Data from sea floor could resolve a long-standing controversy.

From Herald Wire Services

Scientists have discovered evidence that could resolve a long-simmering feud that has grown out of Charles Darwin's historic study of the evolution of species on the Galápagos Islands.

The islands are only about three million years old, and some biologists have argued that that is not enough time for the wide diversity of wildlife to have evolved there, as Darwin's work suggested.

But geologists aboard the Thomas Washington, a Scripps Institution of Oceanography research vessel, have found something that Darwin could not possibly have known: There were other, much older islands in the region that have long since slipped beneath the ocean, and some of the creatures on Galápagos that needed more time to evolve may have begun their ancestral journey on islands that are no longer there.

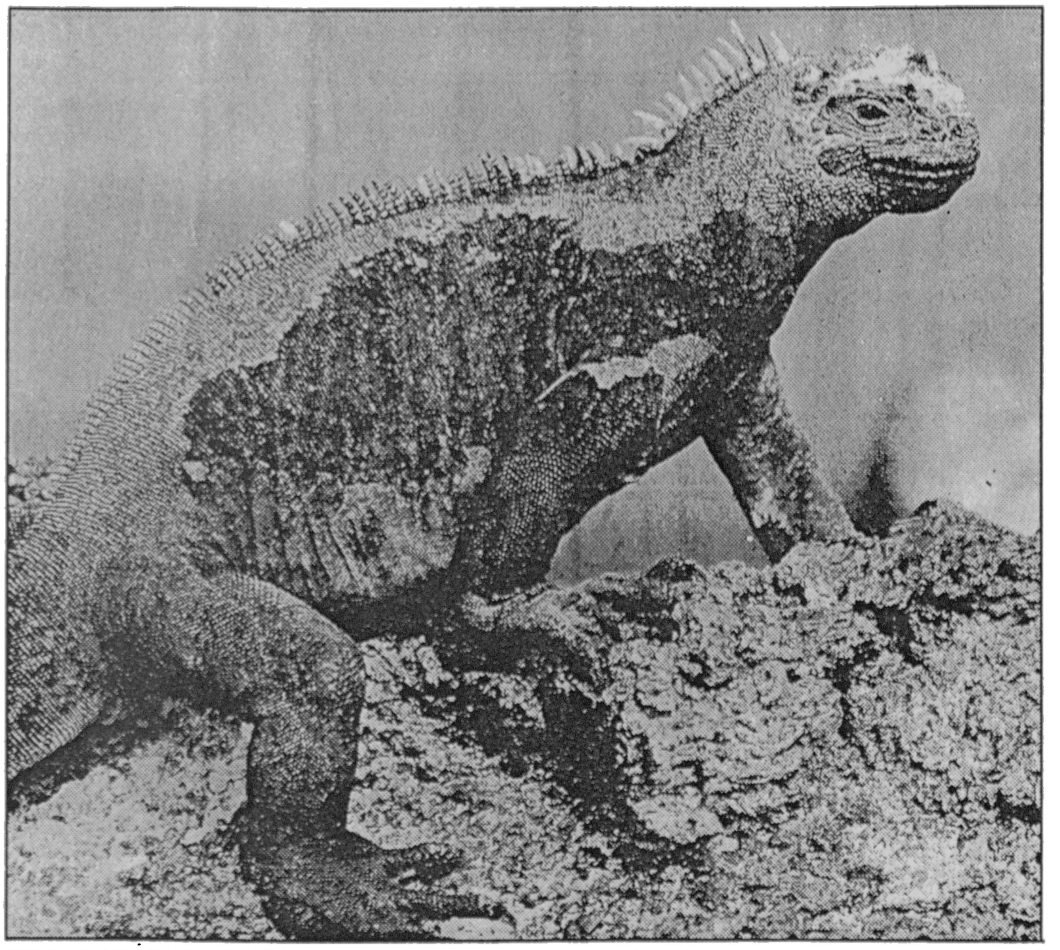
Some of the hidden islands are at least nine million years old. Some may be 90 million years old.

The finding does not prove Darwin's theory of evolution, but it does make the theory compatible with the current understanding of genetics and how long it would have taken for some species to diverge into separate groups.

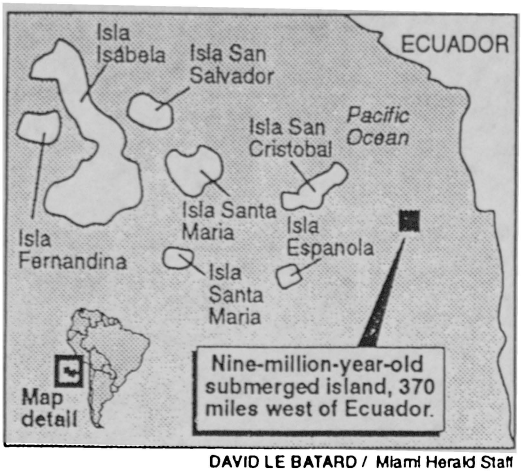
It also confirms a controversial hypothesis by two molecular biologists, Dr. Vincent M. Sarich and Dr. Jeffrey S. Wiles of the University of California at Berkeley. In 1983, they predicted that such "drowned" islands would be found. They reasoned that only the existence of long-vanished islands could account for the extensive evolutionary changes undergone by Galápagos species in the period since their ancestors arrived on the islands, which were originally lifeless.

