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TIME, FAITH, AND FOSSIL WHALES

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Time has been a big issue in most controversies related to science and faith since the first non-biblical models for the origin of earth and organisms were proposed in the early 19th century. Geologists and naturalists like James Hutton and Charles Lyell, among others, saw long periods of time in many features in the geological record, including the deposition of sedimentary layers, cooling of igneous rocks, and succession of fauna and flora in past times. Charles Darwin and Alfred Russel Wallace were apparently successful in linking evolutionary lineages in organisms with long periods of time during which death of the weakest and survival of the fittest gave way to more complex, intricate and adapted organisms. If changes (both in the biological and the geological realms) occur at the rate we see today, then Earth and life must be very old for the accumulated changes to bring forth new forms. This circular reasoning is reiterated by the concise expression "the present is the key to the past." Long eras were further supported by the development of radiometric techniques in the mid-20th century, which allowed the calculation of decay rates of unstable elements present in igneous rocks.

A Whale of Time?

Over the last five decades, several techniques have been refined that repeatedly yield consistent ages of hundreds of thousands and millions of years. Carbon 14 (C-14) is widely known as yielding ages ranging from hundreds to 50,000 years, although accuracy for the older ages is highly disputed. Series of unstable elements and their daughter products such as K/Ar (Potassium/Argon, U/Pb (Uranium/Lead), and Rb/Sr (Rubidium/Strontium) are commonly utilized to date older rocks and the fossils therein.

Radiometric dating is problematic for those who believe in the Genesis creation account, because it sets the clock long before the time inferred from the genealogies of Genesis 5 and 11 and Ellen White's statements, which indicate that humankind has been on Earth for about six thousand years. Indeed, radiometric dating is the major challenge that young-earth creationists face as scientists; and many Christians believe that the scientific evidence is strong enough to challenge the validity

of the biblical assertions regarding creation, and therefore choose to believe in alternative models such as progressive creation or theistic evolution.[1] Many go so far as to question the validity of the New Testament statements about creation, including those by Jesus, and the apostles Paul and Peter. Consequently the Seventh-day Adventist Church has taken special interest in scientific and biblical research that supports the creation story and the flood. In this sense, a number of scientists and biblical scholars endeavor to unravel the mysteries of time locked in the rocks and in the biblical genealogies in order to bring light into the current controversy between science and Scripture.

Although radiometric dates are commonly assumed among geologists to be reliable throughout the geological column, across basins and continents, it is also true that sometimes they are inconsistent with other geological and paleontological evidence available. The time spans obtained by using unstable isotopes may be far longer than the actual time needed for deposition of the sedimentary beds and/or fossil formation and preservation. One example of this is the sedimentary beds that indicate rapid deposition of sediments and fossil turtles in the Bridger Formation, Wyoming. These turtles are inferred to have been accumulated and buried over long periods of time in a lake environment affected by occasional volcanic ash falls. However, research by Loma Linda University paleontologist Leonard Brand and others has shown that the turtles more likely were rapidly buried by floods and volcanic ash in a short span of time.[2]

Time for the Whales

Another example is the occurrence of fossil whales in diatomaceous siltstones and sandstones of the Pisco Formation in southern Peru. In this deposit, thousands of fossilized cetaceans have been found in sedimentary layers deposited in an ancient shallow marine embayment, which is now up to 30 kilometers away from the coast. These fossils are being studied by a multidisciplinary team of geologists and paleontologists from United States, Spain, Peru and Italy, who have found multiple layers of well-preserved fossils of baleen whales, dolphins, sea lions, turtles, penguins, and other creatures. But before we go on in detail about these fossils we need to say a few words about the processes modern whales undergo after death.

Whales are actively swimming, air-breathing marine mammals that usually have a high fat content. When a whale dies its body may immediately sink (low-fat species) or float (high-fat species) for a certain amount of time, until it eventually sinks to the seafloor. Soon after death bacterial decay and scavengers descend on the carcass and remove the flesh and fat until the bones are exposed. These processes may take several months depending on the size of the whale and the fat content. A particular characteristic of many whales is that their bones are fat-rich (which helps with floatability), and that fat (also called blubber) is a source of food even long after the bones are clean of flesh. Modern observations of whale skeletons lying on the seafloor show that they are colonized by an abundant and diverse community of encrusting invertebrates like clams, snails, worms, crustaceans, etc., which settle on the bones and in the associated seafloor (Fig. 1). They burrow the sediment in search of nutrients leaked out of the decayed carcass, and bore into the bones to feed on the blubber. It is believed that these skeletons may hold a large community of small marine invertebrates for many years.[3] The bones of these sunken whales are usually corroded, disarticulated and sometimes removed by the action of water currents and/or scavengers. If the skeleton has been washed onto the beach, it is likely that the bones will become very scattered by the action of waves and storms.

