forms, the rippled sandstones of a beach of more advanced species, and finally the blank limestone farther out to sea. But paleontologists have also figured out how to inspect the kidneys of extinct whales. The terrestrial ancestors of archaeocetes had spent 300 million years adapting their kidneys to surviving on land, using them to concentrate wastes to hold back their water. They were not ready to live in salt water. Manatees and other sirenians have been grazing along coasts for 50 million years, and in some ways they're still not ready: they have to drink fresh water occasionally to survive. Run a hose of fresh water overboard off the coast of Florida and they will pay you a visit. Whales, on the other hand, get enough fresh water from the air they breathe and the prey they catch, but also occasionally swallow salt water.

Oxygen in a river weighs less than oxygen in the ocean. The atoms that help make up water molecules in seawater tend to carry one more neutron than in freshwater, thanks to the physics of rain and evaporation (each kind of atom is called an isotope). When a growing animal drinks, oxygen in the water works its way into the developing bones and teeth, and so it was that Thewissen and a crew of geochemists and paleontologists were able to watch whales go to the ocean by analyzing the oxygen in their fossils. They first measured the isotopes of oxygen in the teeth of living cetaceans and found that river dolphins, which live in freshwater, had significantly lighter oxygen isotopes than marine species such as killer whales and bottlenose dolphins. Thewissen and the other paleontologists then surrendered ten teeth of early whales, including *Pakicetus* and *Ambulocetus,* to the geochemists. *Pakicetus* fell in with the river dolphins, as did *Ambulocetus,* but later species had teeth as isotopically heavy as a sperm whale.