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João Rui Pita
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(eds.)

Darwin, Evolution, Evolutionisms

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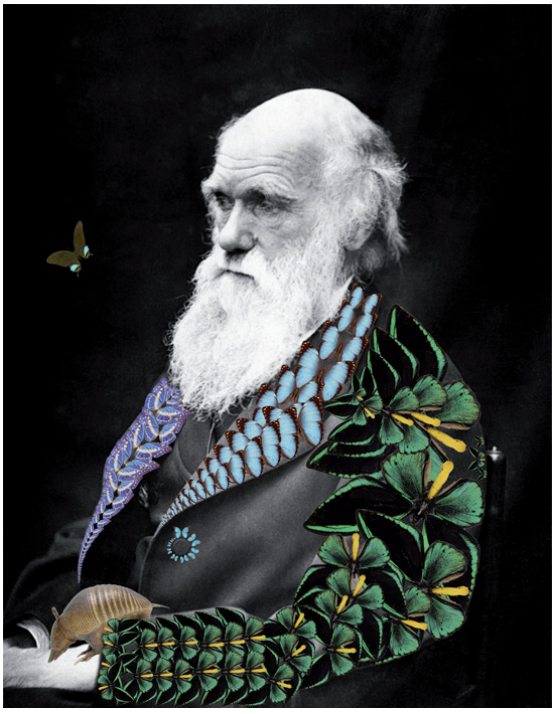

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Corallines and other Macroalgae Collected during the *Beagle* Voyage

Introduction

The *Beagle* voyage lasted four years and nine months, two thirds of which Darwin was on shore (Keynes, 2000). He studied a great diversity of geological characteristics, fossils, living organisms (animals and plants) and met various people, among natives and colonists, during the voyage. Darwin collected methodically a great number of specimens, many of which new to science, characteristic which gave him the reputation of naturalist. His detailed annotations showed his gift for theorization and were at the base of his previous works, giving his descriptive, social, political and anthropological points of view of the regions he visited.

Charles Darwin is not usually remembered as a "botanist" although he had published various books about different aspects of vegetable life, based partly on his personal experience. In his autobiography (Barlow, 1958), Darwin wrote: "my appreciation for natural history, in particular the gathering and collecting of living organisms was well developed during my life. I tried to name the plants and collected various types of objects: shells, stamps, coins and minerals. The passion for collecting is the reason a man is a systematic naturalist, a virtuoso or a scrooge, it was very strong in me and clearly innate, as none of my brothers or sisters ever had". This "passion for collecting" was more evident during the expedition aboard the *Beagle.* After the voyage, Darwin traded his passion for collecting specimens to collecting information (Porter, 1987).

By publishing "Darwin's coralline algae collected on the voyage of the *Beagle*", the Irish botanist William Henry Harvey (1811- 66, Curator of the Herbarium, "Trinity College", Dublin) cites various excerpts of handwritten notes of Darwin about his collected material and thanks Darwin for the donation to his Herbarium of coralline which he had collected during his voyage around the world, on board the *Beagle* and for the permission to freely use his handwritten notes. However, the transcribed excerpts by Harvey differ, in some cases, from the "field notes" of Darwin included in *Zoological Diary* (Porter, 1987).

Darwin wrote in his autobiography (Barlow, 1958) that "… on the *Beagle* another of my occupations was to collect animals and plants of various classes, writing a brief description and dissecting many of the marine organisms collected. However, due to my lack of skill for drawing and an absence of profound knowledge of the anatomy of some of the beings collected, a great pile of marine organisms mounted in my cabin

and much of what I did during the voyage revealed itself almost useless. Thus, I lost much of my time, with exception of that which I spent acquiring some knowledge of Crustaceans, knowledge which allowed me to later on write a monograph on the infraclass Cirripedia". Despite of what Darwin wrote in his autobiography on these notes and drawings in 1876, today researchers (Porter, 1987) consider all this information (written and iconographic) of extreme usefulness to understand Darwin's evolution of thought and his transformation from naturalist to scientist.

The specimens collected by Darwin and described in this work can be found, in their great majority, in the herbariums of "Botany School, Trinity College", in Dublin and in the "Cryptogamic Herbarium" of the British Museum of Natural History. Many of these specimens are the types of names published by Harvey.

The Voyage

Santiago, Cape Verde Archipelago

The Voyage of the Beagle is the title generally given to the book written by Darwin and published in 1839 as *Journal and remarks.* The title refers to the second expedition of topographical survey of the *Beagle,* which sailed from Plymouth Sound on December 27th 1831 under the command of Captain Robert FitzRoy. It passed Madeira Island, then went to Tenerife, but was prohibited to disembark due to the cholera quarantine imposed on ships coming from England.

