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including some classic poems, are reproduced in large decorative script above each environmental setting, conveying something of the inspirational side of natural history. The display is housed in the oldest part of the museum building, which dates from 1870, and it is a credit to the Designers that this modern display blends so well with the Victorian architecture.

The displays are complemented by a small visitors' study room, with reference books, leaflets and children's work-sheets. A further section, incorporating a hands-on discovery bench and temporary-exhibition facility is to be added soon.

Although I said earlier that I simplified things there is, after all, so much in the gallery, that one tour is not enough to take it all in. But this just is as I want it - hoping to encourage repeated visits! However, the main purpose of the displays is to stimulate the visitors to explore the real Derbyshire, or at least to open their eyes to what is in their own localities. It is not a substitute for the actual countryside or urban environment. My motto is 'get them in to get them out'. I also hope that the gallery will help people to realise that all of us have a role to play in conserving our wildlife in the face of what often seem overwhelming destructive forces. If it sparks off such an awareness, even among a fraction of our visitors, then I will feel that all our efforts have been worthwhile.

A Task of Dinosaur Proportions
Collecting, Conserving and Exhibiting the "Rutland Dinosaur"

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In 1965, Leicester City Museum had on its staff two geologists and four biologists. When the Manager of Great Casterton clay pit telephoned to say he thought one of his staff had found a dinosaur, it was Ian Evans –

Keeper of Biology at the time and the person he happened to know – that he asked for. The museum's Landrover and trailer were despatched to collect the five tonnes of rock that had already been excavated and put to one side. Five tonnes of potential dinosaur, but no geological data.

This is the story of how Leicester's Cetiosaurus was recovered from this fairly inauspicious beginning.

Cetiosaurus was a sauropod dinosaur. It was a Middle Jurassic genus, known from fossils found in Buckinghamshire, Oxfordshire and Northamptonshire as well as in Rutland, and it was one of the animals described by Richard Owen in the "Report on British Fossil Reptiles" (1842) that introduced the term 'dinosaur' to the world. Owen thought Cetiosaurus was a giant crocodile, so it does not qualify as one of the first dinosaurs named, but the genus was eventually restored to its rightful place in the canon of British dinosaurs (Phillips 1871).

The Williamson Cliff brickworks had, and has, its own quarry. The clay, used for making bricks and other more specialised products, is part of the middle Jurassic Rutland Formation (Bradshaw 1978), the beds previously known as the Upper Estuarine Series (Judd 1875). These are mainly cream, buff and multi-coloured clays and silts with rootlets, all interpreted as freshwater or lagoonal deposits. In Rutland, they usually rest upon a weathered surface of the Lincolnshire Limestone Formation – a surface that appears to have been weathered sub-aerially to produce a karstic landscape in a subtropical environment. In some places, however, there are deep, steep-sided hollows in the top of the Limestone and these are full of black clay; presumably, these hollows were ponds in Jurassic time. The dinosaur skeleton came from one of these pond clays. A contemporary photograph shows the digger driver who found the fossil and who reported its discovery to the quarry manager. One or both of these people happened to be amateur fossil collectors, and this is where the good luck began. Most of the skeleton was preserved in nodules of ironstone (clay-siderite/hematite nodules) at the bottom of one of the black pond clays. The nodules must have looked entirely nondescript, except for a few bits of weathered bone protruding from their sides, and indeed the clay was only being excavated because emptying the clay-filled hollow would cre-

ate a sump to drain the quarry. It was a combination of the digger driver's keen eye and the small-scale mechanisation of the quarrying operation at the time (and for this particular sump-digging job) that ensured that the fossiliferous nodules were collected, an occurrence of extreme rarity in modern quarrying.

After the call to Leicester Museum, the Landrover and trailer were despatched within a few days. Meanwhile the quarry operation continued, and the ironstone nodules were helpfully removed from the clay and heaped at the side of the quarry. This made collection and loading onto the trailer easy but of course, destroyed the geological context of the skeleton – its position, the relationship of the various elements to one another, and the nature of the surrounding clay. It was not until 1976 that M. Bradshaw (*pers com*) visited the quarry as part of his Doctoral thesis fieldwork, and the stratigraphy and sedimentology of Williamson Cliff quarry were recorded. More recently, I and others (R.G. Clements and G.A. Weightman, unpublished site recording for RIGS listing) have revisited the quarry, identified the approximate find-site and recorded and re-interpreted similar lithological sequences elsewhere in the quarry. The actual find-site is now restored and built over.