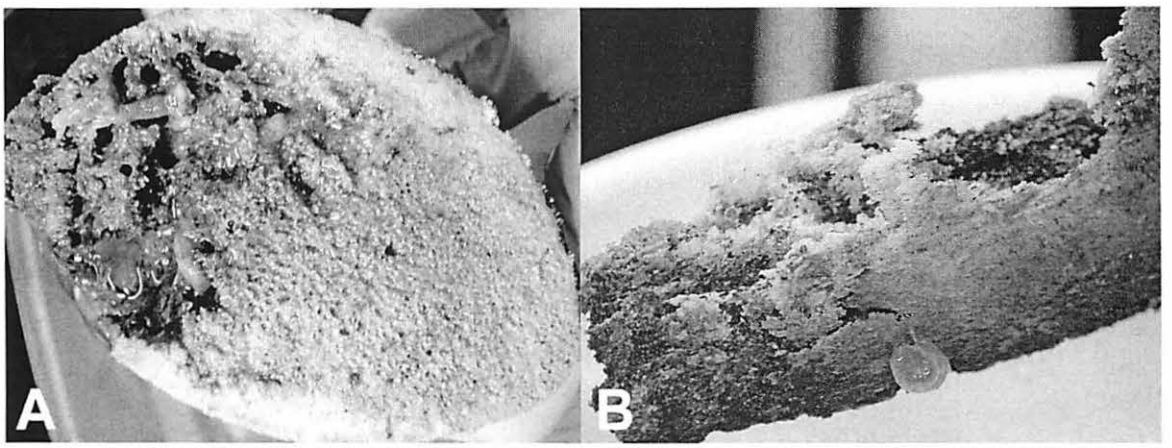

Figure 1. A: Cross-section of a rib collected from a whale skeleton on the seafloor, on the Monterey Basin, off California. The section of the bone shows a large colony of *Osedax* worms that actively eat the bone in symbiosis with heterotrophic bacteria. B: Piece of rib in longitudinal view, showing advanced destruction of the bone by scavengers. These two photographs were taken approximately three years after the whale carcass reached the seafloor, and illustrate the degree of destruction of the bones a short time after death.

In comparison to modern examples, the fossil whales of the Pisco Formation present a rather different picture, although some similarities apply. Some skeletons appear partially or totally

disarticulated as is the case with modern counterparts, but the bones are associated and clustered, indicating that little disturbance of bones occurred before burial. A large number of skeletons are entirely articulated with bones in life position (Fig. 2). This feature clearly indicates rapid burial. Since the sediments were laid down in shallow water (<100 m depth), abundant mollusks, crustaceans and worms would have bored into the bones in the attempt to feed on the blubber inside, had they been resting on the seafloor for many years. Also, water currents could have moved some bones. Instead, the preservation of the bones is excellent, with no evidence of damage by water currents, burrowing and/or scavenging by invertebrates. Furthermore there is no evidence of any invertebrates buried with the whale bones. It seems as though there was not enough time for the invertebrates to colonize the bare bones and leave their marks on them.

