Venusian craters

from David W. Hughes

MAN'S first picture of the surface of Venus caused great interest and some surprise as it revealed that Venus, like Mercury, Moon and Mars, had a cratered surface. The picture was obtained using simultaneous Doppler and time delay processing of 12.6 cm wavelength radar echoes reflected from the surface (Rumsey *et al.*, *Icarus*, **23**, 1; 1974). Looking at a 1,500 km diameter circular area at the centre of the planetary disk on June 20, 1972, they found it to be nearly flat but cratered. The biggest crater was 160 km in diameter, the floor appearing to be on the same level as the surrounding terrain but with the rim 500 m above the floor. By contrast a lunar crater of this size would be about seven times deeper.

Venus and Earth have fairly similar masses and both seem to have large raised regions on their surfaces. The "continents" on Venus do not appear to be isostatically compensated so that active internal convection may be taking place coupled with a degree of surface volcanism. Craters will be formed both by volcanic activity and by meteoritic activity; however, the information needed to determine which phenomenon is more likely is still lacking.

Michael Tauber and Donn Kirk (NASA–Ames Research Center) have now attempted to determine the sizes of the stone and iron meteoroids which can penetrate the atmosphere of Venus and cause hypervelocity impact craters on the planet's surface (*Icarus*, **28**, 351; 1976). Obviously the surface pressure of 90 atmospheres and the atmospheric density of 64 kg m^{-3} present a major obstacle to the passage of meteoroids. Ninety percent of the meteoroids will have atmospheric entry velocities ranging from 10 to 40 km s^{-1} and if all of the kinetic energy lost by atmospheric drag was available to heat and vapourise the meteoroid no meteoroids less than 10^{11} kg in mass would survive passage through the atmosphere. Actually only a small fraction of this energy goes to heat the body, the great majority's being lost as it heats the atmospheric gases. The complex interactions between the body and the high temperature–high pressure shock layer surrounding it make the mass loss calculations very difficult. Tauber and Kirk find that bodies over 10^{8} kg only lose a few percent of their mass by vapourisation, mainly because entry takes place so quickly. The velocity of the body can decrease drastically though.

A hypervelocity impact crater is produced when the shock pressure at the impact point exceeds the compressive dynamic strength of the target material. Venera 8 measurements suggest that Venus has a granite-like surface material and the authors calculate that basalt and iron projectiles with velocities greater than 1.1 km s^{-1} and 0.7 km s^{-1} will produce hypervelocity impacts and craters. For basalt and iron particles they find that it is only those larger than 100 m and 40 m that have final velocities above these limits. One complication is the possible mechanical break-up of the body before impact. This is caused by a combination of thermal stress from frictional heating and also air pressure acting on the high speed body as it is retarded in the atmosphere. Frictional heating is confined to a thin shell and probably does not affect large meteoroids. The atmospheric forces on the other hand become very large and may exceed the compressive strength. It seems that for large bodies this only happens for a second or so before impact so there is not enough time for the cracks to spread throughout the body or for fragments to separate significantly. So on Venus this effect does not change the size of the crater produced. The authors calculate that a stone meteoroid 1 km across, entering the Venusian atmosphere at 40 km s^{-1} will produce a crater 33 km in diameter. This diameter is proportional to the sixth power of the particle's density and its kinetic energy raised to the power 0.28. They also find that the smallest hypervelocity impact crater on the surface of Venus is about 150 to 300 m across. This contrasts dramatically with the Moon which has no atmosphere to retard or fragment the meteoroids and is pockmarked with craters of all sizes greater than a fraction of a micrometre.

Venera 8 measurements (*Icarus*, **20**, 407; 1973) indicate very low surface winds on Venus so the crater structure may be preserved for long periods of time. The radar picture taken by Rumsey *et al.* had a resolution of about 12 km, so it cannot be used to test Tauber and Kirk's theory. Radar mapping from a planetary orbiter, or radar using the Arecibo radio telescope could provide the resolution. In fact photography from a probe descending through the Venusian atmosphere is possible as the daylight illumination level at the surface is thought to be about 2% of that on Earth. The discovery of primary impact craters smaller than the 150–300 m calculated above would indicate that the impacts occurred when the atmosphere of Venus was less dense than it is now. So crater size distribution thus provides a straightforward indication of atmospheric evolution.

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ing soil salinity until eventually, in highly saline conditions, only one species, *Mesembryanthemum nodiflorum*, survives. Danin describes this gradient as one in which a physiological stress reduces the number of niches until, under extreme stress, a one niche habitat results. This situation does not preclude competitive interplay, but demonstrates the superior growth potential of the surviving species under the stress conditions. In the Hutchinsonian sense it can thus be termed a one niche habitat. What one must not discount, however, is the possibility that there could be unrecognised opportunities even here for species which have either not yet invaded, or may not even yet have evolved in the area. Could one term such an availability of opportunity, such untapped resource potential — such unoccupied hyperspace, a vacant niche? □

Nuclear polysomes

from J. R. Tata

CELL biologists often emphasise the intracellular segregation of transcription and translation between the nucleus and cytoplasm as a major distinguishing feature between eukaryotes and prokaryotes. Every so often, however, fresh controversy is generated by reports that challenge the validity of this intracellular compartmentation of macromolecular synthesis by demonstrating that nuclei can also synthesise proteins (for a review, see Kuehl, in *The Cell Nucleus*, edit. by Busch, H., **3**, 345; Academic Press, New York, 1974). Many such claims have had a short life since these are based on indirect evidence, or fail to identify a special class of proteins synthesised within the nucleus. Perhaps the most important reason for the controversy over whether or not the nucleus possesses a protein synthetic apparatus may reside in the ease with which isolated nuclei are contaminated with cytoplasmic polyribosomes (Penman, *J. molec. Biol.*, **17**, 117; 1966), particularly those associated with the perinuclear endoplasmic reticulum (Lewis and Tata, *J. Cell Sci.*, **13**, 447; 1973).

Jo Alene Goidl and coworkers at the