

Preliminary approaches to macrofossil preparation of a new well-preserved Middle Jurassic (Bathonian) Echinoderm lagerstatte from South West England UK – one of the best Jurassic sites for fossil Echinoderms anywhere in the world!

Introduction

We have been conducting fieldwork in Wiltshire & Gloucestershire for many years, backed up by reviewing historical research papers and geological maps for new areas to explore. This quarry exposed the right stratigraphic horizon for investigation!

Investigation of a private quarry in the Forest Marble Formation in Wiltshire with the Natural History Museum, London has revealed an exquisitely preserved echinoderm fauna in clays and silty mudstone units.

Echinoids were found with spines and jaw apparatus intact, articulated stalked (Isocrinidae), and stalkless (Comatulidae) crinoids, starfish (Asteroidea), brittle stars (Ophiuroidea) and Sea Cucumber (Holothuroidea) remains were evident on the underside of thinly bedded mudstone and siltstone units.

The discovery resulted in national and international media coverage of this exceptional fauna including newspaper articles, extensive social media and television interviews for the team.



Figure 4



Conservation

A discovery of multiple articulated individuals on indurated clay matrix was only found after preparation – as the specimens were not that obvious in the field, only fragments were found when we were surface collecting. Challenges faced during preparation are to retain delicate pinnules or cirri, with unconsolidated matrix this has proven difficult. Utilising variable pressures and adjusting powder flow rate has resolved this to allow pinpoint accuracy as well as wearing high magnification surgical loupes during the preparation process has resulted in many of the fine structures remaining intact. Further consolidation involves using 20% Paraloid B72 in Acetone to consolidate loose or friable matrix.



Figure 8

A Sea Urchin - figure 8 (before) & figure 9 (after)
Note the length of the spines and the fact they seem to be radiating together to five points.

Figure 9



Preparation

These specimens have been prepared using a Vaniman master pro blast air abrasive unit and 53 micron Aluminium oxide powder at 35- 80 psi (2.4- 5.5bar). The pressure was adjusted according to how indurated the matrix covering the enclosed fossils is. Most of the echinoderms retain delicate structures including pinnules and cirri on the crinoids and both primary and secondary spines (pedicellariae) on the Echinoids. Starfish retain all of their ornamentation and secondary ossicles. Holothurians are represented by oral discs and disarticulated body wall ossicles. Many of the Crinoid crowns are slightly flattened and preserved three dimensionally which facilitates preparation on both sides. They are commonly found as complete crowns weathered out of the clay. Sedimentological evidence suggests the echinoderms were buried by a submarine mudslide precipitated by a storm event or were buried in a tempestite. Slabs dried out naturally (figures 4, 6, 8 & 10) are then air abraded to reveal the beautiful well preserved echinoderms. Each slab can take hours of preparation (figures 5, 7, 9 & 11).

Figure 5



Conclusions

Future and further preparation of this exceptional fauna on slabs extracted from the site coupled with detailed sedimentological analysis and scanning using CT and light source/muon neutron sources will undoubtedly reveal a wealth of new taxonomic and geochemical information that will help further in understanding of the taxonomy and ecosystem in which these echinoderms lived and died.

So far, it seems that at least three species new to science have been discovered in these slabs - a feather star (Comatulid), brittle star & sea cucumber (Holothuroidea). Many of the other species uncovered are already known to science, however many were described on incomplete and imperfectly preserved material over 100 years ago (T. Ewin Pers. Comm. 2021).

Many prepared slabs are destined for museum display with the focus being the Natural History Museum, London but interest has been expressed from other museums too!



“With every piece cleaned they provide tantalizing evidence of Jurassic seafloor life, 167 million years ago.”

Acknowledgments

We would like to thank the Landowners for permission and Dr Tim Ewin (NHM) Mark Graham (NHM), David & Alison Ward (NHM) and Dr Charlie Underwood (Birkbeck, University of London) as key leads and collaborators



Figure 10



Figure 11



Figure 1



Figure 2



Figure 3

Observation

“We think that a catastrophe did take place as a single but complex event with multiple channels filled with echinoderm material and wood that was dumped and settled rapidly from highly turbid water and over several tidal cycles.” Dr Tim Ewin (NHM, London), Dr Charlie Underwood (Birkbeck, University of London)

We believe that as systematic excavations continue the spatial relationship of the individual sub-beds mapped in more detail has the potential to establish whether this is highly localised. Hopefully as the quarry is extended then a more extensive outcrop can be mapped in detail which will help to resolve this fascinating and enigmatic locality.



Figure 6



Figure 7