

AQUANEWS

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Coral Reef Development: History in the Making

Article by Joel Simon

Coral reefs are complex, enduring, magnificent -- dynamic living structures of geologic proportion. They are among our planet's most prolific and intricately interrelated ecosystems. They are also the planet's oldest natural community. Snorkelers floating above a coral reef are immediately struck with the teeming variety of life; an organic tapestry of dazzling color, bizarre form, and endless activity. Spread before them is a panorama of eons of development, the progeny of the sea's entire evolutionary process, a history of a billion years, or more. All major taxonomic levels are present, from single-celled algae, invertebrates still without terrestrial counterparts, to fish, reptiles, and the largest mammals to ever grace this earth.

The fossil record reveals the ancestry of this glorious congress, many of which have kin embedded in sedimentary layers from 50 - 100 million years ago. Today's reefs are simply the most recent link in a lengthy genetic chain. Understanding modern reefs and especially corals, will give us the tools to better decipher their intriguing history.

For centuries corals were thought to be plants. They have no heads, tails, or feet; no eyes, no ears. They don't crawl or swim. Close-up they look like flowers. When in 1723, naturalist Jean Andre' Peyssonel proposed that corals might be animals, he was functionally expelled from the French Academy of Sciences. Today we know he was right. Corals, along with jellyfish and anemones, are

members of a large and varied group of animals called Cnidarians: round little creatures, with tentacles surrounding a mouth. In the South Pacific alone, over 700 species of coral have been identified so far.

Individually, most corals measure less than half an inch across, yet collectively they have built the largest organic structures on earth. Ever. The Great Barrier Reef stretches over 1,250 miles along Australia's eastern shore, and the Palancar reef bordering Mexico, Belize, and Honduras is nearly as large. Although solitary corals are found in all seas, from the fjords of Norway to the weathered shores of Patagonia, and to depths exceeding 15,000 ft., reef building corals form a vast shallow living wreath centered along the earth's equator -- a setting scientists would not have expected to host such robust communities.

Tropical seas are nearly devoid of nutrients, which is one reason the water is usually clear. Yet reefs which thrive within them are among the planet's most prolific living systems, veritable oases in oceanic deserts. How so much life could be sustained on so little food remained one of the greatest scientific mysteries until 1929 when researcher C. M. Yonge unraveled one of the most marvelous cooperative relationships in the animal kingdom. Living within the stomach cells of all reef building corals are microscopic plants, single-celled algae with an unwieldy multi-syllable name: zooxanthellae. These algae are doing

(Continued on page 2)

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exactly what plants do best. Taking advantage of readily available organic waste from the coral's metabolism (basically fertilizer) and carbon dioxide from the coral's respiration, the plants produce usable nutrients and oxygen.

This is precisely what a coral animal needs to grow. Just as with plants on land, in this remarkable recipe, one more ingredient is necessary for survival: sunlight for photosynthesis. The more sunlight the better. Although the reasons are unclear, it seems this relationship also mandates water temperatures above 72° F. Limited by dependencies on sunlight and warmth, reef building corals are constrained to clear, shallow, tropical waters, making them conveniently accessible to snorkelers and scuba divers. The origin of this vital coral/algae collaboration is a topic of speculation, but the partnership is as old the reefs themselves.

Reef building corals, like most animals, have a calcium skeleton. As a coral grows upward (or outward) to maximize exposure to sunlight, it deposits calcium around its base. Fast growing corals may expand one inch per year although most are much slower. During the day, when the photosynthetic algae are most productive, corals grow approximately 14 times faster than at night. Clouds can reduce growth by half. Eventually, this calcium, which over time may be hundreds of feet thick, becomes the actual reef structure. The coral animal essentially becomes a living veneer over its own dead body. And within these enduring dead bodies are contained significant clues to the ancient history of both coral and our world.

The calcium skeleton provides an excellent fossil record and core samples yield fascinating geological insights. Corals have survived, in one form or another, for over 500 million years, so they must be doing something right. "Modern" corals first appeared about 230 million years ago, when today's continents were a single land mass. Changes in the elevation of the sea due to passing ice ages and tectonic land movements are accurately reflected by ancestral reefs, now stranded high above and below our modern-day sea level. On the border between Texas and New Mexico, the Guadeloupe Mountain Range embodies a 3000 foot-high, 360 mile-long ridge of jagged rock, once a thriving coral reef submerged beneath tropical seas.

Corals leave daily growth rings in their skeleton, similar to trees. In 1963, John Wells made a remarkable discovery, since confirmed by subsequent researchers. Because corals grow so much faster during the day when the algae are active, careful study of these rings in fossilized corals indicate the earth's

(Continued on page 3)

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Mission Statement:

To provide, promote, and advance environmental protection, care, and voluntary clean-up of waterways by any and all lawful means; to promote the importance and care in every manner possible by environmental awareness and otherwise; to purchase, print, publish, and circulate literature to promote the importance and care of the waterways and the work of the Corporation. To perform all acts the Corporation may deem appropriate or advisable in such operation; to establish, provide, and voluntary clean-up waterways, to encourage, support and subsidize the cleaning and protection from pollution.

rotation may be slowing down due to atmospheric friction. Coral core samples from approximately 400 million years ago imply the Devonian year had nearly 400 days!

Other inferences are equally astounding. Fossilized corals from the Cretaceous period, some 100 million years ago, are found at 50° north latitude, roughly equivalent to Vancouver, London, and the southern tip of the Aleutian Islands. Conversely, similarly dated corals extend to only about 20° present south latitude promoting theories that the earth rotated on an axis far different than today. Using the same techniques, corals from the Ordovician times, roughly 500 million years ago, indicate that the North Pole may have been near Hawaii and the South Pole off the coast of West Africa!

