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This paper describes the in situ *conservation of a wall-mounted vertical display of large Jurassic fossil marine reptiles, or Saurians, at Whitby Museum in North Yorkshire. The project commenced in September 1994 with a survey; the subsequent report contained an eight point plan to conserve the specimens and improve collection care and presentation. After funds were raised, five complete ichthyosaurs, one complete plesiosaur, one complete teleosaur (or crocodile), six partial marine reptile specimens, and two sets of dinosaur footprints were treated. Conservation problems addressed were the removal of a badly degraded surface consolidant, treatment of pyrite decay, and remounting of loose sections of specimens where original mounts dating from the mid-nineteenth century had failed. Working* in situ *in a vertical plane meant that bench techniques had to be specially adapted and a temporary laboratory had to be constructed within the museum. The project was initiated from a base 380 kilometres away so all equipment and materials were transported to the site. Conservation was carried out by a team of conservators in three phases over three years and was completed in May 1997. The project was awarded the runner-up prize in the 1998 UK Conservation Awards.*

Cet article décrit la conservation in situ *d'un ensemble de grands fossiles marins du Jurassique, ou sauriens, montés à la verticale sur un mur au Whitby Museum, dans le North Yorkshire. À la suite d'un examen en septembre 1994, un plan en huit points visant à conserver les spécimens et à améliorer le soin et la présentation de la collection a été soumis. Après une levée de fonds, cinq spécimens complets d'ichtyosaures, un spécimen complet de plésiosaure, un spécimen complet de téléosaure (ou crocodile), six spécimens partiels de reptiles marins et deux groupes d'empreintes de dinosaures ont été traités. Du consolidant très dégradé a dû être enlevé de la surface des spécimens, des zones affectées par la dégradation de la pyrite ont dû être traitées, et plusieurs sections de spécimens ont dû être remontées, le support original datant du milieu du XIX^e siècle ayant fait défaut. Les techniques de travail en laboratoire ont dû être adaptées au travail* in situ*, à la verticale, et un laboratoire temporaire a dû être installé au musée. L'équipement et les matériaux ont dû être transportés jusqu'au site, sur une distance de 380 km. Une équipe de restaurateurs a mené le projet à terme en trois phases, la dernière se terminant en mai 1997. Le second prix des UK Conservation Awards a été décerné à ce projet.*

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Introduction

Whitby, an isolated sea port on the North East coast of Britain, is famous as the scene of Dracula's landing in Britain and as the departure point for Captain James Cook's 1768 voyage of discovery to Australia on the ship *Endeavour*. More importantly for this paper, is the fame of its now ruined Abbey, once the home of St. Hilda, and the spectacular cliffs, packed with fossils, that run for several kilometers either side of the town. Legend states that St. Hilda turned the local snake population into stone, so creating the many snake stones (or ammonites). The alum shale deposits in these cliffs, forming part of the sequence of the Yorkshire Lower Lias, provided the raw materials for the first British chemical industry that led to large scale extraction of rock.[1]

In Britain in the early nineteenth century, the science of geology gripped the popular imagination. The discovery and scientific description of many fossils found in the area around Whitby, especially the large vertebrates dug up in the alum works, coupled with popular fascination for the new science prompted the formation of the Whitby Literary and Philosophical Society which set up the Whitby Museum in 1823. Although the museum has moved several times since 1823, it has occupied its current purpose built home in Pannet Park since 1931. The "Saurians" conserved in this project were amongst the earliest acquisitions of the museum, intended to impress and even horrify visitors with their size and completeness. The largest of the skeletons is over seven meters long and up to four meters wide, three others are each between three and five meters long (**Figure 1**).

The geological collections at Whitby Museum were built up largely in the nineteenth century and consist of the "Saurians" (five complete ichthyosaurs, one complete plesiosaur, six partial marine reptile specimens, two sets of dinosaur footprints mounted on two walls, and one teleosaur in a large floor standing case) and a collection of some 6,000 mainly invertebrate fossils including a large amount of type material. More recent acquisitions include examples of the suite of evaporite minerals from the nearby Boulby Potash mine.

