

Rodent jaw lights up dark age of evolution

Scrambling about the slopes of the Tinguiririca River valley in the Chilean Andes, André R. Wyss hoped to find dinosaur bones. Wyss, a paleontologist at the University of California, Santa Barbara, reasoned he stood a good chance because a nearby tourist attraction featured exposed footprints of the ancient beasts.

Bones he found, but of a different sort—a beautifully preserved jaw of the earliest rodent ever encountered in South America lay embedded in rock, along with hundreds of other mammal fossils.

The discovery of this jaw pushes back the arrival of rodents in South America some 10 million years. Furthermore, the fossil's morphology supports the long-contested theory that ancestral rodents from Africa somehow crossed the Atlantic Ocean to populate South America, Wyss and his co-workers report in the



Oldest rodent jaw found in South America.

Sept. 30 NATURE. This collection of mammal remnants defines a new interval in South American mammalian evolution, helping to fill a huge gap in current understanding of that process, Wyss says.

South America was an island continent for most of the past 80 million years, and for some 40 million years its mammals evolved undisturbed by outside competitors. What happened in the next 20 million years remains a mystery, even though the study of South America's mammal evolution began before Charles Darwin's visit.

"At some unknown point during this gap, rodents and primates must have arrived from other parts of the world and quickly thrived in South America. The Tinguiririca fauna falls nicely within that hole," explains Wyss. Given that scientists know neither rodents nor primates evolved in South America, "the big question is when, whence, and how did they get there?" observes paleontologist Bob Savage of the University of Bristol in England. Some scientists hold that ancestral rodents invaded South America from North America, while others argue that they came from Africa.

The when and whence of the rodents' voyage are now clearer: "Our rodent sets at least a minimum age of between 31 and 37 million years," says Wyss, so they must

have arrived sometime earlier. The molars of the ancient rodent appear to have had five crests, Wyss says. Such teeth establish a phylogenetic relationship with early rodents found in Egypt, strengthening the African connection. In contrast, the molars of primitive North American rodents show only four crests.

Scientists "obviously need more than this jaw to be sure," says Savage, "but it already makes a pretty strong case for the African origin." Wyss is optimistic that he will find more fossils, including primate bones, now that the Tinguiririca River valley has become a treasure trove for paleontologists. "We've already discovered a second site of an even older period," he says. "I think we may find many different slices of evolutionary times represented in that area."

One advantage of the fossil-containing volcanic deposits is that they can be dated precisely, using a technique based on the gradual decay of the trace gas argon. The more than 400 fossils Wyss

and his colleagues have excavated in five field seasons since 1988 are tightly sandwiched between layers of sediment 31 and 37 million years old. These measurements provide the first definite dating in a period stretching from roughly 28 to 58 million years ago, Wyss says.

Fossils unearthed earlier, in other parts of South America, could only be dated relative to each other. The new Chilean site lies in volcanic rock and thus may improve dating of other evolutionary phases in that still-fuzzy period 37 to 58 million years ago, says Wyss.

Although these volcanic deposits preserve animal bones extremely well, the rock is so hard that it takes months to get a fossil out, notes Wyss. That's why it took him three years to realize that he had found a paleontological gem. "When we broke the rock encasing that specimen, we saw only the cross section of a jaw and thought it was just another marsupial—of which we had found so many that we were tired of them. Given our preparation backlog, this jaw then sat around until someone finally got around to preparing it."

—G. Strobel

Astronomers find four bodies beyond Neptune

The observable edge of the solar system just got more crowded. A flurry of new findings supports the notion that the solar system's outskirts are littered with chunks of material left over from the formation of the planets.

In just one week last month, two teams of astronomers detected a total of four distant bodies that lie beyond the orbit of Neptune. One of the teams—David Jewitt of the University of Hawaii in Honolulu and Jane X. Luu of Stanford University—had previously detected the only two other bodies known to exist at these great distances (SN: 4/10/93, p.231).

