

# Would You Recognize A Holotype If It Hit You in the Chevron?

Here's a trick question: What's the difference between the "type specimen" and the "holotype" of a species? The question is tricky because the two terms refer to exactly the same thing.

In understanding what paleontologists and other scientists mean when they use these words, the definition from the *Oxford English Dictionary* is a good place to start: "A specimen chosen as the basis of the first description of a new species." The *OED* dates the first use of the word to an article by the famous invertebrate paleontologist, Charles Schuchert (1858-1942), director of the Peabody Museum of Natural History at Yale University from 1904-1923, the first president of the Paleontological Society, and an avid fossil-hound who amassed one of the largest brachiopod collections in the world.

In April 1897, Schuchert wrote in *Science*: "A holotype in natural history is a particular individual deliberately selected by the author of a species, or it may be the only ex-

ample of a species known at the time of original publication." In other words, a holotype or type specimen is the physical specimen upon which a taxon (generally but not always a genus or species) is established—or, in the jargon, "erected"

Holotypes are meant to be registered and deposited with a museum or institution where, at least in theory, they can be consulted by others. Institutions are typically

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identified by a code (YPB is the Yale Peabody Museum, FMNH is the Field Museum, and BHI is the Black Hills Institute—as in BHI 3033, the *Tyrannosaurus* illustrated by Fabio Pastori in this issue).<sup>1</sup>

This institution code is followed by numbers or letters that identify the specific specimen in the institution's collections, allowing the holotype—again theoretically—to

be available as a basis of comparison and standard of reference for any future finds. Is this specimen I've found of the same species? Check the description of the holotype and, if possible, the actual specimen itself.

And how about another term, as long as we're throwing them out: paratype. Paratypes are specimens identical to the holotype and included in the "type series" by the author in the original publication of the new taxon. (Botany has somewhat different rules for the use of the term "paratype," however.) So, if a paleontologist collected five specimens of the same species of a brand-new brachiopod she wanted to name, and mentioned them all as part of the series of specimens examined, one would become the holotype and the other four would be paratypes.

So far so good. Unfortunately, it turns out that things are a little more complicated than that.

Currently, a mini-debate has erupted over whether holotype must always mean the original specimen



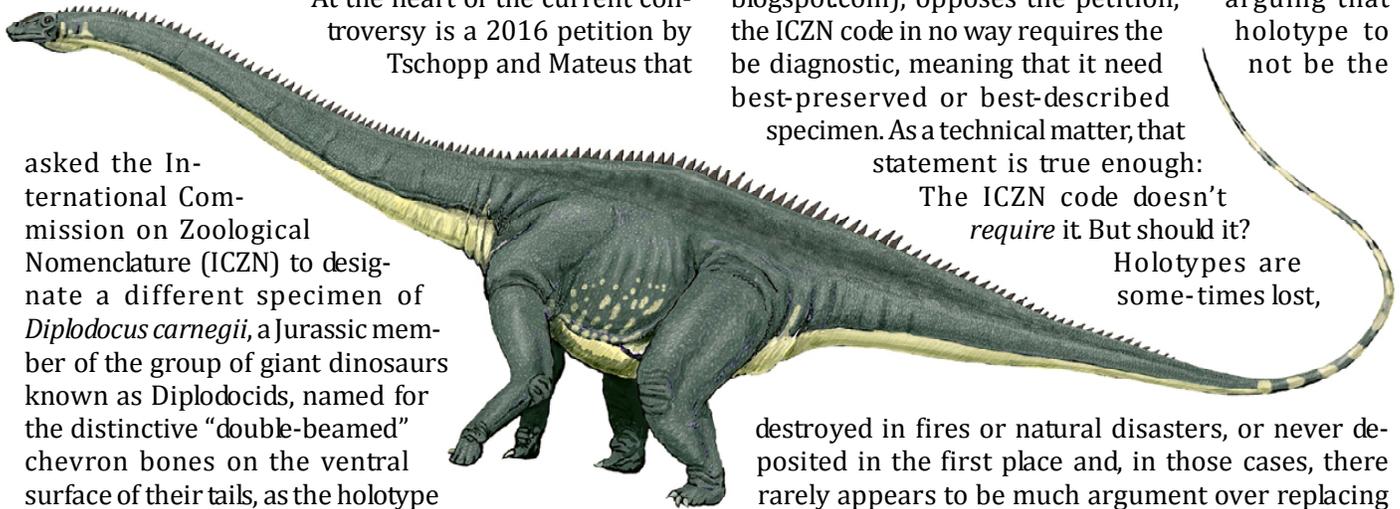
*Chevrons are a series of bones on the underside of the tail of many reptiles (as well as some mammals). Pictured is a replica of an eleven-inch specimen of a Diplodocus chevron.*

upon which a taxon is erected, or whether the definition should be “loosened” to encompass the specimen that best represents or is most diagnostic of the species.

