SPPC 2020 - “Flaky” - Preparing an Early Jurassic plesiosaur from Yorkshire, England

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Introduction

This specimen was collected by Dean Lomax and Ben Hyde at Kettleness, near Whitby, North Yorkshire on 28th October 2010 whilst photographing the coastline and field locations for the book 'Fossils of the Whitby Coast'. It is from the Jet Rock, in the Mulgrave Shales Member of the Whitby Mudstone Formation. It was found as a number of rather water-worn blocks of limestone showing bone on the surface and had evidently been exposed for some time.

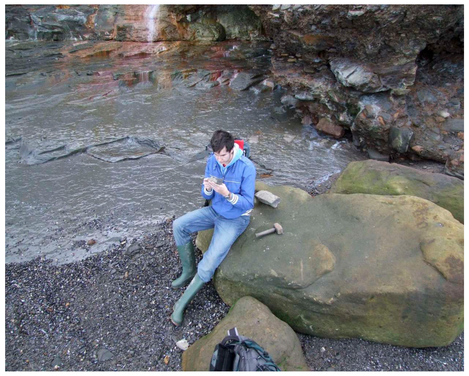
Initial inspection of the material and testing suitability for preparation suggested that it’s worth tackling as a project especially as there appeared to be a partial skull and one of the blocks has teeth on the surface.

The aim of the preparation is to expose as much of the morphology of the specimen as can be achieved. It's fragmented nature makes it very difficult to reassemble in anything close to its orginal disposition. I'm taking a systematic approach, assigning a number to each block, describing it and preparing as much as is practical. A record of the process is kept as notes made in the workshop which are added to an on-line database.

Preparation is tricky because although the bone is generally well-preserved and undistorted, it is also very soft and in some cases very friable - the consistency of a Cadbury’s Flake and hence the nickname! This made the use of acid or airbrasive methods impossible. Most has been carried out using air pens (ZOIC Palaeo Tech TR and MR pens) and a grinder (Ken Mannion’s AG Grinder). A Dremel drill wtth a diamond cutting wheel was used to remove larger thicknesses of matrix by cutting parallel grooves and chipping out the rigdes made by the process. When working on particularly delicate elements such as teeth scalpels and pins were used thought the hardness of the matrix made this of limited value.

Bone was consolidated using a 5% or 10% b.w. solution of paraloid in acetone as soon as it was exposed. A number of bones could be extensively prepared without risking damage, in particular both rami of the lower jaw. This allowed it to be identified as the long-necked plesiosaur *Microcleidus*, known from several specimens from the Toarcian.

The scattered and fragmentary nature of the find, and the wear on the blocks has made it impossible to reassemble the specimen in either an anatomically correct arrangement or reconstruct its disposition within the rock band.



A young Dean Lomax examining one of the fragments when the specimen was collected.

Block containing girdle elements and ribs. Because of its weight it was not possible to collect it from the beach, which is accessible only via a high, steep in places dangerous path. Some of this block was retreived at a later date by a local collector and can be retreived in future.

A block showing how bone has worn away more than the matrix. The softness of the bone was the major challenge during preparation as it had to be consolidated as soon as it was exposed to prevent disintegration. I used a weak (5% by weight) solution of paraloid in acetone for most of this. Where bone was very friable with fragments breaking away from the surface as soon as it was exposed to air I used stronger solutions (10% and 25%) to hold the surface together.

Tools used: Dremel drill with diamond cutting wheel ZOIC Palaeo Tech MR and TR pens, and a Ken Mannion AG grinder. The block is resting on a pad used to prevent bed sores (it helps to have a daughter who is a nurse. They throw these away if they have left the hosptial even if still sealed in their original sterile packaging). The work piece is supported by a bed of slightly damp playground sand on two layers of polythene sheeting. Fragments of matrix are saved periodically by pouring them from the sheeting.

Adhesives and solvents and all sorts of different tools and applicators. I have this as a standard set-up so that I can reach for the correct bottle without looking. Left to right: acetone spray, acetone in bottle, 50% paraloid, 25% paraloid, 10% paraloid, water spray. For weaker paraloid solutions I add acetone to a small pot of 10% mix.

