ANNOTATIONS FROM THE LITERATURE

BIOGEOGRAPHY OF THE SOUTHERN BEECH

Hill RS, Dettmann ME. 1996. Origin and diversification of the genus *Nothofagus*. In: Veblen TT, Hill RS, Read J, editors. The ecology and biogeography of *Nothofagus* forests. New Haven and London: Yale University Press, p 11-24.

Summary: The southern beech, *Nothofagus*, is restricted to the southern continents, both at present and in the fossil record. It is a prolific pollen producer, so it is very likely to leave evidence of its presence in the fossil record. It is sensitive to salt water, and is thought not to be able to disperse across the sea. The excellent fossil record and poor dispersal abilities of *Nothofagus* have led some biogeographers to regard it as one of the most reliable indicators of conditions in the past. However, the record of *Nothofagus* in New Zealand strongly suggests dispersal across the sea during the Cenozoic. If this is substantiated, *Nothofagus* biogeography may need some reinterpretation, and its status as a key to the past may be lost.

Comment: The presence of living *Nothofagus* trees on now-separated continents has led some to claim that the geologic time scale for continental breakup must be accepted. Some creationists have long suspected that a key to this problem was the possibility of over-sea dispersal of *Nothofagus*. This may not occur under normal conditions, but the high-energy events associated with a worldwide catastrophe would produce highly unusual conditions in which dispersal by transport of seeds on trees or parts of trees by marine currents might be expected.

CYCLIC SEDIMENTATION: MILANKOVITCH CYCLE

Brack P, Mundil R, Oberli F, Meier M, Rieber H. 1996. Biostratigraphic and radiometric age data question the Milankovitch characteristics of the Latemar cycles (Southern Alps, Italy). Geology 24:371-375.

Summary: Finely laminated sediments are found in numerous places, including the Italian Alps. Such sequences may show patterns

of repeating variation of lamina thickness. One such sequence involves hundreds of carbonate cycles in the Middle Triassic Latemar platform. These have been explained as due to the Milankovitch cycle of 20,000 years. At least 598 cycles are reported, implying a total time of about 12 million years. However, a combination of index fossils and radiometric dating indicates a maximum age of 4.7 million years for the deposits, and probably less than 4 million years. This suggests that the patterns in the laminae may not be a result of the Milankovitch cycle. The authors suggest that ancient carbonates may not supply sufficient data for unambiguous identification of Milankovitch cycles.

Comment: Possible rejection of Milankovitch cycles as the explanation for cyclic patterns of variation in laminated sediments should stimulate efforts to find better ways of explaining the origin of thin laminae in sediments. It seems remarkable that a lake should maintain relatively constant conditions of deposition over periods in excess of 100,000 years, much more so for the longer periods often suggested by the Milankovitch cycle interpretation.

EVOLUTION OF TURTLES

Rieppel O, DeBraga M. 1996. Turtles as diapsid reptiles. Nature 384:453-455.

Summary: Reptiles are typically divided into groups based on their skull openings in the temporal region. Turtles are grouped separate from other living reptiles. However, turtles have so many morphological specializations that comparisons with other groups are difficult. The temporal roofing of the stratigraphically lowest turtle does not match that of the fossils with which turtles have been traditionally grouped (anapsids). However, such features as jaw muscles and limb and girdle structure suggest an affinity with the lizards and their allies (lepidosauriform diapsids). This is further supported by several features of development. Acceptance of turtles as diapsids will greatly alter our understanding of their relationships.

Comment: Turtles are not clearly related to any other group, and may represent one or more separately created lineages.

MUTATIONS AND DEGENERATION

Andersson DI, Hughes D. 1996. Muller's ratchet decreases fitness of a DNA-based microbe. Proceedings of the National Academy of Sciences (USA) 93:906-907.

Summary: Since it appears that most mutations are harmful, it would seem that organisms would tend to degenerate. This has been proposed to happen unless variation is provided by sexual reproduction. Examples of degeneration are known among RNA viruses, which have unusually high mutation rates. This is the first report to show spontaneous degeneration among DNA-based organisms, specifically the bacterium *Salmonella typhimurium*. Cells were grown asexually, with repeated bottlenecking to promote random accumulation of mutations. After 1700 generations, 1% of the 444 lineages showed decreased growth rate. During the experiment, the mutation rate for a group of about 200 genes was calculated to be about 10^{-9} per base per pair per generation.

Comment: This experiment suggests that species tend to degenerate genetically, but the process is slowed by natural selection.

PALEONTOLOGY: SHARK AND THELODONT FINDS

Samson IJ, Smith MM, Smith MP. 1996. Scales of the thelodont and sharklike fishes from the Ordovician of Colorado. Nature 379:628-630.

Summary: Apparent scales of sharks and thelodonts have been discovered in the Harding Sandstone of Colorado. This is the stratigraphically lowest record for both groups. The discovery of apparent shark scales lowers their first appearance from the Lower Silurian (Llandovery) to the Upper Ordovician (Caradoc), supposedly 25 Myr. Thelodonts were previously reported from the Upper Ordovician (Ashgill), a difference of some 10 Myr. Possible acanthodians and heterostracan-like fish are found in the same location. This indicates that fish were already diversified before Silurian sedimentation began.

Comment: Lowering the first appearances for these groups of vertebrates crowds them together toward the Cambrian Explosion. The appearance of virtually all phyla near the bottom of the Phanerozoic strata is an outstanding feature of the fossil record.

PALEONTOLOGY: EARLY FOSSIL BIRDS

Hou L, Martin LD, Zhou Z, Feduccia A. 1996. Early adaptive radiation of birds: evidence from fossils from Northeastern China. Science 274:1164-1167.

