Earth Sciences

From the annual meeting of the Geological Society of America in Dallas, Texas

No killer crater near Cuba . . .

Throughout the last decade, geologists have roamed the globe looking for a 65-million-year-old crater — hard evidence that a huge meteorite knocked the planet silly at the end of the Cretaceous period, snuffing out a large fraction of species. Earlier this year, two researchers nominated an island off the southwestern corner of Cuba as a candidate for the long-sought impact site (SN: 4/28/90. p.268). But other geologists who visited Cuba in June are advising their colleagues to continue the search elsewhere.

Robert S. Dietz and John McHone of Arizona State University in Tempe arranged to visit Cuba as attendees of an international convention on marine sciences. While there, they contacted Cuban geologists and examined the purported impact evidence.

Many large craters have a central rocky peak, and researchers had proposed Cuba's Isle of Pines as a central peak for the Cretaceous crater. Dietz and McHone could not visit the Isle of Pines itself, but they did analyze rock samples collected there by Cuban geologists. The samples showed no evidence of the telltale "shocked" minerals that form during violent impacts, they report.

Dietz and McHone personally examined another Cuban site mentioned as evidence for an impact: a thick limestone formation containing huge boulders. Proponents of the Cuban crater idea had read descriptions of this formation in geological reports, which led them to suggest the huge boulders had been strewn there by a nearby impact. Dietz and McHone, however, believe normal weathering of the limestone rock created the boulders. Although the Tempe researchers can't entirely discount the Cuban candidates, they say it's unlikely the meteorite hit there.

. . . but what about the Yucatán?

Crater hunters from the University of Arizona in Tucson have begun investigating an intriguing formation at the northern end of the Yucatán peninsula. Alan R. Hildebrand, William V. Boynton and their colleagues report that gravity and magnetic surveys show a buried circular structure measuring 180 kilometers in diameter, centered below the Mexican town of Chicxulub. Drill holes have revealed glassy rocks that could have formed during a meteorite impact, they say.

Earlier this year, Hildebrand and Boynton suggested a subseafloor location north of Colombia as a potential site (SN: 5/19/90, p.311). However, Hildebrand says it will take much more work to determine whether either structure is an impact crater.

Does Mount Rushmore need a face-lift?

The wrinkles of age spare no one — not even the famous faces at Mount Rushmore. The granite rock from which these sculptures were carved contains many fractures and other flaws that could eventually threaten the memorial's structural stability. A crew of geologists is now conducting a detailed study to assess the health of the Rushmore faces and to determine whether they need artificial support.

Researchers from RE/SPEC Inc. in Rapid City, S.D., began their work by mapping the memorial's topography and structure. To create their unprecedented maps, they placed 99 bull's-eye targets on the front and back of the monument and then used an airplane and helicopter to obtain aerial photographs. The maps are based on 100,000 data points taken from the photos.

Next, the geologists will build a three-dimensional computer model of the sculptures to study the orientation of blocks within the mountain. They also plan to examine the effectiveness of the crack-filling materials used by the sculptor to stop water from enlarging the rock fractures.

Physics

Dead end for a fifth force

Precise measurements of the gravitational force at various heights on a 300-meter tower in Erie, Colo., furnish the best evidence yet that Newton's law of gravity accurately predicts the magnitude of the attractive force between two objects. In effect, the new findings rule out the existence of a "fifth force" of nature strong enough to make itself felt in such an experiment. If a fifth force exists at all, it would have to be much weaker than theorists had imagined.

Newton's law of gravity specifies that increasing the distance between two objects should reduce the gravitational force between them in a well-defined way. Several years ago, however, a number of measurements of the gravitational force at different heights on a tower and depths in a borehole hinted that the measured attractive force may be somewhat less than expected, suggesting the influence of a small, additional force acting on a scale of 10 meters to 10 kilometers (SN: 7/26/86, p.55). Those disturbing fragments of data prompted an intensive, four-year quest for evidence of a new force of nature to join the four types already known: gravity, electromagnetism, and the strong and weak nuclear interactions.

Data from the latest tower experiment closely mirror the Newtonian predictions, leaving little room for the existence of anything but an extremely weak fifth force. "Agreement of the measured values with the Newtonian predictions is clearly excellent and the validity of [Newton's law of gravity] under the conditions of the experiment is confirmed," report James E. Faller of the Joint Institute for Laboratory Astrophysics in Boulder, Colo., and his colleagues in the Oct. 15 PHYSICAL REVIEW LETTERS.

Various other experiments have produced similar null results (SN: 9/22/90, p.183).

Particle beams, bubbles and beer

The story goes that physicist Donald A. Glaser, while developing the bubble chamber for detecting subatomic particles at the University of Michigan back in the 1950s, used to sit for hours in the student union staring into a glass of beer, looking for tracks of bubbles left by mu mesons — energetic particles created in violent encounters between cosmic rays and particles in the atmosphere.

The story itself is apocryphal. Nonetheless, physicist Frank S. Crawford of the University of California, Berkeley, felt compelled to tackle the question: Do ionizing particles actually produce bubbles in fresh beer?

He tried holding a small, cobalt-60 source of gamma rays against a glass of freshly poured beer. He saw no extra bubbles. He tried more intense gamma-ray sources. Still no bubbles.

The quest escalated to stronger and stronger particle interactions, with each experiment requiring increasingly sophisticated equipment. Crawford tried alpha particles, then iron nuclei, and finally looked at the effect of firing bare uranium nuclei into beer. He and an assortment of onlookers monitored the uranium experiment, performed last spring at the Bevatron accelerator in Berkeley, by remote television.

"Stare as we might, we saw no bubbles," Crawford reports in the November AMERICAN JOURNAL OF PHYSICS. "After turning off the beam, we sprinkled a teaspoon of salt into the beer. It foamed as strongly as usual."

The observation that ionizing particles don't generate bubbles in beer but produce them in copious quantities in a liquid-hydrogen bubble chamber isn't a complete surprise. The superheated liquid in a bubble chamber is physically quite different from a supersaturated liquid — in this case, beer saturated with carbon dioxide.

Perhaps it would be worth trying the experiments on champagne — just to check.