

Reading Guide 6

Geographical distribution

6.1 Darwin [1872, ch 12, p. 316]: Geographical distribution, I

1. How, according to Darwin, do the facts of geographic distribution support the theory of evolution? What facts does he cite? How does evolution account for them?
2. Much of Darwin's argument is about dispersal ability. Which types of plant and animal can travel across oceans? Which cannot? How does Darwin estimate these differences in dispersal ability? What facts does he explain in this fashion?
3. What facts were inexplicable to Darwin, given his ignorance about continental drift?
4. Why did Darwin think ocean barriers might not be permanent?
5. How do ice ages account for the similarity of species isolated on mountain tops, such as the pika populations of the Wasatch and Oquirrh mountains?
6. Fleeming Jenkin [1973, p. 342] was sarcastic in his comment on this chapter:

The peculiarities of geographic distribution seem very difficult of explanation on any theory. Darwin calls in alternately winds, tides, birds, beasts, all animated nature, as the diffusers of species, and then a good many of the same agencies as impenetrable barriers. There are some impenetrable barriers between the Galapagos Islands, but not between New Zealand and South America. Continents are created to join Australia and the Cape of Good Hope, while a sea as broad as the British Channel is elsewhere a valid line of demarcation. With these facilities of hypothesis there seems to be no particular reason why many theories should not be true.

What do you make of this? Is it a fair criticism of Darwin's chapter?

6.2 Darwin [1872, ch 13, p. 343]: Geographical distribution, II

Vocabulary

endemic species A species that is found only in a given region and nowhere else. For example, the *ring-tailed lemur* is endemic to Madagascar.

oceanic island An island that was never attached to a continent. These are often volcanic. Examples would include the Galapagos Islands and the Hawaiian Islands.

continental island An island that was once attached to the mainland. New Zealand is such an island. Great Britain is another.

batrachian Frog or toad

Discussion questions

1. How do fresh-water mollusks and plants move from one river drainage to another?
2. Compared with a continental region of the same size, do islands tend to have more species or fewer? Why?
3. Oceanic islands seldom have native species of amphibian or land mammal. They often, however, have native reptiles, birds, and bats. Why?
4. The mammals living on separate islands tend to be more different if the water separating the islands is deep—less different if that water is shallow. Why?

6.3 Douglas Dewar [1931, ch. 3] on Geography

1. Dewar [1931, p. 14] summarizes Darwin’s arguments about geographic variation. Which of Darwin’s arguments does he leave out?
2. Dewar argues that if evolution were true, we should find fossil marsupials in Eurasia. Make sure you understand his argument. Then consider J.B.S. Haldane’s response:

I cannot follow your argument about marsupials. Till a bit more palaeontology has been done in Asia one cannot lay any stress on the absence of marsupials found in Europe in the Eocene. If evolutionists are right, they must have been there before Australia was cut off at the end of the Cretaceous. The only Asiatic Cretaceous mammals known are, I think, from Mongolia. When half a dozen Cretaceous mammalian faunae without marsupials are known from India, China, Malaya, and so on, you will have a case; but not till then. These things, like the transitional cases in birds and spiders, not to mention *Plesianthropus*, are generally found when people start looking for them. [Dewar et al., 1949, p. 40]

(The full text of this debate is on the course website under “Further reading.”) Finally, consider this recent news item: <http://news.bbc.co.uk/2/hi/science/nature/3311911.stm>, which is also under “Further reading.”

3. Dewar [1931, p. 19] asks an interesting question. If fish colonized the land once (becoming amphibians), why did they not colonize it repeatedly on oceanic islands? What do you think? Why didn’t they?
4. Dewar agrees that new species and genera evolve on islands. But he emphasizes that nearly all island species are members of families that are also found on continents. For this reason, he argues that families and sub-families do not evolve on islands. Would you agree? Can you think of an alternative explanation?

5. In other publications, Dewar emphasizes taxa with discontinuous distributions. For example, tapirs

are found in Malaya and in Central and South America. The geographical separation of these two groups (American and Malayan species of Tapirs) could hardly be more marked, or suggest a longer period since they might have interbred; yet the two groups are still so alike that all their members have to be classed in the same genus. [Dewar et al., 1949, p. 15]

Furthermore,

The Coecilians (legless, worm-like, burrowing amphibia) occur in America from Mexico to Peru, Tropical Africa and the East Indies. How did they come to be thus distributed? [Dewar and Shelton, 1947, p. 145]

How would you explain these distributions?

