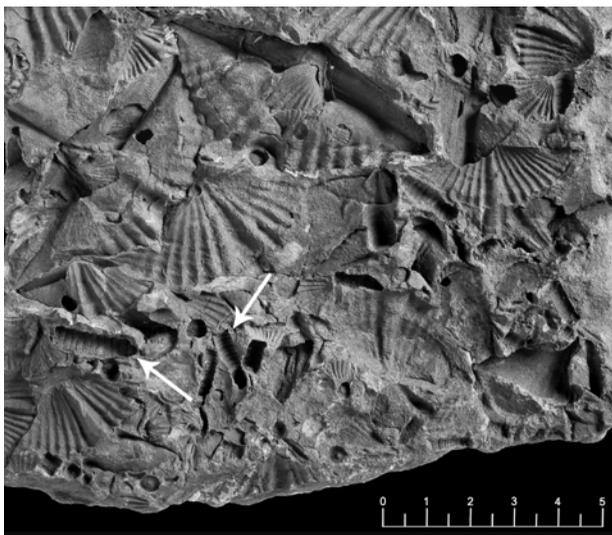


CHARLES DARWIN'S 'GORGONIA' – A PALAEOONTOLOGICAL MYSTERY FROM THE FALKLAND ISLANDS RESOLVED

by

Phil Stone, Adrian Rushton and Fiona Fearnhead

During the celebrated voyage of HMS *Beagle*, Charles Darwin visited the Falkland Islands twice, in March 1833 and March 1834. He thought the islands bleak and inhospitable, but was much excited during his first visit to discover fossils at Port Louis. These he recognised as brachiopods (a type of shellfish) and crinoids (often described descriptively as 'sea-lilies' but actually animals related to sea urchins); an example of the kind of fossils that he saw is shown in Figure 1.



*Figure 1. An example of typical fossils from the Fox Bay Formation similar to those seen and collected by Charles Darwin: NHM specimen number BB17520. He correctly identified the impressions and casts of strongly ribbed shells as brachiopods, and also correctly noted the presence of short sections of crinoid stems (arrowed) and the small round pits that are the remains of individual columnals. Scale in centimetres. For an example of a specimen collected by Darwin see *Falkland Island Journal* 9(2) for 2008, page16.*

The fossils are contained in yellow-brown, silt- and mica-rich sandstone which they indicate to be of Early Devonian age (about 400 million years old). The sandstone is now included formally in the Falkland Islands rock succession as a part of the Fox Bay Formation. On his second visit, Darwin collected more fossils at Port Louis but on this occasion he also found specimens in the same sandstone unit at nearby Johnson Harbour; some of these were types familiar from Port Louis, but others puzzled him. Along with the fossils, Darwin collected specimens of their host sandstone and many other examples of the rocks that he encountered in East Falkland. More rock specimens were brought to him by members of the *Beagle's* crew who had been dispatched on surveying expeditions around the West Falkland coast.

Darwin's fossil collection

Darwin summed-up his ideas on the geology of the Falklands in his geological diary (which covers the entire voyage of HMS *Beagle*) and on page 167 wrote as follows about his fossil collection from the Fox Bay Formation sandstone, also recording his specimen numbers which fall into two groups, the first batch collected in 1833, the second batch in 1834.

“This rock is chiefly remarkable for very numerous impressions of organic remains. 1089-1128, 1152, 1903-09, 1939-1946. These are chiefly species of the subgenera? *Terebratulae* [a variety of brachiopod] & *Entrochites* [crinoids]; of the latter I only procured the joints of the stems [columnals], but I heard of one flower-like head having been found. In one part there were numerous casts which appeared to have been formed by some coral, such as *Gorgonia*; even to this day some fibres of organic matter remain in the tubular cavities. These casts [referring to the whole fossil assemblage, not just *Gorgonia*] occur in particular seams in the sandstone & sometimes in such quantity, that the rock is wholly composed of them.”

