Re-impacts from the craters residing at the deepest location generating the blue units on Phobos

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Re-impact sites from the deepest crater on a body in space preserve much of original information. The surface of the Martian satellite Phobos is spectrally divided into red and blue units [1]. The former are globally distributed, while the blue units have been observed inside and outside the Stickney crater—the largest and deepest crater on Phobos. Outside the crater, the blue units are concentrated in the region from the south to the west (south-west blue units) and in the region east of the crater (east blue units). Several models can explain the east blue units [e.g., 2, 3]. However, the mode of formation of the south-west blue units is still unknown, despite its vast area. We propose that the combination of ejecta from Stickney and Limtoc (a crater located on the floor of Stickney) contributes to the formation of the blue units. We test the model using ballistic simulations incorporating an updated shape model with randomly generated ejecta velocities, different values of orbital radii to Mars, and various launching velocities to track the emplacements of the ejecta particles. The results show the distribution of global blue units are recreated when the combined re-impact sites of ejecta from Stickney and Limtoc have orbital radius (X_{Ph}) values of $X_{Ph} > 3.34\ R_M$ and $X_{Ph} < 3.04\ R_M$, respectively. This suggests that the blue material is concentrated deep underneath the surface, and the age of Stickney crater may be sufficiently old to be estimated from the crater densities [4].

References

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