

Sauropod necks: how much do we really know?

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Despite recent studies on the anatomy, function and posture of the necks of sauropod dinosaurs, much of what we think we know rests on very shaky foundations.

1. Incomplete fossils. For most sauropod genera there are no complete necks, and multiple necks are known from only a handful of genera. Even "trusted" specimens like the Carnegie *Diplodocus* are damaged and possibly incomplete.
2. Distorted fossils. Even the few complete necks are invariably crushed and otherwise distorted. This is almost inevitable due to the fragile construction of sauropod cervicals.
3. Unpreserved cartilage. Extant animals show that it is impossible to understand the vertebral column in the absence of intervertebral and zygapophyseal cartilage -- even neck length cannot be determined.
4. Ignored soft tissue. As palaeontologists, we tend to concentrate on bones, but animals are also made of muscle, ligament, skin and other organs. We have yet to see a realistic attempt to restore the soft tissue of a sauropod neck: all neck mass estimates are whistling in the wind.

In summary, many palaeobiological studies of sauropod necks are based on soft-tissue-free models of cartilage-less bones that are distorted and do not constitute complete necks.

These problems are difficult, but not wholly intractable. The way forward is to apply data from extant animals in a phylogenetic context. Recently, work on cartilage, skeletal pneumaticity and neck posture of extant archosaurs has been applied to sauropods with good effect. Much more is needed.