man, which should be reflected in their relative abundances in urban and rural habitats. The purpose of this paper is to compare avian population densities from studies of farmland with parks and cemeteries in Leicester and its shire in order to discover which species fit into which of the above categories.

DEFINITIONS OF HABITAT

Man inhabits essentially a grassland environment in which trees are tolerated up to a point, and bushes are either used to delineate boundaries or are tolerated as isolated decorative individuals. Thickets and woods form no large part of this environment. The habitat divisions examined in this paper are influenced by man to conform to these requirements. The main differences are in the size of the grassland plots between the shrub boundaries, and the density of decorative trees and shrubs.

The definitions are:

Farmland - grassland modified by the activities of man on an annual cycle. Shrubs and trees form boundaries, and are very low in density. McNeil (1995) showed that for avian studies these areas were statistically uniform, so more exact definitions of the type of farming activity would not be of any value. No censused areas defined by the British Trust for Ornithology as woodland or riparian were included, though such habitats do occur as a small part of some farmland areas censused.

Parks and cemeteries - smaller plots of grassland with isolated trees and shrubs, not necessarily forming boundaries, and higher in density than farmland. These plots are surrounded by gardens and/or other built-up areas. Maintenance is variable, but is usually more frequent than for farmland.

In addition to the above habitat divisions, a very limited quantity of data was available from suburban gardens. These are very small plots divided between numerous land-owners, and varied greatly in their layout and the frequency of their tending. The data came from a study in Birstall, a northern suburb of Leicester. Shrubs and trees in this area have a much higher density than is the case for the parks and cemeteries.

METHODS

Data for 11 farmland plots, 2 cemeteries and a park were taken from B.T.O common bird census returns (see McNeil 1994, 1995, 1996) and the data for gardens from Kirkman (1988). The latter source gave counts of nests discovered over a 10 year period in a discontinuous area, whilst the former gave estimates of territories in continuous areas in which breeding may not have occurred. These data are therefore not directly comparable.

Should the avian populations of the three habitat divisions outlined above be only influenced by human intrusion, it may be expected that each would be a subset of a set of "farmland birds" and with similar ranking. To test this hypothesis, a Kendall Rank Correlation was calculated between the mean figures for each division (see McNeil 1995).

The comparisons within each species between farmland and parks, were made using standardised densities. To calculate these densities data from each census were averaged over the years it was active and expressed as territories per 10 hectares. Means and standard deviations were then calculated from these averaged figures for each habitat division.

This comparison may distort
1. the contribution of those areas which were censused for only a short time compared with longer censuses
2. the effects of medium term trends in populations for the years over which the census work was carried out
3. those riparian species which have only a linear density and will be subject to a variable overestimate
4. for parks and cemeteries which were smaller than 10 hectares, those species whose home range is greater than 10 hectares will be overestimated.
An earlier study (McNeil 1994) suggests that errors 1 and 2 may not be large, whilst 3 and 4 refer only to species with low populations in the present study areas.

More serious distortions could result from the very limited data available for this study from parks. The justification for pursuing this work can therefore only be as a pointer to further researches in this area.

Differences in the densities for each species between habitat divisions were at or better than 5% significant.

RESULTS

Table 1: A Comparison of the Mean Relative Rankings for Each Species Between Habitats using Kendall’s Rank Correlation

<table>
<thead>
<tr>
<th></th>
<th>Gardens</th>
<th>Parks</th>
<th>Farmland</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.596** (21)</td>
<td></td>
<td>0.391** (26)</td>
</tr>
</tbody>
</table>

The numbers in brackets are the number of species in common used in each correlation.

All are significant at the 1% level. This suggests that for the species in common there was no fundamental difference between the three nominal habitats.

Table 2: A Summary of Occupied Habitat Divisions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All three</td>
<td>21</td>
</tr>
<tr>
<td>Gardens and Parks only</td>
<td>0</td>
</tr>
<tr>
<td>Gardens and Farmland only</td>
<td>5</td>
</tr>
<tr>
<td>Parks and Farmland only</td>
<td>8</td>
</tr>
<tr>
<td>Gardens only</td>
<td>0</td>
</tr>
<tr>
<td>Parks only</td>
<td>5</td>
</tr>
<tr>
<td>Farmland only</td>
<td>35</td>
</tr>
<tr>
<td>Total Species</td>
<td>74</td>
</tr>
</tbody>
</table>

If the habitat is compressed between divisions as suggested above, the density of a species should increase with that compression provided that it was “neutral” to the presence of man.

Where there is mild intolerance, the density in parks may be expected to be equal to or lower than that of farmland, but the species should still occur in gardens. A higher degree of intolerance will be shown if the species does not occur in gardens. In the extreme, a species should only be represented on farmland. By this argument, in no case should a species have a higher density in parks than on farmland and be absent in gardens. For those species for which this is true no generalisation can be made from this study.

Table 3: The Totals of Species with Each Tolerance.

<table>
<thead>
<tr>
<th></th>
<th>Neutral</th>
<th>Intolerant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slight</td>
<td>Mild</td>
</tr>
<tr>
<td>Division 1</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Division 2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Division 3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Division 4</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3 lists the totals for each of these requirements. The results are set out using the league tables of species for farmland drawn up by McNeil (1996).

