



Characteristics of Pebble- and Cobble-Sized Clasts Along the Curiosity Rover Traverse from Sol 0 to 800.

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The transport, sorting and abrasive processes that modify the loose surface fragments comprising a sedimentary population are best recorded in the morphologic characteristics of those fragments (also termed clasts or particles). Here we assess morphologic characteristics (size, shape, roundness, texture) of clasts in the pebble to cobble size range (2-256 mm) in Gale Crater imaged along the path of the Curiosity rover from sols 0 to 800. Pebble- to cobble-sized clasts along Curiosity's traverse most likely include geologic materials from the walls of fluvial canyons that debouch onto the crater floor, fragments shed from the central mound of the crater, and grains from modern eolian dunes. Our goal is to help constrain the boundaries of potential transport mechanisms important throughout the geologic history of the crater interior.

Clast survey observations were taken on 162 sols. Most common clast types include:

Type 1. These grey, fine-grained clasts are the most common type between sols 0 to ~650. Particles are angular to sub-angular (though sub-rounded clasts appear beginning ~sol 548), with flat facets terminating in sharp or slightly rounded edges. Surface texture is often smooth, but fresher facets can be rough and knobby at the sub-mm scale; occasionally, faint layers can be discerned. Wind-eroded features are common.

Type 2. These clasts are gray and angular to sub-angular, displaying faces with circular or elongated concave-outward ellipsoids averaging 0.5-1.5 mm long-axis. A potential variant of this clast type is one in which ellipsoids are so deeply weathered that the particle takes on a scoria-like shape.

Type 3. This class consists of angular to sub-angular void-rich clasts. These are rare, and disappear after ~sol 50, but reappear around sol 672.

Type 4. These particles are angular to sub-angular and clast-rich. Clasts protrude as they wear, making surface textures jagged-looking.

Type 5. Particles in this class vary in color, are equidimensional or somewhat elongate, and tend to be subrounded to well-rounded. Such fragments are a significant component of the clast population in some areas along traverse, often littering the surface surrounding larger conglomerate fragments.

Type 6. These particles are angular to sub-rounded in shape, with a knobby, rugged surface texture. This type weathers to similar shapes as Type 4 but lacks protruding grains.

Type 7. This class consists of platy or chunky fragments with a grainy surface texture. This type begins to appear around sol 746 and is the predominant clast type starting sol 780. This type is similar to the surrounding outcrop and thus likely did not travel far.

The diverse morphology indicates that a complex interplay of varying lithologies, transport mechanisms, and environmental circumstances is responsible for the morphology observed. Morphology of clasts suggests that the majority of pebbles and cobbles have not been significantly altered in transport. The exceptions are pebbles that likely wore out of conglomerates, and a sub-rounded population near the base of Mt. Sharp that we are beginning to explore.