When HMS *Beagle* returned to Britain, Darwin passed most of his specimens on to appropriate experts and the Falkland Islands fossils were examined by John Morris and Daniel Sharpe, two of the foremost palaeontologists of the time. Their descriptions of eight species of brachiopod, with abundant crinoid columnals and traces of bivalves and a trilobite were published by the Geological Society of London in its 'Quarterly Journal' (Morris & Sharpe 1846) preceded by a general account of the geology of the Falkland Islands by Darwin (1846). There was no mention of fossil corals or *Gorgonia*. The specimens described by Morris and Sharpe passed first into the care of the Museum of Practical Geology, the Geological Survey's London museum that had been established in 1841. They moved to their present home at The Natural History Museum, London in 1881, following the establishment of that institution as a separate branch of the British Museum. At first, the new museum was

known as the British Museum (Natural History) and only became an independent entity, and The Natural History Museum, as recently as 1965. However, for simplicity in this account and despite any resulting anachronisms, we will refer to it consistently as The Natural History Museum (NHM).

Tracking-down *Gorgonia*

There has been much study and collection of the Falkland Islands Devonian fauna since its discovery by Darwin, as reviewed by Stone & Rushton (2012), but no corals of any sort have been found. Darwin himself made no further references to *Gorgonia* in his published work, and until very recently it was unclear what he was describing when using the term. The name *Gorgonia* was originally coined for the group of corals sometimes known as ‘sea-fans’. Use of the name was then extended to include comparable fossils with a similar branched character, but all of the fossil forms were regarded as rather problematical organisms. Two examples of fossil ‘*Gorgonia*-like corals’ from an authoritative work by Sir Roderick Murchison, published in 1839, are shown in Figure 2. Darwin would have been familiar with the contemporary nomenclature and it was probably something like these illustrations that he thought he had seen in the Falkland Islands. But what was he actually looking at when he suspected the presence of a *Gorgonia*-like coral?

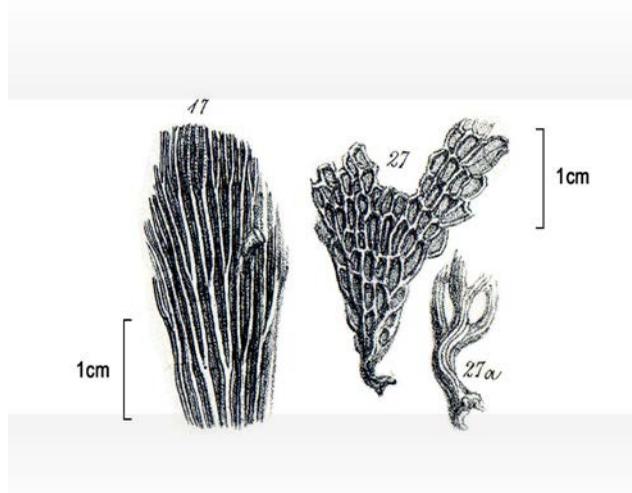


Figure 2. Illustrations from Murchison (1839 - plate 15, numbers 17 & 27) showing what were then described as *Gorgonia*-like corals: *Fenestella milleri* (17) and *Gorgonia assimilis* (27), with enlarged detail of the latter (27a).

