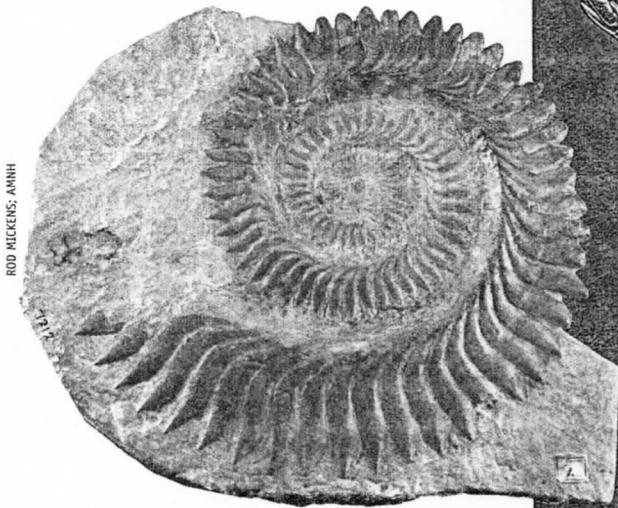


## AT THE MUSEUM

# The *Helicoprion* Mystery

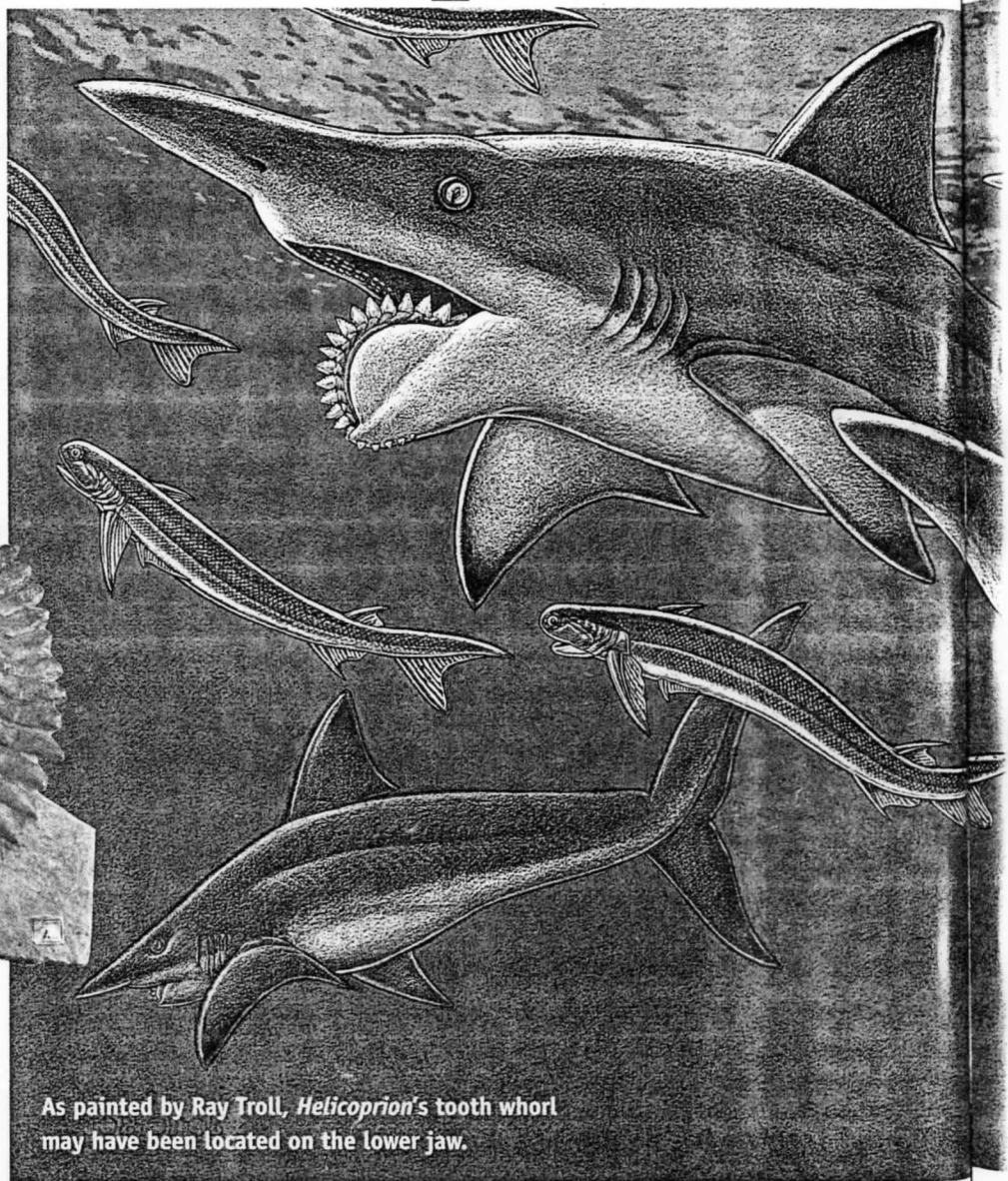
Where were the teeth situated on this ancient shark? In its jaw? On its tail? On its back?

By Richard Ellis



*Helicoprion* fossil

In the Museum's Hall of Vertebrate Origins is a most intriguing object, tucked away where few people see it. The object appears to be a perfect spiral of teeth, and the label below it reads, "What is this fossil?" This seems a curious question to be asking of Museum visitors, but the label provides the answer: "Many isolated tooth whorls of *Helicoprion* have been found, such as this specimen, but complete fossil skeletons are unknown." The specimen came from a phosphate mine in Idaho, but others like it have been unearthed in Wyoming as well as in



As painted by Ray Troll, *Helicoprion's* tooth whorl may have been located on the lower jaw.