What it is even more striking is the preservation of baleen (the filtering apparatus) and, in a few cases, the mineralization of the spinal cord, because both are soft tissues and tend to detach and decay much faster than bone. Baleen is made of keratin (the same kind of tissue that makes up hair and nails) and is not rooted into the whale's mandible, but only attached onto the gum by means of an organic glue. It is known from modern observations that baleen detaches from the upper mandible in a matter of a few hours or days after death, making preservation of the skeleton along with its feeding apparatus extremely unlikely, unless very rapid sedimentation occurs.
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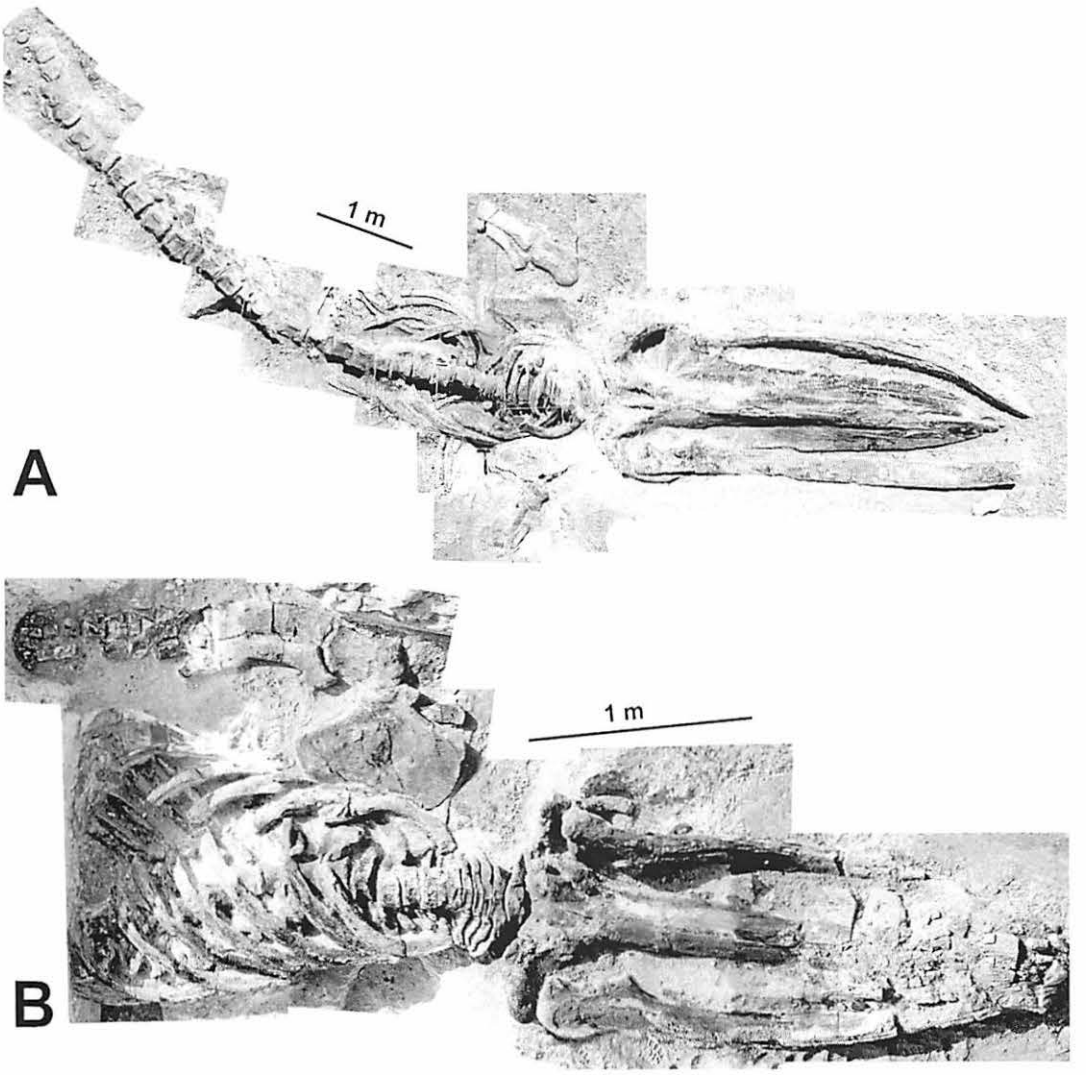

Figure 2. A: Whale skeleton WCBa-20. This fossil whale was complete and articulated. The bones show excellent preservation, and no evidence of scavenging, weathering, abrasion or any damage from long exposure on the seafloor. B: Whale skeleton WCBa-32. Partial skeleton of a fossil whale that shows excellent preservation and articulation. The skeleton was only partially excavated because the sediment on

