

Sequence of post-moult exoskeleton hardening preserved in a trilobite mass moult assemblage from the Lower Ordovician Fezouata Konservat-Lagerstätte, Morocco

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Euarthropods have a tough exoskeleton that provides crucial protection from predation and parasitism. However, this is restrictive to growth and must be periodically moulted. The moulting sequence is well-known from extant arthropods, consisting of: (i) the long inter-moult stage, in which no changes occur to the hardened exoskeleton; (ii) the pre-moult stage where the old exoskeleton is detached and the new one secreted; (iii) exuviation, when the old exoskeleton is moulted; and (iv) the post-moult stage during which the new exoskeleton starts as soft, thin, and partially compressed and gradually hardens to the robust exoskeleton of the inter-moult stage. Trilobite fossils typically consist of inter-moult carcasses or moulted exuviae, but specimens preserving the post-moult stage are rare. Here we describe nine specimens assigned to *Symphysurus ebbestadi* representing the first group of contemporaneous fossils collected that preserve all key stages of the moulting process in one taxon, including the post-moult stage. They were collected from a single lens in the Tremadocian part of the Fezouata Shale Formation, Morocco. Based on cephalic displacement and comparison to other trilobite moults, one specimen appears to represent a moulted exoskeleton. Four specimens are typical inter-moult carcasses. Four others are wrinkled and flattened, with thin exoskeletons compared to inter-moult specimens, and are considered post-moult individuals. These *S. ebbestadi* specimens illuminate the preservation and morphology of the post-moulting stage, characterised by strong anterior-posterior exoskeleton wrinkling, as well as overall body flattening and reduced visibility of thoracic articulations. Being found in the same lens, these specimens likely represent the first preserved in-the-act mass moulting event. The displayed sequence of moulting suggests the moulting process in trilobites was comparable to modern arthropods, and conserved within euarthropod evolutionary history.

Key words: Trilobita, mass moult, soft-shelled, post-moult, moulting, exoskeleton, Ordovician, Morocco.

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