A buried Iowa crater finally comes of age

Like an aging movie star, a large crater buried beneath the fields near Manson, Iowa, has deceived people with the appearance of youth. Scientists had thought that an asteroid or comet carved the crater 65 million years ago, concurrent with the mass extinction of the last living dinosaurs and many other species at the boundary between Earth's Cretaceous (K) and Tertiary (T) periods. But new work suggests that the Manson crater is older and played no role in the K-T die-offs.

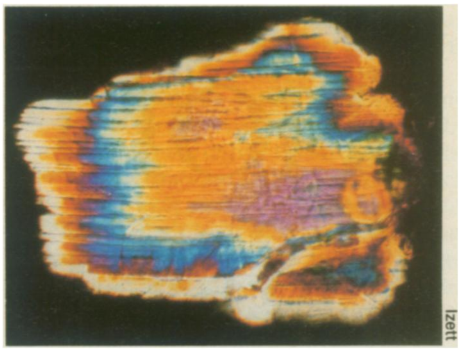
Glen A. Izett from the U.S. Geological Survey (USGS) in Denver and his colleagues dated rocks collected last year when a team of researchers drilled 12 holes through the 100 meters of glacial deposits covering the Manson structure. Using the radioactive decay of potassium as a clock, they calculated that the impact occurred 73.8 million years ago.

That finding, reported in the Oct. 29 SCIENCE, surprised scientists with the drilling project. "We started out pretty confident that Manson was somehow involved in the Cretaceous-Tertiary event. It turns out it isn't," says Eugene M. Shoemaker of the USGS in Flagstaff, Ariz.

A member of the group that misdated the Manson crater during the late 1980s, Izett says the earlier effort arrived at the wrong age because of the rock used in the analysis. Those researchers dated samples of a mineral called microcline, pulled up during drilling in the 1950s. Microcline has a relatively loose crystalline structure, which allows some of the argon produced by radioactive decay to escape. Thus, the rock appears younger than it is. In the most recent effort, the researchers dated sanidine, an ideal mineral because of its tight crystalline lattice.

The redating of the Iowa crater leaves only one other known suspect in the K-T drama: the Chicxulub crater in the Yucatán Peninsula. Geologists reported last year that this 180-kilometer-wide crater formed at the end of the Cretaceous and has the same age as a clay layer found around the world (SN: 8/15/92, p.100). Scientists believe the clay to be fallout from an impact dust cloud that would have circled the Earth, blocking out light and knocking the climate out of kilter.

At 35 kilometers wide, Manson ranks as the second largest impact crater known in the United States. By redating the structure, Izett and his colleagues may help explain a curious layer of rock in South Dakota that has puzzled geologists for 50 years. Called the Crow Creek Member, the stratum consists of sand and broken pieces of shale quite unlike the smooth shale layers found above and below the



Izett

Quartz shows parallel shock fractures.

Crow Creek. Geologists know the shale formed in the quiet bottom of a sea that covered the interior of North America at the time, but they have wondered what created the unusual Crow Creek layer.

Because the Crow Creek Member formed roughly 74 million years ago, Izett's team suggests that the Manson impact created the layer, perhaps during a huge tsunami generated by the crash. In support of that theory, the group notes that the size of the sand grains and shale pieces grows bigger close to Manson. Izett's group also found that the Crow Creek layer contains slivers of "shocked" quartz – grains with unusual fractures that form only during impacts. They suggest the grains were lofted skyward by the Iowa impact and landed in South Dakota. – *R. Monastersky*

Embryo's nerve-inducing messenger found

Leave it to an embryologist with a wry British wit to name his new chemical messenger "noggin." Technically a quarter of a pint, noggin is also slang for head and, more recently, the name of a protein that seems to induce brain development in amphibian embryos.

Richard M. Harland of the University of California, Berkeley, coined this name for the substance because without it, "you can make an animal that will make no head," he says. And if one exposes a developing embryo to too much noggin, "it will turn the whole animal into a head," Harland jokes. He reported noggin's existence in 1992, having found it in the part of a developing embryo that becomes nervous tissue. Then last February, he and his colleagues demonstrated that noggin could cause ventral mesodermal tissue – the stuff of blood and bone – to become dorsal mesoderm, the precursor of muscle.

Now, they show that noggin probably plays a key role in brain development.

The finding, reported in the Oct. 29 SCIENCE, is part of a renaissance in research about how embryos develop nervous tissue, says Harland. Almost 70 years ago, biochemists realized that certain chemicals play a key role in this conversion, but their studies of newt and salamander tissues yielded no decisive answers to those chemicals' identity. Indeed, some laboratory reagents seemed to induce nerve-cell development.

However, Harland and others now use the South African clawed frog, *Xenopus*, and know more exactly the timing of this induction. By looking for substances that appear at that time, they are better able to pinpoint putative neural inducers, he explains.

Teresa M. Lamb *et al.*/SCIENCE

Dark staining shows nervous tissue in normal embryo (left) and in altered embryos treated with noggin (middle) but not in untreated, altered embryos (right).

Harland and his colleagues conducted a series of experiments. In some, they transferred into embryonic frog tissue the messenger RNA that translates the genetic code for noggin; in others, they applied noggin directly to embryos at different stages of development. The researchers used embryos altered to lack a natural supply of this protein.

The experiments showed – for the first time, Harland notes – that noggin causes cells to become neural tissue, even when added at inappropriate points in development. Its presence activates certain genes and leads to the production of molecules associated with newly created nervous tissue, his group reports.

However, Harland cautions that his team's experiments used much more noggin than they would expect to find in a normal embryo. Thus, noggin probably works in conjunction with other substances. It may actually perform some function other than neural induction in normal embryos.

Indeed, other neural inducers must exist, since noggin causes forebrain and midbrain to form but not spinal cord or hindbrain, Harland and his colleagues report. Moreover, "the [induced] cells don't differentiate into neurons," he adds. – *E. Pennisi*