Recent Results From the Spirit Mars Exploration Rover Mission S. W. Squyres[1], and the Athena Science Team, 1. Department of Astronomy, Cornell University, Ithaca, NY, 14853 squyres@astro.cornell.edu.

The Mars Exploration Rover Spirit landed in Gusev crater, and has been exploring there with emphasis on a search for evidence of ancient aqueous processes. The landing site lay on cratered basaltic plains. After investigation of these plains, Spirit drove approximately 2.5 km to the southeast toward the Columbia Hills, a low range of hills with summits ~100 meters above the plains. Since Sol 156 of the mission, Spirit has been characterizing the rocks of the Columbia Hills. The primary area of geologic investigation has been the West Spur of Husband Hill, which is the westernmost extension of the highest summit in the range.

Most of the rocks in the West Spur are loose "float", but several bedrock exposures have been investigated. The main properties of these rocks are consistent in most major respects across the investigated portion of the West Spur, suggesting a common origin.

Pancam images of West Spur rocks show a range of morphology, from massive to finely layered. In Pancam images of massive rocks there are morphologic indications that clasts up to several mm in size are present. Layered rocks show layering on scales as small as ~1 cm or less. Layers are well expressed, with clear evidence for vertical variability in the degree of induration and susceptibility to erosion. In some locations, gradations in layering, from fine to massive, are seen within a single outcrop. Some possible evidence for cross-stratification has been observed, but it is not compelling.

Microscopic Imager images show the rocks of the West Spur to be clastic in nature, with a substantial range in grain sizes. Within a single MI frame (~3 cm in size), it is common to see grain sizes ranging from the limit of resolution (~30 micrometers per pixel) to several mm in size. Poor sorting seems to be a common attribute of the rocks of the West Spur. Grains vary from rounded to angular.

Rocks of the West Spur have a distinctive spectral signature in the mid-infrared. Mini-TES data show little variability from one rock to the next with in the West Spur, suggesting a fairly homogeneous composition over the region. The best fit to the IR spectral signature of the rocks is dominated by basaltic glass.

The chemistry revealed by the APXS is dramatically different from that observed in the basalts of the plains near the landing site. The rocks are basaltic in their major-element chemistry, but there are significant differences from what was seen on the plains, including enhancements in Ti and Na, and depletions in Fe, Mn, Ca, and Cr. The most notable difference, however, is that the rocks of the West Spur are substantially enhanced in K, P, S, Cl, and Br relative to plains rocks. These enhancements are not simply present in shallow surface coatings, as they are seen in RAT holes as deep as 9 mm.

Mössbauer results are also substantially different from those obtained for plains basalts. Olivine is absent in West Spur rocks, and pyroxene signatures are weak. Ferrous iron is much less abundant, and Fe oxides and oxyhydroxides are present. In particular, the iron oxyhydroxide goethite has been identified.

The rocks of the West Spur also have physical properties different from those on the plains. RAT grind energy per unit volume, which is related to compressive strength, is substantially lower than for plains basalts.

Taking these data together, we interpret the rocks of the West Spur to be aqueously altered basaltic materials of volcaniclastic or impact origin. The poor sorting, glassy spectral signature, and variations from massive to layered appearance are all consistent with deposition via some high-energy event such as an impact or volcanic explosion. The strong enhancement of elements easily mobilized by water, the absence of strong primary igneous mineralogy, and the presence of Fe oxides and, especially, oxyhydroxides all point to an aqueous alteration process. The aqueous alteration need not have been contemporaneous with the original deposition. We have found no compelling evidence that the aqueous alteration was related to a lacustrine episode in Gusev Crater.

Since leaving the West Spur, Spirit has explored toward the northeast, working onto the northern flank of Husband Hill. Very recent data have revealed that the north flank of the main hill is dominated by a completely different rock type from any investigated to date at either landing site. As of this writing, all instances of this new rock type have been float, rather than bedrock. It appears to be prevalent on the north side of Husband Hill. The new rock type is also clastic and poorly sorted, but has substantially different mineralogy and chemistry from both plains rocks and the rocks of the West Spur. Olivine is present, and the abundance of phosphorous is strikingly high. New and more detailed results for these rocks will be reported.