

f10 Whales < wolves not >

You have your language too,
 an eerie medley of clicks
 and hoots and trills,
 location-notes and love calls.
 —Stanley Kunitz *The Wellfleet Whale*.¹

If we view a Porpess [meaning *porpoise* as *porpess* is now the name of a cetaceous fish (genus *Delphinus*) that some sailors call *sea-hogs*]² on the outside there is nothing more than a Fish. [But] if we look within, there is nothing less.
 —Edward Tyson (1650-1708) *Anatomy of a Porpess*, 1680.³

Land animals are a reservoir from which some, so long as there have been land animals, have evolved to dwell in the sea. These animals, unlike fish, retain evidence of their exclusively land dwelling ancestors. So it has been with whales⁴ (order Cetacea) which descended from four-legged mammals.⁵

In Georgia, a 40 million year old yet-to-be-named species of whale with a pelvis like that of a land mammal was found in 1993. Richard C. Hulbert Jr., who described it, suggests that this transitional whale had large hindlimbs.⁶

In Egypt, Philip D. Gingerich in 1993 found a whale that had external legs. The legs are too small to have helped propel the animal on land. Called *Basilosaurus*, this whale most likely spent all of its time in water. Gingerich speculates that it used its tiny hindlimbs to grasp its partner during copulation with its dork (penis internally supported by a bone rod, the “baculum” absent in, humans, horses, and living whales). In central Pakistan, Gingerich in 2000 unearthed two 47 million year old early aquatic whales, each about the size of sea lions, that he named *Artiocetus clavis* and *Rodhocetus balochistanensis*.⁷ These are the first of cetaceans ever discovered with intact ankle bones. Since living cetaceans have no vestige of these bones, the discovery of early whales with ankles provides a “Rosetta stone” to a reading of the descent of whales. The ankle has a unique form that is found only in artiodactyls.⁸

Once a land animal takes to living in the ocean, the ancient mariner problem arises: “Water, water every where / Nor any drop to drink.” When did whales evolve the ability to survive without freshwater as marine cetaceans do today?⁹ Johannes Geradus Martinus **Thewissen** in 1986 reported on how fossil whale teeth can help to answer that question: Isotope composition of mammalian teeth is a direct reflection of the isotope composition of the ingested water. This turns out to be so because body temperature is nearly constant in mammals. Modern freshwater cetaceans have tooth phosphate $\delta^{18}\text{O}$ values at least three per mil lower than those of marine cetaceans. Evidently by the Middle Eocene, some had evolved an osmoregulatory system to handle the excess salt load of living free of the land.¹¹



J. (Hans) G. M. **Thewissen**.¹⁰

Whale species first appear in the Early Eocene. *Pakicetus*, is the oldest known whale genus. A well-preserved skull of *Pakicetus* was unearthed in Pakistan by Thewissen in 1991-1992.¹² Extrapolating from younger fossil transitional whales, it would have spent much of its life on land. In 1993, Thewissen found, in Pakistan, a 50 million year old fossil whale with legs and feet. He named this transitional whale *Ambulocetus natans*. How its legs attached to the rest of its skeleton, a critical factor in understanding the animal's locomotion, is as yet unknown as its pelvis was not found. Thewissen suggests that sea-lion sized *Ambulocetus* led an amphibious lifestyle. It could walk on land, but the shape of its bones suggests it had weak hindlimbs. It may have walked while dragging its body as do sea lions.¹³

Pakicetus and *Nalacetus* ingested freshwater—their fossils are found only in shallow freshwater deposits). *Ambulocetus* ingested salt water—its fossils occur only in littoral (cont.)