Five species in division 4 could not be categorised by this system as they were either woodland or aquatic specialists, and only occurred in parks. Another five species occurred in both farmland and gardens, but not in parks. Of these, the swallow, jackdaw and house martin require human buildings to nest on, and could be classified as preferring the presence of man. For the wood pigeon the data are incomplete, due to its omission from early common bird census analyses. No explanation can be offered for the remaining species, the bullfinch, unless its distribution reflects the abundance of fruit trees.

The number of extremely intolerant species may be seen to increase from division 1 to division 3. As each division is based on both relative abundances and distribution on farmland, and as the 'lower' divisions represent increasing rarity, this result may have been predicted, the much larger area of agricultural land having a greater probability of hosting rarer species. It may be, therefore, that the tolerances of some species in the lower divisions are not truly represented by this analysis.

DISCUSSION

Given that the three habitat divisions represent successive increases in the densities of trees and shrubs, table 1 suggests that at least 12 species are influenced by this increase, and may therefore be classified as arboreal or scrub-loving species which tolerate both man and his activities in creating grasslands. Further, it has been shown that local climates in cities are more favourable in winter than the surrounding countryside (see, for example, Hames et al. 1957). In addition, scavenging for waste food is more favourable in urban and suburban areas. These factors would be expected to result in a higher survival rate for tolerant birds, which in turn should result in a higher proportion of available territories being occupied.

For the remaining species there is some restriction requiring a varying degree of avoidance of man and his activities. Such restrictions could be:

1. a need for more continuous stretches of hedge, and/or thickets and woods for those scrub-loving species less tolerant of the grassland regime;
2. predation and/or frequent disturbance of ground-nesting birds by man and his predatory pets;
3. a need for marshy ground and/or rivers and streams for riparian species.

The second extreme of island biogeography applies only to eight species - tree sparrow, willow warbler, carrion crow, stock dove, blackcap, tree creeper, mallard and kestrel - in Leicestershire by this analysis. Of these, the willow warbler is a grassland-nesting species, the mallard is riparian, whilst the kestrel relies on nests inherited from carrion crows in which to breed. The blackcap is a scrub-loving species. All the others nest in trees, and it may be the restrictions placed on the growth and aging processes of trees in close proximity to man which tends to exclude these species.
Recent dramatic reductions in populations of certain species have been attributed to chemical sprays, and changes in farming practices. Such changes should not affect tolerant species unless

1. there is a drain of their young away from cities as a result of overcrowding and dispersion to temporarily favourable habitat in farms

2. there is a higher mortality than may be expected in cities, which are replaced by dispersal from the countryside.

Many of the birds with declining populations are limited to agriculture - skylark, lapwing, partridge and pheasant for example. Others, such as the spotted flycatcher, swallow and song thrush are not farmland-dominant, and unless one of the mechanisms above operates on their populations, other explanations for their decline must be sought.

ACKNOWLEDGEMENTS

I would like to thank the British Trust for Ornithology for making part of this data available to me, and to acknowledge the efforts of all those people who went out in all weathers to collect it. Mr S. Grover of the Leicestershire Museums Service made encouraging remarks about an earlier draft of this paper. Lastly, I would thank Mr A. Wilson of the B.T.O. for reading it and for helpful comments.

REFERENCES


Kirkman M. 1988; Birds of Birstall, Leicestershire Museums, Art Galleries and Records Service.


Appendix

Each species is listed with their abundances (derived from their densities in pairs per 10 hectares) for each of the habitat divisions (A - farmland; P - parks and cemeteries). (G) indicates the species was also present in the garden census. 'Greater than' and 'less than' symbols indicate differences significant at the 5% level.

Data for starling, wood pigeon and house sparrow are incomplete as these species were not included in earlier B.T.O. censuses. Data for the tawny owl may be incomplete because of its nocturnal habits.

