

# Holotomography reveals reproduction with giant sperm in Cretaceous microcrustaceans (Ostracoda)

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The filiform sperm cells of the ostracod Suborder Cypridocopina are giant, reaching up to ten times the male's body length, representing some of the longest sperm known in animal kingdom. Due to high production costs and the requirements for adaptations in sexual organs and egg fertilization, the very existence of sperm gigantism is an evolutionary conundrum. No information exists on the persistence of giant sperm through geological time – a question that influences hypotheses relating to their function(s) and evolution.

Synchrotron holotomography of exceptionally preserved Cretaceous cypridoidean ostracods from the Santana Formation (Brazil) revealed that they possessed organs similar to those of extant freshwater ostracods, used to maneuver giant sperm cells. Large, inflated seminal receptacles in females indicate that they contained sperm before death, and thus represent a fossilized impregnation, a first for the fossil record. Our results indicate that ostracod reproduction with giant sperm persisted for at least over the last 100 Myr. Beside organs of the internal reproductive systems of both genders, we detected supporting structures of the esophagus and the frontal stomach area, as well as the internal framework of the male copulatory appendages. This application of synchrotron radiation exemplifies its important role in investigation of exceptionally preserved microfossils. Non-invasive as it is, holotomography is the most valuable and thus trendsetting tool for visual analyses in micropalaeontology.