CHARLES DARWIN, A SOMEWHAT RELUCTANT DEBUTANT?

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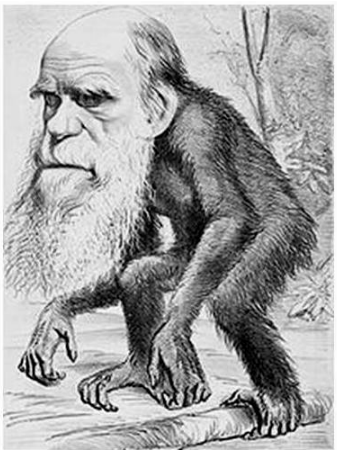


Fig 1: 'A Venerable Orang-outang', a caricature of Charles Darwin published in the Hornet, 1871

How big a part did geology play in the development of Darwin's theories?

It has been suggested that it was only by the middle of the nineteenth century that an adequate understanding had been gained about the Natural Sciences for the essentials of the Theory of Evolution to be formulated with any confidence, and that England was probably the most likely location for such revolutionary thought. This indicates an inevitability in the unfolding of such a theory, but I am still captivated by the actual sequence of the events preceding the publishing of the 'Origin' and I am fascinated by the revelations which have been made regarding the nature of Darwin himself. By all accounts he was a fine exemplary family man. He was able to put together a relatively complete explanation for the processes of evolution, which enabled first this country and then the whole world to start coming to terms with the past realistically.

Some Relevant Chronology	
1654	Bishop Usher calculated the time for the Creation of the World as 9am 23 October BC 4004
1650-1800	Approximate period of the so-called Age of Enlightenment, in which 'reason' started to prevail over long held 'dogmas'
1687	Isaac Newton deduced his 'Principia Mathematica', which in due course provided the basis for calculations to get man to the moon
1815	William Smith prepared his Geological Map, which 'changed the world'
1830	Charles Lyell published his 'Principles of Geology', shaking prevailing views of how the Earth had been formed
1832	The Great Reform Act greatly extended the franchise and resulted in more freedom of expression.
1831-1836	'Voyage of the Beagle' in which Charles Darwin accompanied Captain Fitzroy around the world, principally as a companion and naturalist
1859	Charles Darwin published his book 'On the Origin of Species'
1862	Lord Kelvin dated the Earth as some 20 million years old on the basis of heat loss calculations.
1911	Ernest Rutherford's understanding of radioactivity enabled accurate dating of the Earth.
1953	Francis Crick and James Watson discovered the structure of DNA, contributing greatly to developments of the science of genetics and an understanding of mutations.
1965	Arthur Holmes published his 'Principles of Physical Geology', articulating Continental Drift.
2009 19 May	Announcement made for 'Ida, Darwinius masillae' (47 million years old fossil primate).

I think it is interesting to speculate as to why this fairly ordinary man, who in his early years had not been regarded by his contemporaries as being of exceptional potential, should have been the first to correctly interpret the signs which surrounded him. I believe it to be due to his unique circumstances. This is indicated in the opening lines of the 'Origin', which reads:

"When on board H.M.S. Beagle as naturalist, I was much struck with certain facts in the distribution of the inhabitants of South America, and in the geological relations of the present to the past inhabitants. These facts seem to me to throw light on the origin of the species - that mystery of mysteries - as it has been called by one of our great philosophers."

In the first part of the chronology provided above I have drawn attention to some of the relevant developments of the preceding two hundred years, of which Darwin himself would have been all too aware. He spent two years at Edinburgh University, in a city which has been described as central to the Age of Enlightenment, and this would have helped to develop Darwin as a free thinker. However, I believe that it was his growing understanding of the true nature of Geology which was crucial to the development of his thought. He studied Natural Sciences under John Stephen Hounslow at Cambridge University and this would have provided him with a general introduction to Geology. Events in his field trip to Wales with Alan Sedgewick shortly before 'the Voyage of the Beagle' may have had a profound effect on him. He became aware that the geological mapping that they were using was significantly wrong, and he himself was able to identify the correct geological sequences. In the next thirty years he was able to show that much of the general understanding of the Biology of his time was essentially incorrect, and he is largely responsible for establishing the fundamentals of our current knowledge.

The emphasis of Darwin's interests, at any rate for the early period of the voyage, is illustrated by the fact that he sent back some 1400 pages of