The bulk of the collected material – perhaps 5 tonnes of matrix - was first placed in an off-site store. This was to be a big job, and it is not completely finished even now after 33 years!

In 1965-68, a few nodules were worked on, and about six neck vertebrae were prepared. This work was done by M.D. Jones, then Assistant Keeper of Geology. In 1968, Jack McIntosh, a sauropod expert and associate of the Carnegie Museum of Natural History, Pittsburgh, visited Leicester to assist with identification of the newly prepared bones. The find was published as Cetiosaurus (Jones 1970). After this, however, other work intervened; staff changed, and the famous fossil was more or less forgotten. However in 1980 new staff (the writer and J.A. Cooper) 'rediscovered' the material when a museum open evening with a Victorian theme required fossil material to be prepared using traditional hammer and chisel methods. After that evening, preparation began in earnest, for we had realised what an important specimen we had.

As noted above, the fossil bones were mostly preserved in clay-siderite/hematite nodules, although a few were clear of mineralised concretions and could be prepared by simple removal of the black clay matrix. The original bones were also heavily mineralised, mostly by iron oxides; the details of bone histology and structure were beautifully preserved but the fossils were often very delicate and softer than the matrix, so preparation had to be by painstaking mechanical methods. The equipment used included large, medium and small airpens (ARO, Pisani and Desoutter), electric vibrotools, airbrasive techniques (various abrasive powders), hammer and chisel, needles and scalpels. Consolidant (Butvar B-98 - polyvinyl butyral, in isopropyl alcohol (propanol)), was applied at every stage of the preparation process, and repairs were carried out using HMG adhesive or a thick solution of Butvar.

Sometimes, although the fossil bone was missing because of weathering or collection damage, the form survived as a natural mould in the rock matrix; this was used to cast the missing element, using dental casting plaster. Where symmetry or morphological interpolation allowed it, missing sections of individual bones were modelled, again using plaster; these sections were distinguished from original fossil bone by the finishing paint colour applied. The whole job of preparation, including description, illustration, photography and documentation, extended over 4 years, and was carried out by museum staff (principally the author and J.A. Cooper) and volunteers. Ultimately, a partial skeleton (albeit the most complete British Jurassic sauropod to date) was produced. It included most of the 14 cervical vertebrae and ten dorsal vertebrae, elements of the sacrum and 14 caudal vertebrae, together with ribs, parts of the pelvic girdle and fragments of the limb bones.

For the planned display, the missing elements of the skeleton were modelled on the equivalent bones in other specimens of Cetiosaurus, for example in Oxford and Stroud. Where the elements are still unknown for the genus Cetiosaurus, the replicas were based on other sauropods in the family Cetiosauridae, or even on sauropods generally, in North and South America, North Africa and China. Research on the comparative anatomy and taxonomy of the Leicester specimen gave welcome opportunities for

visits to the leading museums worldwide with sauropod collections, and helped raise the international profile of Leicester Museums. The replicas were sculpted using fire-retardant polystyrene foam (obtained in blocks up to $2m^3$) and given a skin of plaster, both materials chosen for their cheapness and low weight. In the final display mount some skeletal elements present in the fossil, including ribs, limb bones and tail vertebrae that were either too heavy or too delicate for mounting in the gallery were also replicated.

The mounting method was cheap – by necessity – and innovative. Traditionally, dinosaur skeletons have been displayed using a steel frame onto which the bones were threaded or mounted. The frame had to be preconstructed, as far as possible, to fit the expected shape of the skeleton. The result was often a skeleton in an anatomically impossible pose, with disarticulated joints. The 'Leicester method' suspends individual elements in loops of stainless steel welding wire; where the wire passes against the fossil bone, polythene tube is used to protect the specimen, and the wires are hung from a ceiling-mounted steel (1cm spacing) mesh. Cable clips and crimps permit adjustment and fixing of the wires at ceiling height. Apart from cheapness (the primary consideration) and speed, the method has a serendipitous extra advantage: it is possible, for the first time with display of an articulated original dinosaur skeleton, to ensure the anatomical accuracy of bone-to-bone relationships as the skeleton is built up. The hind limbs determine the position of the sacrum, from which point the natural curvature of the vertebral column – joints in neutral position, or within their limits of up, down and sideways flexure – is determined by observation.

