Background

The fossils of Blue Lias Formation (BLF) are world-renowned for exceptional preservation, but their preservation processes have often been overlooked. The formation is Lower Jurassic (200–180 Ma), encompassing the end of the Triassic and the beginning of the Jurassic. Mary Anning’s work on ichthyosaurs from the BLF, along with her extensive knowledge of the surrounding marine outcrops and their fossil content, has allowed her to make significant contributions to the field of ichthyosaur research.

Questions

- What were the conditions that led to the death and preservation of relatively complete large vertebrate skeletons in the Blue Lias?
- How is it that we know about anatomy and preservation affected by taphonomic, collection, and preparation biases?
- What is the “taphonomic legacy” of the pioneering work by Mary Anning and the scientists who described and studied the fossils she collected?

Methods

BLF ichthyosaur specimens were examined at the following museums:
- Smithsonian Institution, National Museum of Natural History
- Sedgwick Museum of Earth Sciences
- Lyme Regis Museum
- Natural History Museum, London

Evidence of postmortem alterations in various lithologies in 23 marine reptile specimens were observed and recorded on data sheets:
- Presence of nodules
- Presence of soft tissue
- Skeletal element positions
- Presence of invertebrates
- Plastic deformation
- Matrix composition

The 14 ichthyosaur carcases were divided into anatonical units, each assigned into stages (0–4) of articulation (Clary, 2015, and Beardmore, 2012). The articulation stages of the anatonical units were then averaged to represent the entire preserved carcass.

An example of a unit and the stages is shown using the Dorsal Vertebrae. (See next column.)

Stratigraphy

The Blue Lias Formation stratigraphy is cyclical; its lithologies alternate between shale, marl (limey mudstone), and limestone. In the Devonian period, the Blue Lias Formation is exposed between the eroding shale layers and the resistant limestone, compared to the rest of the body units; this likely reflects the different strength in the different lithologies, but nonetheless, retained high skeletal articulation. We found that Blue Lias ichthyosaurs varied in preservation among the three main lithologies, but nonetheless, retained high skeletal articulation. We found that ichthyosaur carcass variation appeared to be an individual specific trait, compared to the rest of the body units; this clearly shows that the different lithologies have a role in the overall preservation and their properties.

Results

The cycle of the shale, marl, and limestone has been attributed to astronomical cycles. These could have caused sea level, temperature, and water column stratification to vary over periods of 10’s to 100’s of thousands of years. (Paul et al., 2009, Mingelbier & Gallo, 2010)

Conclusions

The organisms that are preserved survive unique preservation processes that create bias as we learn from the fossil specimens. These biases are not unimportant, as they may affect the results of paleontological studies, especially when fossils are collected privately and public data also have methodological issues. We would like to thank Chris Andrew, Claire Badgely, Elizabeth Cottrell, Jason Head, Gene Hunt, Steve Jabo, Peter Kroehler, David Norman, Michelle McKean, R. & Gillette, D. (2015) for their help and support.

References & Acknowledgments


Future Work

Our findings generate more questions pertaining to the BLF environment. A more in-depth study could provide insight on these questions:

- What would be the impact of a larger sample size? Many specimens are retained in private collections in Southern England. What would ichthyosaur fossils in these collections have to offer in terms of their taphonomy?
- How does the preservation in the Blue Lias ichthyosaurs compare with other ichthyosaur bearing formations, such as the Posidonia Shale (Lower Jurassic) of Germany. How would the preservation in the Blue Lias ichthyosaurs compare with other ichthyosaur-bearing formations, such as the Posidonia Shale in Germany? How does the preservation in the Blue Lias ichthyosaurs compare with other ichthyosaur-bearing formations, such as the Posidonia Shale in Germany?

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