clarify the issue of whether energy amplification is necessary at some stage in chemosensory transduction. Many of the speakers implied that it is, and this is clearly a crucial problem.

The low threshold for the response of many insect antennae to sex attractants is now well known. Dr R. A. Steinbrecht (Max Planck Institute für Verhaltensphysiologie, Seewiesen) explained how the silk moth antenna collects molecules of sex attractant, bombykol, and how these molecules reach the receptor cell membrane, and Drs K. E. Kaissling and G. Kasang (also of Seewiesen) discussed its remarkable isomeric specificity and its ability to resolve brief pulses of sex attractant applied in series. The properties of this receptor mechanism are rivalled in specificity by those of the antenna of the moth *Plusia ni* in response to its sex pheromone, cis-7-dodecenyl acetate. Dr L. K. Gaston (University of California, Riverside) spoke of the enormous differences in responses by this preparation when stimulated by different isomers of the compound, and similar ones of differing hydrocarbon chain length. Other speakers, including Dr J. Jakinovich (University of Michigan, Ann Arbor) on fly chemoreceptor specificity in response to different isomers of inositol, and Dr W. A. Kafka (Seewiesen) on the relative responses of locust olfactory cells to different isomers of methylbutanoic acid, revealed astonishingly narrow specificities. But few clues have emerged about the structure of the receptor sites for any of these pheromone molecules.

Studies were also presented on aspects of response characterization of sensory cells of vertebrate nasal and lingual epithelia, on the innervation of these cells, and on the way in which their responses may be influenced through intravascular stimuli. Perfused cyclamates can generate responses which summate with those to sweet tasting substances applied externally to the rat tongue (Dr R. M. Bradley, Nuffield Institute for Medical Research, Oxford). Another interesting study presented by Dr B. Oakley (University of Michigan, Ann Arbor) indicates that sets of taste papillae of the rat tongue, which show similar response characteristics, become associated with branches of the same afferent nerve fibre. This may imply that nerve fibres growing out into the tongue "search for" and recognize papillae of similar specificity pattern.

The proceedings of the symposium are due to appear in a volume of collected papers in about six months time, and it was agreed that the next symposium in this series would be held in Melbourne, Australia, about three years hence.

THE EARTH

Chondritic Again

from our Geomagnetism Correspondent

THE idea that the principal minor element in the Earth's fluid outer core may be sulphur rather than either nickel or silicon—and thus that the Earth as a whole may be chondritic after all—has now received further substantial support from Hall and Murthy (*Earth Planet. Sci. Lett.*, **11**, 239; 1971). This thesis, which Murthy and Hall propounded last year (*Phys. Earth Planet. Interiors*, **2**, 276; 1970) on the basis of an analysis of the relative abundance of volatile elements in the crust and mantle, was more recently taken up by Lewis (*Earth Planet. Sci. Lett.*, **11**, 130; 1971) who adduced several pieces of indirect evidence for it and discussed in some detail its important consequences. But Lewis's admitted difficulty was the lack of the thermodynamic data needed to make the case really convincing. It is this deficiency which Hall and Murthy have now remedied to a limited extent.

The classical view of the formation of the Earth's core is that an iron–nickel mixture segregated from a silicate matrix. It is Hall and Murthy's contention, however, that the first melt to form during the early history of the Earth was an FeS–Fe eutectic. These different processes are clearly likely to have different effects on the distribution of elements throughout the Earth and thus imply different courses for the Earth's subsequent history. So how would the elements be distributed if an Fe–S liquid had separated to form the Earth's core? In an attempt to answer this question Hall and Murthy have taken seventeen "diagnostic" elements, including the alkali metals Li, Na, K, Rb, and Cs, the alkali earths Be, Mg, Ca, Sr, and Ba, the transition metals Mn and Fe, and other critical elements such as Cu, Zn, U, Th, and Pb, and have tried to determine thermodynamically how they would become distributed between a predominantly Mg–Fe silicate matrix and an Fe–S melt during the Earth's early history.

As a starting point Hall and Murthy present thermodynamic data for the simple reaction $MeO+FeS=MeS+FeO$ where Me is an electropositive element. It is quite clear from the table they have compiled that K, Rb and Cs have high negative free energies of reaction at both 298 K and 1,000 K and thus preferentially form sulphides. These data thus support Lewis's contention that if an Fe–S liquid segregates into the core it will take with it a great deal of the available K, Rb and Cs, so that these elements will accordingly be depleted in the crust relative to a chon-

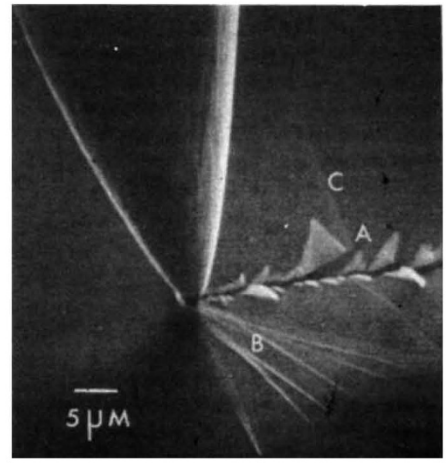
The Micro-friction of Graphite

NEW frictional studies of graphite at low loads (1 to 400 mg) have revealed much greater differences between the coefficient of friction of the basal and edge planes than expected. In next Monday's *Nature Physical Science*, Skinner, Gane and Tabor report their measurements of the coefficient of friction, using a scanning electron microscope and a delicately loaded tungsten stylus with a tip radius of about 1 μm.

They have found that the coefficient of friction on the edge plane is between fifteen and sixty times greater than the coefficient measured on the basal plane (0.3 compared with about 0.005 to 0.02); this is a much larger anisotropy than has been measured previously. Skinner *et al.* suggest that this is because their experiment involved not only small loads but also almost perfect surfaces which were carefully selected under the electron microscope.

At loads less than 40 mg, the low coefficients of friction of the basal plane were usually accompanied by only slight surface damage and, in some cases, by no damage at all. Sometimes the cleaving of a flake was observed as in the figure and very occasionally a peeling action took place; this was associated with much higher coefficients of friction (about 0.4).

At greater loads the basal planes were often too weak to support the stylus and even when they did, the stylus was found to penetrate further and further into the specimen until the experiment had to be stopped.



Scanning electron micrograph of a stylus sliding on the basal plane of graphite. *A*, Flaking of the surface; *B*, peeling; *C*, a cleavage step.