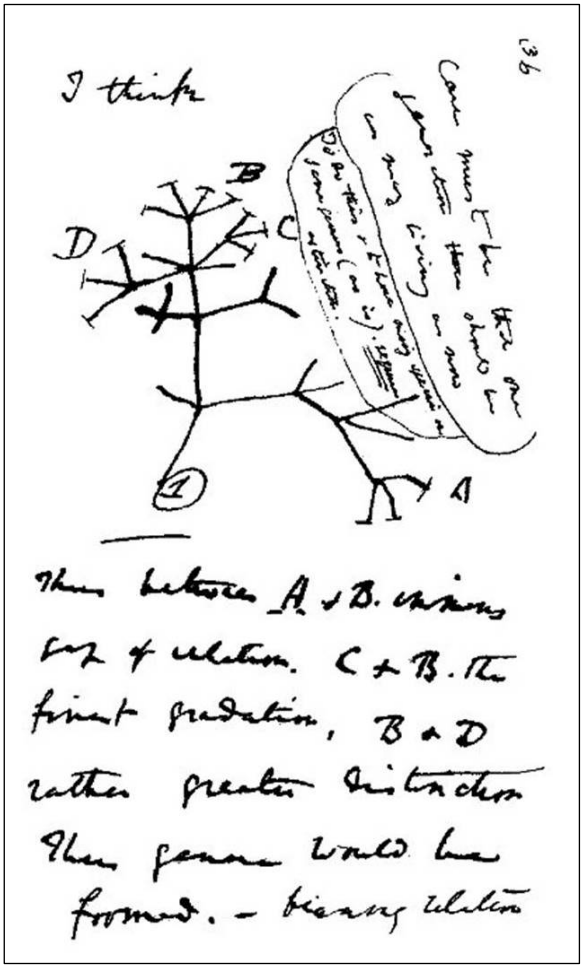


Fig 2: Darwin's 'Tree of Life' from his "B" notebook, around 1837, illustrating his first understanding of an evolutionary tree

notes of geological observations as against 360 pages of notes relating to zoological matters. He had taken with him a copy of Charles Lyell's revolutionary book 'Principles of Geology' (first printed shortly before the 'Voyage') and this undoubtedly had a great influence on him.

While in Valdivia, Chile, Darwin was able to observe 'Geology in the making'. He was in close proximity to a fairly substantial earthquake of about 2 minutes duration, for which he and Captain Fitzroy measured an eight-foot uplift of the land. This experience must have helped establish a mind-set which enabled him to interpret his later observations in the Galapagos Islands in terms of the processes of Evolution. The archipelago chain of islands extending out into the Atlantic was subjected to major cyclic climate changes with the occurrence of the Niños. This provided him

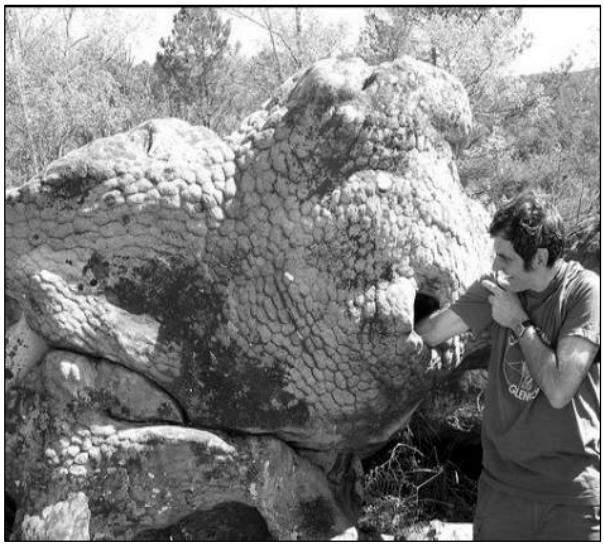
with insights into how flora and fauna have had to adapt to survive and how new species have evolved.

Darwin's deductions about the 'Tree of Life' are key to the development of his theories of Evolution. The sketch, which appeared in one of his notebooks and is reproduced as Fig 2, illustrates his early thought processes on such matters. It was typical of this modest man that it should be annotated with the words 'I think'.

Some of the major discoveries made since the time of Darwin that are of particular relevance to a fuller understanding of the mechanics of Evolution, are referenced in the Chronology. It is extraordinary to find how little conflict has subsequently emerged over the general principles first identified by Darwin. A matter that had worried him at the time, namely the actual mechanics for change, is now quite well understood with the recent development in the science of genetics. The occurrences of mutations have been described by leading geneticist Steve Jones as 'the fuel for the Darwinian factor'. Much scepticism about his theories was initially expressed because of the apparent lack of evidence for transitional varieties. Darwin recorded his own concerns about these aspects in Chapter 9 of the 'Origin' (On the Imperfections of the Geological Record), but expressed the belief that examples would be found by future generations. This has indeed proved to be the case. It may not be a coincidence that the announcement for the very spectacular 'Ida, Darwinius masillae' fossil should have been made during this Centenary Year. This extraordinarily well preserved Primate fossil has been studied in secret by world experts for the past two years. It is 47 million years old and is thought to lie close to the split into the branches for Apes and Lemurs. It therefore may well be a direct ancestor to the human species. The fossil, when it came into the hands of Dr Hurum, was more than 90% complete and impressions of the fur and soft body outline were discernable. A sketched representation of Ida, as provided in Fig 3, is therefore likely to be quite accurate.

Fig 3: The sketched representation of Ida by Bogdan Bocianowski comes from the report published by the research team, on the Public Library of Science web site, May 2009

PHOTO CAPTION COMPETITION



Please write a caption for the photo and send your answers to chairman@bathgeolsoc.org.uk or 'phone 01225 742752.

Captions will be shown at the October meeting.

There will be a small prize for the funniest!

The photo, by Michèle Bourne from the Earth Science Education Unit, Keele University, shows the Tertiary Fontainebleau sandstone. It is said to show poikilotopic texture, mentioned in the Osmington Mills article.