



Igneous composition variations determined by ChemCam along Curiosity's traverse from Bradbury to Rocknest area at Gale crater, Mars

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Since landing in Gale Crater (-4.59, 137.44) the rover Curiosity, has driven during the first 90 sols, 420 meter east descending 20m from the Bradbury Landing site towards Glenelg. From sols 13 on, the ChemCam instrument suite performed compositional and imaging analyses of rocks and soils along the route. Each ChemCam LIBS observations covers a spot between 350 and 550 m dia thus individual observations generally do not represent the whole rock composition but rather represent individual grains or a mixture thereof. Most of observations consist of a linear 5-point raster or a 3 x 3 grid. All major elements were regularly reported together with minor and trace elements. During the traverse, two distinct zones have been characterized:

Zone I, from sol 0 to sol 47 (i.e. 280 meter traverse), belongs to the Hummocky terrains supposed to be a part of the alluvial fan below Peace Vallis, which descends from the crater rim to the Northwest. It is defined by abundant gravels and igneous float rocks and isolated conglomerate outcrops. Rock textures indicate a high ratio of intrusive over extrusive: plutonic rocks vary from homogenous grain size either coarse (1-3mm grains Mara) or fine grained (less than 300m Coronation) to variable grain size within a given rock (Jake-M). Some contain abundant laths of whitish minerals. ChemCam analyses are Si-rich (up to 60% wt.% or more) together with high Al (more than 15%) and high alkali (Na > K) in a range expected for alkali feldspar compositions. The lowest Si content correlates with low Al and high Fe consistent with ferromagnesian composition. The highest Si content (Stark a white vesicular rock) could indicate the presence of quartz. Clasts analyzed in one conglomerate (Link) had a range of compositions dominated by feldspathic material consistent with loose pebbles in the area and igneous porphyroblast.

Beyond Anton soil (sol48), Curiosity entered zone II, transitional to a more distal unit with respect to the fan, defined by bedded and light toned fractured rocks characteristic of the Glenelg-Yellowknife bay area. It is characterized

by stratified outcrops where layered dark rocks alternate with light-toned cross-bedded units. Throughout these strata the rocks appear significantly finer grained compared to zone I. They may show sandstone-like texture (Bathurst Inlet) and vesicular to laminated morphology. Aeolian ripples replace gravels. Textural changes in the rocks translate chemically to compositions that are lower in Si and Al, and higher in Fe and K compared to zone I, consistent with under-saturated basaltic compositions close to basanite. Zone II is rather complex, showing evidence of lava flows on one hand and ambiguous rock textures on the other hand. The latter may be interpreted as lithification of sediments from an igneous source corresponding either to some explosive type of volcanism or deriving from complex sedimentary processes.

In conclusion zone I appears to reveal feldspar-rich crustal bedrock for the first time on Mars, which may come the crater rim. Zone II, dominated by iron- and potassium-rich undersaturated basaltic compositions, result from a complex sequence of processes not yet fully understood.