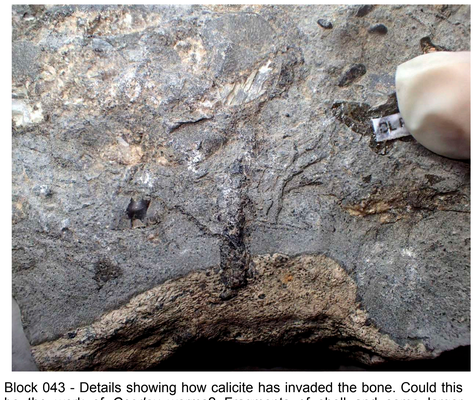
Using the Dremel. Where there is clearly no bone in the matrix I removed it by making parallel cuts using a diamond cutting wheel (sold for grout removal) on a Dremel drill, then chipping out with the TR pen.

Preliminary work on Block 014 was carried out to find out if it would be possible to prepare the specimen. This shows a partial cervical centrum. The bone is softer than the matrix, but is not distorted by overburden pressure.

Block 006 showing skull elements. The presence of skull elements indicated that preparation is desirable. Unfortunately there has been a lot of erosion on the dorsal side and the remaining bone is very thin and friable, limiting the degree to which it can be prepared.

Detail of part of the skull showing parietals and squamosal. Other elements are present, but too poorly preserved to be clearly identifiable. A block with partial teeth exposed on the surface is awaiting preparation, though this will be very challenging owing to their fragility.

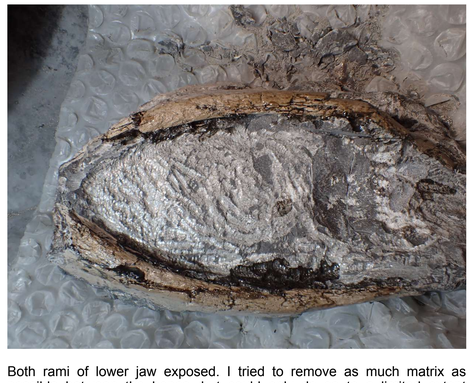
The limestone is riddled with veins of brown, crystaline calcite containing ammonites and other small invertebrate fossils. The fragment of ammonite shell on this image shows colour banding. Specimens of this have been saved.



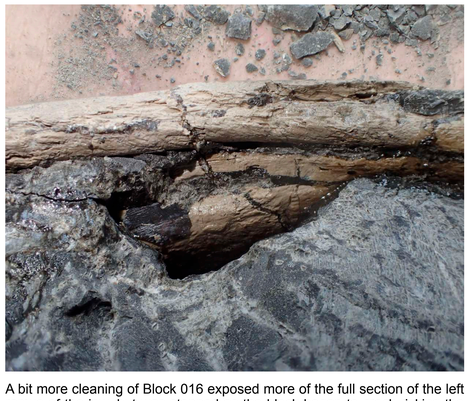
Block 043 - Details showing how calicite has invaded the bone. Could this be the work of *Osedax* worms? Fragments of shell and some larger crystals can be seen here as well.

Block 042. Intitially I thought this might be part of the palate, but further preparation showed that it is ribs and a vein of calcite. The nature of the bone in some places makes it hard to distinguish from these veins.

What looked intially like a rib turned out to be the ramus of a lower jaw. Further preparation of the block revealed both rami, and from their morphology the specimen could be confidently identified as a Microcleidid plesiosaur. The genus *Microcleidus* is represented by several specimens from the Toarcian of Yorkshire. (see Brown *et al* 2013, Owen 1865)



Both rami of lower jaw exposed. I tried to remove as much matrix as possible between the bones, but could only do so to a limited extent because of the fragility of the material. The extent of disarticulation of the skeleton is shown by the presence of a fragment of femur on the other side of this block.



A bit more cleaning of Block 016 exposed more of the full section of the left ramus of the jaw, but was stopped as the block began to crack risking the loss of the very fragile bone. I flooded the crack with 10% paraloid to hold it and decided not to risk anything more in this area.

References David Brown, Peggy Vincent, and Nathalie Bardet "Osteological Redescription of the Skull of Microcleidus homalospondylus (Sauropterygia, Plesiosauria) from the Lower Jurassic of England," Journal of Paleontology 87(4), 537-549, (1 July 2013). https://doi.org/10.1666/11-104

Owen, R, 1865. A monograph of the fossil Reptilia of the Liassic formations. Part 3. Monogr. Palaeontogr. Soc, 1-40.