Luu and Jewitt used the University of Hawaii's 2.2-meter telescope atop Mauna Kea to make the first two of the new observations, scanning the same one-degree-square patch of sky in which they had made their earlier findings. The newly identified bodies, dubbed 1993 RO and 1993 RP, appear to lie about 32 and 35 astronomical units (AU) from the sun, respectively, and form a 60° angle with Neptune's orbit. (An AU is the mean distance between the sun and Earth, about 149.6 million kilometers; Neptune now orbits the sun at about 30 AU.) The researchers reported their findings in circulars of the International Astronomical Union (IAU) late last month.

Just days after Luu and Jewitt made their discovery, another team, using the 2.5-meter Isaac Newton Telescope in the Canary Islands, Spain, verified the 1993 RO sighting. In addition, these astronomers discovered two other distant objects. One of the bodies, 1993 SB, lies an estimated 33 AU from the sun, while the

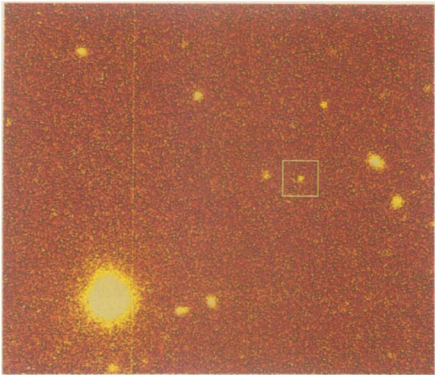
other, 1993 SC, appears to orbit at about 34.5 AU. Iwan P. Williams of Queen Mary and Westfield College in London, England, and Alan Fitzsimmons and Donal O'Ceallaigh of Queen's University in Belfast, Northern Ireland, also reported their findings in an IAU circular. All four objects, which resemble asteroids, may have a diameter of about 100 kilometers.

Both teams emphasize they will need several months of observations to pin down the exact trajectories of the newly identified objects. But they suggest that the bodies may rank among the most intriguing detected in the outer solar system.

According to Jewitt, all four may belong to or have recently escaped from a primordial reservoir of comets that astronomers have theorized should exist. This ring-shaped storehouse, known as the Kuiper belt, would serve to replenish the supply of short-period comets—icy remnants from the creation of the solar system, each of which visits the inner planets at least once every 200 years.

While the two bodies Luu and Jewitt found earlier seem to have circular orbits beyond Pluto, all four of the recently identified objects appear to lie closer in, just beyond Neptune's orbit. Depending on the location of the Kuiper belt, this may indicate that the two bodies beyond Pluto reside in the belt, while the other four are escapees, Jewitt suggests.

"We may have caught these bodies at the point where they're about to become Neptune crossers," he says. "Neptune will kick them in toward Uranus, and Uranus may kick them toward Saturn, and they



Boxed object, 1993 RO, is a newly identified member of the outer solar system.

Jewitt, Luu

may ultimately feed down [to the inner planets] over the next billion years."

Alternatively, notes Jewitt, the four bodies may rank as the first Trojan asteroids found near Neptune. Defined as asteroids that lead or trail a planet by about 60°, Trojans are known to exist only near Jupiter.

Based on an analysis of the past 20 million years of solar system dynamics, Matthew J. Holman and Jack Wisdom of the Massachusetts Institute of Technology reported in the May *ASTRONOMICAL JOURNAL* that Saturn, Uranus, and Neptune could each have a stable family of Trojans. A more extensive analysis by the researchers also indicates that Kuiper belt residents could "leak" more easily into the inner solar system than previously thought.

— R. Cowen

Kids cite value of abuse-avoidance classes

Elementary and secondary school students reap real-world benefits from instruction aimed at helping them to avoid and to report physical and sexual abuse, according to a study presented at a national symposium on child abuse prevention in Dallas last week.

"This is the first study to suggest that, when children with abuse-prevention training actually get victimized or threatened, they behave in ways envisioned by prevention educators," says David Finkelhor, a psychologist at the University of New Hampshire in Durham who directed the survey.

