SCIENCE NEWS of the week

Tiny Tooth Upends Australian History

Australian paleontologists have discovered a fossilized tooth—about as large as the capital letter starting this sentence — that promises to overturn long-standing beliefs about the origins of kangaroos, koalas and the other strange marsupials found in the land down under.

Known for carrying their newborns in external pouches, marsupials have dominated Australian ecology since the fall of the dinosaurs. On other continents, though, marsupials were largely wiped out by placental mammals. Judging from that record, paleontologists have presumed marsupials to be an inferior group that succeeded in Australia solely because they were the only mammals present on the continent when it split off from Antarctica and became an island. By that theory, the marsupials won Australia by default.

But the discovery of a 55-million-year-old molar from a placental mammal shows that these animals did indeed reach Australia early on and competed with marsupials before the continent went its separate way, a group of paleontologists asserts in the April 9 NATURE.

"The age-old notion that marsupials are competitively inferior to placentals does not hold water. It looks like just the opposite — that marsupials and placentals were together in Australia but that marsupials dominated and placentals went extinct," says Michael Archer of the University of New South Wales, one of the fossil's discoverers.

The molar bears a number of characteristics that led Archer and his colleagues to identify it as belonging to a placental mammal. A particular cusp, called the hypoconulid, sits in a back central part of the tooth. In marsupials, the cusp is displaced toward the tongue side. The fossil tooth also lacks another defining marsupial trait: a little shelf around the base of the tooth. These features were so striking that Archer's group identified the tooth as placental within a few seconds of finding it.

Studies with a scanning electron microscope and a laser scanning microscope revealed that the microstructure of the tooth's enamel also resembles that of a placental mammal.

The tooth belonged to an animal the size of a large rat, says Archer. It may fit in an order of mammals called the Condylarthra, which enjoyed great success in other parts of the world, ultimately giving rise to many different evolutionary lines. The researchers have named the new animal *Tingamarra porterorum.*

Prior to discovery of the tooth, the oldest Australian placentals (other than bats) dated to 5 million years ago—a time when the northward-moving continent had drifted close enough to allow the passage of Asian rodents across the Malay Archipelago. Bats appeared far earlier in the Australian fossil record, and scientists have long presumed that they flew to Australia after it had separated from Antarctica. But Archer and his coworkers have found bat remains in the same deposit as the *T. porterorum* tooth.

The scientists say they cannot explain why marsupials dominated in Australia while suffering defeat on all other continents. Archer speculates that marsupials — which give birth very soon after they conceive—may hold a distinct advantage in an unpredictable climate. If conditions grew particularly bad, a marsupial mother could survive by abandoning her newborns, whereas a placental mother facing the same conditions might die because she carries her young internally for a much longer time.

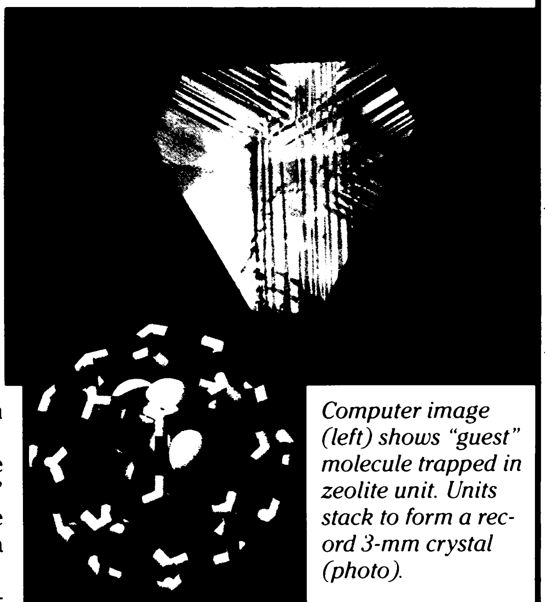
Alternatively, chance may have decided the marsupials' fate, both in Australia and elsewhere. "Maybe it's just a lottery," Archer says.

Michael O. Woodburne, a paleontologist at the University of California, Riverside, comments that while the new-found tooth resembles those from placental mammals, "I would not say that a placental affinity has been proven." He cautions that researchers know very little about the marsupials from this time period, leaving open the possibility that the tooth belonged to an unusual marsupial.

— *R. Monastersky*

Persistence pays off with zeolite gem

Once too small to see with the naked eye, those inorganic crystals called zeolites will soon come in extra-large sizes, thanks to the persistence of a team of chemists. Scientists have grown near-perfect zeolite crystals that measure several millimeters across. And they expect to make bigger, better specimens soon, Walter G. Klemperer of the University of Illinois in Urbana-Champaign announced this week at the spring meeting of the American Chemical Society in San Francisco.



W. G. Klemperer and Todd Marquart

Computer image (left) shows "guest" molecule trapped in zeolite unit. Units stack to form a record 3-mm crystal (photo).

Usually, "[zeolites] are more on the order of tens of microns," says Klemperer. "But these are things that you can mount on a ring."

Scientists use these compounds — whose internal structure resembles a Swiss cheese — as molecular sieves, catalysts for refining petroleum and even water softeners. Zeolites appeal to chemists because of their large surface areas and their internal cavities, or channels, which are big enough to admit small molecules but small enough to contain the product formed when those molecules react inside the crystals. Scientists have increased the size of these channels (SN: 8/3/91, p.77) but have shied from making large crystals because of the technical difficulty of the task.

Klemperer and his group at Illinois worked three years and finally got decent macroscopic crystals on the 327th try. Larger crystals provide better views of the internal organization of the zeolites, says Klemperer. Already the Illinois group and colleagues at the University of Nebraska in Lincoln have observed how temperature changes affect this organization. Next they plan to grow larger, more perfect crystals and to make ones with channels that will allow guest atoms to travel throughout the crystal.

Just as the development 40 years ago of methods for making macroscopic quartz crystals led to many new applications for that material, this work "opens up enormous potential for zeolites," Klemperer says. Bigger zeolites could prove important in a wide range of optical and electronic applications.

— *E. Pennisi*