Summary: Recently discovered fossils from Liaoning Province, China threaten the status of *Archaeopteryx* as the possible ancestor of all other birds. Two genera of birds are reported from rocks at about the boundary of the Upper Jurassic and Lower Cretaceous. They are listed here as Upper Jurassic, but this is controversial. *Confuciusornis* is a magpie-sized member of the enantiornithine birds, which are the most common fossil landbirds found in Cretaceous rocks. It has a horny beak, and lacks teeth. *Liaoningornis* is a sparrow-sized bird with characteristics of ornithurines, the group that includes all living birds. This species has features, lacking in enantiornithines, that suggest the existence of a modern type of bird lung with air sacs. *Chaoyangia* is found in Lower Cretaceous deposits in the same region, and is also an ornithurine bird. The existence of both major types of birds at the Jurassic-Cretaceous boundary argues against the hypothesis that *Archaeopteryx* is the direct ancestor of modern birds, with the enantiornithines as an intermediate. Instead, *Archaeopteryx* and the enantiornithines form one group, separate from the ornithurines and modern birds. Still unexplained is the fact that the most birdlike of the dinosaurs are primarily Upper Cretaceous, stratigraphically considerably higher than *Archaeopteryx* and numerous other birds.

An accompanying commentary (p 1083) notes that the rocks at the Liaoning Province have given Lower Cretaceous dates, reducing the force of the argument.

Comment: Although *Archaeopteryx* has been postulated to be the direct ancestor of other birds, several paleontologists have been skeptical. The diversity of birds found in Lower Cretaceous rocks seems too large to be accounted for by an origin with the Upper Jurassic *Archaeopteryx*. Alternative ancestors for the birds have been proposed, but no alternative well-preserved potential fossil ancestor has been identified. These discoveries in China underscore the problem by showing that both major groups of birds were buried together in Upper Jurassic or Lower Cretaceous deposits. Some Middle Jurassic footprints from Africa (see *Origins* 19:39 for comment) are a possible record of birds stratigraphically lower than *Archaeopteryx*.

PALEONTOLOGY: ICHTHYOSAURS

Motani R, You H, McGowan C. 1996. Eel-like swimming in the earliest ichthyosaurs. Nature 382:347-348.

Summary: Ichthyosaurs are marine reptiles superficially resembling dolphins or sharks and found only in Mesozoic rocks. The stratigraphically lowest ichthyosaur is *Chensaurus*, from the Lower Triassic of China. Compared to other ichthyosaurs, *Chensaurus* has a smaller caudal fin, more narrow body, and more vertebrae in the trunk of its body. This morphological structure implies that is was a less efficient swimmer than other ichthyosaurs. The authors suggest that *Chensaurus* may be a transitional form between terrestrial diapsid reptiles and more advanced ichthyosaurs, as illustrated by *Mixosaurus* and *Stenopterygius*, from Middle Triassic and Lower Jurassic rocks, respectively.

Comment: Mobility is one of the features thought by creationists to play a role in determining the fossil sequence. In this case, the first ichthyosaur to be buried and preserved appears to be the weakest swimmer of its type. *Chensaurus*, *Mixosaurus* and *Stenopterygius* appear to form a series of increasing mobility.

SPECIATION RATES

Johnson TC, Scholz CA, Talbot MR, Kelts K, Ricketts RD, Ngobi G, Beuning K, Ssemmanda I, McGill JW. 1996. Late Pleistocene dessication of Lake Victoria and rapid evolution of cichlid fishes. Science 273:1091-1093.

Summary: The African rift lakes are famous for their species flocks of cichlid fish. Lake Victoria has more than 300 endemic species of cichlids. Studies of bottom sediments indicate that the lake completely dried up during the Late Pleistocene. The lake filled again at about 12,400 radiocarbon years ago. This scenario implies that the speciation process is rapid enough to produce 300 new species in no more than 12,000 years.

Comment: Some creationists have long believed that speciation rates could be much more rapid than typically stated in the literature. This example seems to support such a belief, and is all the more remarkable because sympatric speciation seems to be required. One

might expect allopatric speciation to be more rapid than sympatric speciation.

STRATIGRAPHY: ANOMALOUS BLOCK IN THE OCEAN

Bonatti E, Ligi M, Borsetti AM, Gasperini L, Negri A, Sartori R. 1996. Lower Cretaceous deposits trapped near the equatorial Mid-Atlantic Ridge. Nature 380:518-520.

Summary: Rocks close to a seafloor spreading zone are expected to be young relative to rocks farther from the spreading zone. Thus it is surprising to find Lower Cretaceous rocks near the spreading center of the Atlantic Ocean. A further surprise is that the Atlantic was thought to have not been in existence in this area during Lower Cretaceous sedimentation. The anomalous Cretaceous rocks are a pelagic limestone, overlain by lower Tertiary siltstones of continental origin. One possible explanation for this anomaly, suggested by the authors of this paper, is that the block of material might have been transported back and forth by fault jumping along the nearby Romanche fracture zone. Fault jumping would mean that the boundary fracture between eastward and westward moving plates might jump to a new location. If the fault jumped past the block of material, the fault jump would effectively transfer the block from one plate to another, reversing the direction of movement of the transported block.

In an accompanying commentary (p 480-481), Rohr expresses some skepticism over this explanation. The block in question is at least 50 km wide and more than 200 km long, and it seems unlikely that faulting would jump such a large distance. An alternative explanation is that the block was trapped in a complex zone of multiple fractures, not permanently attached to either plate. Whatever the explanation, the phenomenon may well change our views of plate tectonics.

Comment: The theory of plate tectonics has been highly successful, but it does not explain all the data. We will have to wait to see whether the observation reported in this paper will result in changes to the theory.