ters produced on glasses and crystalline materials in the laboratory with projectiles the velocities of which exceed 10 km s^{-1}. Because of this, and because of the presence of a glass-lined pit in most lunar microcraters, Hörz *et al.* conclude that the velocity of 10 km s^{-1} must also be regarded as the minimum velocity for the production of these microcraters. On the face of it then such microcraters could be produced by the ejecta of a large scale impact event, for Gault *et al.* (in *Shock Metamorphism of Natural Materials*, Mono Book Corporation, 1968) recently showed that the velocities of such ejecta may well reach 20 km s^{-1}. The velocities of fine-grained particles within any given impact "jet" are unlikely, however, to exceed 10 km s^{-1}. The only other particles impinging on the Moon with greater velocities are primary cosmic rays; and so Hörz and his colleagues are led to the conclusion that at least 95 per cent of the lunar microcraters are produced by cosmic ray impact.

But velocities are not the only consideration. Three of the crystalline rocks examined by Hörz *et al.* have sharp boundaries between heavily cratered and completely uncratered surfaces. In theory, of course, this phenomenon is quite easy to explain in terms of the effect of secondary ejecta—uncratered areas could be taken to be newly broken surfaces not yet exposed to the bombardment of secondary projectiles. If this were so, however, boundary lines would be associated with the sharp edges and corners characteristic of breaks.

But in the lunar rocks examined there is no such correlation. On the contrary, in all three samples the boundaries between heavily cratered and uncratered areas run across relatively flat surfaces and bear no relation at all to rock geometry. Moreover, the boundaries are planes rather than lines in that they can be traced around the whole circumference of the rocks. As a result of these features, Hörz and his colleagues suggest that the uncratered surfaces were simply buried in the lunar regolith and thus remained unexposed to cosmic rays.

Finally, as Hörz *et al.* point out, the presence of a spall zone around the crater pits shows that the predominant erosion process on the scale observed is the "catastrophic rupture" of rock surfaces by discrete microfracturing events. Overlapping spall zones are frequent, the complete or partial destruction of craters by individual events is commonly observed and discrete pieces of pit walls are often seen to be broken off. All these features indicate not the gradual removal of material but catastrophic removal by high velocity, high energy impacts.

INSECTS

Cricket Songs

from a Correspondent

ACOUSTIC biology was, as expected, the chief (but not sole) concern of a semi-ACOUSTIC biology was, as expected, the insect body and between insects held in the Animal Acoustics Unit of the Sir John Cass School of Science and Technology (City of London Polytechnic) on June 9 and 10.

After a short film of bush-cricket stridulation (Mr A. Currie, Sir John Cass), some physical aspects were discussed by Dr H. C. Bennet-Clark (University of Edinburgh) and Mr H. Nocke (University of Cologne). Comparing *Drosophila* (an acoustic doublet in a free field) with the mole cricket in its burrow (a piston-driven exponential horn) highlights their differing communication problems—*Drosophila* loud, but short range and private, *Gryllotalpa* long range and broadcast. In *Gryllus*, Nocke's elegant series of experiments shows unequivocally that the "harp" of the tegmen (not the "mirror") is the radiator—a linear-type resonator uniformly tuned; and that it can also resonate to the emission of another cricket, as far away as 150 cm.

The discussion of hearing by Professor F. Huber (University of Cologne) and Mr D. B. Lewis (Sir John Cass) started with song recognition and its neuronal basis, and the control on responsiveness. Regen's classic work was always misinterpreted—he never claimed to have found clear frequency discrimination. Nevertheless, physiological evidence of some possible degree continues to accumulate, even to the level of processing in the brain. In intensity/time studies, an important new finding is that at the cellular level,

Greater Complexity in the Mantle

ONCE upon a time the upper mantle seemed to be a remarkably homogeneous region within the Earth. But as seismic techniques have gradually become more refined the upper mantle has gradually come to appear less and less homogeneous. So many discontinuities and partial discontinuities have now been observed, often quite close together, in the upper 1,000 km of the mantle that it is no longer possible to be sure that the boundary one seismologist observes below one part of the Earth's crust is the same as that observed by another worker at a roughly similar depth below a different part of the crust. Nor is it clear that any given discontinuity actually exists around the whole Earth whether at a constant or varying depth. In short, the picture gradually becomes more confused; and in next Monday's *Nature Physical Science* observations reported by Simpson *et al.* apparently add to the confusion. This is not, of course, an adverse criticism of these authors' work but merely a reflexion on the complexities of nature.

Simpson and his colleagues have taken advantage of the greater resolution available from combining seismic array data (P wave travel-time gradients) with conventional travel-time data to discover a previously unknown segment of travel-time curve. The array in question was WRA (Australia); and 330 earthquakes within the Indonesian–Philippines region (epicentral angles 12° to 30°) were analysed. The uncorrected P wave travel-time gradients clearly indicate the presence of upper mantle discontinuities at 360 km and 650 km—discontinuities which have been observed previously by several other seismologists. But between epicentral angles of 19.4° and 20.6° Simpson *et al.* have detected, for the first time, several low amplitude arrivals a few seconds earlier than the times predicted from a simple model involving only the two discontinuities at 360 km and 650 km. In the sense that these newly discovered arrivals arise from epicentres within a very limited region (the Molucca Passage), they may just be a reflexion of crustal structure, even though Simpson and his colleagues have attempted to correct for such structure. Simpson *et al.*, however, adduce other evidence which suggests that this problem does not arise here and, as a result, conclude that the 360 km discontinuity should be replaced by a doublet at 280 km and 440 km.

How then does the new Simpson model (discontinuities at 280 km, 440 km and 650 km) compare with others? The closest perhaps is that deduced recently by Whitcomb and Anderson (*J. Geophys. Res.*, **75**, 5713; 1970) who, using a completely different method, observed discontinuities at 280 km, 520 km and 630 km. This is a pretty good correspondence for the upper and lower boundaries but not for the middle one. Although Whitcomb and Anderson observed no obvious boundary at 400–450 km, however, there is ample evidence for such a discontinuity which has even been interpreted in terms of a phase transformation from olivine to a spinel structure. The point is that the existence of Simpson's 440 km discontinuity is well supported by other workers. On the other hand, the 520 km boundary does not appear in the Simpson model. The discrepancies between the two models thus remain.