8 hours of nighttime sleep, the amounts of time spent in stage 2 by each subject under each condition are abnormally low, well below the typical value of 50 percent of the total sleep time (*8*), while values of stages 3 and 4 are abnormally high (Fig. 1). Stages 3 and 4 are also unusual in occurring throughout the entire night, rather than only during the first few hours of sleep. One must conclude either that the authors did not score the records according to the conventional procedures (*3*) as they claimed or that all the subjects were suffering from severe sleep deprivation (*7*). Figure 1 also shows several periods marked by solid areas, extending higher than the stage 4 level on the ordinate, which are left unexplained.

The authors reported retrieval of mental activity during different periods of wakefulness. Presumably this means that subjects were being interviewed at times during the experiment in addition to those described under condition (iv). These interventions should have been described and accounted for, since they might well have influenced the results.

The times at which meals were taken were not controlled. Food intake might have a profound effect on activity cycles, and this should have been held to fixed times in all subjects and under all conditions for purposes of comparability.

5) Although the data of Othmer *et al.* do not support their conclusions regarding the independence of REM sleep processes from sleep itself, studies by Globus (*6*) do support this conclusion. Globus observed that the occurrences of REM sleep periods during afternoon naps were determined by real time and not by the time of prior stage 2 sleep onset, which was systematically varied.

Finally, Othmer *et al.* identify REM sleep as the time at which dreaming occurs with no reference to the considerable data which indicate that dreams also occur during NREM sleep (*9*).

Present knowledge indicates that, in the adult, the REM sleep process is unique to the sleep state itself and that REM sleep may serve cerebral-activating functions normally contingent upon the prior occurrence of NREM sleep (*10*). Data presented by Othmer *et al.* would not seem to contradict this statement.

RALPH J. BERGER
Crown College, University of California, Santa Cruz 95060

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Lunar Thermal Anomalies: Magnetic Phase Transitions on the Lunar Surface?

Allen and Ney (*1*) recently discussed the anomalous behavior of temperature-time cooling data for surface material of the lunar craters Tycho, Copernicus, and Aristarchus as determined by infrared measurements. The conspicuous feature of these anomalies is an initially rapid decrease in the brightness temperature to 170 ± 30°K, with the temperature then remaining nearly constant through the rest of the lunar night, whereas the temperature normally falls to about 90°K in most other areas of the lunar surface. Allen and Ney suggest that the thermal anomalies are evidence that the craters contain hot and cold regions—with the hot portions (rock fragments 1 m or larger in size, constituting 2 to 10 percent of the areas) having a color temperature of 220°K. These fragments are thought to be "thermally connected to a subsurface temperature of about 200°K."

Another possible explanation for these unusual temperature-time curves can be found in the thermal properties of those minerals believed to be crystalline phases in lunar surface materials. It is known that some of these phases undergo magnetic phase transitions at temperatures ranging from 56°K in titanomagnetite and 65°K in fayalite, to 1033°K in metallic iron (Table 1). In the process of cooling a paramagnetic mineral through its spin-ordering transition, a thermal arrest may be encountered due to a large increase in heat capacity in the vicinity of the transition (*2*). Considering the postulated abundance and distribution of ferromagnesian phases in lunar material (*3*), the thermal arrests indicated by the infrared data may be related, at least in part, to magnetic phase transitions.

The prolonged thermal arrests in Tycho, Copernicus, and Aristarchus and in other areas outside the craters (*4*) may indicate the presence of a mineral unusually enriched in a transition element or simply a larger proportion of such a phase in the surface material. If the arrests are due only to magnetic ordering, the fact that the brightness temperature remains nearly constant through the night suggests that complete ordering is not achieved before dawn.

