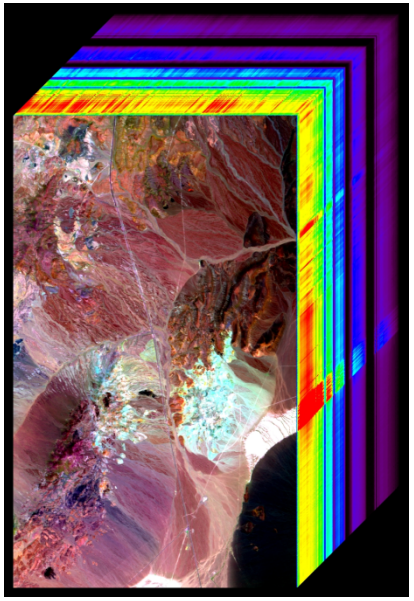
VQ6. Earth Surface, Snow/Ice and Shallow Water Benthic Composition

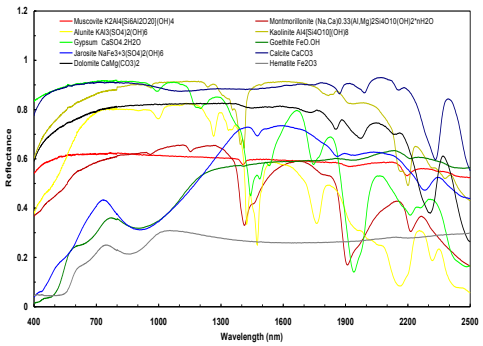
What is the land surface soil/rock, snow/ice and shallow water benthic compositions?

VQ6. Earth Surface, Snow/Ice, and Shallow Water Benthic Composition – Sub Questions

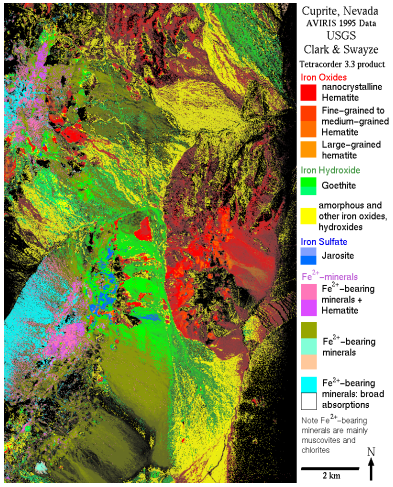
- What is the distribution of the primary minerals and mineral groups on the exposed terrestrial surface?
- What is the bottom composition (sand, rock, mud, coral, algae,SAV, etc) of the shallow water regions of the Earth?
- What fundamentally new concepts for mineral and hydrocarbon research will arise from uniform and detailed global geochemistry of the exposed rock/soil surface?
- What changes in bottom substrate occur in shallow coastal and inland aquatic environments?
- What impact do desert dust and black carbon have on critical water resources through the acceleration of snow and glacier melt?
- What is the impact of climate change on the reflectivity of snow and ice in the Earth's polar regions?
- How can measurements of rock and soil composition be used to understand and mitigate hazards?

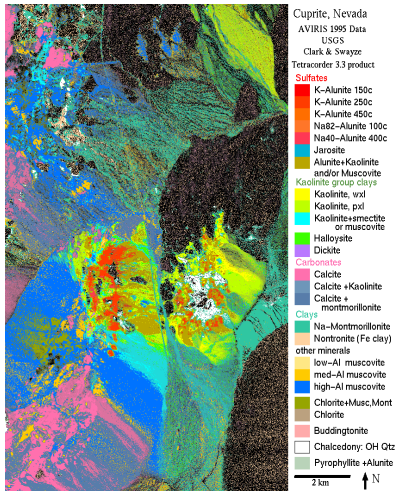
What is the distribution of the primary minerals and mineral groups on the exposed terrestrial surface?





Left: Imaging spectrometer measurements of exposed rock and soil. Above: Spectral signatures of select rock and soil forming minerals.