The first stop was made on the volcanic island of Santiago in the Cape Verde Archipelago, where Darwin's Journal had its first account. While precise readings were done to confirm the data on longitude, Darwin visited the beach, having stayed on the island from January 16th until February 8th. During this period he made several notes in his Journal (Barlow, 1933) regarding organisms collected from the coastline, including a specimen of *Jania micrarthrodia* J.V. Lamoroux (Corallinales, Rhodophyta), having been mounted on the same page along with nine other specimens, including a specimen entitled "close to *J. micrarthrodia* of King George Sound, in Western Australia" (Porter, 1987). The epilitic specimens are, apparently, less common than epiphyte specimens (see Figure 1A) (Womersley & Johansen, 1996).

During the return voyage to England, the *Beagle* was in the harbour of the city of Praia from August 31st until September 4th of 1836. Darwin collects a few more specimens of algae, mainly *Amphiroa beauvoisii* J.V. Lamouroux (Figure 1B) (Corallinales, Rhodophyta).

Archipelago of Fernando de Noronha, Brazil

On February 20th 1832, Darwin was at the archipelago of Fernando de Noronha, aboard the *Beagle*, where he did various studies of the place, leaving an important account of his observations on the archipelago. From his observations and notes there is *Caulerpa webbiana* Montagne algae (Caulerpaceae, Chlorophyta) (see Figure 1C).

Bahia, Brazil

After passing through various other islands, the *Beagle* arrived at Salvador da Baía (Brazil) on February 29th; Darwin was marvelled with the luxuriant rainforest (tropical forest). At this location he collected various specimens of *Melobesia mamillaris* Harvey (see Figure 1D), synonymous (basionym) of *Neogoniolithon mamillare* (Harvey) Setchell & L.R. Mason (Corallinaceae, Rhodophyta). The syntype locations of these species are: Bahia, Brazil; Tierra del Fuego; Cape Verdean Islands; Algoa Bay, Cape Province, South Africa (Silva, Basson & Moe 1996).

During the return voyage to England the *Beagle* docked in Bahia, in August 1836. Darwin logs in his Journal that *Melobesia mamillaris* Harvey synonymous *Neogoniolithon mamillare* (Harvey) Setchell & L.R. Mason) and the *Lithothamnion scabiosum* (Harvey) Foslie "are very common fouling species on the smooth surfaces of granite rocks, in tide pools."

Archipelago of Abrolhos, Bahia, Brazil

Abrolhos is an archipelago located in the Atlantic Ocean south of the coastline of the state of Bahia and composed of five islands situated six nautical miles (approximately seventy two kilometers) from the coast of Caravelas. The *Beagle* was near the Archipelago of Abrolhos from March 27th until March 30th 1832 (Porter, 1987). Darwin collected at this location various specimens of *Halimeda opuntia* (Linnaeus) J.V. Lamouroux (see Figure 1E), and, contrary to what was assumed then, these organisms are not coralline algae, but members of Halimedaceae (Chlorophyta) (Guiry & Guiry, 2009).

Cabo Frio, Rio de Janeiro, Brazil

Close to this location were collected samples of *Amphiroa variabilis* Harvey, synonymous (Basionym) of *Arthrocardia variabilis* (Harvey) Weber-van Bosse (Harvey, 1847; Weber-van Bosse, 1904. According to Darwin's Journal (Barlow, 1933), the *Beagle* was in the proximity of Cabo Frio from April 3rd until July 5th 1832, but does not explicit if the samples were collected during these dates. Most likely they were collected during his trip, on land, to the Macaé River, between April 8th and 22nd or were collected by someone that stayed aboard the *Beagle* (Porter, 1985).

Botafogo Bay, Rio de Janeiro, Brazil

Various specimen of *Amphiroa variabilis* were collected at Botafogo bay in June 1832. These specimens are, maybe, the ones mentioned in his Journal, dated June 8th: "…collecting some coralline on rocks surrounding part of Botafogo's bay…". There is a description of these specimens of a type of *Amphiroa* on page 56 of *Zoological Diary* (briefly paraphrased by Sloan, 1985): "…very flat branches, formed

by arched layers, very fragile, calcareous, in the shape of parallel longitudinal fibres…". Besides these species, "in Spirits" specimens of *Amphiroa beauvoisii* J.V. Lamouroux (Figure 1B) (Corallinales, Rhodophyta) were also collected and preserved.

