

Did Horny Young Dinosaurs Cause Illusion of Separate Species?

Of all the strange-headed dinosaurs, the prize for toughest, prickliest noggins probably belongs to the pachycephalosaurs—literally, the “thick-headed lizards.” Some sported domed skulls, and all had bony spikes studding their long snouts. Four species are known from roughly 65-million-year-old rocks in Wyoming, Montana, and South Dakota alone. It’s an impressive display of diversity for the waning days of the dinosaurs.

Or maybe not. At the Society of Vertebrate Paleontology’s annual meeting here last month, Jack Horner of Montana State University (MSU) in Bozeman argued that three of the species are just one. What were thought to be two unique species, he says, are in fact juveniles of different ages that would have grown up to be bony-headed *Pachycephalosaurius*. “It’s a dramatic remake,” says Peter Dodson of the University of Pennsylvania.

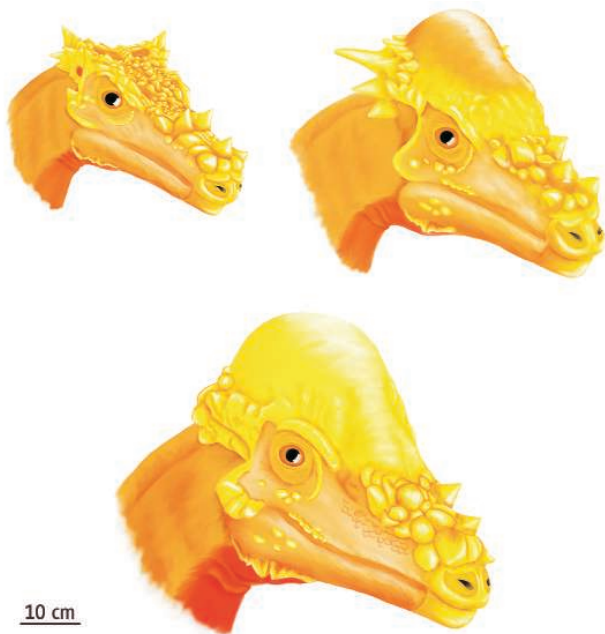
The revision would remove two particularly colorful characters from the paleontological bestiary, and not everyone is convinced. Getting the taxonomy right has major implications, says David Evans of the Royal Ontario Museum in Toronto: “It’s really important for understanding a whole range of evolutionary phenomena.”

First described in 1931, *Pachycephalosaurius wyomingensis* has such a prodigious pate that paleontologists speculated males butted heads with each other, although many now doubt it (*Science*, 5 November 2004, p. 962). In 1983, a related species made its debut. *Stygimoloch spinifer* (“horned devil from the river of death”) had a smaller dome but fearsome spikes. The newest addition was introduced last year: *Dracorex hogwartsia* has a flat head with telltale nasal horns. The dragon-king was named in honor of J. K. Rowling, whose *Harry Potter* novels feature the Hogwarts School of Witchcraft and Wizardry.

Horner and colleagues—MSU doctoral student Holly Woodward and Mark Goodwin

of the University of California, Berkeley—suspected that young dinosaurs might have been misidentified as adults. During previous work on another pachycephalosaur, *Stegoceras*, they noticed that the bone of smaller specimens was full of radial canals, a spongelike texture that indicates rapidly growing bone and suggests that they were juveniles.

The team cut open skulls of *Pachycephalosaurius* and found dense bone without canals, suggesting that the specimens were



E pluribus unum. Three species of pachycephalosaurs may actually be just one that changed drastically during adolescence.

full-grown adults. *Stygimoloch* bone was full of canals. “This is not even close to being full-grown,” Horner says. The spikes had a spongy texture and showed signs that the bone was being resorbed—suggesting it was a juvenile *Pachycephalosaurius*.

There is only one specimen of *Dracorex*, housed in the Children’s Museum of Indianapolis, so Horner couldn’t cut it open to look at the tissue. Horner notes that little bumps on the top of the head of *Dracorex* resemble those that give rise to radial bone growth in *Stygimoloch*. Two large holes in the top of the skull are another characteristic of

juveniles that haven’t finished growing. Given the lack of a dome and the shorter skull, Horner suspects that *Dracorex* is an even younger *Pachycephalosaurius*. He says the hypothesis could be falsified if researchers were to discover, say, a new skull of *Dracorex* that is as big as *Pachycephalosaurius* or that has mature bone.

The argument makes sense to Robert Sullivan of the State Museum of Pennsylvania in Harrisburg, who co-authored a paper describing *Dracorex* published last year in the *New Mexico Museum of Natural History and Science Bulletin*s. In another talk at the meeting, Sullivan speculated that juvenile pachycephalosaurs in Asia may have been misidentified as new species. But another author, Robert Bakker of the Houston

Museum of Natural Science in Texas, adamantly opposes lumping together the three North American species. “The differences are [so] astonishing,” he says, that he can’t imagine that one could have grown into the other. Evans, on the other hand, says such big changes are possible. “What dinosaurs teach us is that relative growth can be extreme, particularly in the skull,” he says.

What’s needed are careful measurements of many specimens to see how shape changes with size, Evans says; this can help reveal whether various specimens all belong to a so-called growth series. If some features, such as the height of the dome, do not depend on size, it would suggest they rightly belong to different species. Because juveniles tend to start out with features of their evolutionary ancestors and modify them as they grow, it’s important to distinguish juveniles from adults or family trees may get confused. That would give researchers a skewed picture of how various pachycephalosaurs are related to one another and to more distant taxa.

If Horner turns out to be right, the diversity of pachycephalosaurs would be 50% lower than previously thought for the latest Cretaceous. “It makes a lot more sense,” he says, because other kinds of dinosaurs were also declining in diversity at the time. Not even an honorary degree in wizardry, it seems, was enough to save them. —ERIK STOKSTAD