<table>
<thead>
<tr>
<th>Division 1</th>
<th>Division 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>Relative Status</td>
</tr>
<tr>
<td>Blackbird</td>
<td>(G)P&gt;A</td>
</tr>
<tr>
<td>Yellow Bunting</td>
<td>A</td>
</tr>
<tr>
<td>Chaffinch</td>
<td>(G)P=A</td>
</tr>
<tr>
<td>Skylark</td>
<td>A</td>
</tr>
<tr>
<td>Dunnock</td>
<td>(G)P&gt;A</td>
</tr>
<tr>
<td>Robin</td>
<td>(G)P=A</td>
</tr>
<tr>
<td>Blue Tit</td>
<td>(G)P=A</td>
</tr>
<tr>
<td>Wren</td>
<td>(G)P&gt;A</td>
</tr>
<tr>
<td>Tree Sparrow</td>
<td>P=A</td>
</tr>
<tr>
<td>Song Thrush</td>
<td>(G)P=A</td>
</tr>
<tr>
<td>Great Tit</td>
<td>(G)P=A</td>
</tr>
<tr>
<td>Linnet</td>
<td>(G)P=A</td>
</tr>
<tr>
<td>Carrion Crow</td>
<td>P=A</td>
</tr>
<tr>
<td>Reed Bunting</td>
<td>A</td>
</tr>
<tr>
<td>Willow Warbler</td>
<td>P=A</td>
</tr>
<tr>
<td>Starling</td>
<td>(G)P=A</td>
</tr>
<tr>
<td>Greenfinch</td>
<td>(G)P&gt;A</td>
</tr>
<tr>
<td>Whitethroat</td>
<td>A</td>
</tr>
<tr>
<td>Partridge</td>
<td>A</td>
</tr>
<tr>
<td>Moorhen</td>
<td>(G)P=A</td>
</tr>
<tr>
<td>Magpie</td>
<td>(G)P=A</td>
</tr>
<tr>
<td>Swallow</td>
<td>(G)A</td>
</tr>
<tr>
<td>Cuckoo</td>
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<table>
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<tbody>
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<td>Species</td>
<td>Relative Status</td>
</tr>
<tr>
<td>Rook</td>
<td>A</td>
</tr>
<tr>
<td>Shelduck</td>
<td>A</td>
</tr>
<tr>
<td>House Martin</td>
<td>(G)A</td>
</tr>
<tr>
<td>Green Woodpecker</td>
<td>A</td>
</tr>
<tr>
<td>Redstart</td>
<td>A</td>
</tr>
<tr>
<td>Grasshopper Warbler</td>
<td>A</td>
</tr>
<tr>
<td>Sedge Warbler</td>
<td>A</td>
</tr>
<tr>
<td>Curlew</td>
<td>A</td>
</tr>
<tr>
<td>Chiffchaff</td>
<td>A</td>
</tr>
<tr>
<td>Snipe</td>
<td>A</td>
</tr>
<tr>
<td>G S Woodpecker</td>
<td>A</td>
</tr>
<tr>
<td>Garden Warbler</td>
<td>A</td>
</tr>
<tr>
<td>Collared Dove</td>
<td>(G)P&gt;A</td>
</tr>
<tr>
<td>Corn Bunting</td>
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<tr>
<td>Sparrowhawk</td>
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<tr>
<td>Willow Tit</td>
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<tr>
<td>Canada Goose</td>
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<tr>
<td>Turtle Dove</td>
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</tr>
<tr>
<td>Hobby</td>
<td>A</td>
</tr>
<tr>
<td>Redpoll</td>
<td>(G)P&gt;A</td>
</tr>
<tr>
<td>L S Woodpecker</td>
<td>A</td>
</tr>
<tr>
<td>Jay</td>
<td>A</td>
</tr>
</tbody>
</table>

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THE OCCURRENCE OF THE "COPPER ORE" CHALCOPYRITE (CuFeS₂) IN LEICESTERSHIRE

R.J. KING

Abstract: The 200 years of history of the discovery of chalcopyrite in Leicestershire are examined chronologically. The mineralogy of the 13 known occurrences of it in the county are described under the geological chronology of the host rocks, which range in age from Precambrian to Triassic. Indication is made where typical material from each locality is lodged.

INTRODUCTION

Chalcopyrite is widespread throughout the geological column present in the county and the several technical descriptions below are examined under geological chronology. It is comparatively abundant at some localities and is often beautifully crystallized, forming most attractive aesthetic material which compares favourably with better known material from other British counties.

HISTORY

Many references to the occurrence of chalcopyrite in Leicestershire simply speak of "copper" or "copper ore", the common parlance in mining circles, without mentioning the species' name. Many often repeat previous records. There are, unfortunately, not many which provide data of any scientific value.

The oldest record found to date is that of Throsby (1790 p.428), who, when describing Earl Ferrers' seat at Staunton Harold, reported the fact that on his lordship's estate: "is got excellent lime, coals, lead, iron and copper".

Sowerby (1806 (2) p.107) gave the first useful description of chalcopyrite in the county when describing its occurrence at Staunton Harold: "Sulphuret of copper in somewhat irregular groups of crystals... of a golden hue, and almost in tetrahedrons". Phillips (1823 p.535) referred to the presence of "copper at Earl Ferrers' mines".

The first record of the occurrence of chalcopyrite at Mountsorrel was made by Phillips and Kent (1824 p.6), who spoke of: "... yellow copper ore, dispersed through the granite". Hull (1860 p.16) mentioned the occurrence of: "Copper pyrites at Dimingsdale" (sic) (= Staunton Harold). Hall, in his Mineralogist's Directory of 1868 (p.63), reported the presence of "Towamite" (= chalcopyrite) at Staunton Harold, but referred to the locality as Ashby-de-la-Zouch.

Harrison in his prolific writings twice mentioned the occurrence of chalcopyrite at Staunton Harold: once in his Sketch of the Geology of Leicestershire and Rutland, reprinted from White's History, Gazetteer, and Directory of the Counties (1877a p.16), where he spoke of "copper pyrites" at "Dimingsdale" (sic), and in a paper read before the Geologists' Association (1877b p.129), where he spoke of "copper ore" at "Dimingsdale".

Woodward (1881, p.89) published, in several parts, his Minerals of the Midlands. This essentially simple list of mineral species found up to 1881 in the English Midlands, listed "towamite" as occurring at Staunton Harold, although he was obviously quoting Hall (1868).

The first technical description of the species was that published by Binns and Harrow (1897, p.254). In this they described the presence and form of chalcopyrite as minute single crystals deposited along the edge of a calcite vein, associated with other sulphides, cutting the Eureka Rock in Netherseal Collivery, the workings of which are partly in Leicestershire. Rudler (1905 p.178) published a description of the minerals which made up the Ludlam Bequest to the Geological Survey Museum. In this he described chalcopyrite specimens from Staunton Harold, under Accession Nos. 1372 and 1376: "In some cases the copper pyrites is sprinkled over the calcite, rather recalling the association seen in certain specimens from Ecton." Fox-Strangways (1907 p.110) repeated Binns and Harrow's account of 1897, and mentioned the occurrence of "Copper pyrites... at Staunton Harold."