The fine structure of the cooling data for some lunar material (*5*) also suggests that magnetic ordering in one or more of the minerals may go to completion within a few hours after sunset (or shortly after the start of an

Table 1. Temperatures of heat capacity "maxima" associated with magnetic transitions (*10*). Hematite (Fe_2O_3) has a magnetic transition at 250°K, but no heat capacity anomaly at this temperature (*11*).

Mineral	Formula	Heat capacity "maximum" (°K)
Titanomagnetite	Fe_2TiO_4	56
Ilmenite	$FeTiO_3$	57
Fayalite	Fe_2SiO_4	65
Chromite	$FeCr_2O_4$	75
Titanomagnetite	Fe_2TiO_4	99
Magnetite	$FeFe_2O_4$	114
Chromite	$FeCr_2O_4$	135
Alabandite	MnS	139
Wustite	$Fe_{0.947}O$	189
Troilite	FeS	598
Magnetite	$FeFe_2O_4$	880
Maghemite(?)	Fe_2O_3	950
Iron (alpha)	Fe	1033
Maghemite(?)	Fe_2O_3	1050

eclipse), at which point the cooling curve appears to drop off sharply (which is expected behavior for lambda-type transitions) and then resumes with "normal" heat-loss characteristics. Thus, even if the thermal arrests are not as prolonged as observed (*1*, *4*) or due entirely to magnetic ordering, detailed temperature-time curves are likely to yield new information on mineralogical and compositional variations of the lunar surface.

The temperatures of the heat capacity maxima related to magnetic transitions in lunar materials can be expected to vary widely because of the known variations in the bulk compositions of minerals (*6*) and from the effect of particle size on the ordering temperatures of very finely divided substances (*7*). It is not reasonable at this time, therefore, to attempt a correlation of Allen and Ney's (*1*) data with a specific mineral or mineral assemblage, inasmuch as detailed low-temperature heat capacity data are not yet available for basalt, ferrosilite ($Fe_2Si_2O_6$) or for any Fe-Mg-Mn-silicate solutions. Some theoretical consideration has been given to the effects of simple variations in C_p with temperature (*8*), but the present lack of empirical data on the above substances and on samples of lunar surface material precludes further theoretical analysis.

Large discontinuities in thermal expansion are also associated with some ordering transitions, as for example, in magnetite (*9*) and quartz. If such is the case for magnetic ordering in lunar materials, repeated cycling through one or more phase transition of this type would be an effective mechanism for fracture and erosion of the lunar surface.

D. R. WALDBAUM
Department of Geological Sciences, Harvard University, Cambridge, Massachusetts 02138

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Age of Bed V, Olduvai Gorge, Tanzania

It is becoming increasingly clear that the various deposits which have up until now been bracketed together as bed V are not all of the same age or origin. The date obtained from the fossil bone in bed V at the fifth fault is not in question, but it cannot be regarded as indicative of the age of all that has been called bed V. For example, a date of 30,000 B.P. has been recorded (*1*) for a caliche overlying bed V in one part of the gorge. The age of the so-called bed V overlying the Capsian site at the second fault cannot be inferred from the fifth fault evidence at present.

L. S. B. LEAKEY
Centre for Prehistory and Palaeontology, Nairobi, Kenya

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Lead Poisoning in Children: Detection by Ion-Selective Electrode

In an account (*1*) dealing with lead poisoning in children caused by the ingestion of lead-based paints, attention was called to the need for more rapid and sensitive detection methods suitable for the diagnostic screening of large numbers of children.

A new analytical device which might be of some help in this connection (*2*) is a solid-state ion-selective membrane electrode selective for lead ions in solution. This electrode seems to have the appropriate characteristics of sensitivity (to as low as $10^{-7}M$ Pb^{2+}) and selectivity (normal ionic constituents of body fluids should not interfere) to warrant further exploration of its use as a diagnostic tool. Similar electrodes, selective for Cl^-, are being used for the detection of cystic fibrosis in children (*3*).

GARRY A. RECHNITZ
Department of Chemistry, State University of New York, Buffalo

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