A new lease of life: Ontogentic shift in anatomy and ecology of a holobiont vent snail shown using synchrotron micro-CT

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The dominating species at deep-sea hydrothermal vent fields often have a highly modified anatomy, adaptive to exploiting chemosynthetic energy through endosymbiotic bacteria. Of all vent animals, only molluscs and annelids have evolved true internal endosymbiosis, yet within molluscs this has happened several times independently. Adults of Gigantopelta chessoia, a neomphaline snail recently discovered from the East Scotia Ridge vents in the Southern Ocean, host thiotrophic endosymbionts in a greatly enlarged oesophageal gland. This represents a case of convergent evolution with another gastropod, the 'scaly-foot' Chrysomallon squamiferum. Chrysomallon relies on nutrition from endosymbionts for its whole life, starting at settlement; by contrast, in Gigantopelta the oesophageal gland is not enlarged in juveniles, thus they are unlikely to use endosymbionts as the main source of nutrition before reaching adult size. To test the hypothesis of an ontogenetic shift in Gigantopelta's feeding mode, we constructed 3D models of the internal anatomy for a growth series via synchrotron (hard x-ray) micro-CT scanning. In each specimen, the digestive system was reconstructed using the specialist software AMIRA, to quantify the relative size of the oesophageal gland across ontogeny and the contents of the gut. Transmission electron microscopy of oesophageal gland and gill of both adults and juveniles were conducted to investigate potential differences in endosymbiont distribution between the life history stages. Gigantopelta is a dominant component of the biomass at East Scotia Ridge. Understanding its life history is crucial to reconstructing hydrothermal vent food webs.