On page 63 of *Zoology Notes there are some general notes on the distribution of corallines and other organisms on Brazil's coastline:* "Roaming the coast: the rocks, as in Bahia and other tropical locations, are visited by… many species of *Pilumnus* (type of class Malacostraca, crabs) on specimens of the order Fucales: in the original. "Fuci" (Fucales, Phaeophyceae) …"

Falkland Islands

Passing by the Falkland Islands, Darwin collected, on March 25th 1833 numerous samples of *Corallina officinalis* Linnaeus (see Figure 1F). From light pink to purple, calcified, articulated fronds with 60-70 (-120) mm in height, from cylindrical to long axles, always feather-like. Very polymorphic species, sometimes of reduced dimensions. In disfavouring habitats this algae presents a vestigial erect system and can exhibit an extensive basal part (Guiry & Guiry, 2009). According to Porter (1987) there were presumably collected samples of *Amphiroa exilis* Harvey, synonymous of *Amphiroa beauvoisii* J.V. Lamouroux (Corallinales, Rhodophyta).

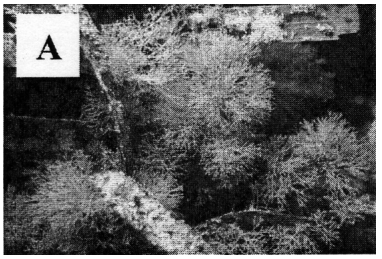
Regarding *Macrocystis pyrifera,* although Darwin apparently did not collect these conspicuous brown algae, he wrote in *Zoolgical Diary,* due to its ecological importance: "…the immense quantity and number of species and organic beings which are intimately connected to "Kelp". This plant, *Fucus giganteus* (Figure 1G), is always anchored to the rocks. In fact, the algae is very common in this area of the globe and the name is synonymous to *Macrocystis pyrifera* (Linnaeus) C. Agardh (Laminariales, Phaeophyceae) (Porter, 1987; Guiry & Guiry, 2009).

Puerto Deseado, Patagonia, Argentina

At this location, in January 1834 there were samples collected from the species *Amphiroa orbigniana* Decaisne (see Figure 1H), synonymous (basionym) of *Bossiella orbigniana* (Decaisne) P.C. Silva (Corallinales, Rhodophyta),