Conservation History of the Collections

Concerns have been expressed over the years about losses and damage to specimens and the evidence of pyrite decay. A 1991 report by David Hill, Geological Conservator for the Area Museum Service for South Western England, highlighted evidence of historic damage through minor vandalism and pyrite decay, and general poor condition with specimens coated in an almost black consolidant. Hill recommended a programme of conservation on the wall mounted specimens, but lack of funding prevented action being taken at that time.[2]

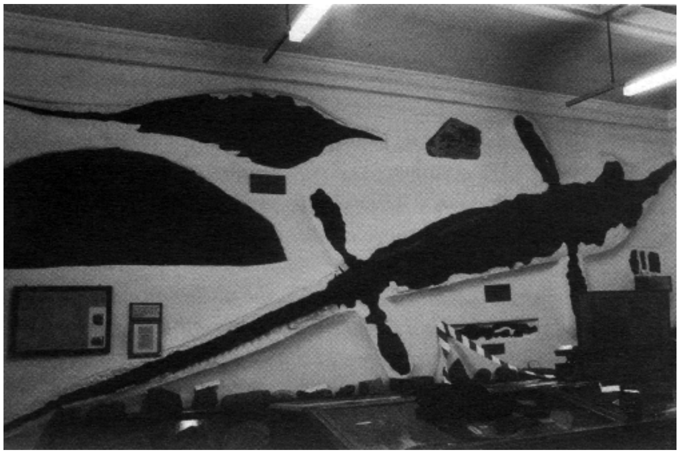

Figure 1. East wall of Saurians before conservation.

The museum building has experienced several maintenance problems over the years. Until a new pitched roof was constructed in the early 1990s, the original flat roof and skylights leaked regularly; as a result, several specimen labels located beneath the old skylights were water stained. The building is constructed of a cavity wall, the inner leaf composed of concrete blocks and the outer leaf of bricks, joined by mild steel wall ties placed every few courses in a regular pattern. By 1994, many of the wall ties had corroded and sections of the outer leaf of the exterior walls were sagging. A programme of replacing the wall ties with stainless steel ties and in places, complete rebuilding of the outer leaf was started. In the light of Hill's 1991 report on the state of the specimens, and the possibility that the specimens were built into the wall, Dr. Nicol, Honorary Keeper of the Museum was concerned that work could result in severe damage. In September 1994, as work approached the area behind the Saurians, he requested an urgent visit to assess and mitigate the immediate risks.

The conservation assessment, carried out over two days in September 1994 by the author, revealed conservation problems with the specimens and a poor internal climate related to faults in the fabric of the building. In addition to the corroded wall ties and failed pointing, severe problems caused by poor maintenance of the rain water removal system of guttering and down pipes were noted. These included water saturated walls, algal growth on exterior walls, and salt efflorescence on interior walls. In one display case, a completely dissolved and re-crystallized specimen of sylvite provided independent evidence that relative humidity in that area had reached over 85%.[3] Thermohygrograph charts from the previous winter had recorded relative humidity rising to 76% in the gallery.

The Saurian specimens mounted on the east and south walls of the museum form the focal point of the geological area of the museum. The south wall is an outside wall and the east wall, following the construction of an extension, is now an internal wall. The specimens appear to be mounted flush with the wall, leading lay people to assume that they are actually built into the block work of the inner leaf of the wall and hence the extreme concern that work on the walls could dislodge the specimens. Previous experience of conserving marine reptiles suggested that this was unlikely. Preparing and setting out such specimens to their best advantage was normally achieved by arranging specimens in shallow wooden boxes, padding around the object with a wide range of materials, and then filling with plaster. Large specimens were often divided into sections for easier handling.

Metal supports hidden behind the plaster work were located using a metal detector borrowed from the building contractors. Further detailed inspection revealed that the specimens were resting on iron brackets, either attached directly to the matrix, as with the dinosaur footprint slabs, or supporting the various sections of the specimen within plaster filled wooden boxes. An arrangement of studding and plastered over lathes had been constructed around the specimens to create the apparently flush surface. At the top of the south wall, invisible from the gallery floor, is a return of about 20 cm that gives an indication of the true depth of the specimens.