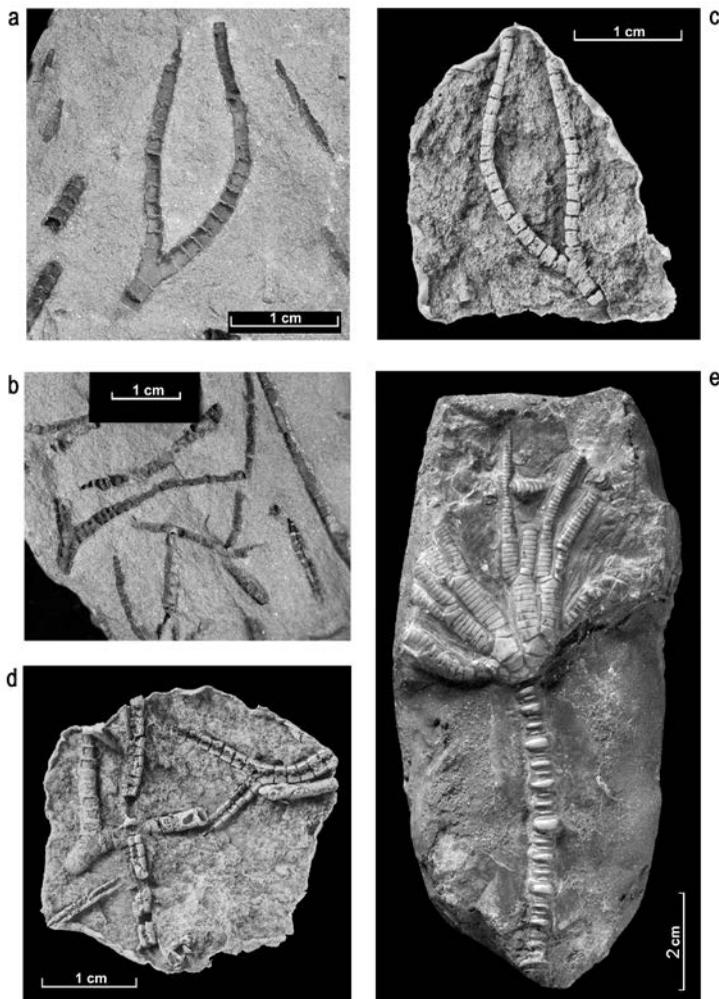


Figure 3. Illustrations of Darwin's 'Gorgonia' specimens, now in the Sedgwick Museum, University of Cambridge and re-identified as arm fragments from crinoids: a) Darwin's Beagle collection specimen number 1941; b) Darwin's Beagle collection number 1942; c) latex rubber cast of number 1941; d) latex rubber cast of Beagle specimen number 1943. For comparison: e) a well preserved crinoid from the south of Scotland (*Woodocrinus* sp.) showing the relationship of the stem to the calyx and branching arms. BGS image number P693045.

Most of Darwin's Falkland Islands fossil collection, including all of the material described by Morris and Sharpe, is still held by the NHM; all of their identifications can be broadly confirmed and there is nothing present that was likely to have been confused with a *Gorgonia*-type organism. In addition to the NHM collection, a small number of Darwin's fossil specimens are now held in Cambridge University's Sedgwick Museum (SM) – appropriately so as the Rev. Adam Sedgwick had been Darwin's geological mentor when he studied at the university. The SM fossils had been retained by Darwin during his lifetime and then, along with most of his rock specimens, they were donated to Cambridge University by his second son, George, in 1897, fifteen years after Charles' death (Anderson, 2009). The SM fossils are less imposing than most of those in the NHM collection, and were probably the examples not selected for close examination by Morris and Sharpe. Like the NHM specimens, the SM fossil collection comprises various brachiopods and crinoids, with nothing present that was likely to have been confused with *Gorgonia*.

The mystery of Darwin's Falkland Islands *Gorgonia* was finally solved by an examination of his rock specimens from the archipelago, which now form part of the SM's 'Harker Collection' and are registered and stored separately from the fossils. Alfred Harker, an eminent petrologist and honorary curator of the SM had catalogued, in about 1907, Darwin's rock specimen collection from the voyage of HMS *Beagle*. Included with the Falkland Islands rocks were six specimens of sandstone from Johnson Harbour that had originally been labelled as *Gorgonia*. Examples are shown in Figure 3, with Darwin's *Gorgonia* proving to be articulated fragments of thin and, in some cases, branching crinoid arms.

The details on the original SM label had presumably been copied from Darwin's notes, but the *Gorgonia* identification was subsequently revised by an unknown hand to '*Bryozoa*', and later still the specimens were correctly recognised to be crinoids – and since 2009 had been displayed as such in the SM. Darwin's original specimen numbers have been preserved on all of the *Beagle* rocks in the 'Harker Collection' and the numbers of the '*Gorgonia*' specimens (1939–1944: 1939 and 1942 are matching parts of the same specimen) confirm that the material was collected during Darwin's 1834 visit to the Falklands. His observation that from the original animal 'some fibres of organic matter remain in the tubular cavities' was incorrect. The traces of brown organic material are most probably the result of relatively recent microbial colonisation of the nooks and crannies in the fossils.

Crinoids: explanation and speculation

Crinoid morphology is summarised in Figure 4. Although many of their component parts are made of hard calcium carbonate, the crinoid organism as a whole is quite fragile, and commonly falls to pieces after the animal's death.