Strait of Magellan

The Strait of Magellan is a navigable passage of approximately 600 km immediately south of South America, situated between the continent and Tierra del Fuego with Cape Horn south. The strait is the biggest and most important natural passage between the Atlantic and Pacific Oceans and, during its crossing, Darwin collected various specimen of *Polysiphonia berkeleyi* (Montagne) J.D. Hooker, synonymous of *Heterosiphonia berkeleyi* Montagne (Ceramiales, Rhodophyta) (Montagne, 1842).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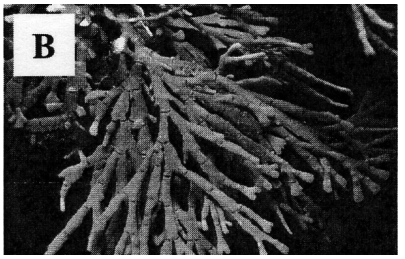
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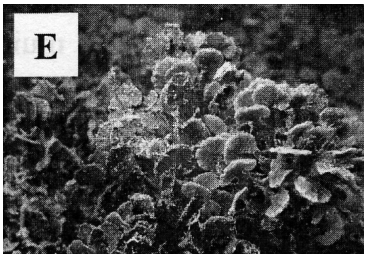
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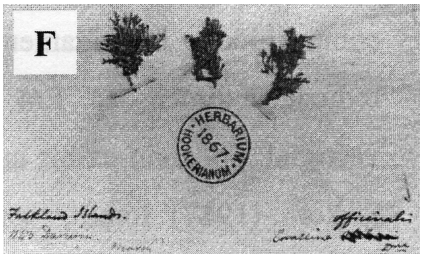
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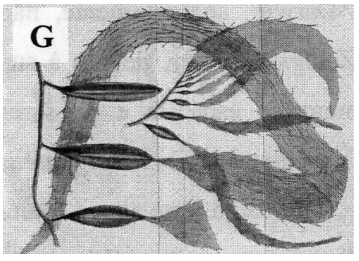
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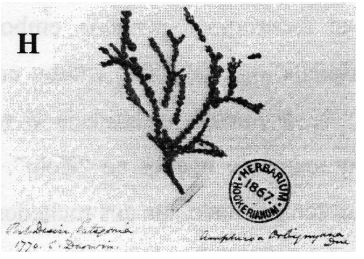
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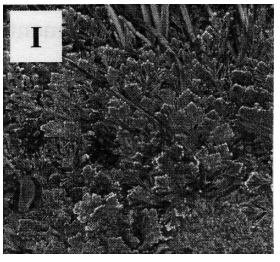
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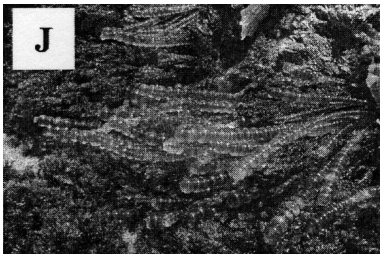
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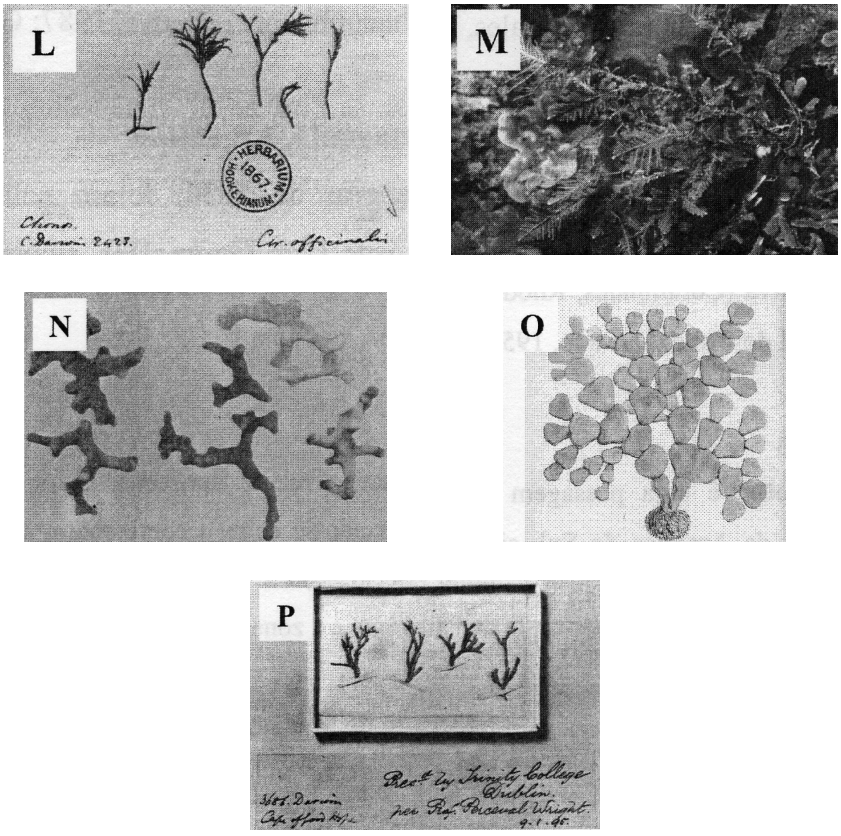

Figura 1. – A – Jania micrarthrodia; B – Amphiroa beauvoisii; C – Caulerpa webbiana; D – Melobesia mamillaris; E – Halimeda opuntia; F – Corallina officinalis (collected in the Falkland Islands); G – Fucus giganteus (Macrocystis pyrifera); H – Amphiroa orbigniana; I – Corallina officinalis var. chilensis; J – Chaetomorpha coliformis; L – Corallina officinalis (collected in the Chonos Archipelago, Chile); M – Jania rosea; N – Phymatolithon calcareum; O – Halimeda macroloba; P – Amphiroa exilis var. crassiuscula

Santa Cruz, Argentina

Here, there were probably specimens of the type of *Fucus* (Fucales, Phaeophyceae) collected during the second week of May, when the *Beagle* was sailing between Santa Cruz and the Tierra del Fuego (Porter, 1987).

Valparaiso and Port Famine, Tierra del Fuego, Chile

The *Beagle* navigated this area during the months of August and September 1834, having Darwin collected specimens of *Corallina chilensis* Decaisne, synonymous (basionym) of *Corallina officinalis* var. *chilensis* (Decaisne) Kützing (Corallinales, Rhodophyta) (Figure 1I), whose lectotype location is Valparaiso, Chile (Silva, Basson & Moe, 1996).