Fifty one years then elapsed before a new reference appeared. This was the 53rd Annual Report of the Leicester City Museum: 1958-9 (1959 p.31). In this the acquisition of Specimen No. 113'1958: "Chalcopyrite and Dolomite. Breedon Cloud Quarry, Leicestershire", was reported.

King (1959 p.25) described the occurrence of chalcopyrite at Mountsorrel, where it occurred in its Hydrothermal Stage 1 assemblage, as "bright yellow masses not exceeding 8 mm. across."

Sylvester-Bradley and King (1963 p.729) described sulphide mineralization, including chalcopyrite, and its association with hydrocarbon compounds at Staunton Harold.

In 1966, King (p.294) mentioned the association of chalcopyrite with galena and baryte in the Leicestershire Coalfield, but was merely quoting Binns and Harrow (1897). Ford (1968 p.123) also spoke of chalcopyrite in septarian nodules in the Pottery Clay Series in the Coalfield. King (1968 p.116) mentioned its occurrence in septarian nodules in Lower Lias Clay.

King and Ford (1969 p.85) reported the finding of chalcopyrite in veins in the lower level (1969) of Newhurst Quarry near Shepshed.

MINERALOGY

In the Precambrian rocks of Charnwood Forest, chalcopyrite is restricted to the intrusive diorite masses, both Northern and Southern types, where certain occurrences are quite spectacular.

1. Although not common at Sheehtedges Wood Quarry, Groby (SK 525083), several minor occurrences have been found. This quarry was noted for its chlorite-carbonate-sulphide-hematite vein systems, which characteristically strike between 320° and 335°. Whilst never strongly developed (average width: 35 mm), they
tended to be concentrated into shear zones and aligned to the major tectonic trend.

The chalcopyrite occurred as a sporadic development of small anhedral masses. Though small, they varied from minute specks to masses measuring 20 x 6 mm. across. Some masses were threaded through by a mosaic of goethite veinlets, but were generally unarmoured and possessed the characteristic brass-yellow colour (King Colln., K2266-52, Natn. Mus. Wales).

Another type occurred in the same quarry, where the mineral was seen in intimate association with chalcoite.

A minor development of chalcopyrite occurred at the southern end of Sheedhedges Wood Quarry. Here minute anhedral masses could be seen completely enclosed in a vertical vein of pyrolusite.

2. Chalcopyrite occurred in the Bluebell Wood Quarry, near Groby (SK 525085) where it was intimately associated with bornite.

3. There was a strong development of chalcopyrite in Newhurst Quarry near Shepshed (SK 488179). Here it formed one of the more important members of the hypogene system, where, in the same quarry, it had been subjected to solution and re-deposition. In the hypogene veins it occurred with bornite, and its increase in the veins was always at the expense of the bornite. It formed strings up to 13 mm thick and constituted 76% of the sulphide content of the veins. Usually it lay in a central position in the veins, but where richer, completely filled them. This was the case in 1968, where these north-westerly trending veins were cut during the westerly extension of the newlower level of the quarry. Chalcopyrite in these tight veins was anhedral, clean and bright, suggesting a high temperature hypogene source. There was no sign of oxidation (King Colln. K2845-68 and K68-5, Natn. Mus. Wales). It formed a brocaded lode on the south face of the quarry where it was accompanied by much bornite and sericite.

Both of these types of primary system were subsequently modified by oxidizing solutions beneath the Triassic unconformity. Though chalcopyrite is less vulnerable to attack than bornite and survived in the veins nearer to the source of oxidation, it was eventually completely oxidized to goethite and malachite. The veins, when rich in copper, then took on the appearance of a copper gossan. Boxwork textures developed from the early beginnings of the mosaic of goethite-malachite veinlets, until the whole sulphide was lost.

Where the primary veins cropped out on the pre-Triassic surface, they were eroded and part preserved during Lower Mercia Mudstones time, as detrital relics in the basal beds of that formation. The Leicester City Museum possesses a specimen of this type from Newhurst Quarry (accession No. 96571967-1).

Also in Newhurst Quarry there was an epigenetic supergene system, distinctly different in character and form to that of the previously described hypogene systems. This suggests it may have been the product of the modification of the hypogene systems within the Triassic ground-water circulation, probably during Lower Mercia Mudstones time and later. It took the form of infillings of low points on the Precambrian topography, and in open joints. The age of filling of the latter in relation to the hypogene veins could readily be seen. These vein-like bodies followed the master-joint system of the diorite. Where they intersected the hypogene veins, the latter were strongly oxidized within a limited area around the intersection (Fig. 1). The mineralogical content of these supergene veins was quite characteristic. They were invariably lined by coarsely crystalline or concentric white to buff-coloured dolomite, and the central void filled by Charnian debris, red clay from the overlying Trias, and much copper mineralization. Nearly all of the latter was carbonate, but, embedded in the malachite and goethite-rich clay, there were nodular or botryoidal masses of chalcopyrite, closely resembling the so-called "blister copper" of the Cornish mines. These roughly spherical masses attained the maximum diameter of 60 mm. Unlike their Cornish counterparts, the Newhurst "blisters" were not smooth surfaced, and upon examination were seen to be roughly crystallized. The heavy, and difficult-to-remove ferric encrustation, prevented any interpretation of symmetry. Broken portions show that the chalcopyrite was massive, uncleaved and variably cut by goethite and malachite veinlets (King Colln. K2846-68. Natn. Mus. Wales).

