

GREGORY S. PAUL'S DINOART NOTES

FAT ANKYLOSAURS— REALLY, REALLY FAT ANKYLOSAURS

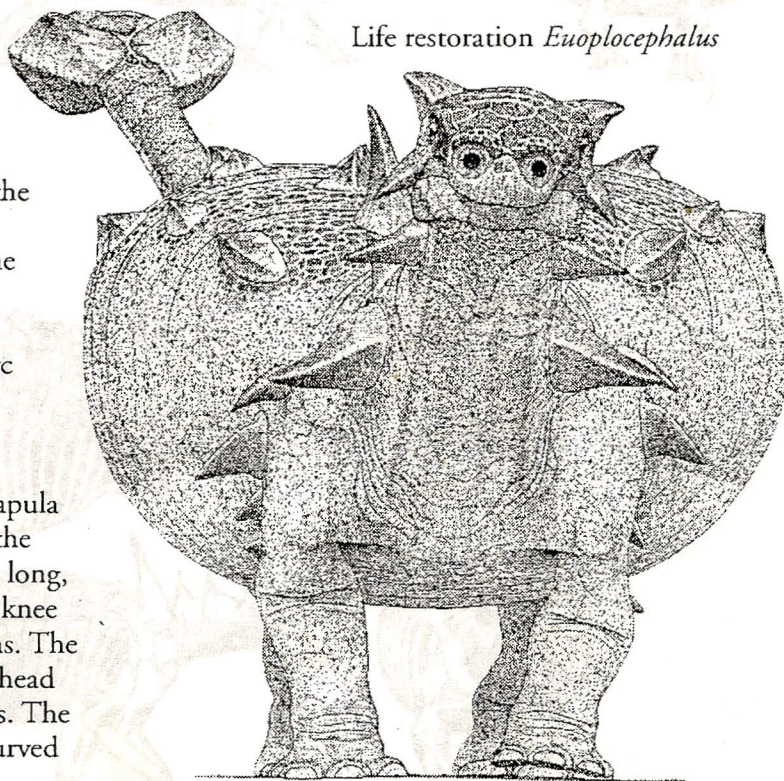
Ankylosaurs have been among the most difficult subjects for the paleoartist. They are rare, and complete skeletons with armor in place are especially so. Their species identity and relationships are confusing, hindering attempts to combine partial skeletons to make a whole animal. Finally, the structure of ankylosaur skeletons is most peculiar, making it hard to figure out how they go together. Many past restorations have been rather formless, sprawling legged caricatures with inaccurate armor. More modern efforts have placed the armor more correctly, and have brought the legs under the body so that they could walk out the narrow gauge trackways assigned to ankylosaurs.

The many problems caused me to avoid attempting to restore ankylosaur skeletons until recently. I chose two fairly well known North American examples, the Early Cretaceous nodosaurid *Sauropelta*, and the Late Cretaceous, club tailed ankylosaurid *Euoplocephalus*. There are complete but skull-less skeletons with almost all the armor in place in New York and London museums.

The hips of ankylosaurs are extremely broad, almost unbelievably so. Some recent restorations have narrowed the hips, but the very long ribs at the front of the pelvis had to be arbitrarily shortened. Ankylosaur hips do not show signs of such extreme crushing, so their respiration ability has to be worked into restorations. The posterior ribs of ankylosaurs are fused to the vertebrae, and they are far out to the sides, so far that the middle of the ribcage is almost as broad as the hips. The ribcage narrows strongly progressing forward to the chest. The narrowing is so sharp that the blade of the scapula is twisted along its length in order to conform to the strong curve of the ribcage. Ankylosaur bodies are long, and the legs are short and flexed at the elbow and knee (less so in nodosaurs), so they were low lying forms. The short, horizontal neck accentuates the effect. The head was directed downwards, especially in nodosaurids. The tail sloped gently downward from the hips, and curved

until it was carried horizontally—there are no tail drag marks. Nodosaurid tails were fairly supple along their entire length. The last half of ankylosaurid tails were rigidly braced and inflexible. This helped carry the tail club, which was porous and not as heavy as the mineralized fossil looks.

The result is a flat-topped body that one could almost have lunch on. In front view the appearance can only be called ludicrous. There is nothing similar alive today. One ankylosaur that does not share this construction is Asian *Talarurus*, which has a rounder, more hippo-like body. The enormous belly contained a great fermenting digestive vat that broke down food little processed by a weak dentition. The limbs of ankylosaurs are longer than those of hippos. The latter can trot faster than humans can run, so ankylosaurs were probably even faster, albeit not as fast as rhinos. The more flexed, stronger legs of ankylosaurids suggest they were faster