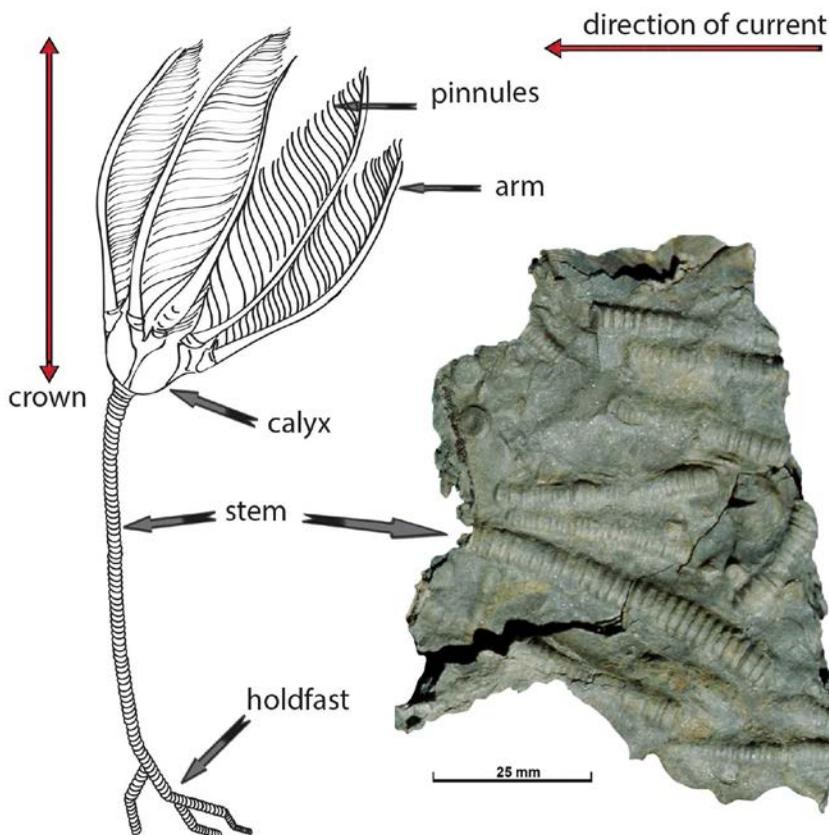


Figure 4. An idealised crinoid with the main components identified. The stem length in most real examples ranges approximately from 1 cm (microcrinoids) to 2 m or sometimes more (fossil crinoid stems that were attached to floating logs can be much longer). The associated specimen of crinoid stems from the Fox Bay Formation is held in Stanley by the Falkland Islands Department of Mineral Resources. If the fossil stems appear as depressions try turning the picture upside-down.

The crown of the animal (Darwin’s “flower-like head”) comprises the calyx and the arms, together with the feathery, food-gathering appendages (pinnules) that they support; it is much more fragile than the stem and its components are only very rarely preserved. The commonest parts to survive are the myriad small bead-like discs, the columnals, that make up the stem and which are scattered through many of Darwin’s fossil-bearing sandstone specimens from the Falkland Islands. In the case of the

examples from Johnson Harbour, it is possible that the enclosing sandstone was deposited rapidly, burying the stems and arms of living crinoids before there was any opportunity for their disaggregation. When long sections of the stem retain integrity the resulting fossil can be quite spectacular, as in the intact examples illustrated from Pebble Island, West Falkland, in Figure 5; the remains of one calyx and the beginnings of the arms can be faintly seen at the water's edge in the lower left corner, as indicated by the arrow. One of the Pebble Island examples has been formally described as *Botryocrinus doubleti* (Clarke 1913). Darwin's arm specimens from Johnson Harbour, and indeed all of the widely preserved stems and columnals, are not sufficiently distinctive to allow any more than their general assignment to the Class Crinoidea.



Figure 5. Long sections of still-articulated crinoid stems from the Fox Bay Formation of Pebble Island, West Falkland. Note the calyx and the beginnings of the arms faintly discernable at the water's edge in the lower left corner and indicated by the arrow. The Falkland Islands two pence coin is 2.5 cm in diameter.