It would be intriguing to know whether investigation below the present lower level of the New Cliff Hill Quarry, near Markfield, below the Triassic unconformity, which recently yielded the exotic copper-silver supergene assembly would produce comparable epigenetic vein systems to that of Newhurst Quarry. Information, recently to hand, suggests that this is highly likely. A strongly oxidized specimen of chalcopyrite found at New Cliff Hill Quarry, partially enriched by chalcoite and bornite, could represent a profile of primary chalcopyrite under secondary enrichment at the depth of a former water table, subsequently under a higher regime of oxidation (Personal information - Mr. Neil Hubbard).

4. As described by King (1959, p.25) chalcopyrite was relatively abundant at Mountsorrel, where it was associated with minerals of granitic hydrothermal origin. Since 1959, better material was found, some of it greatly exceeding the size limit quoted by King. All the new material originated in the same area, namely the northeastern side of the main quarry at Mountsorrel (SK 579149). Its most common associate was pyrite which was usually crystallized, whereas the chalcopyrite, as expected, was always anhedral. (King Colln. K 2627, K 3108 and K 48MS68. Natn. Mus. Wales).

5. Chalcopyrite has been found in Croft Quarry (SP 513964), as minute (c.1.4 mm) single tetrahedral crystals sparingly dispersed on an early generation of malachite, associated with similarly sized crystals of marcasite. The majority of the occurrence was on No. 8 level. Many crystals show varying degrees of oxidation, and may then be confused with similarly oxidized marcasite.

6. All the inliers of Dinantian limestone in Leicestershire and South Derbyshire have been hosts to copper mineralization. In Leicestershire the one most notable is that of Cloud Hill, one mile south of Breedon on the Hill (SK 413214). Here red beds of the Bromsgrove Sandstone Formation of the Middle Trias lie unconformably on highly distorted white limestone. On the pre-Triassic erosional surface of the limestone and in open joints below it, strong lead and copper mineralization, preceded by flows of magnesium-rich brines, has precipitated a striking mineral association, largely in a medium of decalcified limestone now largely yellow dolomite "sand". The oldest of the base metal sulphides to be deposited was galena. This formed masses, weighing up to 29.2 kg., though they were usually much less, the average being 1.42 kg. Coating these galena masses, a film of chalcopyrite, sometimes as thick as 4.6 mm. thick, was next deposited. Further below the unconformity, chalcopyrite was deposited alone in the form of ball-like masses. These aggregated at depth to form veins, all within a halo of strongly dolomitized limestone. In this latter situation the chalcopyrite was occasionally crystallized. Large tetrahedra up to 15 mm. across, or aggregates
of the same have been observed. In all these mineralogical possibilities the chalcopyrite was heavily oxidized. Nowhere in the quarry does the chalcopyrite mineralization extend below the zone of oxidation. In the near-surface deposits, where chalcopyrite had formed shells round the nodules of galena, the chalcopyrite was usually completely oxidized to goethite, malachite and sometimes wires of native copper and cuprite. Further down the oxidation zone the effects were less, and relics of chalcopyrite remained, the quantity being in proportion to the size of the original mass.

In some cases, malachite was dominant over goethite, and very attractive specimens of this type could be found. The malachite was spheroidal and of a fine dark-green colour providing a strong contrast to the relic chalcopyrite. Where oxidation had completed the breakdown process, layered masses of goethite, often in highly vitreous sheets, with interleaved thin films of malachite, were the end product. Elsewhere, as black sooty films was associated with it (King Colln. K 2683-64 and K 62BC9. Natn. Mus. Wales).

7. The occurrence of chalcopyrite in Earl Ferrers' mines at Staunton Harold (SK 3772177) (King, 1990 p.39) is a famous one and well documented, although technical data is sparse.

When careful study is made of the many fine specimens preserved in the museums and private collections of this country, it soon becomes apparent that the paragenetic history of the mineralization of this very old mine is highly complex.

At Staunton Harold chalcopyrite is always the youngest of the species present, and is dispersed on the surfaces of the older members of the paragenetic sequence, though it seems to have a marked preference for first generation calcite. This holds good for every part of the little mining field. A study of the contents of the shaft dumps lying between the site of the laundry and Staunton Harold Hall commenced in 1947 also showed the same universal late arrival of chalcopyrite. Unfortunately the ore bodies were rich in metastable pyrite and marcasite, the breakdown of which has produced highly acid conditions in the dumps and greatly reduced the chances of finding sulphides in them. Because of this it is a matter of luck whether or not a block may be found large enough to protect the mineral assemblage in its interior from the effects of oxidation.

