RECENT RESULTS FROM THE SPIRIT ROVER AT GUSEV CRATER. S.W Squyres[1], R. E. Arvidson[2], and the Athena Science Team. [1]Department of Astronomy, Cornell University, Ithaca, NY 14853, USA (squyres@astro.cornell.edu); [2]Dept. Earth and Planetary Sciences, Washington University, St. Louis, MO, 63130, USA.

The MER rover Spirit has now spent more than two years on the surface of Mars, traversing more than 5.5 km within Gusev crater. From its landing site on the basaltic plains of the crater floor, Spirit drove initially to the West Spur of Husband Hill, reaching it on the 157th sol after landing. On sol 581 the rover reached the summit of Husband Hill, located ~1.2 km from the entry to the West Spur and ~80 m above the plains.

On the way to the summit Spirit carried out detailed measurements on numerous rock targets, including outcrops tilted to the northwest and exposed along Cumberland Ridge, and rocks exposed along the northwestern flank of Husband Hill. Several soil targets were examined in detail, most notably Paso Robles, a bright, sulfate-rich deposit exposed by rover wheel motions. The rocks examined during the ascent are largely granular in nature and range from breccias, finely laminated deposits, to cryptocrystalline materials. Five rock classes were identified during the first part of the ascent: Clovis (soil-like composition with hematite and goethite), Wishstone and Watchtower (enriched in phosphorus, titanium, and depleted in chromium relative to plains basalts), Peace (basaltic sand cemented by Mg- and Ca-sulfates), and Backstay (relatively unaltered basalt enriched in sodium and potassium relative to plains basalts).

As Spirit completed the ascent of Husband Hill and began its descent of the other side, we continued to find rocks that showed substantial compositional diversity. High on the western flank of the hill, Independence is a fine-grained bedrock outcrop enriched in silicon and depleted in iron relative to plains basalts. The elemental chemistry of Independence suggests that it may contain phyllosilicate phases. Just below the summit, Voltaire is a breccia deposit with clasts of Wishstone materials embedded in a fine-grained matrix of Clovis class material. Some clasts appear to have been rounded before emplacement in the breccia.

On the summit plateau, we found a rock named Irvine that is yet another class of basalt. Irvine, like Backstay lower down the hill, may have been emplaced via localized intrusions within the Columbia Hills after most of the other older, more altered rocks there formed – perhaps contemporaneously with the emplacement of lavas on the Gusev plains. At the very summit of the hill, the outcrop Hillary was found to be nearly identical in composition and texture to the Watchtower Class rocks that were found at Larry's Lookout, which was tens of meters lower and hundreds of meters distant. Larry's Lookout and Hillary represent the only instance of possible stratigraphic correlation over a substantial distance found to date on Husband Hill.

After completing investigation of the summit plateau, Spirit began a descent of Haskin Ridge, the eastern ridge of Husband Hill named after the late geochemist Larry Haskin. The rock Kansas on Haskin ridge has a composition suggesting impact mixing Watchtower and Clovis class materials, and (like rocks of Clovis and Watchtower class) shows evidence for a moderate degree of aqueous alteration.

Spirit then descended southward off the crest of Haskin Ridge into the "Inner Basin" that separates Husband Hill from McCool Hill to the south. Since leaving the crest of Haskin ridge, the geochemical character of the rocks has changed substantially. Major outcrops investigated during the descent to the inner basin include Larry's Bench, Seminole, Algonquin, and Comanche. All of these outcrops are very rich in olivine, and show little evidence for alteration. Values of Fe^{3+}/Fe_{Total} are typically no higher than about 0.3. The rocks on the south side of Husband Hill are therefore dramatically different from those on the north and west sides, with much less evidence for any kind of alteration.

Upon reaching the Inner Basin, Spirit briefly investigated El Dorado, a large deposit of dark wind-blown sand that is seen from orbit as a striking low albedo patch on the south side of Husband Hill. The sands there are well rounded, well sorted, and olivine rich. Because of El Dorado's heterogeneity over a large area, these observations may provide particularly valuable ground truth for some orbital remote sensing observations.

At the time of this writing (early January, 2006), Spirit has left El Dorado and is proceeding rapidly toward Home Plate, an elevated plateau of light-toned material within the southern portion of the Inner Basin. If the rover remains in good health, our current plan is to investigate Home Plate, and then proceed quickly to the north-facing slopes of McCool Hill, which will provide a northerly tilt to the solar arrays that may improve Spirit's chances of surviving a second winter on Mars.