At the time of the 1994 survey, the specimens were continuing to suffer from the minor losses and badly discoloured consolidant recorded by Hill in 1991. Since the specimens were covered with a network of cracks and many bones were loose, further losses were feared from vibration during building work. Immediate damage was mitigated through the application of emergency padding of acid free tissue paper pads backed by thin closed-cell polyethylene foam to the most severely cracked areas. After discussing the problem, the contractors agreed to reduce vibration damage by using only hand tools in the area behind the specimens.

Of greater concern was that many specimens had also developed active pyrite decay since 1991 which was causing more serious losses and rapid deterioration. This indicated that major conservation work was urgently required on the wall-mounted specimens and that further maintenance and improvements to the fabric of the building were also necessary to reduce relative humidity in the building to below 60%.

As a result of the assessment visit in September 1994, a detailed report including a preliminary condition report on the Saurians was prepared.[4] This set out an eight point plan to safeguard the entire geological collection, starting with rescue conservation to stabilise the pyrite decay:

1. Identify the source of damp causing high humidity and then rectify the problem by undertaking the proper repairs to the building.
2. Establish and monitor a safe level of relative humidity in the museum. It was suggested that this would probably be best achieved with thermostatically controlled heating, but de-humidification could also be necessary.

3. Emergency treatment of wall-mounted specimens with pyrite decay.
4. Full conservation survey of the remainder of the geology collections to identify any other problems.
5. Complete conservation of wall-mounted specimens suffering from pyrite decay. This would comprise removal of the blackened consolidant, reconstruction of the most obvious missing areas of bone and a complete cleaning and consolidation. One specimen should be completely conserved at the same time as the emergency conservation work (point 3 of the plan) in order to be able to make an accurate estimate of the time required for conservation of other specimens.
6. A longer term programme of conservation of wall-mounted specimens without pyrite decay and case-mounted specimens and any of the smaller specimens identified as requiring work in the conservation survey (point 4 of the plan).
7. A curatorial assessment of the collection followed by a programme of curation — sorting the geological specimens to identify type, figured and cited material, assigning unique accession numbers, *etc.*
8. Design and installation of interpretative and educational material for both casual visitors and school groups to improve their understanding of the geological collections.

The Conservation Project in Three Phases

The high cost of conservation had been the major factor preventing work from proceeding in the past, despite earlier concerns and surveys. In the winter of 1994, a national lottery draw was launched in Britain and a proportion of the funds generated were allocated to the Heritage Lottery Fund for distribution to heritage projects. A conservation project at Whitby Museum was felt to stand a good chance of receiving funding once needs and costs were accurately established. The eight point plan was, therefore, reworked into a phased conservation action plan. Grant aid for phase one, to cover points 3, 4, and the treatment of one ichthyosaur (point 5) was then sought.

Phase one of the project was undertaken in May 1995 by the author and Jane Thompson. This phase lasted eight person weeks and was partly funded by a grant from the Yorkshire and Humberside Area Museum Service. One of the complete ichthyosaurs, badly damaged by pyrite decay, was fully conserved and pyrite decay in all other affected specimens was stabilized. A visit was made at this stage by the freelance geological curator, Rosemary Roden and a collections report compiled. Conservation problems in the smaller items on display were also identified at this point. Phase one of the work allowed an accurate costing and a work plan to be devised for phases two and three, which in turn enabled the museum to make a successful bid for funding from the Heritage Lottery Fund. This was the first conservation project of any kind to be awarded funds.

Phase two of the project was undertaken by the author, Jane Thompson, and Joanna Swannell between March and May 1996, for a total of 30 person weeks. A display describing the conservation work was also set out in the gallery. The teleosaur or crocodile, mounted in a floor standing case, was conserved during phase three by the author and Juliet Hay over six person weeks in May 1997.

Rosemary Roden started work on the curation in May 1997, assisted initially by Pamela Ramsey-Cohen, a Canadian Museum Studies student on placement and later by the documentation officer and a team of volunteers. Curation work and preventive conservation re-packing of smaller specimens has also continued in phases and should be complete by late 1999.

