AGFA: (Airborne) Automated Geologic Field Analyzer

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This work reports on an integrated software system (AGFA) that automatically and unbiasedly characterizes rocks/soil in an imaged scene (in various wavelengths). This technology enables automated science analysis for robotic spacecraft, further expanding the possibilities for future intelligent and autonomous robotic exploration of remote planetary surfaces. This can be accomplished by merging the expertise of a field geologist with traditional exploration spacecraft to form a *science craft*. Its main benefit will be the ability to yield high science returns at a significant savings in cost and time. Although reconnaissance field geologists can become astronauts, the initial forays to Mars and other planetary bodies will be done by robotic craft. Numerous steps are necessary in order for a science craft to map, analyze, and characterize a geologic field site, and effectively formulate working hypotheses. We present and discuss a tool for automated science analysis of geologic field sites: the *Automated Geologic Field Analyzer (AGFA)*. AGFA, using various wavelengths, maps and characterizes rock/soil materials; this is done, both on the ground and from the air, by extracting features such as size, color, albedo, vesicularity, and angularity. Based on the extracted features, AGFA summarizes the field site numerically and flags targets of interest. It is our vision that this step will lead to autonomous robotic space exploration of remote planetary surfaces.

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Paleoenvironmental study of Doushantuo Formation: Insights of trace element and carbon isotope

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The upper phosphorite bed of Neoproterozoic Doushantuo Formation, Weng'an, South China, preserves a unique assemblage of what are propally the earliest metazoan fossils in the world that could contribute to a better understanding of early faunal evolution on Earth. However, no animal forms have been found in the lower phosphorite bed. Trace element geochemical characteristics show that the upper ore bed with clear negative Ce anomalies (Ce_{anom} ranging from -0.34 to -0.17) and lower redox element contents (Mn ranging from 125ppm to 452ppm, Mo ranging from 0.23ppm to 1.35ppm, U ranging from 3.79ppm to 7.05ppm and V ranging from 13.85ppm to 24.46ppm) compared to the lower ore bed with less negative Ce anomalies (Ce_{anom} ranging from -0.05 to -0.02) and higher redox element contents (Mn ranging from 897ppm to 1524ppm, Mo ranging from 1.52ppm to 13.95ppm, U ranging from 5.53ppm to 22.07ppm and V ranging from 9.70ppm to 52.68ppm), indicating the marine depositional environment changed from anoxic in the lower ore bed to oxic in the the upper ore bed. We might infer that increase of oxygen content in paleo-ocean probably caused the emergence of the earliest diverse eukaryote in the upper ore bed of Duoshantou Formation. $\delta^{13}C$ value trend generally increase from lower ore bed to upper ore bed although they are with several oscillations, indicating higher organic productivity and higher burial rate of organic carbon in the upper ore bed than in the lower upper ore bed.

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