"The controversy may disappear," Hampton L. Carson of the department of genetics and molecular biology at the University of Hawaii wrote in an analysis of the research, published recently in the journal Nature.

A PUZZLE SOLVED?



ON GALAPAGOS ISLANDS: The marine iguana, above, and land iguana are believed to be descended from a common ancestor many millions of years ago.



DAVID LE BATARD / Miami Herald Staff

The existence of an island chain at least 6 million years older than the present Galápagos Islands would account for the state of evolution of some animals — such as the marine iguana, above — seen on the islands today, biologists say.

Darwin's voyage

Darwin was only 22 when he began an expedition aboard the H.M.S. Beagle in 1831 that was to revolutionize human thinking. Biologists thought then that species either had continued unchanged since their creation, or acquired characteristics that could simply be inherited by their offspring. But the young naturalist found evidence to conclude that all plant and animal species change over time to meet

Galápagos animals may be older than their islands

environmental demands.

On the Galápagos Islands, Darwin studied birds that were distinct from those found on the mainland. Some were also different from others found on the 10 widely separated islands. Darwin concluded that the birds had evolved through natural selection, or "survival of the fittest," and the evidence from the islands formed a key part of his seminal research published a quarter of a century later.

As other experts studied the research many years later, they found no proof that the birds Darwin studied could not have evolved during the three million-year history of the present islands. But there were other creatures on the islands, including iguanas, whose "genetic time clocks" would have required much longer for them to evolve, Carson said.

When David M. Christie, a geologist at Oregon State University in Corvallis, and several colleagues returned to the Galápagos aboard the Scripps vessel in the summer of 1990, they found the evidence that could explain how the critters found time to evolve.

How islands were created

The Galápagos Islands were created in much the same way as the Hawaiian Islands. In both cases, a "hot spot" deep inside Earth sends plumes of hot mantle boiling toward the surface, where it burns through the crust and forms volcanoes. Each "hot spot" remains in a fixed position relative to Earth, but the huge tectonic plates that make up the crust are constantly moving.

As a result, the hot spot constantly produces new volcanoes as the crust passes over. The youngest volcanoes are directly over the hot spot, and older islands are left behind as the plate moves on.

Scientists have long understood that process, largely because of extensive research on the Hawaiian islands and a series of subsurface hills — called seamounts — that stretch northwestward across the Pacific. Similar evidence has been found near the Galápagos, but it was not clear whether the small seamounts found there had ever been tall enough to reach above the Pacific and become islands.

Christie said images created with sonar equipment aboard the Scripps vessel reveal that some of the old seamounts have terraces that look as though they were cut by waves, suggesting that the mounts once existed as islands. But that was not the most conclusive evidence. The vessel also has dredging equipment that allowed the scientists to retrieve rocks from the slopes of the seamounts.

"The real clincher is we found lots of beautiful rounded pebbles like you would find on an Oregon Beach," he said. "You can't make those in the deep ocean."

The submerged seamount of the Galápagos chain lying closest to the present-day coastline of South America is about 370 miles west of Ecuador, something less than half the distance from Ecuador to the existing islands. The age of this seamount, whose summit is now about 6,500 feet below the surface of the waves, is about nine million years, the scientists determined.

The existence of an island chain that old would be long enough to account for the state of evolution of the Galápagos animals seen today, biologists say.

Evolutionary clock ticks

Sarich and other molecular biologists have demonstrated a chemical basis for the ticking of an evolutionary clock at a more or less constant rate. Essentially, each tick occurs when one amino acid in the backbone chain of a particular protein molecule is switched for another. The protein Sarich uses for his clock is albumin, and he reckons that in a typical species, between 2.5 and 3 of these substitutions occur in the course of a million years.

Sarich also studied the protein chemistry of several Galápagos species, particularly that of the marine and land iguanas. These two species, Sarich said, clearly descended from a common ancestor, a sea-faring pioneer who floated from the South American coast aboard some kind of natural raft.

The marine and land iguanas of the Galápagos are more closely related to each other than either is to mainland relatives. However, Sarich said, they have evolved in very different ways. The units of difference in the amino acids of their respective albumins suggest that these two species must have diverged from their common ancestor many millions of years ago, and this finding led Sarich and a coauther to publish a paper in 1983 entitled "Are the Galápagos iguanas older than the Galápagos?"

"So you can see why," he said, "that we were pretty sure these sunken islands would eventually turn up. I'm not at all surprised by Dr. Christie's discovery."