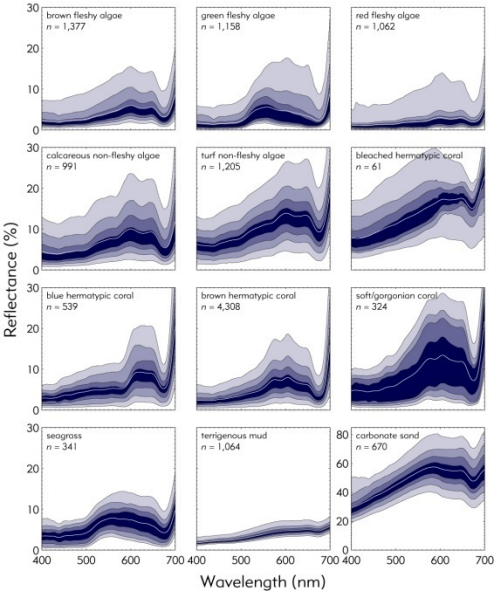


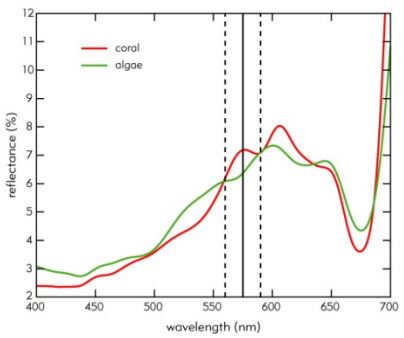


Above left and right: Spectroscopically derived maps of minerals in the 400 to 1500 nm and 1500 to 2500 nm spectral regions.

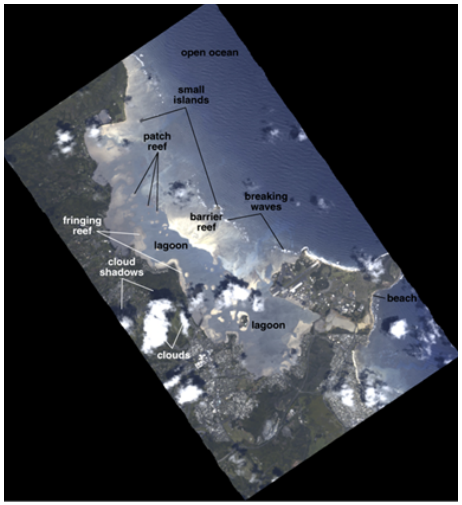
- Science Issue
  - The composition and distribution of the exposed rock and soil substrate of the terrestrial surface is not accurately known globally. Surface rock and soil composition is closely linked to an understanding of resources, hazards and is a major critical element of the Earth system.
- Tools
  - Contiguous spectral measurement from 400 to 2500 nm at 10 nm spatial sampling at 60 m with high signal-to-noise ratio and with excellent spectral and IFOV uniformity.
- Approach
  - Measure the exposed surface rock and soil compostions globally.
  - Measure the available rock forming and alteration minerals and subtle changes in composition via spectral absorption position and shape.
  - Derive fractional abundance through spectral mixture analysis and related approaches.

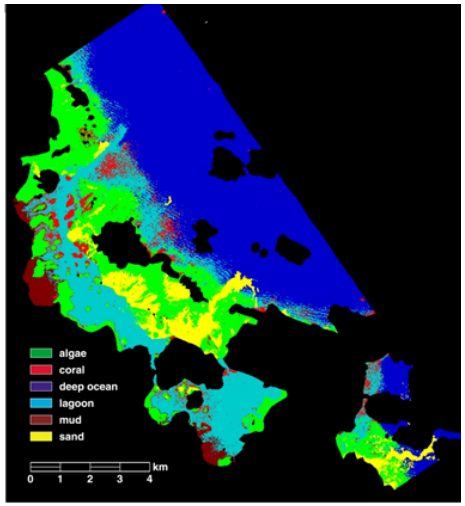
What is the surface composition (sand, rock, mud, coral, algae,SAV, etc) of the shallow water regions of the Earth?





Left: In situ spectral measurements of benthic materials. Above: Example spectral descrimination of algae and coral .

