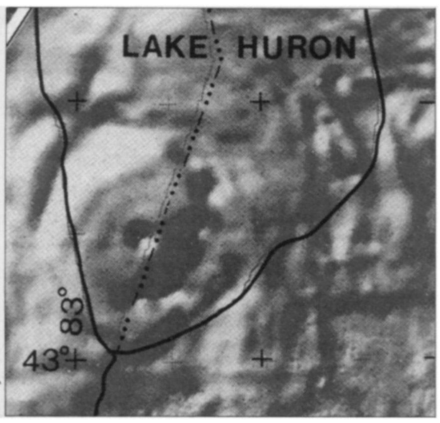
Impact crater may lie beneath Lake Huron

With the help of magnetic sensors, scientists have detected a rimmed circular structure, 30 miles in diameter, more than a mile beneath the floor of Lake Huron. They believe the magnetic ring marks a buried crater—potentially one of the largest known — blasted by a meteorite at least 500 million years ago.

Four researchers with the Geological Survey of Canada unexpectedly discovered the circular pattern while examining new, high-resolution magnetic images of a southern Ontario region previously labeled as "essentially featureless." They noticed that the patterns of gravitational and magnetic forces emanating from the structure resembled those of verified impact craters. The Ottawa-based researchers, led by David A. Forsyth, temporarily named their discovery the Can-Am structure because it straddles the Canadian-U.S. border. They describe the find in the August GEOLOGY.



Magnetic image reveals the Can-Am structure, an apparent crater buried beneath Lake Huron. Dotted line indicates Canadian-U.S. border.

Scientists have taken particular interest in impact craters over the last decade, in light of new theories linking meteor and comet strikes with ancient climate disruptions and mass extinctions. These theories suggest that massive meteorites colliding with Earth have periodically clouded the atmosphere with dust, triggering climate changes, photosynthetic failures and subsequent mass extinctions, including the great dinosaur demise some 65 million years ago (SN: 5/19/90, p.311).

But so far, the impact data have been too scattered to prove any correlation between the collisions and the species extinctions, says Jay Melosh, a planetary scientist at the University of Arizona in Tucson. With more craters like Can-Am to study, he says, "we can test those correlations."

A hole the size of the Can-Am anomaly would have required a projectile about 3 miles in diameter, Melosh estimates. "We would expect 100 craters this size or greater during the last 500 million years," he says. "We know of about six."

Petroleum engineers might also want a closer look at Can-Am, since impact structures sometimes trap hydrocarbons. "The Can-Am structure may fall into this category," Forsyth says.

The only way to establish whether the Can-Am structure actually resulted from a meteorite collision is to examine the rock beneath it. "Impact pressure [approximates] the pressure in the core of the Earth," Melosh explains. Under the tremendous heat and pressure of a meteorite impact, rocks melt, shatter or metamorphose into strange forms that not even volcanic explosions can generate. Some of these forms — like stishovite, a phase of quartz produced under extremely high pressure — are "generally considered indisputable evidence [of an impact] when found near the surface," Melosh says.

"We need somebody to drill [Can-Am]," Forsyth says. At an average depth of only a mile or so, this could prove light work for modern drilling techniques. The U.S. scientific drilling program, however, has stalled in recent years, and the fledgling Canadian drilling program is just getting off the ground. Forsyth says he has heard of no plans to probe the secrets of the Can-Am structure. — *W. Stolzenburg*

Seeing supernovas in galactic 'chimneys'

Recent theories hold that clusters of hundreds to thousands of exploding stars, or supernovas, hurl fountains or cannonballs of gas and dust out of the disks of spiral galaxies. Such expulsions would affect the galaxy's shape and rotation speed, while redistributing its chemical elements (SN: 11/11/89, p.310). In the "chimney" theory, barrages of supernovas go off like dynamite explosions at a construction site, blasting steep-sided pits that pockmark the interstellar medium of gas and dust forming the galactic disk.

Now, astronomers present the first observational indication of these supernova-containing galactic chimneys. Evidence that exploding stars occupy such pits comes from records of supernova sightings dating back to 1885, say Sidney van den Bergh and Robert D. McClure of the Dominion Astrophysical Observatory in Victoria, British Columbia.

In two classes of spiral galaxies—called Sc and Sd — the Canadian researchers found a sharp rise in supernova frequency among disks that appear nearly face-on as viewed from Earth, at a tilt no greater than 25°. This, they propose in the Aug. 20 ASTROPHYSICAL JOURNAL, indicates that "a significant fraction" of the supernovas in Sc and Sd galaxies remain hidden in steep-walled pits, obscured by intervening gas and dust, because the galaxy tilts too much for a direct view. McClure and van den Bergh think such galactic cavities form when "superbubbles" created by the stellar explosions burst out of the disk, leaving behind smoking chimneys rich in supernova cinders.

Optical and radio astronomers have captured images of material erupting out of supposed chimneys, and radio astronomers have found holes — *sans* supernovas — in spiral disks, notes astrophysicist Carl Heiles of the University of California, Berkeley. But "nobody has ever seen the holes [with the supernovas in them]," he says. "This is the first time there has been any sort of concrete optical evidence for these [supernova-occupied] holes." In 1979, Heiles pioneered the idea of superbubbles created by supernovas.

Some theorists regard the new finding as an unexpected bonus. "It's a natural and consistent result, but we didn't predict it," says astrophysicist Colin A. Norman of the Johns Hopkins University in Baltimore. Norman originated the chimney theory in 1989 with Satoru Ikeuchi of Japan's National Astronomical Observatory in Tokyo.

Others challenge the chimney interpretation of the new data analysis. David Branch of the University of Oklahoma in Norman calls the connection "very speculative" and suggests a simpler model for the tilt effect. "What comes to mind immediately is just a very clumpy interstellar medium," he says.

To van den Bergh and McClure, the sudden jump in supernova frequency for nearly face-on galaxies — whatever its explanation — indicates that they underestimated supernova rates, which astronomers use to help gauge the intensity of star formation in galaxies. The Canadian researchers conclude that Sc and Sd galaxies contain two to three times more supernovas than they originally thought.

Indeed, the team began analyzing the observational data specifically to try to resolve the difference between their estimate of the supernova rate in Sc and Sd galaxies and a higher estimate by Gustav A. Tammann of the University of Basel, Switzerland. Tammann's sampling of galaxies had already excluded Sc and Sd galaxies that were not oriented face-on. Applying the inclination correction to their own estimate brought it into line with Tammann's, not just for the Sc and Sd spirals but for all types of galaxies, van den Bergh says.

Branch and others argue that the newly matching estimates may still be too low, missing many faint supernovas that aren't even visible head-on. — *P.L. Weiss*