Without exception Staunton Harold chalcopyrite takes the form of well developed single or twinned tetrahedral crystals, implying a low temperature mechanism. No vein structures or ameboidal masses have been observed. The single crystals are small with an average size of 0.8 mm, though crystals up to 1.7 mm have been measured. Forms present include: (112), usually heavily striated; a poor development of (112), and rarely (011) and (001). Malformation and elongation of (112) is quite common. Twinned aggregates of crystals are also very common, and, on certain specimens examined, are ubiquitous, making up as much as 80% of the chalcopyrite present. Twinning is often complicated, both contact and interpenetration being present. Staunton Harold chalcopyrite is noted for its lack of tarnish and the brilliance of its lustre. When the mines were in operation, and even during the 1939 opening, specimens were extracted and dispersed amongst the collectors. It is suspected that their Lordships gained more financially from the sale of cabinet specimens than from the sale of ore. Fine specimens are available for study in several institutions. In the collections of the Leicester City Museum there is a specimen accessioned under No. 356/1954. The Natural History Museum, London, possesses a number of very fine specimens from Staunton Harold, which include: B.M. 58979-*Ashby, Leicestershire, Rgdt. 1883*; B.M. 90468-*Ashby-de-la-Zouch, Leicestershire. Allan-Greg Coll. Bought 1860*; B.M. 1911,551-*Ashby-de-la-Zouch, Leicesters. Geol. Soc. Colln. Presented 1911.* The chalcopyrite on this last specimen shows a rare bright green iridescence; B.M. 1911, 552-*Lord Ferrers' Lime Works, Ashby-de-la-Zouch, Leicesters. Geol. Soc. Colln. Presented 1911.* The specimen label reads: "Lord Ferrers' Limeworks, Staffordshire"; B.M. 1957, 805-*Staunton Harold, Ticknall near Ashby-de-la-Zouch, Leicesters. Ex. Thomas Kingsbury Collection" which is perhaps the most attractive specimen of the whole collection; B.M. 1958, 263-*Staunton Harold, Ticknall, nr. Ashby-de-la-Zouch, Leicesters. Thomas Kingsbury Collection; 3967 "Lord Ferrers' Mine, Staunton Harold, Ashby-de-la-Zouch, Leicesters." The Russell label is of great interest and is worth quoting: "From the old workings reopened by Lord Ferrers in 1939. Collected by A. Russell March 1, 1940."

The Natural History Museum also possesses a suite of specimens, formerly the property of the former Institute of Geological Sciences. They include 12353-*"Lord Ferrers' mine, nr. Ashby-de-la-Zouch. Presd. by C.B. Greenough (Early 1900's).*; 12354-*same locality and donor; 13033-5 -*Three specimens all labelled, "Staunton Harold, Ashby-de-la-Zouch, Leicestershire"; 16404-7 - Four specimens all labelled: "Ashby, Leicestershire. Ex. Ludlam Collection.* Of these four, specimen No. 16404, is on display, and shows a fine development of chalcopyrite; 1522-*Ashby, Leicestershire. Ex. Neville Collin.*

The City Museum of Sheffield also has a fine collection of specimens from Staunton Harold, the majority of which show chalcopyrite. Six of the twelve specimens examined are not accurately located, but are so similar to those still bearing labels, that their assignment to this locality is probably correct. Specimen 187- *Calcite (CaCO₃), Selenohedra - on Barytes (BaSO₄)."
Leicestershire. Presid. by Sheffield Lit. & Phil. Soc., is an important one, as it shows undoubted evidence of two generations of chalcopyrite deposition. The first generation has developed small crystals, which are often twinned while the second generation crystals are much larger, and usually single. The following numbers in the Sheffield collection also carry well crystallized chalcopyrite: 1971.581, 582 and 584. (See also: King Collection K1230-55, K2251, and K2399-47 Natn. Mus. Wales).

8. Not unexpectedly chalcopyrite has been found in the Leicestershire and South Derbyshire Coal Field, usually connected with the mineralization of septarian nodules. In 1955-6 an opencast coal site was opened on the Roaster Coal near Heath End at SK 3521. Bands of sideritic septarian nodules occurred above this coal. The large majority, though never greater than 112 mm. in diameter, were well mineralized. The paragenetic sequence of this mineralization was: Siderite-pyrite-kaolinite-barite-chalcopyrite. The latter was dispersed upon the older generation minerals in the form of minute (average 0.2 mm.) isolated tetrahedra, all strongly striated and iridescent. (King Colln. K56.018, 20, 22-3, Natn. Mus. Wales).

9. Prior to the abandonment of the Merry Lees Drifts, near Desford (SK 46850586), a collecting visit was organized (26/11169) in an attempt to salvage anything of geological value. In the course of construction of the twin drifts "windows" were left open in the concrete linings of the adits for the benefit of future visiting geologists (Butterley and Mitchell 1946). In "No. 16 Window-Coal Measures", southwest of the exposed Thringlestone Fault, here 34.8 m. wide) crushed Coal Measures shale was exposed. This was threaded through by a ramifications of sulphide-bearing ferroan-calcite veins. Chalcopyrite was present as minute (max. 0.23 mm.) single and twinned tetrahedra, completely embedded in the carbonate.

Chalcopyrite was rare in the adjoining Desford Colliery, but the Leicestershire City Museum collections possess two specimens which carry minor amounts of chalcopyrite on them. The first, Accession No. 6036, is labelled, "Calcite and Marcasite. Desford Colliery, Desford Coal Co." The specimen is composed principally of calcite, with a minor development of pyrite but, completely enclosed within the calcite, there is in places a strong concentration of chalcopyrite. The second specimen takes the form of a very fine septarian nodule, the internal voids of which are lined with beautifully crystallized siderite. Sparingly sprinkled upon the surfaces of these crystals are minute but perfect highly lustrous chalcopyrite tetrahedra. Its accession No. is 258/1959b.

