

Chiton – a story

Harry Green

In October Brenda Laver who was undertaking volunteer work for the Worcestershire Wildlife Trust found an ‘odd object’ in her garden and gave it to Conservation Officer Dominique Cragg asking if she knew what it was. She didn’t and sent me a couple of pictures but I didn’t know what it was either and asked if it was a fossil or possibly the remains of an animal with shell-like characteristics. The answer was ‘not a fossil’ as it was flexible with eight hard plates. With that information I circulated pictures to several Worcestershire naturalists. Few replied but Brett Westwood suggested it was a Chiton, possibly the Marbled Chiton *Tonicella marmorea* and directed us to pictures he found on an internet link (*pers. comm.* see references). Rosemary Winnall showed our first rather poor images to a group of conchologists and their consensus was that the pictures showed a fossilised non-British chiton with the proviso it is always difficult to tell from a photo!

As it happens I have a couple of books with keys on marine fauna (Fish & Fish (third edition 2011) and Hayward & Ryland (1995) so I looked at the keys and drawings therein. Although I had heard of chitons I knew nothing about them and had never seen one. I was fascinated to read about these primitive marine molluscs that clung to rocks and fed tough encrusting seaweeds using a rasping radula in a similar way to limpets. If dislodged they able to roll up like a giant legless woodlice. The edges are bordered with a tough girdle and the animal clings to a surface with a large hidden foot. Gills lie between the girdle and foot. The head and body are always enclosed. Sense organs known as aesthetes penetrate the outer shells. Several species are common on British coastlines where they live in rock pools or on rocks at the lower edge of the tide line often beneath overhanging rocks.

I collected the specimen from the Trust office. It was slightly flexible, 32 mm long and 18 mm wide and made up of eight plates held together by other tissue and with the remnants of a leathery girdle round the edges. The inner sides of the plates were shiny and iridescent like the inside of a Swan Mussel *Anodonta cygnea* and other shells. I then spent many hours trawling the internet for information and pictures and looking at the keys and descriptions in books. Most of the pictures were either line drawings or of colourful living animals often adorned with spines and bristles with an obvious fleshy or leathery girdle round the edges: they were not much help in identifying the dry specimen. I held the specimen next to hundreds of pictures on-screen identifying it first as one species then another! In the end I came to the conclusion that Brett was probably correct: Marbled Chiton *Tonicella marmorea* or possibly a smaller relative *Tonicella rubra* or even perhaps *Lepidochitona cinereus* or ... I don’t know for sure! All these occur on British shores often with northern and westerly distributions.

I found interesting descriptions of chitons in the classic *Collins Pocket Guide to the Sea Shore* by Barrett & Younge (my old 1964 revised edition) and especially in Younge & Thompson (1976) *Living Marine Molluscs*. There is also a paragraph and picture in Archer-Thompson & Cremona (2019) *Rocky Shores* and, at the other extreme in Edward Step’s old *Shell Life* (revised edition 1945) of Warne’s Wayside and Woodland series.

During internet searches I came across papers showing that tiny pits and bumps (the aesthetes) on the shells were eyes with argonite lenses Speiser et al (2011) in their summary state “Hundreds of ocelli are embedded in the dorsal shell plates of certain chitons. These ocelli each contain a pigment layer, retina, and lens, but it is unknown whether they provide chitons with spatial vision.” Ling Li et al (2015) in their summary state “... the biomineralized armor of the chiton *Acanthopleura granulata* incorporates an integrated sensory system that includes hundreds of eyes with aragonite-based lenses. We use optical experiments to demonstrate that these microscopic lenses are able to form images.”

The final question is to ask why were the remains of a chiton found in a Worcestershire garden. I put the question to Brenda Laver who found it and she replied “I’m sorry I really can’t be of more help! I have two daughters who used to pick up shells and other bits while on holiday, mostly in Cornwall, France or Greece, and which found their way into the garden. They must have been around now for many years! We live in Claines, Worcester, and I happened to come across it whilst gardening. I took it into the Trust on one of my volunteering days and wondered if any of the Reserve Officers could shed light on it, but only out of idle curiosity”.



01. Chiton found in garden. Dominique Cragg.



02. Chiton found in garden. Dominique Cragg.



03. Chiton found in garden. Side view showing plates and remnant girdle. Harry Green.



04. Chiton found in garden internal view of plates. Harry Green.. Harry Green.



05. Chiton found in garden side view. Harry Green.



06. Chiton found in garden side view of base of plates showing pits and projection probably housing sensory aesthetes. Harry Green.



07. Chiton found in garden side view of base of plates showing pits and projection probably house sensory aesthetes. Harry Green.



08 A living chiton *Lepidochitona cinerea* South Wales. Rosemary Winnall.



09. A living chiton *Acanthochitona fascicularis*, Barranagh, Ireland. Rosemary Winnall.

Acknowledgements.

Many thanks to Brenda Laver sending the specimen; Dominique Cragg for showing it to us and for photographs of the chiton shell; Brett Westwood for putting us on the correct trail; and Rosemary Winnall for pictures of living chitons.

References

- Archer-Thompson, J. & Cremona, J. 2019. *Rocky Shores*. The British Wildlife Collection. Bloomsbury.
- Barrett, J. & Younge, C. M. 1964 revised edition. *Collins Pocket Guide to the Sea Shore*. Collins, London
- Fish, J. D. & Fish, S. (third edition 2011), *A student's guide to the seashore*. Cambridge University Press.
- Hayward, P.J. & Ryland, J. S. (Eds.) 1995. *Handbook of the Marine Fauna of North-West Europe*. Oxford University Press.
- Ling Li, Matthew J. Connors, Mathias Kolle, Grant T. England, Daniel I. Speiser, Xianghui Xiao, Joanna Aizenberg, Christine Ortizl. 2015. Multifunctionality of chiton biomineralized armor with an integrated visual system Article in *Science* November 2015. See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/284224285>. DOI: 10.1126/science.aad1246
- Speiser, D. I., Douglas J. Eernisse, D. J. & Sönke Johnsen. 2011. Report: a chiton uses aragonite lenses to form images. *Current Biology* 21, 665–670, April 26, 2011.
- Step, E. 1945 revised edition. *Shell Life*. Warne's Wayside and Woodland series.
- Younge, C. M. & Thompson, T. E. 1976. *Living Marine Molluscs*. Collins, London.

Westwood, B. (*pers. comm.*). "My first thought is that it looks like a chiton shell...size is right and the underside looks similar to the marbled chiton in this link.
https://www.google.co.uk/search?q=Chiton+shell&xsrf=ACYBGN5mp5yzV9JNSNJ4T6V2BvvAv-dmlg:1570817505356&source=lnms&tbn=isch&sa=X&ved=0ahUKEwj7nKeb55TIAhViXhUIHRgsDLUQ_AUIESgB&biw=1280&bih=617#imgrc=MQMhYH8PEWF_DM:&spf=1570817294539".

Images

01. Chiton found in garden. Dominique Cragg.
02. Chiton found in garden. Dominique Cragg.
03. Chiton found in garden. Side view showing plates and remnant girdle. Harry Green.
04. Chiton found in garden internal view of plates. Harry Green.
05. Chiton found in garden side view. Harry Green.
06. Chiton found in garden side view of base of plates showing pits and projection probably housing sensory aesthetes. Harry Green.
07. Chiton found in garden side view of base of plates showing pits and projection probably house sensory aesthetes. Harry Green.
08. A living chiton *Lepidochitona cinerea* South Wales. Rosemary Winnall.
09. A living chiton *Acanthochitona fascicularis*, Barranagh, Ireland. Rosemary Winnall.