Conservation Treatments and Adaptations Associated with Working *In situ*

The conservation problems exhibited by the Whitby Saurians were fairly typical of material of this historical age. What was unusual was the number and large size of the specimens. It was apparent even at the conservation assessment that conservation work could only take place if work was carried out *in situ*. Since the museum was unwilling to lose visitors by shutting completely, work proceeded in the geology gallery with the rest of the museum still open to the public. A temporary conservation lab was constructed for each phase of the work with walls made of heavy duty polyethylene sheeting fixed with wooden batons to the ceiling and floor. A mobile scaffolding tower was hired for phases one and two to gain access to the upper parts of the wall. Local extraction was achieved using a Nedermann fan and elephant trunk vented to the outside via a temporary window vent or an under-floor vent.

Most materials and equipment had to be packed up and transported from the author's normal place of work, 380 kilometers away. Phases two and three of the project were undertaken in tandem with the author's, by then, full time curatorial post. Since only four weeks a year was allocated to income-generating activities, this imposed additional restrictions on timing of the work to occur either side of the financial year end. The scale of the project also required recruitment and temporary contracts for assistant conservators.

Pyrite Decay Treatment

Pyrite decay is the chemical oxidation of the mineral iron pyrite, initiated by exposing the mineral to relative humidity over 60%. It results in the formation of a much greater volume of iron sulphate efflorescence and reaction catalysing acid by-products. The exact progress of the chemical reaction varies according to the degree of water saturation.[5]

Iron pyrite is found in finely disseminated, framboidal form in all dark coloured shales and mudstone. Due to the surface to volume ratio, susceptibility to oxidation increases with decreasing crystal size, framboidal pyrite being the most unstable. Although the bones of the Saurian specimens were replaced with brown coloured apatite (a calcium phosphate mineral), the surrounding material was a mix of dark coloured mudstones and harder muddy limestone. The pyrite decay reaction in these specimens had occurred mainly in the mudstone matrix supporting the bones, but also in some areas of cancellous bone where the voids were infilled with pyrite. Complete replacement by pyrite of the bones was not a feature of these specimens, but acid by-products of pyrite decay can react with the apatite and damage the bones.

Pyrite decay was worst in the ichthyosaur at the top right hand side of the south wall. Areas affected were the mudstone between the jaws and the matrix and cancellous bones in the shoulder and front limb area. Small patches of decay were found in the matrix between the plesiosaur neck vertebrae. The teleosaur had several affected areas in the shale supporting the back limbs and the shale beneath several of the bony scutes. Active pyrite decay, although largely disguised by the blackened consolidant, was visible from the gallery floor as a trickle of white powder and close up as white and greenish-yellow powdery efflorescence. The acrid smell and a pH of 3 or 4 recorded when dampened pH indicator paper was pressed onto the specimen were further indicators of pyrite decay.

Where pyrite decay was noted on specimens, the entire specimen was treated using a modification of the experimental ammonia gas method developed by Waller.[5] The polyethylene glycol (PEG) 400 used in this method ensures that the ammonia vapour given off by the concentrated ammonia solution is dry rather than at an elevated relative humidity that could re-start the decay reaction. Wide mouthed containers to hold the reagent were suspended adjacent to the specimens using string cradles and masking tape (**Figure 2**). A control tube was placed in the area undergoing treatment and a heavy duty polyethylene tent enclosed the area.

Quantities of reagents based on a ratio of 200 g of PEG 400 to 40 mL of concentrated ammonia were measured out quickly, stirred together and poured into the containers. The polyethylene was then taped down with masking tape. The circulation of the ammonia vapour seemed to be limited if the polyethylene was taped too tightly against the specimen. The addition of tucks around the edges of the polyethylene created additional circulation space. Repeated applications were required to achieve the desired penetration of several centimeters. A second round of treatments was carried out on the wall-mounted specimens during phase two. Conservators wore full face ammonia masks, heavy duty gloves and goggles and carried out the treatment cycle at the end of the working day. Local extraction using the elephant trunking further minimized any risk to museum staff.

In order to judge the depth of penetration into the specimen, narrow glass control tubes packed with a 50:50 mix of glass air abrasive powder and iron(III) sulphate, intended to simulate the decayed areas of specimens, were fixed horizontally to the specimen with masking tape or Plasticene. The rate of reaction and the depth of penetration was gauged by the distance the dark red-brown reaction front had moved down the control tube (**Figure 3**). Waller suggests calculating the state of hydration of the iron(III) sulphate, but this was not determined in this instance. The author has used this method extensively in a laboratory environment with hand specimens undergoing treatment in a glass dessicator. Past experience has shown that the rate of penetration is slow (one or two millimeters an hour) until all the decay products have reacted. The reaction front then moves rapidly into the control tube. Exposure for twenty-four hours seems to be sufficient for most hand specimens, resulting in excess of twenty millimeters penetration into the control tube.