Although Darwin's puzzling '*Gorgonia*' fossils have now been located, the second part of the mystery persists. Why did Darwin describe his specimens of crinoid arms as "some coral, such as *Gorgonia*" whilst correctly identifying as crinoid remains the widespread, disarticulated columnals derived from the stem of the animal? Indeed, in

some of the specimens from Johnson Harbour, '*Gorgonia*' is accompanied by obvious scatterings of the disarticulated, individual columnals that Darwin would not have mistaken for anything else. He was clearly familiar with the overall structure of crinoids, referring in the quotation reproduced at the beginning of this article to the animal's "flower-like head" (the crown in Figure 4). It would seem very unlikely that the '*Gorgonia*' specimens were seen by Morris and Sharpe who, despite not being specialists in that animal group, would have indubitably recognised them for what they were and most probably have mentioned them in their 1856 paper. Instead, Darwin would seem to have side-tracked his Falkland Islands oddities into the rock collection, perhaps with the intention of eventually passing them on to an appropriate specialist – but then forgotten about them. When correctly recognised as crinoids, many years later at the Sedgwick Museum, there would have been no appreciation of the Falklands perspective on Darwin's '*Gorgonia*' enigma. Only very recently have all the strands come together.

A summary of specimen information

Details of the SM's '*Gorgonia*' specimens and their labelling are given below; the first number given (emboldened) is Darwin's Beagle collection number, the second number is the SM (Harker/petrology) registration number. For more discussion of the SM collection, and the larger 'Darwin' collection held by the NHM, see Stone & Rushton (2013).

- 1939** – 112299. Johnson Harbour, East Falkland. Fox Bay Formation sandstone with sections of crinoid arms. Originally labelled as '*Gorgonia*', this name has been crossed out and replaced with 'Bryozoa'.
- 1940** – 112300. Johnson Harbour, East Falkland. Fox Bay Formation sandstone with sections of crinoid arms. Originally labelled as '*Gorgonia*', this name has been crossed out and replaced with 'Bryozoa'; in 2014 on display in the Sedgwick Museum as crinoids.
- 1941** – 112301? Johnson Harbour, East Falkland. Fox Bay Formation sandstone with sections of crinoid arms. Originally labelled as '*Gorgonia*', this name has been crossed out and replaced with 'Bryozoa'; in 2014 on display in the Sedgwick Museum as crinoids. Specimen and cast illustrated in Figure 3.
- 1942** – 112299? Johnson Harbour, East Falkland. Fox Bay Formation sandstone with sections of crinoid arms. Originally labelled as '*Gorgonia*', this name has been crossed out and replaced with 'Bryozoa'; in 2014 on display in the Sedgwick Museum as crinoids. This specimen is the counterpart of **1939/112299**. Specimen illustrated in Figure 3.
- 1943** – 112302. Johnson Harbour, East Falkland. Fox Bay Formation sandstone with sections of crinoid arms. Originally labelled as '*Gorgonia*', this name has been

crossed out and replaced with 'Bryozoa'; in 2014 on display in the Sedgwick Museum as crinoids. Cast illustrated in Figure 3.

1944 – 112303. Johnson Harbour, East Falkland. Fox Bay Formation sandstone with sections of crinoid arms and columnals. Originally labelled as '*Gorgonia*', this name has been crossed out and replaced with 'Bryozoa'; in 2014 on display in the Sedgwick Museum as crinoids.

1945 & 1946. Darwin's notes suggest that specimen numbers 1945 and 1946 also showed '*Gorgonia*', but these examples have not been found.

Acknowledgements

We thank Dan Pemberton and Matt Riley of the Sedgwick Museum, University of Cambridge, for their help in locating the '*Gorgonia*' specimens and for facilitating their photography. Brian McIntyre of the British Geological Survey, Edinburgh, helped in the compilation of the figures.

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P. Stone, British Geological Survey,
Murchison House, West Mains Road, Edinburgh EH9 3LA.

A.W.A. Rushton, Department of Earth Sciences,
The Natural History Museum, Cromwell Road, London SW7 5BD

F.E. Fearnhead, Angela Marmont Centre for UK Biodiversity,
The Natural History Museum, Cromwell Road, London SW7 5BD