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in age, the Devonian-Mississippian boundary possibly lying within the Sappington formation.

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Liquid Water in Pumice Vesicles, a Crude but Useful Dating Method

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Condensation of original steam in closed microscopic ($\sim$10–50μ) vesicles yields vacuums ($\sim$0.026 atm H_2O), and $\sim$0.02 per cent (volume) liquid water which diffuses into the walls, within tens of years, forming thin ($<0.01\mu$) hydrated linings and better vacuums.

Glass hydration by meteoric water proceeds inward from external surfaces, cracks, and open vesicles. Hydration rates (Friedman and Smith, 1960) suggest that most pumices are completely hydrated in $\sim10^4$–10^5 years. After complete hydration, further water movement into vacuum vesicles occurs, with most vesicles being filled in $\sim10^7$ years. The exact mechanism is obscure.

Except for possible original condensate, water is never found in vesicles of nonhydrated glass, nor in nonhydrated portions of partly hydrated pumice. Water is not lost from water-bearing vacuum vesicles after weeks at 150° C. Open vesicles contain air or water at 1 atm.

Ninety-one air-dried samples of many pumice types, of approximately known age, were categorized by water content:

Visually estimated H_2O (per cent)	Total samples	Number of samples falling in estimated age brackets	
0	35	28	$<10^4$ years
<10	21	18	10^4–10^6
>10	35	35	$>10^6$

Evidently the degree of filling of closed vesicles may give some measure of pumice age.

Studies of numerous additional samples from thick stratigraphic sections explain some of the apparent errors in age assignment, but many uncontrolled variables make further refinement doubtful. These include vesicle size, shape, wall thickness; glass composition; welding; crystallization; and water environment. The method is quick and simple, however, and is applicable to time spans difficult to measure by other geochronological techniques.

Proposed Curriculum for Astrogeology

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Geologists show little evidence of interest in developing the potential of geological influence on space-age studies; however, geological thinking is needed at the highest levels of advanced planning and research. An astrogeology curriculum must be established if geologists are to participate significantly in the planning for exploration of the Moon and planets.

Astrogeology depends strongly on geology and the traditional methods used in solving geological problems. Basically, an astrogeology curriculum should emphasize the interdisciplinary character of geological education. It should involve such heretofore peripheral areas as meteorology, astronomy, nuclear physics, and electronics. Mineralogy, petrology, geochemistry, and geophysics would be emphasized at the expense of stratigraphy, paleontology, and sedimentation. An astrogeology curriculum would maintain the fundamental identity of geology as a force in lunar and planetary exploration. It would put the cosmological problems of lunar and planetary exploration in their proper perspective as "geo-