6.4 Hallam [1972]: Continental drift and the fossil record

1. Hallam summarizes Wegner's pre-war arguments in favor of continental drift. What were these arguments?
2. What does Hallam mean by "convergence," "divergence," "complementarity," "disjunct endemism," and "subduction?"
3. Hallam re-iterprets the fossil record in light of new discoveries about plate tectonics. He discusses each of the following places and times:
 - (a) 2 my ago at the Isthmus of Panama.
 - (b) 25 my ago in the Tethys Sea (now the Caribbean Sea, the Mediterranean Sea, and Indian Ocean).
 - (c) The Devonian period on both sides of the Atlantic Ocean.
 - (d) The Devonian period on both sides of the Ural Mountains.
 - (e) About 65 million years ago, the Mesozoic era ended and the Cenozoic era began. What was happening at this time to Africa and South America?
 - (f) The super-continent of Pangea, which lasted from 300–200 my ago (from late Permian to early Jurassic). During this period, all modern continents were united.

Choose three of these items, and read Hallan's discussion of what geographic barriers existed, how these barriers changed, and how this affected evolution.

4. Use Fig. 6.1 to comment on item 5 in the discussion about Dewar.

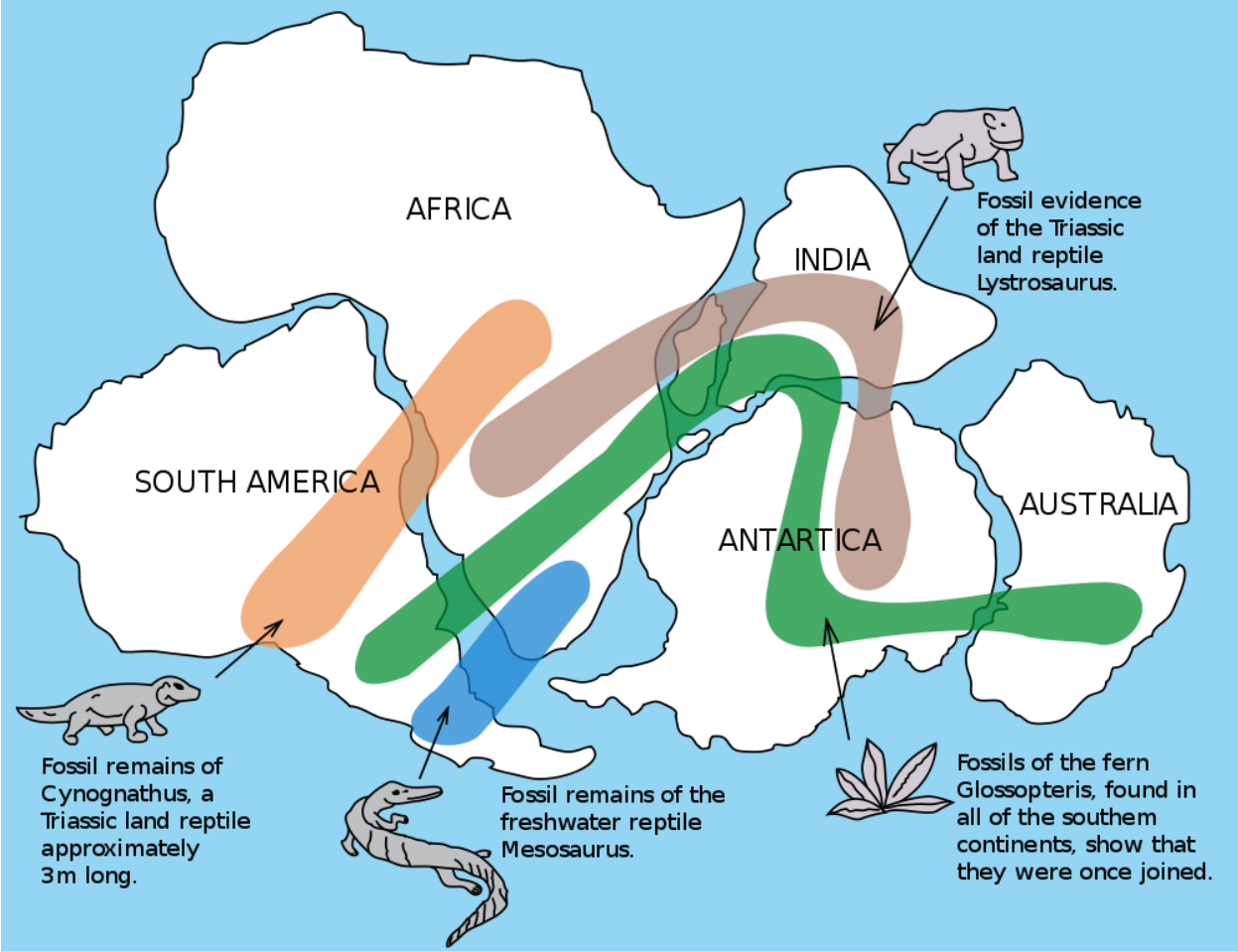


Figure 6.1: Fossil evidence for Pangea (<http://en.wikipedia.org/wiki/Pangaea>).

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