The flow channel is placed in a magnetic field long enough for nuclear polarization to occur. There are two separated radio-frequency coils arranged along the flow path. Coil 1 is connected to a radio-frequency pulser coil. We call the region of deorientated fluid the "bolus." The NMR signal detector "sees" normal NMR signals until the bolus region arrives at the region of the detector coil (coil 2). At that instant of time the detector "sees" a sharply reduced (in some arrangements a negative) NMR signal. By measuring the distance between coil 1 and coil 2, and dividing by the time between the pulse initiation and the reception of the reduced NMR signal, the average flow velocity is obtained. The value of T_1 does not affect the flow measurement. It is only necessary that T_1 not be much smaller than the time needed for the bolus to reach the detector coil.

The principle of the design of this type of NMR flow measurement has been more completely described in our earlier papers (*3*). The Badger Meter Company manufactures a commerical NMR flowmeter based on that design suitable for fluids of widely differing T_1 values.

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Absolute Dating Techniques

In their report (*1*) on the ages of crystalline rocks from the Apollo 14 mission, Husain, Sutter, and Schaeffer present some important results using the ^{40}Ar-^{39}Ar method. This technique, which has been used by several other workers, depends critically on the use of mineral or rock standards of precisely known $^{40}Ar/K$ ratio. The "age" of the standard is not directly relevant. What is required is the $^{40}Ar/K$ in the standard. These standards should be adequately documented somewhere in the literature. Often the point is missed that the ^{40}Ar-^{39}Ar age is not absolute, but is *relative* to $^{40}Ar/K$ of the standard sample. The uncertainty of absolute ages determined by this method *must* include any uncertainty in the $^{40}Ar/K$ ratio of the comparison sample. At the present stage of development of argon-potassium dating in particular, and geochronology in general, it is rather surprising to find that workers continue to determine ages on lunar samples, using "standards" (terrestrial or otherwise) which are themselves uncertain to several percent. In the work by Husain *et al.* it would appear that the actual uncertainty in age due to both analytical error and the error in the hornblende monitor is $3.77 \pm 0.15 \pm 0.15$ eons, or $3.77 \pm \sim 0.30$ eons. Analytical techniques which have been available for some years easily permit more definitive measurements to be made, particularly on valuable lunar materials.

Since the time interval over which lunar igneous activity is presently observed to occur is rather restricted (4.00 to 3.20 eons from current data), the necessity for adequately precise data is apparent.

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The comments of Wasserburg *et al.* are in part misleading and in part incorrect. (i) Only our report on ^{40}Ar-^{39}Ar dating is singled out, as though our work (*1*) is particularly poor in that we use a standard which is uncertain in age to a few percent. Our standard has an age of $2.61 \pm 0.06 \times 10^9$ years (*2*); in another case, Turner, Huneke, Podosek, and Wasserburg (*3*), a standard is used with an age of $1.062 \pm 0.020 \times 10^6$ years, an error of 1.9 percent compared to our error of 2.2 percent. (ii) The method used by Wasserburg *et al.* for computing the propagation of errors is incorrect. The combined error is not a simple arithmetic addition. What is even more important is that the $3.77 \pm 0.15 \times 10^9$ years age quoted in the abstract of our paper (*1*) is the mean age, and the error represents the spread in ages. As such the uncertainty due to the standard age hardly influences the results.

Finally, we would like to comment directly on the reliability and precision of the ^{40}Ar-^{39}Ar method as compared to the Rb-Sr method of age dating. At the present time, while the ^{40}Ar-^{39}Ar method of age dating is still relatively new, the results for lunar rocks agree well with the Rb-Sr method. We have only to quote Papanastassiou and Wasserburg (*4*): "The ^{40}K-^{40}Ar [that is, ^{40}Ar-^{39}Ar] ages determined on the same samples are in good agreement with the Rb-Sr results. There is thus clear evidence that these ages represent the true crystallization ages of these rocks."

The precision of the Rb-Sr method is now only slightly better than the ^{40}Ar-^{39}Ar method. This seems remarkable considering the relative newness of the ^{40}Ar-^{39}Ar method. It appears to us that with refinements such as better standards, and better understanding of the argon release patterns from different minerals, the ^{40}Ar-^{39}Ar method may well prove to be the best method for dating lunar rocks. It already possesses the distinct advantage of small sample requirement, milligram amounts. In addition, an important class of lunar rocks which appear to have high Sr contents and to have vanishingly low Rb contents, the anorthosites, are probably not datable by the Rb-Sr method.

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