10. Higher up the Coal Measures succession, chalcopyrite occurred in the clay pit worked by Messrs. Ellistown Pipes Ltd., at Albert Village (SK 301177). In the lower southwestern end of the pit, the Overseal Marine Band was exposed, 1.2 m. above the Derby Coal in the Pottery Clay Series of the Middle Coal Measures. Enormous septarian nodules lie within the marine band at this locality some of which attained the diameter of 1.3 m. and up to 420 mm. in thickness. These pale grey siderite mudstones were very hard and tough and broken open only with difficulty. They were nevertheless, rewarding once opened, being heavily septarianized, so much so that the centres appeared brecciated. Voige along the septs were lined by beautifully crystallized siderite, Sprinkled on the surface of the siderite were very small but brilliant single and twinned chalcopyrite crystals up to 1.2 mm. in length. The common form was: {112}, but {112} was important. Any malformation of the crystals was usually on the latter form. An additional point of interest concerned the large nodules themselves. When broken open, quite large quantities of concentrated brine poured out, a fact noted by Mannattt (1834, p.71). (King Colln. K69-120. Natn. Mus. Wales).

The Leicestershire City Museum possesses a specimen, accessioned under No. 1885 - and labelled: "Chalcopyrite (and Fish Coprolite in Clay Ironstone), Enson's Clay Boring, Moira, Leicestershire. Presid. by Mr. W.S. Gresley, F.G.S." The specimen is part of a septarian nodule, nucleated by a phosphatic coprolite. The septa walls are lined by crystallized siderite and, dispersed on the latter, are minute tetrahedra (max. 0.31 mm.) of heavily tarnished chalcopyrite, The actual position in the geological column must remain unknown.

ACKNOWLEDGEMENTS

The writer acknowledges with grateful thanks the access freely given by land owners and quarry managers to sites under their ownership or management. He is grateful to Mr. Neil Hubbard for kindly supplying valuable up-to-date mineralogical information, and to Dr. T.D. Ford for his critical reading of the manuscript.

REFERENCES

Hull, E. 1800 On the geology of Leicestershire Coalfield and the country round Ashby-de-la-Zouch. Mem. Geol. Surv. U.K.
Mannatt, E. 1834 A collection of geological facts and practical observations, intended to elucidate the formation of the Ashby Coal-field, in the parish of Ashby-de-la-Zouch and the neighbouring district; being the result of forty years experience and research. Ashby-de-la-Zouch and London, 102 pp.
Stow, J. 1804-1817 British Mineralogy. 3 Vols. London.

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ANNUAL REPORT AND PROGRAMME FOR
THE 156TH SESSION
1997 - 1998

PRESIDENT'S REPORT

In keeping with the tradition on annual reports by my predecessors, I intend to be brief and confine my thoughts to the key theme of the year, and to offer my sincere thanks for support to a number of people.

The significant issue of the year has been the renewal of the crucial relationship between the Leicester Museum and the Society. The Society's Council was keen to re-establish links with the Museum and Leisure Services and we are particularly fortunate in having Sarah Levitt as the new Director of Arts and Leisure, and John Martin as the Curator of the New Walk Museum as our points of contact. A strong rapport was evident at our first meeting and an alignment of thinking on key issues quickly developed. This fusion will be reinforced next session when we shall be privileged to have John Martin as our new President.

I would like now to move from politics to human relations. Each President requires the tolerance of Council and its support in dealing with both broad and detailed matters. I have been blessed with very positive support, specifically by the Vice Presidents, Dr Trevor Ford, Professor John Holloway, The Ven. Hughie Jones, O.K. Smyth and John Higginbottom.

The role of Hilary and Geoff Lewis is a pivotal one. The quality of the programme of lectures is the key to maintaining our level of membership. Once again this year we have had a superb programme. I am now fully aware of the intense energy and commitment involved, and I offer them my sincere thanks.

A person I shall miss having contact with is our remarkable Hon. Secretary, Joan Staples. Her phone calls with concise messages were a feature before our regular Council meetings. Joan's humorous and lucid approach has been a delight to me.

I would like to thank our Hon. Treasurer, David Beeson, who not only operates conscientiously in this role, but with his wife is the team behind the social scene, helping with the post-lecture refreshments.

Our Membership Secretary, Mrs Silver, who greets us on arrival and monitors all aspects of membership, is another person I wish to thank for tremendous commitment.

There are two other members I would also like to thank: David Kenney for carving the special lectern attachment, and Jean Humphreys whose encouragement at an early stage of my office was particularly appreciated.

Without our sponsors the Society would be in financial trouble. I would therefore like to extend our thanks to them: Dillons Bookshop, the University of Leicester Bookshop, De Montfort University, the Royal Society of Chemistry, the Leicester Mercury, and the Geology and Natural History Sections. John Holloway has been instrumental in setting up a day-time lecture for children during the Christmas holidays, also sponsored by the Leicester Mercury.

Finally, I would like to thank the members of staff of the Museum and Art Gallery for providing the back-up for our lectures and for carrying out their duties with efficiency and charm.

When I hand over to my successor, John Martin, in October, I shall feel confident that our Society is in a very healthy and lively mode, thanks to the continuing positive support of our membership and of the people identified in my report.

Grant Pitches, President. April 1998
PROGRAMME DURING THE 1997-1998 SEASON


October 20th 1997 LIFE, TIMES AND LEGACY OF MARY ANNING (1799-1847). Dr Hugh Torrens, Keele University. Joint lecture with the Geology Section.


November 17th 1997 WORLD PROJECTS. Dr K.O. Shuttleworth, Foster & Partners. Sponsored by De Montfort University.