In the past decade, reports of sexual abuse have increased greatly, as has scientific debate about the psychological aftereffects of such abuse (SN: 9/25/93, p.202).

Many elementary and secondary schools in the United States offer abuse-prevention instruction in a variety of formats. Most stress the frequency and nature of physical and sexual abuse, teach children to reject or escape from unwanted overtures and threats, encourage youngsters to tell an adult about such incidents, and assure students that they are not to blame for abusive encounters.

Finkelhor and his co-workers conducted telephone interviews with a nationally representative sample of 2,000 youngsters age 10 to 16, as well as their

parents or caretakers.

Two-thirds of these children reported attending a school program that focused on abuse or victimization prevention. One in three students received "comprehensive" instruction, which included information about sexual abuse within the family, discussion of differences between "good" and "bad" touching, and sessions that occurred on more than one occasion.

A total of 837 youngsters experienced an attempted or completed physical assault; of that number, 115 cited cases of attempted or completed sexual abuse.

Several encouraging findings emerged from the interviews, Finkelhor contends. Children who received comprehensive instruction:

- displayed markedly more knowledge about sexual and physical abuse than other children;
- often used self-protection strategies recommended by instructors when victimized or threatened;
- felt better about how they handled instances of attempted or completed abuse; and
- showed much greater willingness to disclose such episodes to someone else.

Children who received instruction from their parents on how to avoid sexual abuse in addition to comprehensive abuse-prevention training at school were even more likely to benefit, Finkelhor asserts.

"Parental instruction has a heightened urgency to children, gets repeated over time, and is seen as more credible than school programs," he says.

On a less encouraging note, children who attended comprehensive school programs reported no greater ability to prevent physical or sexual abuse from being completed. In fact, particularly between the ages of 13 and 16, they suffered more physical injury during sexual abuse than other children.

This finding may reflect a greater tendency among older children to fight back during episodes of sexual abuse that approximate adult rape, Finkelhor says. Abuse-prevention programs may need to address more thoroughly the issue of how to avoid physical injury during a sexual assault, he argues.

The survey lacks independent confirmation of the children's abuse reports and probably underestimates the incidence of incest in the sample, the New Hampshire psychologist notes. In addition, the findings do not apply to abuse-prevention programs aimed at children in preschool and early elementary grades.

"We can't develop policies for abuse-prevention programs based on this one study," Finkelhor says. "Other researchers need to conduct similar surveys."

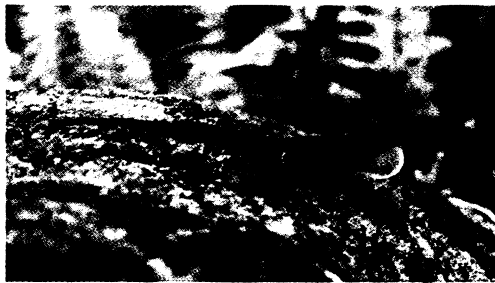
— B. Bower

Lizards flash colors people can't see

People flirt with smiles and warn off rivals with sneers. Likewise, lizards such as this *Anolis cristatellus* (bottom, right) gesture, unfolding a throat fan — called a dewlap — to communicate.



But dewlaps can send signals that humans cannot see, says Leo J. Fleishman, a physiologist at Union College in Schenectady, N.Y. Images from an ultraviolet video camera (top, right) reveal a brilliant dewlap in *Anolis pulchellus* that contrasts sharply with the surrounding vegetation, which tends to absorb light at those wavelengths, Fleishman and his colleagues report in the Sept. 30 *NATURE*. In normal light, the dewlap is less flashy (top, left).



Fleishman/NATURE

Fleishman and Ellis R. Loew of Cornell University in Ithaca, N.Y., stumbled onto special photoreceptors tuned to UV wavelengths while studying the eyes of these lizards for other reasons. They now know that many other lizards and a few snakes also possess these photoreceptors, says Loew.

Among the five anole lizards they investigated, the three that live in open, sunny areas had dewlaps that reflected UV light. The dewlaps of the other two, which live near the shaded forest floor, did not, says Fleishman.