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# Rock Types at the Mars Science Laboratory Landing site Sol 0-180

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## Abstract

The Curiosity Rover has encountered a range of different rock types in the clast population of the ground surface during its ~600 m path from Bradbury Landing to Rocknest and Yellowknife Bay during the first 180 sols. To better understand transport mechanisms at work in the landing site area, we examined loose clasts using an organized, systematically-acquired set of images called the clast survey.

Rock types identified include a range of fine- and coarse-grained, basaltic to gabbroic igneous rocks. In addition, mm-scale layering in some rocks suggests a sedimentary origin. Outcrops of fluvial conglomerates, part of the Peace Vallis fan, were also present between Bradbury landing and Rocknest, notably at the Link and Hottah outcrops. Outcrops of veined, fine- to coarse-grained sedimentary rocks are present within Yellowknife Bay.

## 1. Introduction

Between Bradbury Landing and its location ~600 m to the east at sol 180 in Yellowknife Bay, the Curiosity rover has encountered a range of clast types on the ground surface. These are likely to have been emplaced by different types of transport, including impact-transported ejecta and a population of clasts transported down the Peace Vallis fan, presumably by fluvial processes.

Different clast types have been identified on the basis of their morphology and textures, and we suggest likely original rock types to give an insight into the lithologies emplaced onto the Gale Crater surface. In addition to clasts, outcrop has been encountered along the traverse e.g. at the Link and Hottah outcrops, followed by Bathurst_Inlet (sol 54) and Yellowknife Bay. Curiosity scooped soil at Rocknest (sol102) and drilled at Yellowknife Bay.

The clast survey dataset is comprised of rectified images taken with the two Mastcam cameras, (M34 and M100). More details of the clast survey technique are given in [1] and Yingst et al. (in prep.). In addition to the MastCam imagery we use the Remote MicroImager of the ChemCam instrument [2]. These images complement the Laser Induced Breakdown Spectroscopy (LIBS) and APXS chemical data [3, 4].

## 2. Rock Types

### 2.1 Clasts

Yingst et al. [2] defined a number of clast types based on the clast survey and named them after representative members of the groups. The inferred rock types include basalts, porphyritic basalts, vuggy rocks and coarse-grained igneous rocks. The vuggy rocks may be vesicular basalts, where the vesicles have been eroded by aeolian action. Coarse-grained igneous rocks sometimes have a rough foliation, which may indicate a cumulate origin (Fig. 1).

The Curiosity ChemCam and APXS analyses are consistent with basaltic compositions [4,5,6]. Some of the rock compositions are notably alkali-rich, including a mugearite [4,5].

## 2.2 Outcrops

The Hottah Facies outcrops contain rounded clasts indicating size sorting processes characteristic of fluvial processes associated with the Peace Vallis fan [1].

Bathurst Inlet outcrop contains mm-scale layering, suggesting that a sedimentary origin is more likely. The rocks around the Rocknest area, where scooping of soil took place, appear to be of local origin as well, rather than float rocks. These also show mm-scale layering, consistent with a sedimentary origin.

Yellowknife Bay and the Shaler outcrop revealed extraordinary images of fine- (e.g. Sheepbed outcrop) to coarse-grained clastic sedimentary rocks (e.g. Gillespie outcrop), with a variety of planar and cross bedding structures. Yellowknife rocks contain abundant sulfate veins [7, 8]. The fine-grained lithology of the Yellowknife Bay rocks has been drilled and shown to be smectite-clay rich [9].


Figure 1: Possible gabbro with coarse layering, shown with MastCam image. Peacock Hills, Bradbury Landing.

# References

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