Astronomy

The face of Venus: Going with the flow

The pockmarked faces of Earth, Venus, Mars, Mercury, and our moon bear witness to the comets and asteroids that bombard them. Although scientists have used observations of projectiles striking the moon as models of such collisions, a new study suggests that researchers should exercise caution in comparing lunar events to those on the planets.

When a comet or asteroid collides with the moon or one of the terrestrial planets, it typically generates a shock wave powerful enough to melt some of the rock. The amount and viscosity of the molten material, known as impact melt, varies from planet to planet. This may account not only for the variety of crater shapes generated by such collisions, but also for the character of neighboring terrain — particularly on Venus.

Indeed, a Venusian impact produces three times as much impact melt as a lunar collision that excavates a crater of the same diameter, says Mark J. Cintala of NASA's Johnson Space Center in Houston.

Three properties conspire to produce the larger volume on Venus. The planet's higher surface temperature means that rock melts more easily and stays molten longer. In addition, Venus lies closer to the sun than the moon does, so a colliding projectile has a higher orbital velocity, enabling it to generate more heat and melt more material. Finally, the planet's stronger gravity makes it harder to form craters. This means that on Venus a given impact will create a higher volume of melt relative to the size of the crater excavated.

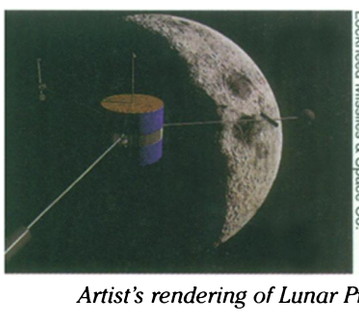
In the March ICARUS, Cintala and Richard A.F. Grieve of the Geological Survey of Canada in Ottawa argue that the low viscosity and larger volume of Venus' impact melt can explain several features seen in Magellan spacecraft radar maps. They assert that the radar-smooth bottoms of some Venusian craters may stem from the larger amount of molten rock, which could have filled in rough spots before resolidifying.

Grieve and Cintala also suggest that unusually long channels discovered on Venus were carved by runny impact melts that overflowed crater walls and headed downhill for hundreds of kilometers. In this model, researchers would not need volcanic sources of molten material to form the channels.

The researchers assert that the flow of impact melt can also explain the unusual depth of the ringed impact basin Cleopatra Patera. This big basin reaches a depth of 2.6 km and abuts a vast area of smooth terrain. Some researchers have proposed that a volcanic eruption centered on Cleopatra or induced by the collision that created the basin sculpted the nearby terrain. But Grieve and Cintala say it's more likely that at least half the melt generated during Cleopatra's formation drained from the basin, flooding the adjacent area and leaving behind the chasm.

New prospects for the moon

In its effort to fund low-cost explorations of the solar system, NASA has given the go-ahead to the Lunar Prospector, a small, $59 million spacecraft that will map the surface composition, magnetic field, and gravity of the moon in unprecedented detail. It will also detect gases released from the lunar surface. During its mission, scheduled to begin in 1997 and last for at least 1 year, Prospector will fly to within 100 km of the moon from a polar orbit. The craft will carry three spectrometers and a magnetometer; radar tracking of Prospector's position and velocity will yield the gravity map.



Artist's rendering of Lunar Prospector orbiting the moon.

Behavior

Making cerebral sense of words

By combining measures of electrical activity and blood flow in the brain, researchers have begun to tease out the sequence and locations of cerebral events by which humans attach appropriate meanings to familiar words in a text.

About one-fifth of a second after reading a word such as "hammer," an area at the front of the brain's left hemisphere begins sorting out the word's meaning, assert Abraham Z. Snyder, a neurologist at Washington University School of Medicine in St. Louis, and his coworkers. Simultaneously, a nearby portion of frontal tissue helps restrict attention to a small group of potential meanings of the word.

After this frontal activity has run its course — though still less than 1 second after reading the word — part of the left hemisphere toward the back of the brain takes over. At that point, word meaning probably starts to get integrated into the overall thrust of a phrase or sentence, Snyder's group contends in the Feb. 28 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

The scientists first used positron emission tomography (PET) scans to measure cerebral blood flow, an indication of cellular activity, in 12 right-handed volunteers. The researchers gathered blood flow data while participants read aloud written nouns. Then the team subtracted these data from data obtained while the volunteers said aloud an appropriate use for the same nouns. This technique revealed brain areas uniquely engaged in the task of determining word meaning but left unclear the timing of their activity.

Another 48 volunteers completed the two noun tasks while wearing electrodes on their heads. Researchers used a similar data subtraction method to estimate both the timing and the location of electrical responses in the brain. A computer program calculated probable cerebral sources of the electrical surges picked up by electrodes.

Both PET and electrical analyses identified largely the same brain areas as integral to endowing words with meaning.

Low cholesterol linked to suicide tries

Men, but not women, suffering from severe psychiatric disorders stand a much greater chance of making a serious attempt at suicide if they have low cholesterol concentrations in their blood, a new study suggests.

"If the findings are replicated, a low cholesterol level might serve as an inexpensive and readily available biological marker of suicide risk in men [with psychiatric disorders]," conclude psychiatrist Julia A. Golier of Mount Sinai School of Medicine in New York and her colleagues.

Golier's group conducted interviews and cholesterol assessments of 307 men and 343 women admitted to a psychiatric hospital. Most participants received a diagnosis of major depression, manic depression, schizophrenia, or substance abuse. Researchers then grouped the men and women separately by age (18 to 29 years, 30 to 39, 40 to 49, and 50 to 59). Those whose cholesterol readings fell in the bottom quarter of their group were defined as having low cholesterol.

Nearly one in three low-cholesterol men reported having made a serious attempt to kill himself, compared to about one in six of the remaining men, the researchers report in the March AMERICAN JOURNAL OF PSYCHIATRY. This association held regardless of the men's age, weight, race, income, alcohol use, and presence of depression. Serious suicide attempts required emergency medical treatment.

Some researchers have theorized that low cholesterol creates a suicide risk by slowing the transmission of serotonin, a chemical messenger in the brain. This proposal, as well as possible reasons for the absence of a link between cholesterol and serious suicide attempts in women, remain speculative, the New York scientists say.