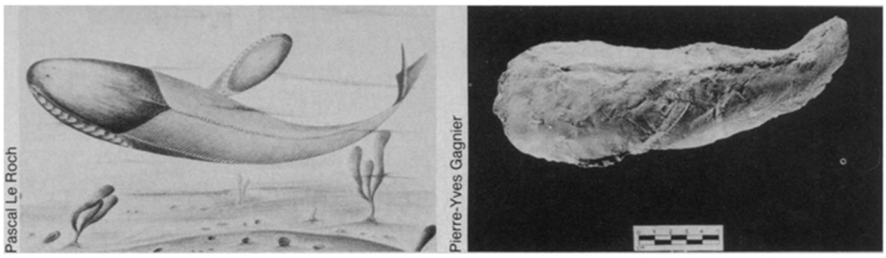
# Fossils flesh out early vertebrates




*Drawing of 470-million-year-old jawless fish (left) is based on Bolivian fossils such as the specimen shown at right.*

The oldest known vertebrates, a collection of remarkably well-preserved remains of 30 jawless fish, have been discovered by an international team of paleontologists in the mountains of southern Bolivia, according to an announcement last week by the National Geographic Society in Washington, D.C., which funded the expedition.

The fossils were embedded in large stone slabs that date to about 470 million years ago, when much of present-day Bolivia was covered by ocean. At least 10 of the specimens are virtually complete, with even the tail sections intact, says expedition director Philippe Janvier of the French National Research Center in Paris.

"This is one of the most exciting and important discoveries in lower-vertebrate studies in the last 50 years," says vertebrate paleontologist David K. Elliott of Northern Arizona University in Flagstaff, who has seen the Bolivian specimens.

These ancient fish were probably poor swimmers that avoided deep water, notes Janvier. Bony plates protected the rounded head of the creature. Its body was covered with thin scales that ended near a narrow tail.

The fossil fish, which are up to 18 inches long and 6 inches wide, appear to represent a new genus, according to Janvier. He and his co-workers have dubbed the genus *Sacabambaspis*, after a village located near the fossil discovery.

Fragmentary remains of fish from about the same time or slightly later have been found in Australia and North America. Those found in Australia closely resemble the Bolivian fossils, says Janvier, while the North American specimens most likely belong to a different group of marine species.

Another vertebrate paleontologist familiar with the new fossils, Hans Peter Schultz of the University of Kansas in Lawrence, says they are similar to several ancient fish imprints previously found in Australian sandstone. The imprints are almost as complete as the new fossils, he notes, and date to nearly 470 million years ago. However, no fossil remains were found with the impressions.

"The Bolivian find shows that there was a broader variety of marine forms at that time than was expected," says Schultz. "Since fossils from around 470 million years ago are now known to be widespread, there must be a long vertebrate history before that time that we have no record of."

Jawless fish, whose modern counterparts include lampreys and hagfish, have been considered the earliest known vertebrates, or creatures with a backbone, for more than a decade. The bony spine typical of most vertebrates is replaced in jawless fish by a flexible rod similar to cartilage. — *B. Bower*

# Biting down on the culprit causing gum disease

About $10^{10}$ bacteria are found in each site of periodontal, or gum, disease. Among those are about 300 different species of bacteria. And among those species about 12 are considered nasty; they are suspected of being involved in the progression of periodontal disease in adults, which destroys the tissue and bone that support teeth.

But because scientists have not been able to determine which ones are the key types, dentists are forced to use a variety of procedures, including antibiotics (SN: 10/24/87, p.268), to halt the progression of the disease. This course of treatment can pose problems because bacteria can develop a resistance to medication. In addition, antibiotics break down bacteria into their component parts, some of which may infect the mouth.

Now, new work is pointing to a specific bacterium, *Bacteroides gingivalis*, as at least one cause of periodontal disease. Dental researchers hope that by pinning down specific bacteria, they eventually may be able to interfere with the progression of periodontal disease, perhaps by preventing the key types from colonizing or by cutting off their food supply, which consists primarily of the by-products of other bacteria.

In recent years, scientists have repeatedly isolated *B. gingivalis* from diseased gums in adults and have linked it to the progression of periodontal disease in humans and monkeys. But they have not been able to say that it is a cause of periodontal disease. For example, when researchers tried to implant it in the mouths of rodents, they did not observe any resulting disease.

However, a group of researchers reports in the Jan. 1 SCIENCE that *B. gingivalis* does cause a burst of periodontal disease in monkeys, whose mouths have a microbiology and immunology similar to humans'. Currently, the group is trying to determine whether other types of bacteria have a similar effect.

"Periodontal disease has a complex etiology. More than one type of bacteria is involved," says Stanley C. Holt of the University of Texas at San Antonio, where the research, funded by the National Institute of Dental Research (NIDR), was done.

In the experiment, the researchers injected four monkeys with the antibiotic rifampin to kill most of the periodontal-disease-causing bacteria. Another four monkeys were given placebos and served as controls. After eight weeks, the researchers placed silk strings around the base of four teeth in each monkey—a process called ligation, which is supposed to lead to periodontal disease.

Eight weeks later, they detected periodontal disease in 10 of 16 control sites and in 4 of 16 sites in monkeys given rifampin. At this time, they implanted rifampin-resistant *B. gingivalis* into two of the ligated sites in each monkey. Twenty weeks later, 6 of the 8 sites in the controls and all 8 sites in rifampin animals bled when touched gently with a probe—a standard sign of periodontal disease.

The researchers then isolated rifampin-resistant *B. gingivalis* itself from 10 of the 16 sites. These numbers agree with the 60 to 80 percent figure usually associated with the prevalence of *B. gingivalis* in adult cases of periodontal disease.

Says Robert Genco, director of one of five NIDR centers for periodontal disease at the State University of New York at Buffalo: "It appears *B. gingivalis* is getting support as a periodontal pathogen."

Holt and his colleagues Jeffrey Ebersole and Kenneth S. Kornman now are determining how to interfere with the progression of periodontal disease and are examining which other bacteria are involved. — *S. Eisenberg*