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Mars, Earth and Titan: Origins of Atmospheres

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The relative abundances of 36Ar, 84Kr and 132Xe in the atmospheres of Earth and Mars (glass in EETA7009) are remarkably similar. The relative abundances of the xenon isotopes share this virtual concurrence. It seems that the noble gases on Earth and Mars represent the "Planetary Component," a label that has been wrongly given to a suite of noble gases in meteorites. The source of this component of noble gases remains an enigma. A delivery to both planets by icy planetesimals is an appealing possibility but we have no observations yet that could test it. This is neither affirmed or denied by recent measurements in Titan's atmosphere. A comparison of C/36Ar on Titan, Mars and Earth supports the consensus that Titan's nitrogen was delivered by NH3 , not N2 . The nitrogen isotopes on Earth, Comet Wild 2 and the meteorites agree that the same delivery should then apply to Earth and Mars. This is consistent with the absence of N2 on comets. D/H in water on Mars is another possible clue to atmosphere origin as the value is now well-established in icy planetesimals and is distinctly different from the value in H2O on Earth. We don't yet have a value for this ratio in water on Mars that has not been affected by atmospheric escape. We look forward to Rosetta and MSL for desperately needed additional data.