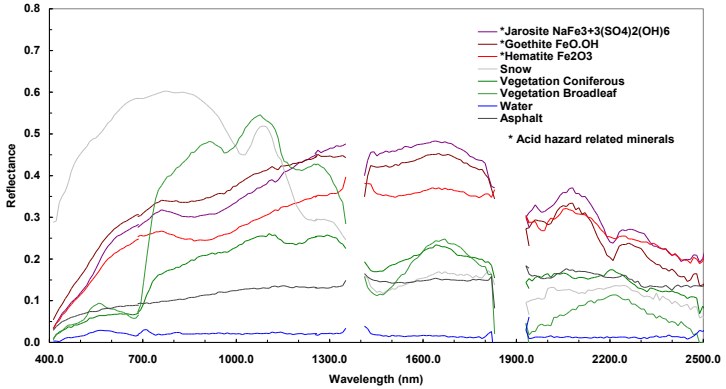




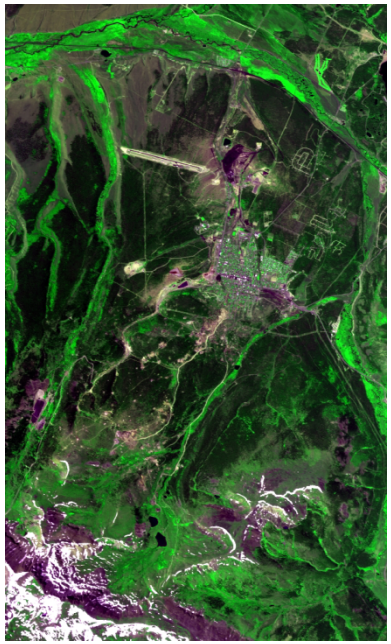
Above left: Imaging spectrometer measurements of Kaneoe Bay, Hawaii. Right: Shallow water bottom composition derived from spectral measurements

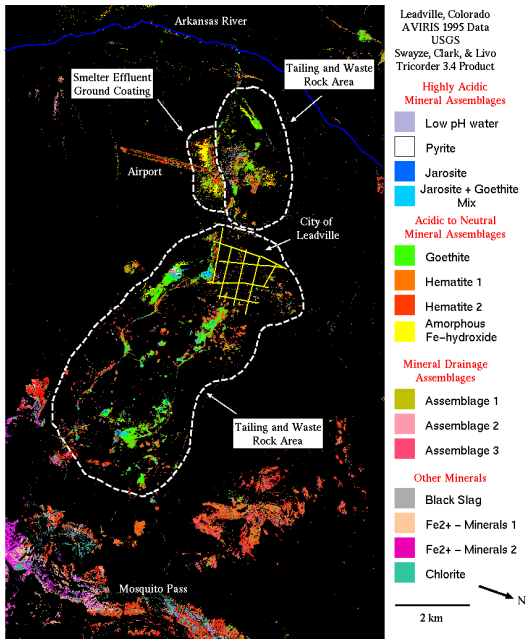
- Science Issue
  - The composition, distribution and seasonal variability of the materials in the observable shallow water coastal regions are poorly understood globally. The habits and resources of the coastal zone is close tied to the composition and structure of the substrate.
- Tools
  - Seasonal measurement of the contiguous spectral signature from 400 to 800 nm at 10 nm spatial sampling at 60 m with high signal-to-noise ratio and with excellent spectral and IFOV uniformity.
- Approach
  - Measure the optically available spectral signature of the coastal zone globally through several seasons
  - Use spectral signature based algorithms and forward inversion approach to measure and extend our understanding of the composition, distribution and seasonal variability of these critical regions of the Earth.
  - Accurate atmospheric characterization and correct is a critical enable requirement.

How can measurements of rock and soil composition be used to understand and mitigate hazards?



Left: Imaging spectrometer measurements of acid generating mineralogies at Leadville, CO.





Above left: Imaging spectrometer RGB image of the Leadville, CO region. Above right: Imaging spectroscopy derived map of acid generating mineralogies associated with mine waste.

- Science Issue
  - In some environmental setting both natural and human placed geological materials can cause a hazard to human health. Two examples are: (1) acid water drainage sulfate bearing mine waste and natural sulfate mineral occurance. (2) distribution and disturbance of asbestos bearing rocks.
- Tools
  - Contiguous spectral measurement from 400 to 2500 nm at 10 nm spatial sampling at 60 m with high signal-to-noise ratio and with excellent spectral and IFOV uniformity.
- Approach
  - Measure the exposed surface rock and soil compostion globally.
  - Measure the molecular and scatturing signatures of the hazard related minerals.
  - Derive fractional abundance through spectral mixture analysis and related approaches.
  - Use imaging spectroscopy derived maps of the hazards for mitigation and control.