Cabo Tres Montes, Chile

In this location, on December 31st 1834, they collected specimens of *Conferva clavata* var. *darwinii* J.D. Hooker & Harvey, synonymous of *Chaetomorpha coliformis* (Montagne) Kützing (Figure 1J) (Cladophorales, Chlorophyta) (Kützing, 1849; Porter, 1987) and of *Sphacelaria funicularis* Montagne, synonymous (basionym) of *Stypocaulon funiculare* (Montagne) Kützing and whose type location is Falkland (Sphacelariales, Phaeophyceae) (Silva, Basson & Moe, 1996).

Chonos Archipelago, Chile

The *Beagle* navigated through the Chonos Archipelago, in the south of Chile, between December 1834 and January 1835. In this archipelago they collected specimens of: *Corallina officinalis* L. (Figure 1L); *Bossea orbigniana* (Decaisne) Manza, synonymous of *Bossiella orbigniana* (Decaisne) P.C. Silva; *Amphiroa orbigniana* Decaisne (Figure 1H), synonymous (basionym) of *Bossiella orbigniana* (Decaisne) P.C. Silva; *Amphiroa darwinii* Harvey, synonymous of *Bossiella chiloensis* (Decaisne) H.W. Johansen; *Melobesia polymorpha* Harvey, synonymous of *Lithophyllum incrustans* Philippi (Corallinales, Rhodophyta) (Porter, 1987; Guiry & Guiry, 2009).

Galapagos Islands

Darwin was at the Galapagos Islands from September 15th until October 19th 1835 and, during that period, observed and collected various algae of the following species: *Melobesia calcarea* (Pallas) Harvey and *Lithothamnion calcareum* (Pallas) J.E. Areschoug, both synonymous names of *Phymatolithon calcareum* (Pallas) W.H. Adey & D.L. McKibbin (Figure 1N) (Corallinales, Rhodophyta) (Porter, 1987; Guiry & Guiry, 2009).

King George Sound, Australia

The *Beagle* docked at King George's Sound from March 6th until 14th 1836. Regarding this location, Darwin wrote in his Journal: "We have been here for eight days and I do not remember, since we left England, having spent such a boring and uninteresting period" (Barlow, 1933). In the rocky intertidal he collected samples of: *Amphiroa stelligera* Decaisne, synonymous of *Metagoniolithon stelliferum* (Lamarck) Ducker; *Jania rosea* (Lamarck) Decaisne (Figure 1M); *Corallina chilensis* Decaisne, synonymous (basionym) of *Corallina officinalis* var. *chilensis* (Decaisne) Kützing; *Jania tenuissima* Sonder, synonymous of *Jania micrarthrodia* J.V. Lamouroux (Figure 1A); *Lithophyllum darwinii* (Harvey) Foslie, synonymous (basionym) of *Melobesia darwinii* Harvey (Corallinales, Rhodophyta) (Guiry & Guiry, 2009).

Cocos-Keeling Islands, Indic Ocean

Situated in the Indian Ocean, northeast of Australia, these islands are approximately 580 miles southeast of Java and form two coral atolls densely covered by coconut trees. The *Beagle* docked at the Cocos-Keeling Islands from April 1st to 12th 1836 and during this period, Darwin collected specimens of *Halimeda macroloba* Decaisne (Figure 10) that, contrary to what Darwin supposed, were not coralline algae but members of the Halimedaceae class (Chlorophyta) (Porter, 1987; Guiry & Guiry, 2009).

Cape of Good Hope, Simon's bay, South Africa

The *Beagle* was anchored at Simon's bay from May 31st to June 18th and Darwin must have collected at that location various specimens of *Amphiroa exilis* var. *crassiuscula* Harvey (Figure 1P), whose name is synonymous to *Amphiroa beauvoisii* var. *crassiuscula* (Harvey) Yendo (Corallinales, Rhodophyta) (Guiry & Guiry, 2009).

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Figure Credits

Figure 1: A – Huisman, J.M. (2000); B – F. Leliaert in Clerck, O., Bolton, J.J., Anderson, R.J. & Coppejans, E. (2005); C – Huisman, J.M. (2000); D – Jan Christian Sørlie (Forskning.no); E – Oliveira, E., Österlund, K. & Mtolera, M.S.P. (2005); F – Porter, D.M. (1987); G – Harvey, W.H. (1858-1863); H – Porter, D.M. (1987); I – Colin Bates (Algaebase.org); J – Nuytsia@Tas (Flickr.com); L – Porter, D.M. (1987); M – Huisman, J.M. (2000); N – Guiry, M.D. (Algaebase.org); O – Harvey, W.H. (1858-1863); P – Porter, D.M. (1987).