participation from all components of its membership save from those colleges that do not grant doctorates? These institutions represent an important segment of our educational system, and prepare many of our future teachers, doctors, and (hopefully) scientifically aware citizens. I hope that the AAAS officers will recognize that science is not the province only of the university, the corporation, and the government.

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Machine Translation

H. Wallace Sinaiko comes to substantially the same conclusion in his letter (17 Dec., p. 1182), "Translation by computer," as that of a National Academy of Sciences–National Research Council committee in 1966. The members of that committee (chairman John R. Pierce, John B. Carroll, Eric P. Hamp, David G. Hays, Charles F. Hockett, Anthony G. Oettinger, Alan Perlis) are gratified at this confirmation.

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Reference

1. *Language and Machines, Computers in Translation and Linguistics*, report of the Automatic Language Processing Advisory Committee (Publ. No. 1416, National Research Council, Washington, D.C., 1966).

Lunar Basalts

We agree with most of Allen L. Hammond's review (Research News, 25 Feb., p. 868) of the history and structure of the moon. However, there is one important point that should be clarified. He says, "Within this period, two major phases of thermal evolution have been identified: (i) widespread melting that apparently occurred about the time of the moon's formation; and (ii) partial melting beginning as early as 4.1 billion years ago to form basalts enriched in potassium, rare earth elements, and phosphorus (KREEP basalts), and somewhat later, flooding of preexisting basins with lava to form the lunar maria between 3.1 and 3.7 billion years ago." He makes other remarks that are not clear about the times at which the basalts were formed.

We conclude that the maria basalts acquired their gross composition 4.5 to 4.7 billion years ago, and that this composition was only slightly modified in the second melting about 3.1 to 4.0 billion years ago. This point was discussed at the Second Lunar Science Conference by Urey *et al.* (*1*), and it has been clearly established by Wasserburg *et al.* (*2*) with an isochrone plot of ^{87}Rb against ^{87}Sr in the average soils of Apollos 11, 12, 14, 15, and Luna 16. We must conclude that these basalts were formed about 4.6 billion years ago, and that a closed-system melting process occurred later. Our explanation for the closed-system melting is as follows: When melting (of undifferentiated terrestrial material) occurs in a strong gravitational field, for example, that of the earth, the liquid separates and forms an extensive pool which, after considerable accumulation, bursts through to the surface. This liquid has the composition of basalt, and the unmelted material below has another composition. The rubidium-strontium composition differs in the two fractions. Because the moon has a weak gravitational field, liquid and solid separate less completely or not at all; when a previously formed basalt melts, solid and liquid flow out together, and the mixture has the same composition as that of the original pack of basaltic rock. The relative distribution of rubidium and strontium in different minerals was changed in the remelting process, although the overall ratio of Rb to Sr was not changed; hence, two isochrones are secured, one when the data from individual crystals of mare basalts are plotted, and the second when the gross compositions of the different mare basalts are plotted. This is the observation of Wasserburg *et al.* (*1*). Our arguments are somewhat different and involve the uranium and thorium-lead dates as well, but we arrive at the same conclusion. We also give a suggestion about the thermal history of the moon, but what we wish to emphasize is that the basaltic composition of the lunar-ash flows must have been acquired 4.5 to 4.7 billion years ago, in the primitive melting and crystallization process, and remained approximately unchanged in the second melting process.

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References and Notes

1. H. C. Urey, K. Marti, J. W. Hawkins, M. K. Liu, *Proceedings of the Second Lunar Science Conference* (M.I.T. Press, Cambridge, Mass., 1971), vol. 2, pp. 987–998.
2. G. J. Wasserburg, G. Turner, F. Tera, F. A. Podosek, D. A. Papanastassiou, J. C. Huneke, *Lunar Science-III, Lunar Science Institute, Contribution No. 88* (Lunar Science Institute, Houston, 1972), p. 788; D. A. Papanastassiou and G. J. Wasserburg, *Earth Planet. Sci. Lett.* **13**, 368 (1972).
3. We acknowledge support from NASA contract NGR 05-009-150.