Other workers have used a treatment method for pyrite decay based on ethanolamine thioglycolate.[6] This technique requires poulticing if applied to large specimens, and for the vertically-mounted Whitby specimens, the chosen treatment was felt to be easier and faster.

Pyrite decay did not appear to have progressed further in any specimens between phases one and two of the conservation work, despite a high moisture content in the wall. The treatment had also reacted successfully with several small areas of decay that were not visible until the surface consolidant was removed.

Figure 2. Pyrite decay treatment on teleosaur specimen, showing container to hold the reagents and the polyethylene cover.

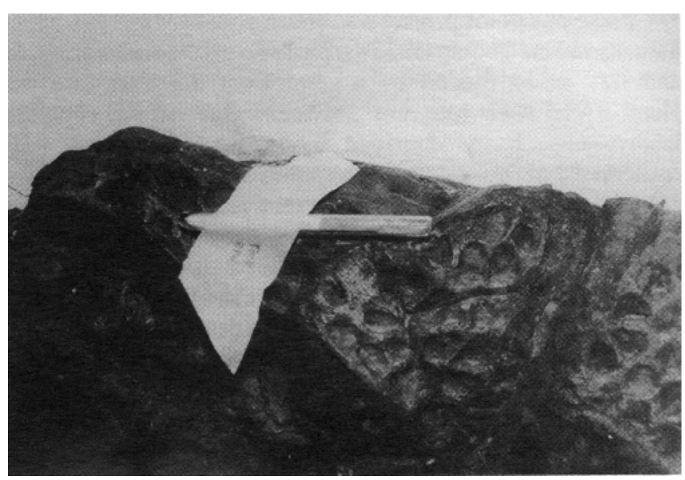

Figure 3. Control tube taped to the teleosaur; the dark reaction front has progressed about 1 cm into the tube.

Removal of Degraded Surface Consolidant

Previous experience of conserving similar specimens suggested that the blackened surface consolidant would be shellac based. Unfortunately, this was not the case and other possibilities including "Ocmatut," the black jet worker's glue (a mixture of fish glue, isinglass, and lamp black) were considered.

A wide range of solvents including hot and cold water, dilute ammonia solution, acetone, industrial methylated spirit, propanol, orange oil based solvents, and a solvent gel used successfully at the Natural History Museum[6] were tested on the highly degraded surface consolidant but all to no effect. An analysis by Dr. Nicholas Eastaugh was then commissioned in an attempt to formulate a suitable solvent gel. He found the coating to consist of two layers of a resin based synthetic polymer, probably a cross-linked and degraded polyester, for which a suitable gel could not be formulated.[7] Neither layer was pigmented, despite the almost black colour. Cost of further analysis was unfortunately prohibitive and so the actual make up of the coating was not established. A record of the date of the application was never discovered.

Removal of the coating from the wall-mounted specimens had to proceed using chemical attack and swelling of the polymer rather than dissolution in a solvent. Methylene chloride based Nitromors paint remover proved to be effective on the fragile areas or parts of the specimen with pyrite decay. The gel was dabbed on by brush and left for a few minutes. The bulk of the gel was removed with paper towels and then blunt scraping tools before swabbing with industrial methylated spirits. **Figure 4** shows the contrast between a partially cleaned specimen and specimens with the surface consolidant still in place.

Ronstrip, a commercially available paint removing poultice, was used on smoother and more robust areas. This had been used successfully to remove thickly applied shellac from stuffed iguanas and other modern reptiles at the Ipswich Museum.[8] It is supplied as a dry powder, consisting of a mix of paper pulp and sodium hydroxide. Mixed with water it formed a stiff paste which was applied to the specimen with a plastic spatula and left to dry for about 15 minutes (**Figure 5**). Brown staining into the poultice indicated that the consolidant had been loosened and the poultice was lifted off by spatula. The area was dry scrubbed with a toothbrush and then cleaned thoroughly with a de-ionized water and alcohol mix applied as a spray and then with swabs.

