reach up to 250 m tall. Because pedestal heights can be used as a proxy for the thickness of the target material from which the pedestal formed, this suggests that both large and small pedestals resulted from impacts into similar deposits [e.g., *Kadish et al.*, 2010; *McCauley*, 1976]. Also, the presence of small pedestals superposed on large pedestals (top of Figure 2a), and large pedestals partially covering or sharing its lower layers with small pedestals (Figure 17) is evidence that both pedestal sizes have been capable of forming over the same time period.

5. Conclusions

[40] Large (>30 km) pedestal craters on Mars tend to be radar transparent and are consistent with a composition bearing water ice and silicates, having derived bulk permittivities generally in the range between 3 and 5. Uncertainties in the permittivity of Martian silicates leads to a broad parameter space, raising also the possibility that pedestals consist simply of porous silicate. Limited CRISM data at marginal layering exposed in one of the large pedestals in Malea Planum show tentative evidence for a mafic composition of these layers, while a spectral signature for ice is absent. Given that ice is unstable at current Martian surface conditions, the lack of evidence for ice in CRISM cannot be used to rule out the presence of ice deeper within the pedestal deposits. In fact, many ice deposits probed by Mars radar sounders lack spectral signatures of ice. Because CRISM observations are limited to only a subset of the pedestals examined with SHARAD, these conclusions cannot be generalized to the entire pedestal population.

[41] SHARAD observations of smaller pedestal craters are more difficult to interpret because reflections produced by the margins of the pedestal (i.e., clutter) tend to overprint subsurface reflections. In the few cases where a subsurface reflection was seen beneath small pedestals, derived permittivity values are higher (~6): either this reflects a more mafic composition of these deposits, or it is a consequence of the greater difficulty in distinguishing the subsurface reflector from clutter. In at least one location in Malea Planum, a partially exposed small pedestal appears to be made of the lower layers of a larger pedestal, which implies the same composition between the two size populations.

[42] The layered nature of the pedestals and their different thicknesses, along with the possibility of an icy composition, are consistent with the hypothesis that pedestals formed upon icy layers deposited at various times during midlatitudinal glaciation. Conversely, a porous silicate composition is also compatible with the permittivities yielded by SHARAD. In this case, a mechanism is needed to explain the fine layering observed at the large pedestals in Malea Planum. Based on volcanic geological context of Malea Planum and the mafic composition suggested a CRISM observation of pedestal layers, volcanic ash deposited over multiple volcanic episodes is also consistent with our results.

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