Norway, Russia, Japan, Greenland, and Australia. Paleoichthyologists have categorized the teeth as sharklike and therefore identified the specimen as having belonged to certain primitive cartilaginous fishes—a group that includes the sharks and chimaeras living some 300 million years ago.

*Helico-* comes from the Greek for "spiral" or "whorl," and *-prion* from the

Greek for "saw." *Helicoprion* thus means "spiral saw." But what was this saw used for? Russian paleontologist A.P. Karpinsky was the first to find and describe a specimen, which he collected in 1899 in the Ural Mountains. He puzzled over where to place it on the shark—the lower jaw, the upper jaw, both jaws, the tail, the dorsal fin, the middle of the back? Only a year after Karpinsky's de-



Above: Paleontologist A. P. Karpinsky found the first specimen of *Helicoprion*'s tooth whorl in 1899, but he could not decide where it might fit on the shark. Almost a century later, Australian paleontologist John A. Long visualized a seemingly extensible apparatus, illustrated below by Ivy Rutzky, of the Museum's Division of Paleontology.



location in the lower jaw "would only prevent the fish from feeding." He therefore placed the whorl in the upper jaw, "where it could serve as effective protection," acting as a shock absorber for the animal's head.

In his 1995 book *The Rise of Fishes: 500 Million Years of Evolution*, John A. Long, curator of vertebrate paleontology at the Western Australian Museum in Perth, includes a hypothetical illustration of *Helicoprion* that shows the shark's lower jaw curling downward into a tooth-studded spiral. One could imagine that the shark uncoiled its jaw and lashed at prey with a sort of toothed whip. Another theory is that *Helicoprion*'s tooth spiral mimicked coiled shellfish called ammonites (especially abundant at the time) in order to attract these ammonites, the shark's prey. "It seems more likely," Long writes, "that these sharks used the jagged tooth-whorls when charging into a school of fish or ammonites and thrashing about to snag prey on the projecting array of teeth."

Richard Lund, a paleoichthyologist at Adelphi University and an expert on sharks from the Devonian Period,

points out two of *Helicoprion*'s radical features: the disproportionate size of the teeth making up the whorl, and the bases of the teeth being locked together during growth, a feature that prevented the shedding of the teeth. "Thus the smaller and older teeth are just shoved out and down, sort of like an ingrown toenail, only with teeth." Lund also believes the spiral must have been proportional to the size of the jaw that supported it: "Any reconstruction of the fish itself must be big enough to accommodate, smoothly, a buzz-saw-like gadget that got up to three feet in diameter. This yields a fish of very impressive size as well as impressive dentures."

A veritable cottage industry is devoted to the solution of the *Helicoprion* tooth-whorl mystery, and the tenor of some of the publications it inspires is unmistakably tongue-in-cheek. In the April 1, 1973—note the date—issue of the *Journal of Insignificant Research*, paleontologists Michael Williams and Kathy Elbaum, quoting from a 1966 paper by Danish paleontologist Svend Erik Bendix-Almgreen ("On the Significance of Karpinsky's Reconstruction") demonstrate that *Helicoprion*'s

whorl was the biomechanical equivalent of a New Year's Eve noisemaker. It could be extended by hydraulic force, releasing "in effect a lethal raspberry."

In their 1994 book *Planet Ocean: A Story of Life, the Sea, and Diving to the Fossil Record*, author Brad Matsen and artist Ray Troll devote an entire page to the "vexing fossil shark." Troll admits to an obsession with *Helicoprion*'s tooth whorl, and he recently made a model of

it. "There was no upper-half whorl of sharp teeth for the whorl to cut against," says Troll, "only rows of small crushing teeth. In all of the whorls and skulls Bendix-Almgreen examined, no other upper teeth were found besides the crushing teeth. . . . I could begin to 'see' the outline of the skull: long and extremely narrow. I realized this thing had a long nose on it much like a modern-day goblin shark. . . . As it grew, it

produced bigger teeth, so what you're seeing is really a fossilized growth ring."

Troll has drawn a new version of *Helicoprion*, but like all such reconstructions, whether by artists or paleontologists, it is at best an educated guess. *Helicoprion*'s secrets are still locked in the 280-million-year-old rocks.

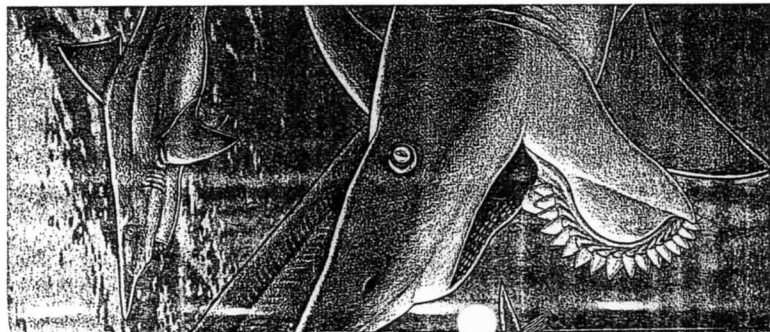
Marine expert Richard Ellis's latest book is *Encyclopedia of the Sea* (Knopf, 2000).

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## The Helicoprion Mystery

Article questions

1. Where was the *Helicoprion* specimen found?
2. What is the *Helicoprion* related to?
3. What is the mystery of the *Helicoprion*?
4. What was the conclusion of John Long?
5. What was the conclusion of Ray Troll?



scription appeared in print, American paleontologist C. R. Eastman wrote: "Of the two leading theories as to the position of . . . 'spines,' the first ascribes them to the jaws of a shark or skate, and the other to the median line of the back, some distance in advance of the dorsal fin." In a 1952 analysis of the tooth whorl, Russian paleoichthyologist Dimitri Obruchev decided that a