The coating on the teleosaur specimen appeared to be less degraded, presumably as a result of the protection afforded by the glass case. The bulk of the coating on this specimen proved to be soluble if poulticed with acetone soaked cotton wool and then swabbed.

Removal of the consolidant from the huge area of these specimens, many of which had a great deal of surface relief and undercuts, was the most time consuming part of the project. Once the blackened consolidant was removed, it became apparent from paint drips and old labels beneath this layer that the specimens had originally been displayed without a surface coating and that the consolidant, therefore, dated from some time after the move to the Pannet Park building in 1931.

Air Abrasion Techniques

Final cleaning of traces of consolidant and minor additional surface preparation was achieved through gentle air abrading using no. 9 glass powder on robust areas and no. 4a sodium bicarbonate on most other areas. Air pressures were between 400 and 700 kPa with low powder flow rates.

Various attempts were made to construct an air abrasive chamber that could be used comfortably in a vertical position and could be moved easily across the specimens. The final design, constructed by Thompson & Swannell, was made from a Perspex fish bowl with a deep collar of open cell foam to provide a seal when pressed against the specimen by the operator's arm and

Figure 4. Contrast between as yet untreated upper specimen and partially cleaned slab of dinosaur footprints.

Figure 5. Jane Thompson applying Ronstrip poultice to the plesiosaur neck; the skull has been partly cleaned.

body weight. Access for the operator's arm and air abrasive hand piece was via a hole cut through the base, protected with a polyethylene cuff (**Figure 6**). Dust extraction, through a side hole, was provided by a Vax 2000 wet and dry vacuum cleaner. A counterbalanced lamp with a fluorescent tube provided exterior local illumination. Operators wore heavy duty full face dust masks and very fine particles were extracted to the outside via an elephant trunk.

Building Maintenance and Stabilization of the Interior Climate of the Museum

The roof rain water collecting system was cleared by the building maintenance section between phases one and two and it was found to be blocked by, amongst other items, dead birds, a football, and a training shoe.

The Heritage Lottery appointed a conservation assessor to monitor the project and advise the museum on climate control. Monitoring of the moisture content of the wall suggested that rising damp may also be a problem. Maintenance of the rain water system seems to be the key to preventing the re-occurrence of a high moisture content in the upper part of the south wall. Measures to isolate the specimens from the wall were beyond the scope of this project. In the longer term, the museum hopes to construct an extension beyond the south wall, thereby converting it into an inside wall and preventing the ingress of damp.

Additional Conservation and Record Keeping

Loose bones and degraded gap fills were removed during the cleaning process and re-adhered or replaced with Paraloid (Acryloid) B72 adhesive. Where new gap fills were required, these were made from Paraloid B72 and glass microballoons coloured with powdered artists pigments and painted with pigment in acrylic medium.

As the work proceeded, it became apparent that the teleosaur specimens had originally been displayed as a table top mount, only being turned into a near vertical alignment during photography for a publication in the early 1930s.[1] In the tail region, the thin plaster collar holding the bones into a very shallow wooden trough had suffered several dislocations. Poor re-mounting had led to many of the bones being in the wrong position, upside down or back to front. As part of this work, almost the entire tail was taken down, plaster fill and excess matrix removed and the tail remounted in a Paraloid B72 and glass microballoons filler. Each individual bone was supported on two form fitting Milliput epoxy putty rests formed around brass panel pins nailed into the original wooden back board. A similar support was constructed for the upper limb.

Osborne's research[1] also revealed that the walls of the 1931 building were designed around the Saurian specimens, but a miscalculation meant that the east wall ended up a few feet too short, so rather than remove part of the tail, the specimen was mounted diagonally.

A contrasting paint colour was chosen for the wall immediately adjacent to the specimens in order to enhance their appearance. A wide range of emulsion paint colours was tested, with a Dulux terra cotta colour providing the best contrast (**Figures 7** and **8**). The museum staff were instructed to leave the case front off the teleosaur specimen (**Figure 9**) for several weeks to allow any acidic vapours from the paint to disperse.[9]

Throughout this conservation project, progress was communicated through regular reports to the museum staff; via posters, articles, and presentations to the conservation and museum communities; and by local press coverage.[10,11] These reports together with copies of lab cards and photographs should prevent conservators in the future from confronting similar initial confusion.

