Section 6. Strange World: Liaoning Diorama

Fun Facts

- The dietary habits of a 30 ton *Apatosaurus* and any modern day chicken have in common the use of gastroliths (stomach stones) to aid in digestion of their vegetarian habits; strong muscles of the gizzard use the stones to break up tough plant fibers; we don't know about dinos but modern day birds prefer brightly colored sand, grit, and pebbles; a ruby gem was found in the gizzard of a pheasant and led to the discovery of some large ruby mines in Burma.
- *Repenomamus giganticus*, the largest known Mesozoic mammal, was a badger-sized mammal. The fossil of its cat-sized smaller relative, *Repenomamus robustus*, was found with the remains of a young psittacosaur in its stomach. (One wonders if salsa was served.)
- Quiet voices, please! *Mei long* (feathered dinosaur) died in its sleep. This fossil shows that *Mei long* apparently slept much as modern birds do, with its feet tucked under it body and it head underneath one wing; English translation of the Chinese *Mei long* is "soundly sleeping dragon."
- *Sinosauropteryx prima* is the first documented evidence of an animal other than a bird with a "featherlike covering"—thin, hollow filaments, "primitive feathers" that probably kept the animal warm, like hair on mammals; had three types of feathers: hair like; downy tufts; and modern-type feathers. There are probably feathered dinosaurs which pre-date *S. prima* but this is the first documented.
- *Caudipteryx zoui* (birdlike dinosaur) had modern feathers but could not fly because its arms were too short.
- Young *T. rex* may have had feathers when young to keep warm but older, larger *T. rex* wouldn't need feathers because large body size creates and holds lots of heat.

Q&A

Q: Where is Liaoning Province?
A: Liaoning Province in northeastern China is just a day's drive from Beijing, located not far from the Korean Peninsula.

Q: Why are there so many fossils in Liaoning and what is their significance?
A: Geography and geology were well suited—dead plants and animals washed into the many lakes and streams; volcanic activity allowed them to be covered quickly with volcanic ash. Liaoning fossil beds reveal not just individual dino fossils, but a glimpse of a 130 million year old ecosystem; thousands of fossil plants and animals—including insects, fish, dinosaurs (including both birds and other feathered dinosaurs), amphibians, and mammals—have been found in Liaoning.

Q: Are all dinosaurs big animals?
A: No, *Psittacosaurus sinensis* (up to 6 ft.), and *Lianingosaurus paradoxus* were small dinosaurs; also *Bambiraptor* (up to 4 ft. as adult). There were MANY small dinosaurs.

Q: Were dinosaurs warm blooded?
A: Dinosaurs were so diverse and of such different size ranges, it is probable that they exhibited different kinds of metabolisms. It seems likely that at least some dinosaurs were "warm-blooded," because modern birds are warm-blooded. Large animals in

particular often have such mass that their bodies are well-insulated from the cold. This may have helped large carnivores, like *T. rex*, stay "charged."

Q: Were flowers part of the dinosaur's diet?
A: Perhaps, but true angiosperms (flowering plants) did not appear in the fossil record until late in the Age of Dinosaurs and were rare as compared to ferns and gymnosperms, such as pines.

Q: How could an adaptation as complex as feathers evolve?
A: Like all complex biological features, feathers evolved in stages and may have had different adaptive advantages; for example, the earliest feathers were simple thin, hollow filaments and probably were used as insulation to keep the animals warm.

Q: Do all feathered dinosaurs have the same type and pattern of feathers?
A: No. Some of the Liaoning dinosaurs had very simple feathers, while others had more advanced ones, similar to those found on modern birds. The evolution of feathers dates back more than 150 million years. Also, some feathered dinosaurs seemed to be gliders and not fliers.

Q: Which came first, flight or feathers?
A: Feathers in feathered dinosaurs; probably first evolved as insulation; non-avian dinosaurs with feathers probably could not fly—their arms were too short; some dinosaurs may have started gliding from trees.

Q: Did birds evolve from pterodactyls (Pterosauria)?
A: No, birds evolved from dinosaurs. Pterodactyls are an entirely different reptile from dinosaurs; pterodactyls had not feathers, but rather a web of skin-like tissue between digits, similar to the webbing of a duck.

Q: Why are there so few mammals in the Liaoning diorama?
A: Dinosaurs and other reptiles were numerous, and could be large and aggressive; mammals were few during the Age of Dinosaurs and small, hiding out in burrows or trees, and likely nocturnal to survive dinosaur predators.

Q: Do volcanoes have an effect on fossil formation, given that fossils are sometimes found in areas of volcanoes?
A: Volcanic eruptions produce deadly gases and blankets of ash deadly to both plants and animals; this can result in quick death, minimal scavenging and quick layering—all essentials for good fossil formation. In some cases, fine-grained ash can preserve very fine details. However, volcanoes are often bad for fossil preservation because the hot ash burns things up and lava flows will destroy areas.