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Active and Noble Gases, and Total Pressures in Bubbles and Internal Cavities of Lunar Material

Active and noble gas contents have been determined in internal cavities of lunar material using gas chromatography and mass spectrometry. The gas was released by crushing the samples in a stainless steel apparatus at room temperature. The void space was determined by density measurements before and after crushing a sample. From total gas amount and volume the gas pressure is calculated.

We have analyzed a number of Apollo 12 rocks, some chips of an Apollo 11 rock and breccia for gas content. In crystalline rocks we have found predominantly nitrogen and methane, with lesser amounts of helium and radiogenic argon. The ratios N_2/CH_4 vary for different rocks, but they are consistent within each sample when crushed in several steps. Related experiments indicate negligible contributions of atmospheric and contaminating components. Total gas amounts released by crushing vary from about 30 to 200×10^{-8} cc STP/g sample for different rocks. Total gas pressures are in the order of 10^{-1} mm Hg.

The breccia is distinctly richer in gas compared to all crystalline rocks analyzed in this work. So far we have detected hydrogen, nitrogen, methane and ethane. The total gas amount released by crushing exceeds that of crystalline rocks at least by a factor of 20. The data obtained by stepwise crushing indicate two different sites of the released gas in the breccia.