




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# DIG THIS

## Traces of the Past

By Coleen L. Geraghty

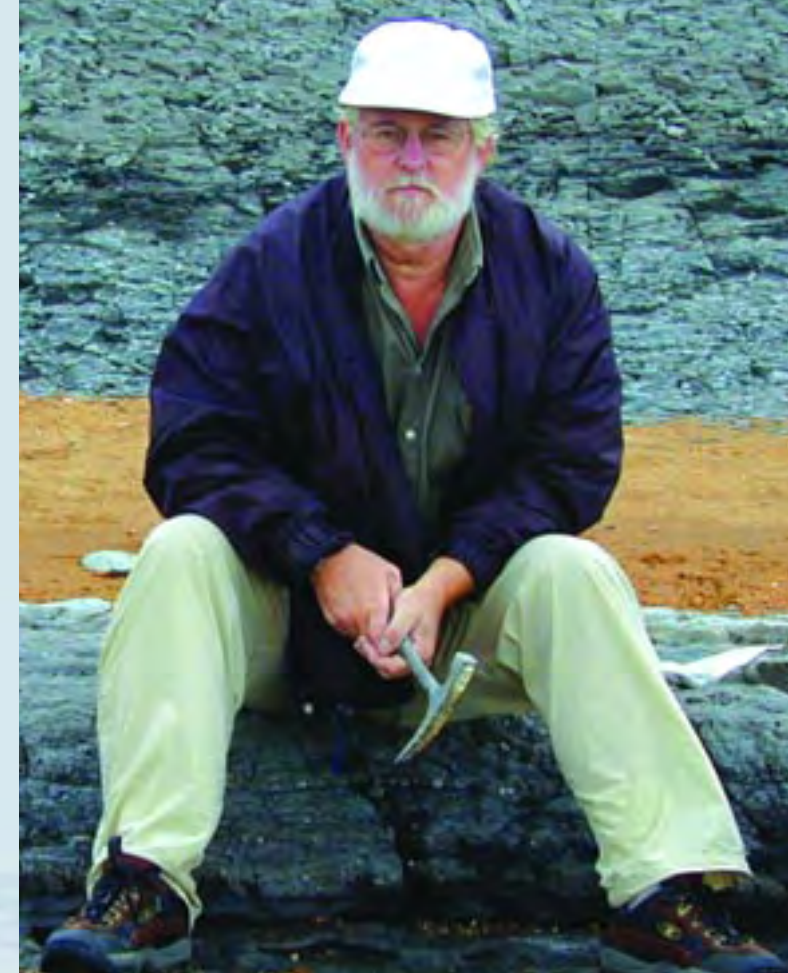
The red sands of the Kyzylkum Desert blanket central Uzbekistan. In this landlocked country of central Asia, the desert steppe occasionally cedes ground to fertile oases that once refreshed merchants traveling the ancient Silk Road between Europe and China. Little did those intrepid voyagers know that the riches they sought in the East paled in comparison with the treasures that lay beneath the desert sand.

**In the last several decades, the Kyzylkum has yielded thousands of fossil fragments** bearing witness to the early history of mammalian life on earth. Led by San Diego State paleontologist J. David Archibald, an international team of scientists continues to dig at a remote site in the desert, uncovering compelling evidence that ancestors of placental mammals actually shared the earth with dinosaurs. Their work is forcing biologists to revise accepted theories of mammalian evolution.

Nearly every year since 1994, the National Science Foundation or the National Geographic Foundation has funded Archibald's expedition to the Dzharakuduk escarpment in the Kyzylkum Desert. There, his team has found fossil remains of placental mammals or eutherians, the group to which we humans belong. Dating back 90 million years to the Cretaceous Period, they are among the oldest such mammalian remnants, and their existence demonstrates that early mammals lived alongside dinosaurs.

Getting to Dzharakuduk from Uzbekistan's capital, Tashkent, is a 60-hour, 700-kilometer journey through Samarkand of Silk Road fame, through the industrialized mining center of Navoi, and on past the desert town of Uchkuduk, where visitors might be forgiven for mistaking the huge dragon-shaped Chinese restaurant for a mirage.