December 8th 1997 THE EXECUTOR OVER YOUR SHOULDER: LITERARY BIOGRAPHY AND OWNERSHIP. Professor Martin Stannard, University of Leicester.


January 26th 1998 OZONE HOLES - FACT OR FICTION? Dr P.S. Monks, Chemistry Department, University of Leicester. Sponsored by the Royal Society of Chemistry.


February 23rd 1998 CHINA IN HOGARTH'S ENGLAND. Lars Tharp, Ceramics specialist. Sponsored by Dillons Bookshop.

March 9th 1998 PUZZLES IN 19th & 20th CENTURY LITERATURE. Professor John Sutherland, University College, London.

March 23rd 1998 THE ILLUSTRATED MAN - THE ART OF TATTOOING. Dr D.A. Burns, Consultant Dermatologist, Leicester Royal Infirmary.


SUMMER EXCURSIONS 1997

May 3rd GRIFF AND JUDKINS QUARRIES, NUNEATON. Leader John Crossington.

June 26th IVES HEAD, Leader Dr Helen Boynton.

August 24th THE OXFORD CLAY OF THE PETERBOROUGH AREA. Leader Alan Dawn.

September 7th THE LOWER LIAS OF THE NORTHcot BRICK PIT, BLOCKLEY. Leader Peter Blake.

September 21st SEDGWICK MUSEUM, CAMBRIDGE.

WINTER PROGRAMME 1997-1998

October 8th THE NEW BRITISH GOLD RUSH - FACT OR FICTION. Tim Colman, British Geological Survey.

October 20th LIFE, TIMES AND LEGACY OF MARY ANNING (1799-1847). Dr Hugh Torrens, Keele University.

October 22nd THE LIFE STYLE OF NAUTILUS - A WINDOW ON THE PAST. Dr M.J. Wells, University of Cambridge. (Joint meeting with the East Midlands Group of the Geological Society).


November 19th INSECTS IN AMBER. Andrew Ross, Natural History Museum, London.

December 3rd TRIALS AND TRIBULATIONS - COLLECTING ON THE ISLE OF WIGHT. Steve Hutt, Isle of Wight Museum.

December 17th. Christmas Social.

January 14th HISTORY AND FUNCTIONS OF MINERAL COLLECTING. Monica Price, Oxford University Museum.

January 28th LARGE EXPLOSIVE ERUPTIONS AND THEIR HAZARDS. Mike Branney, Geology Dept., University of Leicester.

February 11th Members' evening.

February 25th THE AGE OF THE EARTH. Professor Andrew Saunders, Geology Dept., University of Leicester.

March 7th FABULOUS FOSSILS - EXAMPLES OF EXCEPTIONAL PRESERVATION. Saturday School at Vaughan College.

March 11th EVIDENCE AND CAUSE OF GENERAL SIZE REDUCTION IN BATHONIAN (Middle Jurassic) MARINE BIVALVES OF EUROPE. Dr Andy Johnson, University of Derby.

March 25th A.G.M. and Chairman's Address on THE LEICESTERSHIRE LANDSCAPE by John Martin.
ANNUAL REPORT OF THE NATURAL HISTORY SECTION 1997

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P. Tyler

WINTER MEETINGS

January 8th. UPDATE ON THE NATIONAL FOREST. Audrey Brown

January 22nd. BRITAIN'S WILD ORCHIDS. Joe Zorzi

February 5th. CLIMATE CHANGE, HUMAN IMPACT AND THE BRITISH INSECT FAUNA. Dr Paul Buckland

February 19th. FLOWERS OF THE BRITISH COASTLINE. Eric Webster

March 5th. THE ECOLOGY OF HARES. Dr Stephen Tapper

March 11th. (Joint Meeting with the Parent Body): CHIMPANZEE - THE LIVING LINK BETWEEN MAN AND BEASTS. Dr Jane Goodall

April 9th. A.G.M., Quiz and Social Evening.

SUMMER PROGRAMME

April 26th. WILLESLEY SITE. Ian Retson

May 11th. EXCURSION TO THE DERBYSHIRE DALES. Phil Lucas

May 31st. PASTURE AND ASPLIN WOODS. Michael Jeeves

June 18th. BATS OF CHARNWOOD LODGE. Jenny Harris

June 21st. MOUNTSORREL COMMON. Peter Gamble

June 29th. DEVIL'S DITCH AND CAMBRIDGE BOTANIC GARDENS. Eric Webster

July 5th. SEATON MEADOWS. G. and L. Worrall

July 12th. EATON AND STAthERN. Mick Stanley

July 26th. WILLESLEY SITE - MOTH TRAPPING. Harry Ball

July 30th. LODDINGTON ESTATE. Karen Blake

August 16th. BRANDON MARSH. Warks. Trust

August 30th. MARKET BOSWORTH PARK. Glyn Crownman

Sept. 13th. VOLCANOES IN THE SEA - GEOLOGY, Bradgate Park. John Martin

Oct 11th. WARDLEY WOOD - FUNGUS FORAY. Richard Iliffe

WINTER MEETINGS

October 29th. THE NATURE OF TOWNS. Peter Shirley

November 12th. BIRDS OF CHARNWOOD. Mike Webster

November 26th. DO MOSSES REALLY DESERVE WEED-KILLERS? Dr. M. Newton

December 10th. LEICESTERSHIRE DRAGONFLIES. Steve Grover

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founded in 1835

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