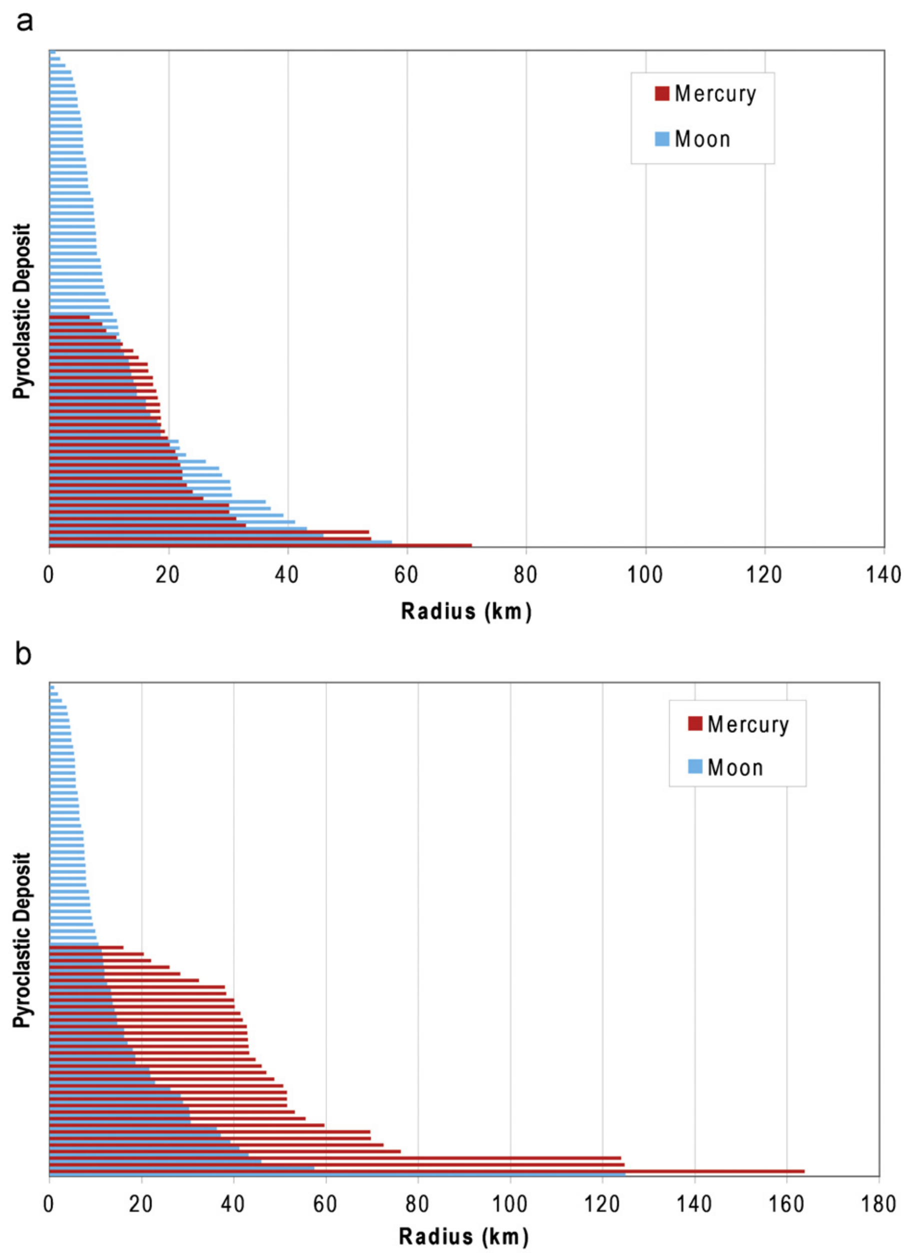

Fig. 5. (a) Graphical representation of the measured radii of the 35 candidate mercurian pyroclastic deposits (red) compared with those of the 76 identified lunar pyroclastic deposits (blue, from Gaddis et al., 2003). The Moon has many more pyroclastic deposits in the small size range than are seen on Mercury. The comparative absence of these features on Mercury is likely an effect of the resolution and coverage of the current data, and it is expected that additional smaller pyroclastic deposits will be discovered during the orbital phase of the MESSENGER mission and the future BepiColombo mission to Mercury. (b) The equivalent comparative sorting but with the radii of pyroclastic deposits on Mercury scaled to lunar gravitational acceleration. Because the pyroclastic beads that make up pyroclastic deposits are propelled in near-ballistic trajectories from the vent, and their range is inversely proportional to gravitational acceleration, pyroclastic beads on Mercury and the Moon that were propelled with the same velocity of ejection would reach different ranges. Scaling the deposit radii in this way allows for direct comparison of the magma volatile contents implied by the deposit dimensions.

compared with a similar plot for lunar deposits in Fig. 5a. Area measurements of Gaddis et al. (2003) were used to calculate approximate radii (under the assumption of circular deposits) for this figure.

Although the radii of mercurian pyroclastic deposits appear to be broadly similar to those of the lunar pyroclastic deposits, they are not directly comparable. Two eruptions of identical energies on each of the bodies would result in deposits with markedly different radii because of the effect of the different surface gravitational accelerations on the ballistic emplacement of the pyroclasts. The radii for the mercurian deposits can be scaled to lunar conditions by recalling that the range of a ballistically emplaced object is inversely proportional to gravitational acceleration g. According to the laws of projectile motion, the horizontal range, X, of a particle in a vacuum is

$$X = v_0 t \sin\theta,$$

where v_0 is the initial eruption velocity from the vent; θ is the ejection angle (measured from the zenith), and

$$t = \frac{2v_0 \cos\theta}{g},$$