While these prototypical coral communities lie sequestered in the annals of extinction, many of today's reefs originated in relatively ancient times. Some atolls of the Central Pacific are built on coral foundations borne of the Eocene era some 50 million years back. The Great Barrier Reef, at least the northern section, had its birthday in the Miocene over 25 million years ago. While terrestrial creatures underwent massive extinction due to extreme changes of climate and terrain, cradled within the relatively stable environment of the sea's embrace, life prospered.

The sea's most powerful geologic arbiter of evolution was changes in sea level, which can be measured in hundreds of feet. Concurrent with water level dynamics were dramatic tectonic and volcanic movements, shoving land masses both up and down. While these presented serious challenges to early corals, they were not insurmountable.

To better understand their survival over the millennia, it is necessary to examine reproductive strategies. Corals, along with numerous other sea creatures, are mass spawners, shedding gametes directly into open water. At the whim of oceanic currents, larval forms are carried far and wide in search of suitable areas for colonization. As old habitats declined, new ones emerged. And larval corals were there and waiting.

Corals have an added advantage. By secreting massive amounts of limestone, they create additional usable substrate, a type of organic landfill. To their heirs, deceased corals leave a precious inheritance: a place to live. Thus new and ongoing colonies are literally supported by their ancestors. The physiological prosperity of corals is crucial--where there are reefs, other creatures follow. Millions of them. Coral reefs harbor more species of plants and animals than any other ecosystem on earth, arguably a consequence of having had more time.

The wealth of marine life on reefs today is the living legacy of longevity, a lifespan borne of relatively uniform environmental factors in tandem with evolutionary opportunity. Although opinions differ on the nature of evolution, no one debates the result. Competition for extensive, but limited resources, has given rise to an unparalleled variety of creatures successfully adapted to their environment.

Whether by chance or plan, some animals have acquired highly specialized capabilities while others have developed more generalized opportunistic talents. Snorkelers can easily observe and compare feeding habits, habitat, and social structure. While some fish limit their diet to a particular food source, others are happy to devour whatever comes their way. Clown fish, live only in the protective tentacles of anemones, while other species range more freely about the reef. Groupers are solitary, butterfly fish survive with lifetime mates, and grunts, surgeonfish, and silversides exist in schools. One strategy is no more "right" than the other: specialization and generalization both work. Combined, they weave an elastic evolutionary fabric that compounds the reef's stability.

Unlike a chain, defeated by one broken link, the tightly intertwined coral reef community maintains integrity, even if a few strands are severed along the way. For example, ninety per cent of the long-spined sea urchins in the Caribbean were recently decimated by a lethal virus. This was devastating to them, but not to the reef. Parrotfish and other algal browsers took advantage of the opportunity. Individual species may die, or suffer great losses, but the community endures and the reef's stability remains intact as it has for millions of years.

Self-Rescue Advice

By Lada Simek

Every year, divers get taken away by a current. It costs the Coast Guard thousands of dollars for a search and rescue. Most get picked up but a few are never seen again. Here are a few tips on dealing with self-rescue.

It is the captain's job to decide if the water conditions are suitable for diving. He wants to make money and he does not want disappointed customers, so a compromise is sometimes in order. You do not have to agree with his decision and you always have the right to decline the dive. I almost always chew a paper spitball and throw it in the water a couple of minutes after the boat is anchored. The drift of the piece of paper shows you what the speed of the current is and based on your ability, you make the decision to go or not to go. It is not the captain's ass in the water, it is yours!

Let us assume you have been wreck diving and on surfacing you find the current too fast to make the boat... The captain should send a swimmer to you with a line. You can't expect him to get you while other divers are in the water. If the current is one knot, (about as fast as a diver can swim at full speed), and if you drift for thirty minutes, you will be over 3000 feet from the boat. That is over a half a mile! PADI recommends signaling and waiting for assistance, but I do not agree with this. You should swim at a pace that you can maintain toward the boat. Say you can swim at one half a knot. Then you would be receding from the boat at half the speed, or be about 1500 feet away. You might still be in sight. You have other options. All wreck divers carry, or should carry a reel or a marker buoy. This is what I would do.

Take your and your buddy's weight belt and clip them together. Attach the end of your reel line and let the belts go to the bottom. You now have an anchor that should drag in the sand or mud and keep you pretty much in place. You can now wait for assistance or do the following. Take off your scuba unit, blow it up quite a bit and use the shoulder quick releases to couple them together. Without your weight belt and scuba gear, there are very few currents in the ocean you could not swim against.

Now for some unexpected news. I spoke with a Coast Guard person who told me:"If a diver ends up missing, we will go and look for him. We do not expect to find him but we will look."

How would a head encased in a black wetsuit stand out against dark green water? The need to be visible is paramount. Only a fool would dive the Atlantic without a safety sausage and a signal mirror. I would carry two, one in each BC pocket. Your hands may be cold and you might drop one. Just think how you would feel if this happened while the helicopter was in sight! You should also know how to use one. (If you don't know what the little hole in it is for, you don't)

There is one last trick you can use to get noticed. Take the regulator off your tank. Hold the valve an inch below the surface and open it wide. The escaping air will create a water spout three feet high. I know one person who saved himself that way in Cancun.

ANNUAL MEMBERSHIP FEES

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Many of our members have not paid their 2009 dues. It would be appreciated if you could pay them as soon as possible so that I can close out the books for 2009.

Also anyone that wants to pay their 2010 dues can do so. You can then take your tax deduction in 2009.

So please send in your \$42 dues early to;

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Happy Holidays!

Have a happy and healthy 2010!
