

Mapping Surficial Geology, Vegetation Communities, and Environmental Materials in Our National Parks: The USGS Imaging Spectroscopy, Integrated Geology, Ecosystems, and Environmental Mapping Project

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Our National Parks have continuing resource management issues which become more acute as park visitation increases. Many parks have only incomplete geologic maps, and only crude, if any, vegetation species/communities or habitat maps. Past mining activity has resulted in many abandoned mines in what are now National Parks and surrounding lands. Increased visitation may be putting stress on the ecosystems in some regions. Surficial mineralogy has a large influence on an ecosystem, and can control the extent of plant communities and animal habitat. Geologic maps, even if complete, do not distinguish surficial mineralogy in sufficient detail to study habitats, so new methods must be employed to derive the appropriate information.

We have begun a program of using imaging spectroscopy and multispectral thermal data to map surficial mineralogy and exposed lithologies, vegetation species/communities, and potential environmentally-hazardous materials that might be associated with abandoned mines in our National Parks. Specific topics being addressed include habitat mapping and cryptobiotic soils mapping.

The integrated study uses AVIRIS imaging spectroscopy data, and TIMS multispectral thermal data for combined visible, near-infrared, and thermal infrared wavelength coverage. A standard mapping run with the AVIRIS data for each park includes mineral maps for many tens of minerals, amorphous materials such as amorphous iron oxides and hydroxides, percent vegetation cover, vegetation species/communities maps, vegetation green-leaf water content, and possible senescence/stress indicator maps. The detail in the vegetation species/communities maps depends on the state of vegetation at the time of data acquisition (data obtained too late in the growing season reduces the ability to discriminate between species/communities). The mineral

maps include clays (specific clays such as Na-montmorillonite, Kaolinite, etc), sulfates (alunite, gypsum, jarosite etc), carbonates (calcite, dolomite and others), iron oxides (hematite, goethite, and others) and other iron-bearing minerals (pyroxenes, chlorites, and others), solid solution series (e.g. Na-K alunite, muscovite Al content), and even detailed mapping of kaolinite group crystallinity. The maps of individual minerals and vegetation parameters form a 150+ layer GIS database.

AVIRIS and TIMS data were acquired by NASA for this program in May and June of 1995 for Arches and Canyonlands National Parks, Petrified Forest National Park, and Joshua Tree National Park. In addition, we are using AVIRIS data for Arches and Canyonlands National Parks, and Organ Pipe National Monument that were obtained in 1991-1994. Current results will be presented at the conference.