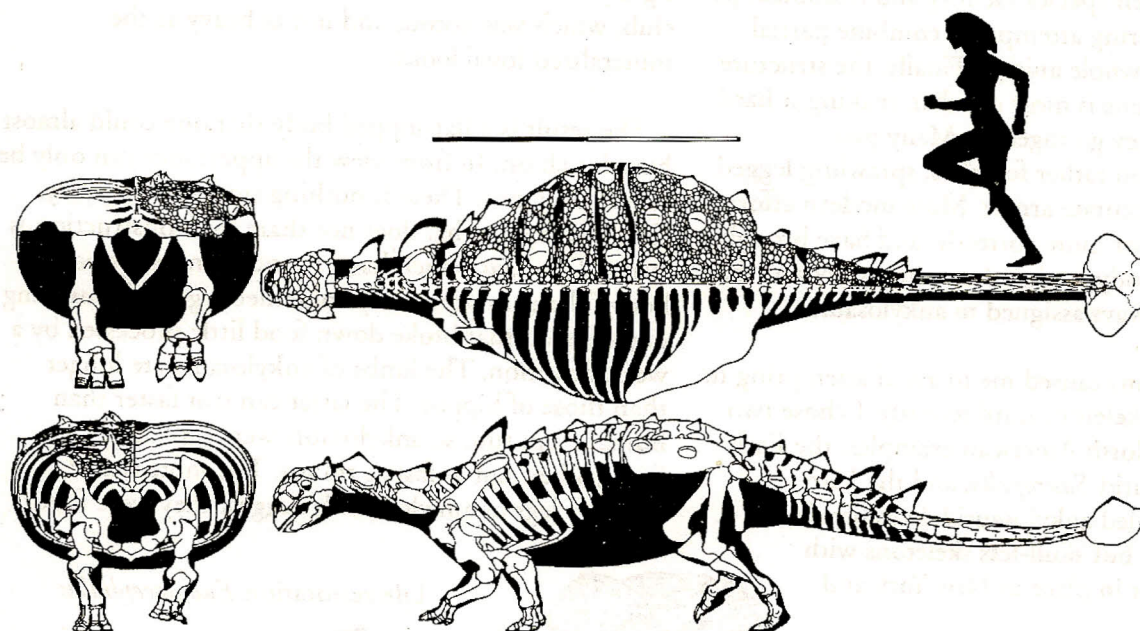
Life restoration *Euoplocephalus*

than the more elephantine nodosaurids. Although the armor of ankylosaurs was very well developed—with bony upper eyelids in ankylosaurids—it was not as extensive as that of tortoises, or the recently extinct glyptodont mammals of the Americas. In particular, the armor protecting the flanks of ankylosaurs was not a series of big plates or spikes as shown in some past restorations. The combination of well developed legs, limited armor, and tail weaponry suggests that ankylosaur defense was often more active than in slow glyptodonts and turtles. Nodosaurids with long shoulder spikes may have tried to spin around and keep

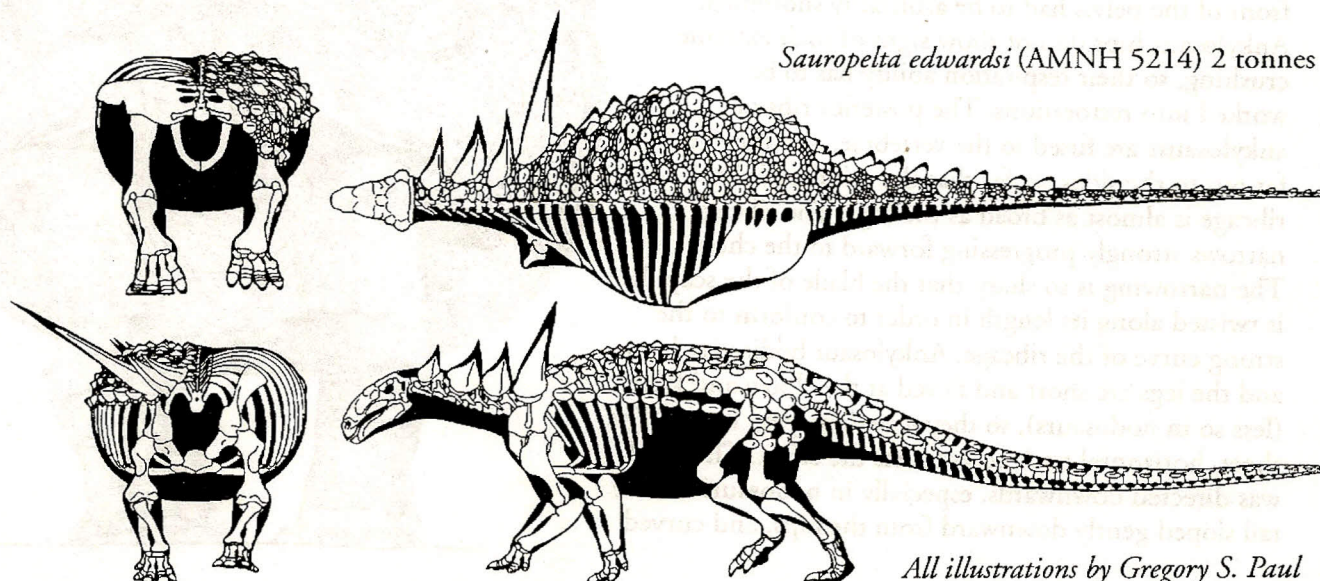
theropods in front of them. Ankylosaurids may have run away from attackers, keeping them behind by swinging their clubs back and forth to ward off assaults, and to land a bone or joint smashing blow to the theropod's delicate legs.

Some ankylosaurs, such as Australian *Minmi*, were small. *Ankylosaurus* was the biggest at up to four tonnes.

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Euoplocephalus tutus (BMNH 5161) 2.3 tonnes



Sauropelta edwardsi (AMNH 5214) 2 tonnes

All illustrations by Gregory S. Paul