Overview of recent results from the Mars rover missions: Spirit and Opportunity

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The two Mars exploration rovers, Spirit and Opportunity, touched down on the surface of Mars in January 2004 and have been conducting extensive observations with the Athena payload. Together the two rovers have traversed $\sim$13 km. Spirit, located on the floor of Gusev crater, has traversed across and made measurements on basaltic plains and older Columbia Hills materials. While in the Hills, the rover has conducted detailed measurements on numerous rock targets, including outcrops and float materials. Several basaltic soil targets were examined in detail, including sulfur-rich soil deposits exposed by rover wheel motions. The rocks are largely granular in nature and range from breccias, finely laminated deposits, to cryptocrystalline materials. Rock data indicate significant aqueous alteration relative to the younger and more pristine plains basalts. The emplacement of the Columbia Hills rocks is interpreted to be due to a combination of impact and volcanic events, with varying degrees of aqueous alteration. Opportunity has carried out the first outcrop-scale investigation of ancient sedimentary rocks on Mars. The rocks, exposed in craters and along fissures in Meridiani Planum, are sandstones formed by wind and water erosion and re-deposition of fine-grained siliciclastics and sulfate-rich evaporites. The evaporites are interpreted to have formed in a series of ephemeral shallow lakes. Based on orbital data the deposits are $\sim$300 m thick in the vicinity of the landing site and sit disconformably on the dissected Noachian cratered terrains. A model is proposed for the formation of these sediments that focuses on a rising water table that traps and alters material in an acid-sulfate aqueous system.