

Surface micromorphology of lunar and
terrestrial glasses

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ABSTRACT

Surface features on glassy objects from Apollo 11 and 12 dust and microbreccia have been examined by scanning electron microscopy and compared with similar features on terrestrial volcanic glasses and tektites.

Lunar glassy objects exhibits a variety of micron-sized surface features. (1) Blebs of adhering materials are believed to be produced by spattering of semi-molten particles. (2) Dome-shaped blisters reflect solidification of out-gassing bubble surfaces. (3) Pitted surfaces probably result from post-solidification impact by small by-passing objects. (4) Circular depressions include those caused by solidification immediately after or concurrent with out-gassing, and high velocity impact by small projectiles. (5) Fractures are caused by impact and thermal effects. (6) Rims, flanges, and flow structures are possibly produced by partial melting associated with ablation during high speed flight in a near vacuum.

The fine surface sculpture on tektites is shown to result from differential etching by chemical weathering at the earth's surface. The only place where the original pre-etched surface is preserved is beneath flanges appressed to the bodies of tektites. Fractured and polished sections of flanged australites examined by optical and scanning electron microscopy have shown that this original surface exhibits small oriented blebs of glass, possibly caused by spatter, and hemispherical blisters of low index glass, along with bubble pits caused by escaping gas.

Pele's tears and other micro-lapilli from Hawaiian and other basaltic glasses, show similar hollow, dome-shaped projections and bubble pits but lack the micro-spatter and impact abrasion features of lunar glasses. Basaltic glass and mineral grains from base-surge deposits produced by maar volcanoes show impact abrasion features and spatter on their surfaces, similar to those on the lunar spheres.

Although a means of distinguishing between impact-produced and volcanically derived components of the lunar dust based on surface micromorphology has not as yet been established, surface characteristics of lunar glasses so far observed are enough like those of some terrestrial pyroclastics to suggest similar causes.

The unfractured surfaces of lunar glass and the primary surfaces beneath the appressed flanges of australites both exhibit spatter, ablation, domal gas blisters and bubble pits. This is not to suggest that australites, or other tektites came from the Moon, but rather that they were produced by similar processes or events on their respective planetary bodies.