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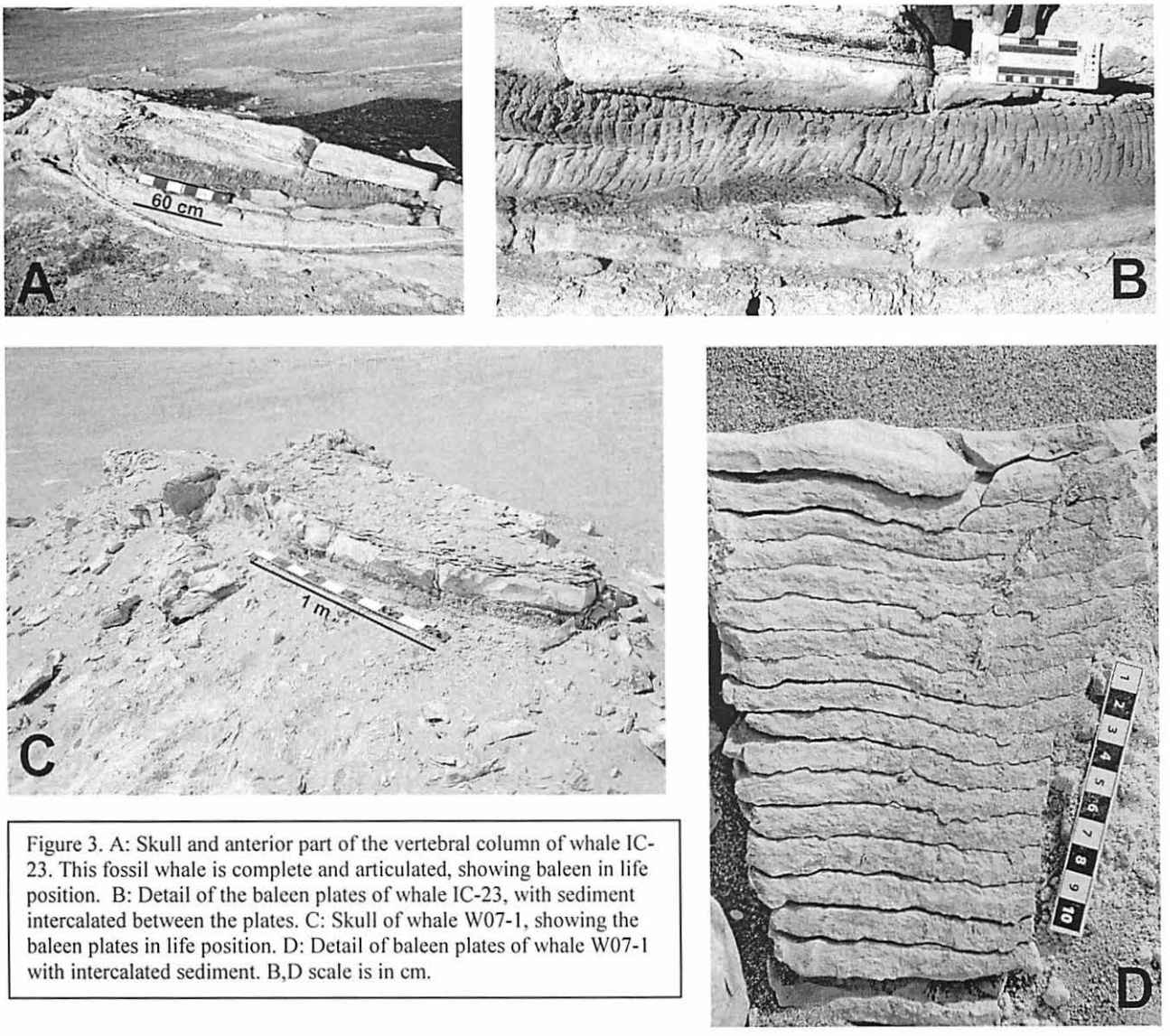

Figure 3. A: Skull and anterior part of the vertebral column of whale IC-23. This fossil whale is complete and articulated, showing baleen in life position. B: Detail of the baleen plates of whale IC-23, with sediment intercalated between the plates. C: Skull of whale W07-1, showing the baleen plates in life position. D: Detail of baleen plates of whale W07-1 with intercalated sediment. B,D scale is in cm.

Several other lines of evidence suggest that sedimentation rates in the Pisco Formation were much higher than those observed elsewhere in modern times and considerably higher than the ones inferred from radiometric dates available for the area.[5] Radiometric dates obtained using K-Ar isotopes indicate a span of time of 10-12 million years for the deposition of the whale-bearing deposits, which have a thickness of up to 500 m.[6] Assuming 10 million years for the deposition of a whole sequence of 500 m thickness, it would take 20,000 years to accumulate 1 m of sediment thickness on the sea floor in that area. Studies carried out in several modern oceans indicate that rates of deposition in the present for sediments similar to the ones of the Pisco Formation are in the

range of 2-260 cm/1,000 years (with averages of 15-50 cm/1,000 years, and 2-16 cm/1,000 years for the Peruvian marine platform), which are over an order of magnitude higher than the rates obtained from radiometric dates.

