# A unique Morrison-Formation sauropod specimen with biconcave dorsal vertebrae

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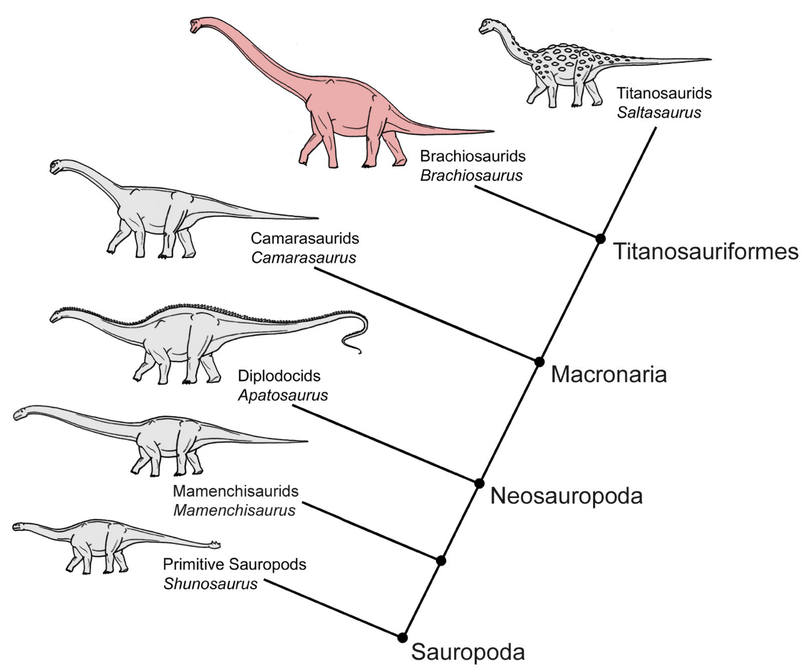
**AMNH FARB 291**: five consecutive posterior dorsal vertebrae.
Top row: dorsal view (anterior to the right).
Bottom row: posterior, right lateral, anterior.

Centrum lengths (anterior to posterior):
207, 205, 232, 222 and 207 mm.
Scale bar = 150 mm.

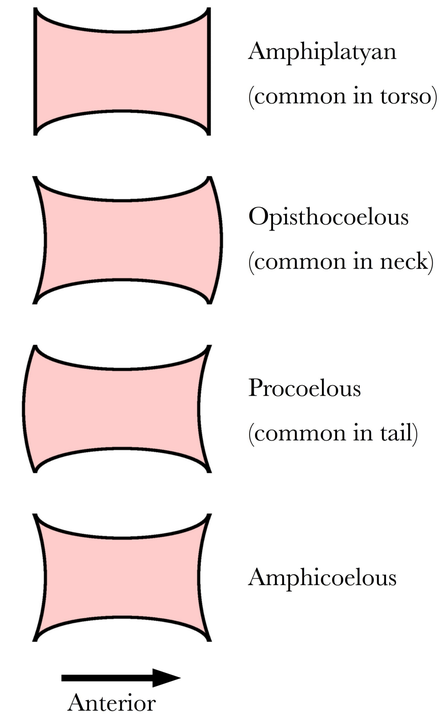

**6th presacral vertebra (D?7) of *Brachiosaurus* in dorsal view.** Note the resemblance to AMNH FARB 291: elongate centrum, long lateral fossa, swept back lobe-like lateral processes, dual SPRLs and SPOLs.

Thanks to Heinrich Mallison for 3D modelling of this vertebra.

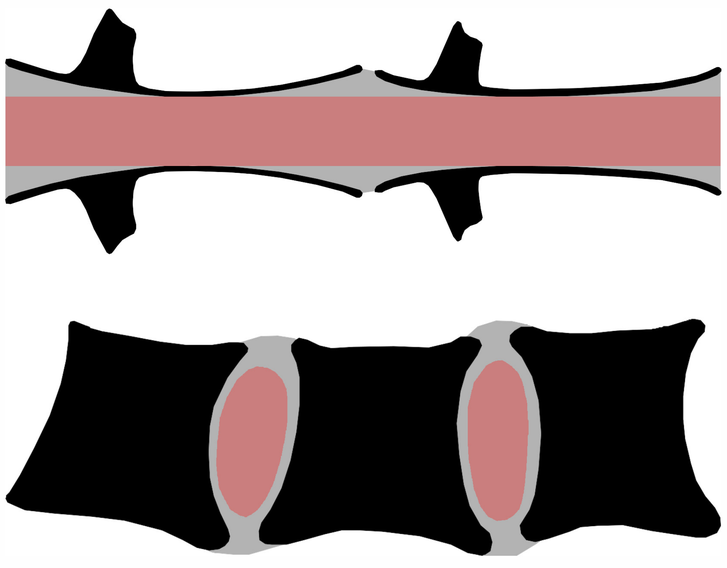
**Representative dorsal vertebrae**, in right lateral view, of sauropod groups in the Morrison Formation: *Brachiosaurus*, *Camarasaurus*, *Haplocanthosaurus* and the diplodocid *Amphicoelias* (which does *not* have amphicoelous vertebrae).




**Simplified relationships of the sauropods.** AMNH FARB 291 was found found in the Morrison Formation (western USA, Upper Jurassic). Diplodocids and camarasaurids are common in this formation; haplocanthosaurids (primitive diplodocoids) and brachiosaurids are also present, but rare. More primitive sauropods, mamenchisaurids and titanosaurs are not known in the Morrison Formation. Brachiosauridae, the group to which AMNH FARB 291 probably belongs, is highlighted.




**Articular shapes of sauropod centra.** The three commonly found shapes (top three above) all preserve roughly interlocking anterior and posterior faces. The unique amphicoelous (biconcave) centra of AMNH FARB 291 do not.



**Two models for biconcave centra.** In both, the notochord is pink, cartilage is grey and bone is black.

**Top:** in the salamander *Eurycea*, the notochord persists into adulthood, contained within a thin bone sheath that is otherwise filled with cartilage.

**Bottom:** in the rodent *Rattus*, full bony centra form, leaving vestigial segments of notochord to form the intervertebral discs.

**AMNH FARB 291, red/cyan anaglyph.** View the structure of the bones with 3D glasses to see the morphology more clearly. Note the forward position of the neural arches, the pronounced spinodiapophyseal lamina especially on the 3rd vertebra, and the deep concavities apparent on both sides of the intervertebral spaces, especially between the 2nd, 3rd and 4th vertebrae.