As a result of our experience with the mounting method, I was surprised to discover how many traditional dinosaur mounts, and for that matter artists' life reconstructions of dinosaurs in exhibitions and books, featured impossible poses and disarticulated skeletons. Ultimately, the completeness and quality of preservation of the Leicester Cetiosaurus vertebral column and our stumbling into the 'Leicester method' gave rise to an interest in biomechanics, anatomy and physiology that developed into a mini 'school' of vertebrate palaeozoology. Its members are to be found in America, Germany, France and Australia as well as in Leicester itself. The aim is to

produce reconstructions of dinosaurs and other extinct archosaurs based on study of available fossil evidence, rather than on hypothesis.

After more than thirty years, Cetiosaurus is still not finished. Although a cluster of research papers have been published (e.g. Martin *et. al.* 1998), and the anatomical description of the Leicester specimen and a review of the genus Cetiosaurus are ready for submission, there are still inaccuracies in some of the replica elements and we are concerned about signs of environmentally-induced problems with both original fossil material and the plaster and polystyrene replicas. In any case, we should now probably be thinking of casting the whole skeleton in resin for display so that the originals can be returned to the store – although that would put Leicester in the same position as most other 'dinosaur museums', no longer showing visitors the real objects in their care. The question is: should a provincial museum, like Leicester, attempt a project this ambitious? My answer is: of course, we should do it. First, because the necessary research is a vital part of our business, whose product and unique selling point is expertise. Original research on local specimens of international importance makes exhibitions up-to-date and authoritative, and makes museums places of which local citizens can be proud. Secondly, because we need the publicity – even of appearing on 'Blue Peter' – and the increase in visitor numbers it brings.

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Rebuilding Mr. Swales' plesiosaur.

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This is the story of the reconstruction, research and display of a relatively complete skeleton of the Middle Jurassic plesiosaur *Muraenosaurus leedsii*. It demonstrates the kind of results that can be obtained from apparently uninspiring beginnings.

Plesiosaurs are a group of extinct, secondarily aquatic reptiles that were a significant component of the marine fauna in the Mesozoic Era between 200 and 65 million years ago. The Oxford Clay Formation of the Peterborough area has been recognised since the end of the last century for the exceptional preservation and completeness of its vertebrate fauna (Leeds, 1956). Alfred Nicholson Leeds (1847-1917) of Eyebury near Peterborough assembled a well known collection of reptiles and fish, the majority of which is now in the Natural History Museum, London.

Specimen History

The specimen in question (LEICT G18.1996) was presented to the Leicester Town Museum in 1902 by Mr R. Swales, a shopkeeper from Peterborough. Swales had been donating fossils from the Oxford Clay and overlying Pleistocene deposits of the Peterborough area to the museum since 1896. It is worth noting that Swales was collecting at the same time as A. N. Leeds. The specimen was presented as a series of 89 lots, for example, accession 125/1902 is given as fragments of the skull, and the locality was given as "Oxford Clay, Peterborough".

There is no evidence of any previous work on the specimen such as old

glue or mends, or that the specimen has previously been on display. It is possible that it was displayed in the "open storage" style palaeontology gallery known to exist at the beginning of this century.

The project

This project began in December 1995, when Arthur Cruickshank, our Honorary Research Associate, assigned volunteer Richard Forrest to the task of reassembling the specimen. Richard wanted to learn about plesiosaur anatomy, and the best way to do that is through hands on experience. My own direct involvement started in January 1997, when Richard had other commitments, which curtailed his volunteering to a large extent.

By 1995, the specimen was in some 3000 pieces spread over a number of drawers in the geology store. All old labels from the drawers were retained and are now in the specimen's history file. The numbering system originally used on the specimen was rejected for two reasons. Firstly, it was impossible to say exactly which lot each piece would have originally belonged under, Secondly, the numbering system in use between 1902 and 1907 resulted in 35 parallel runs of accession numbers, one for each subsection of the museum's collections (Sizer, 1962). Codes, in this case Xw, were later assigned in order to differentiate the separate runs. All objects from this period need to be renumbered to bring them into line with the format used for the rest of the collections and the computerised documentation system. The specimen, previously known as 125-213Xw'02, is now G18.1996.

The elements of the skeleton were reassembled using HMG Paraloid B72 tube glue so all joints could be reversed with acetone if needed. The bone was in good condition, and so no consolidation was needed. Structural support was provided where needed with lengths of narrow dowel (actually sticks from cotton swabs) that were attached with Paraloid. Sand trays were used to support joints as the glue set.

Reconstructing the scene

As work progressed, it emerged that the specimen was remarkably complete, and the decision was made to display it for Science, Engineering and Technology Week (SET[7]) in March 1997. As we had a reasonably com-