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Figure 6. Vertical glove box for air abrasive machine in use by Joanna Swannell on the east wall.

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Figure 7. East wall after conservation.

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Figure 8. South wall after conservation.

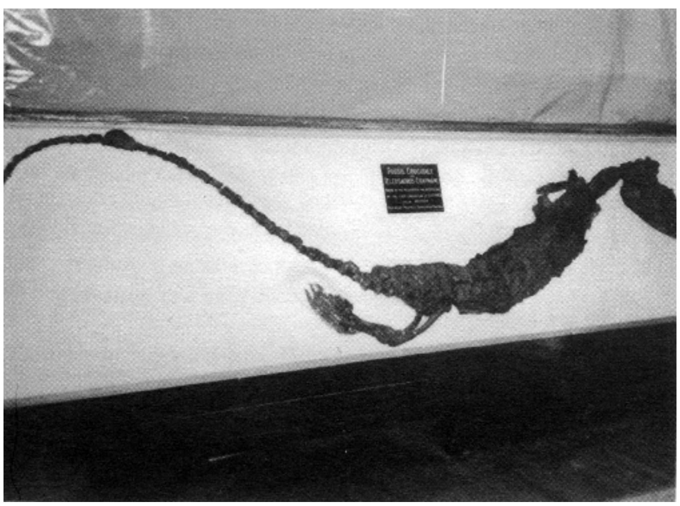

Figure 9. Teleosaur after conservation.

Conclusion

Conservation problems encountered and treated during this project were not atypical for geological specimens from these geological horizons and of this historical antiquity. This project was highly complex due to the enormous size and large number of specimens involved and their vertical alignment, requiring *in situ* treatment, and, therefore, modification of all conservation techniques. The project took forty-four person weeks of site work to complete, a substantial amount of forward planning, and led to a re-curation project of the remainder of the geological collections. This work should ensure that these important and historic specimens survive well into the next millennium.

The author was awarded the runner-up prize in the 1998 Conservation Awards for the work on the Saurian conservation project. The Awards are organized by the Museums and Galleries Commission and sponsored by the Jerwood Foundation.

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Materials

Peel-off Ronstrip: Ronseal Ltd., Thorncliffe Park, Chapeltown, Sheffield S30 4YP, UK; available from hardware stores.

Nitromors professional paint stripper: available from hardware stores.

Milliput two part epoxy putty: Conservation Resources, Unit 1/2/4 Pony Road, Horspath Industrial Estate, Cowley, Oxford OX4 2RD, UK; available from hardware stores.

Glass microballoons: manufactured by Fairlight.

De-solv-it, orange oil-based solvents: Mykal Industries Ltd, 5 Morris Close, Park Farm, Wellingborough, Northamptonshire NN8 6XF, UK.

Paraloid B72: Rohm & Haas, supplied by Conservation Resources, Unit 1/2/4 Pony Road, Horspath Industrial Estate, Cowley, Oxford OX4 2RD, UK.

SS White air abrasive powders (no. 9, glass bead, no. 4a free flowing sodium bicarbonate): REG Abrasonics Ltd, 599-613 Princes Road, Dartford, Kent DA2 6HH, UK.

Dulux Toscana Vinyl Soft Sheen emulsion paint - Heritage Colour range: ICI Paints, Wexham Road, Slough, Berkshire SL2 5DS, UK.

Polyethylene glycol 400: Merck, Hunter Boulevard, Magna Park, Lutterworth, Leicestershire LE17 4XN, UK.

Solvent gels: Nicholas Eastaugh, 1 Park Street, Teddington, Middlesex TW11 0LT, UK.

Artist pigments: Conellison, 105, Great Russell Street, London WC1B 3RY, UK.

Nedermann extractor fan: Nedermann Ltd, PO Box 503, 91, Walton Summit, Bamber Bridge, Preston, Lancashire PR5 8BR, UK.

VAX 2000 wet and dry vacuum cleaner: VAX, Hampton Lovett, Droitwich, Worcestershire WR9 0QH, UK.

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