Seventy kilometers west of Uchkuduk, the jeeps abandon the crumbling road and battle dune fields to reach their destination, a further 30 kilometers away. Dzharakuduk is a tiny settlement, surrounded by desert and



San Diego State's J. David Archibald leads an international team of scientists whose excavations in the desert of Uzbekistan have reset the evolutionary clock.

populated by a few families who barely survive on sheep-raising and truck farming. Archibald hires them to build the team's yurts, tent-like structures used for eating and working.

"No matter how many times we prepare for our departure from Tashkent, there is always the sense that we are beginning a great adventure," Archibald said. "When it's the first field season for someone, the adventure is even better because we're seeing everything through a new pair of eyes."

Led by Archibald and Alexander Averianov, chief of the mammalogy laboratory at the Zoology Institute in St. Petersburg, Russia, the field team spends seven weeks in the Kyzylkum Desert.

In 100-degree heat, they quarry and sieve the red sand for traces of eutherian remains. The yield is typically gratifying: in 2004 alone, the group extracted more than 280 mammal specimens from 74 tonnes of sand and silt.



It's an extraordinary experience for the diverse group of scientists from Uzbekistan, Russia, Britain, America and Canada (hence the acronym URBAC). URBAC members include Hans-Dieter Sues, associate director for research and collections at the Smithsonian Institution's National Museum of Natural History; Noel Morris, Chris King and David Ward with London's Natural History Museum and the University of Greenwich in Britain; Yuri Chikin with the Zoological Institute in Tashkent; and Igor Danilov, Anton Resvyi and Alexi Abramov with St. Petersburg University and the Zoological Institute in St. Petersburg, Russia.

Because every member of the team has a different specialty, their combined knowledge enriches each individual field of research. "But we all learn from Dave Archibald," said Danilov, URBAC member and a student in 1996 when Archibald taught at St. Petersburg University on a Fulbright grant. "He is a professor in the real sense of the word. Dave encourages discussion on new ideas and new ways of doing things."

Democratic is another word colleagues use to describe Archibald. His URBAC team unites seasoned scientists and promising apprentices in a common purpose. Most years, when funding comes through, Archibald includes several SDSU students in the mix. Cory Redman, a master's candidate in biology, joined the expeditions in 2003 and 2004.

"On this planet, there's no other fossil site from the Cretaceous Period that produces anything like the diversity at Dzharakuduk," Redman enthused. "We've found fossils of 12

Sky Dominguez, left, a recent SDSU graduate, works with an Uzbek official at the Dzharakuduk escarpment. Inset: The bowl contains a typical assortment of fish, salamander, lizard and mammal teeth and bones from one tonne of sand.



"There is the sense that we are beginning a great adventure."

different eutherian varieties in the escarpment. We're collecting material that's older than our own species by 89 million years. When you look at the variety, the different shapes, sizes and environments of the organisms that lived over this long period of time, it makes science fiction look like child's play."

The Dzharakuduk treasure trove has yielded material worthy of recognition in the premier scientific journals *Nature* and *Science*. In 2001, *Nature* published Archibald's paper describing a tiny shrew-like creature whose fossilized bones and teeth were unearthed at the site. Showing similarities to modern rabbits

and rodents, the creature bolsters Archibald's theory that placental mammals can be traced back 25 million years earlier than previously thought – to the time when dinosaurs lived on earth.

But attempting to reset the evolutionary clock is not without its perils, as Archibald has discovered. Although molecular DNA evidence clearly supports his analysis, Archibald's conclusions put him squarely at odds with some colleagues. He has also clashed with other paleontologists about what really killed off the dinosaurs – a single catastrophe or a series of unfortunate events (Archibald adheres to the latter view).

These spirited disagreements are an inevitable result of the expanding body of scientific knowledge to which Archibald has contributed. A confirmed desert rat, he returns to Dzharakuduk annually because – ever so gradually – the land is giving up its secrets to the URBAC team.

"After years of effort, we think we see the inklings, the beginning radiations of modern placental mammals," Archibald said with quiet intensity. "Our specimens are not beautiful or spectacular. They're small. But with the fossils at Dzharakuduk, the smaller they are, the better preserved they will be, and the better able to tell us their story."