The problem for paleontology—and especially for vertebrate and dinosaurian paleontology—becomes almost instantly obvious. In the case of specimens that tend to be described as whole entities—an echinoid, an insect (fossil or not), an extant bird—the holotype is virtually always the entire organism or, at least, its complete fossilized remains. But when a new dinosaurian species is established on the basis of a few scattered vertebrae or a tooth, what happens when later workers discover a femur or a partial skull? How can they compare the holotype to these discoveries and come to any useful conclusions?

The doubt that arises spontaneously, of course, is this: Doesn’t this suggest that a certain number of described dinosaurs species may be invalid? In other words, couldn’t partial remains sometimes be assigned to separate species even when they might, in fact, have come from the same kind of organism? And the spontaneous answer to both questions is: Yes.

At the heart of the current controversy is a 2016 petition by Tschopp and Mateus that



asked the International Commission on Zoological Nomenclature (ICZN) to designate a different specimen of *Diplodocus carnegii*, a Jurassic member of the group of giant dinosaurs known as Diplodocids, named for the distinctive “double-beamed” chevron bones on the ventral surface of their tails, as the holotype of the species.

University of Bristol (UK) paleontologist Michael P. Taylor, who curates the Sauropod Vertebra Picture of the Week Blog (svpow.com), not only supports the petition, he goes even further, saying that the “ICZN was never designed with dinosaurs in mind in the first place” (Taylor, 2016a). The problem with the current *Diplodocus* holotype, as Taylor explained in his formal statement to the ICZN in support of the change,

is a familiar one to dinosaurian workers: when working with very large animals that died many millions of years ago, most specimens are incomplete, and often very uninformative.... [This] issue was greatly exacerbated by the “Bone Wars” of E. D. Cope and O. C. Marsh, rival palaeontologists in the late 19th century of the USA, who each aimed to outdo the other by naming more species of fos-

sil animals. As a result, many dinosaurian species were named on the basis of non-diagnostic remains.... Despite being one of the most completely known of all dinosaurs, and among those best known to the general public, *Diplodocus* suffers badly from this syndrome. It was founded by Marsh on a non-diagnostic fragmentary specimen (YPM 1920), which supposedly functions as the type specimen of the type species, *D. longus*.

The petition’s authors themselves argued that “*Diplodocus* should not be typified by an undiagnosable type species,” and that “the undiagnosable state of the holotype of *D. longus* (YPM 1920, a partial tail and a chevron)” is good reason to replace it with “the much better represented [CM 84 specimen of ] *D. carnegii* Hatcher, 1901. CM 84, they go on to say, is a “well-preserved and mostly articulated specimen,” casts of which “are on display in various museums around the world”

Citizen scientist Mickey Mortimer, however, curator of the Theropod Database Blog (theropoddatabase.blogspot.com), opposes the petition, arguing that the ICZN code in no way requires the holotype to be diagnostic, meaning that it need not be the best-preserved or best-described specimen. As a technical matter, that

statement is true enough: The ICZN code doesn’t require it But should it?

Holotypes are some-times lost,

destroyed in fires or natural disasters, or never deposited in the first place and, in those cases, there rarely appears to be much argument over replacing them with what are termed “neotypes.” In the case of *Diplodocus* and the 2016 petition, however, there are deeper questions of whether dinosaurs “deserve special treatment,” as Taylor has written, precisely because they are “in many cases ... represented by eroded and distorted fossils of a tiny part of the animal [and are thus] already an aberration from the perspective of the ICZN” (Taylor, 2016b).

As of this writing, nearly 120 cases remain open before the ICZN, from arachnids to brachiopods, lemurs to sponges, but *Diplodocus* isn’t among them. In fact, Case 3700 is entirely missing from its database. Perhaps the fundamental question raised by the Tschopp and Mateus petition—what exact function a holotype is meant to serve—is giving the committee pause.

—Wendell Ricketts

## References

Taylor, Michael P. (2016a). Comment on the Proposed Designation of *Diplodocus carnegii* Hatcher, 1901 As the Type Species of *Diplodocus* Marsh, 1878. (Case 3700; see BZN 73: 17-24). <<https://svpow.files.wordpress.com/2016/09/taylor2016-support-for-diplodocus-carnegii.pdf>>

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Tschopp, E. & Mateus, O. (2016). Case 3700. *Diplodocus* Marsh, 1878 (Dinosauria, Sauropoda): Proposed Designation of *D. carnegii* Hatcher, 1901 as the Type Species. *Bulletin of Zoological Nomenclature* 73(1): 17–24. <<http://www.bioone.org/doi/10.21805/bzn.v73i1.a22>>

## Note

<sup>1</sup> Anyone geeking out over the curation of natural-history collections should consult the database of more than 7,000 institutions and their codes maintained by GRBio, the Global Registry of Biodiversity Repositories: <http://grbio.org/find-biorepositories>.

[Facing page: Illustration of *Diplodocus carnegii* by Dmitry Bogdanov ([dmitrchel@mail.ru](mailto:dmitrchel@mail.ru)); used via a Creative Commons CC BY 3.0 license.]