Therefore even with a modern average rate of sedimentation of 40 cm/1,000 years it would take a millennium to completely bury a 40-cm thick whale skeleton, and some mechanisms would have to exist to prevent any disarticulation or deterioration of the skeleton originated by the action of water currents, scavengers, and chemical reactions. It seems unreasonable to think that a large skeleton could rest on the seafloor for several centuries in shallow water without being disturbed by physical and biological agents that would cause disarticulation, burrowing, and removal of the bones. Evidence collected from modern studies indicates that whale carcasses in shallow waters last only a few months to a few years.[7] Even if the bones and baleen had undergone rapid mineralization after the death of the animal, it is unlikely that the carcass would have endured so long without any deterioration, let alone with baleen in life position.

Implications

The implications of these figures of sedimentary rates of fine deposits on the seafloor are twofold. First, the excellent preservation of the fossil whales indicates that in the Pisco Basin sediment accumulated much faster in the past than at the present in similar geologic settings (such as the shallow ocean along the Peruvian coast). Certainly the sediment containing fossil whales must have been deposited very rapidly. As more of this type of evidence accumulates, it calls into question radiometric dating techniques and results, because there is not enough sedimentary activity to occupy such a long period of time.

Second, the occurrence of these well-preserved fossils exposes serious shortcomings of the commonly accepted assumption among evolutionist geologists that "the present is the key to the past". If, as we have seen with modern whales, the rate at which processes occurring today (i.e., sedimentation and burial in oceans and lakes) do not satisfactorily explain the occurrence of finely preserved fossils, we need to conclude that the past must have been very different, at least geologically speaking.

I conclude that the fossil whales of the Pisco Formation are a useful example to illustrate the contradictions of the evolutionary assumptions regarding time. On the one hand, radiometric dating suggests long periods of time; on the other hand patterns of fossil occurrence and preservation strongly indicate very short time between death and burial and deposition. I call this contradiction the *paradox of fossilization*. Fossilization should almost have never occurred if conditions in the past had been like conditions in the present, because rapid destruction prevails over preservation, especially in aquatic environments. Conditions might have been different in the past.

An Adventist Approach

There is controversy within the Seventh-day Adventist Church regarding the value of the book of Genesis and the Bible in general regarding historical issues, and the Creation and Flood accounts in particular. Some Seventh-day Adventists reject these stories because they cannot harmonize them with the *current* scientific interpretations, and have difficulties finding evidence that supports short time in the sedimentary rocks. The Adventist Church is concerned about the increasing acceptance of the evolutionary theory among its scholars and teachers, some of whom have accepted some form of theistic evolution.

However, evidence for short geologic time, catastrophism, and rapid burial is abundant and can be found. It requires an open mind and willingness to think within more than only one paradigm. Scientists who are willing to test their hypotheses and think and test their data within *both* the evolutionary and creationist frameworks are more likely to find not only better explanations, but also answers that support both science and the Bible. In this sense, Adventist scholars working within both paradigms have advantage over scientists who limit themselves to the evolutionary model.

Conclusions

More research and study need to be done to ascertain why radiometric dating methods yield long ages as opposed to the catastrophic, rapid changes inferred from many paleontological features. Currently evolutionary geology explains the fossil record as the result of slow processes and change occurring over long periods of time. However, an increasing number of rock formations

and fossil occurrences previously interpreted within such an evolutionary framework must be reinterpreted as the result of rapid, or even catastrophic, processes operating on a different time scale. Evolutionist paleontologists assert that the Pisco Formation fossil whales were deposited over a period of several million years. Our investigations indicate that these fossils must have been buried in a period of time between a few months and a few years, but not millions of years.

We do not need to accept the evolutionist viewpoint to explain the history of life on Earth as recorded in the fossils. Adventist scholars and teachers do not need to lose their faith because they cannot harmonize the Creation and Flood stories with current scientific interpretations, because in-depth, multi-disciplinary, multi-approach studies indicate that many of the features of the sedimentary and fossil record can be explained within a Biblical, short age framework.

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[1] These two models are indeed similar in their assumptions. While theistic evolutionists believe that God created the first organic molecules, cells or simple organisms, and let them naturally evolve to more complex beings, progressive creationists suggest that God was active in creating new forms of life along this long evolutionary path.

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