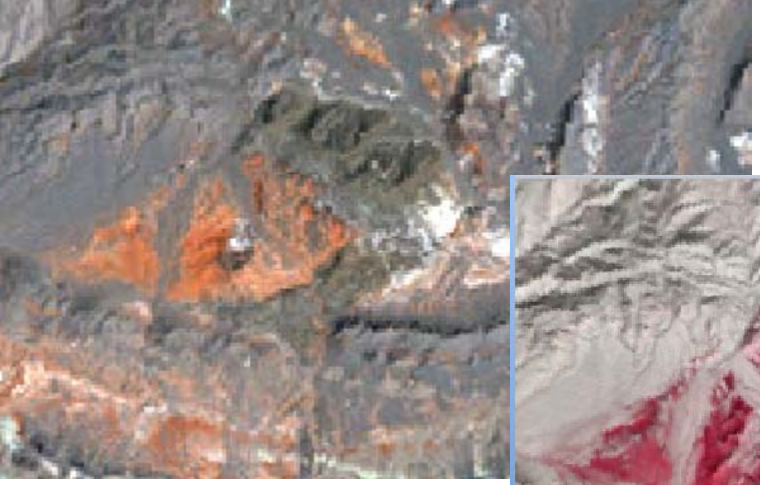
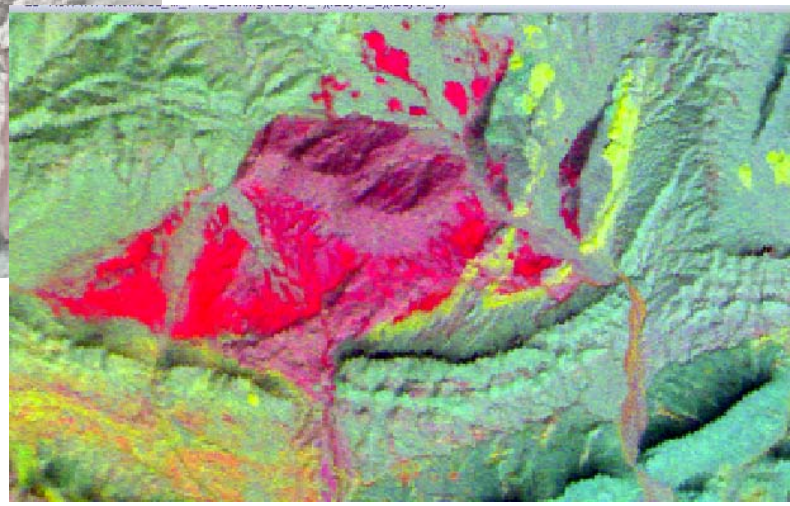


Landsat True Color

Master Thermal Radiance



Master Thermal
Decorrelation Stretch

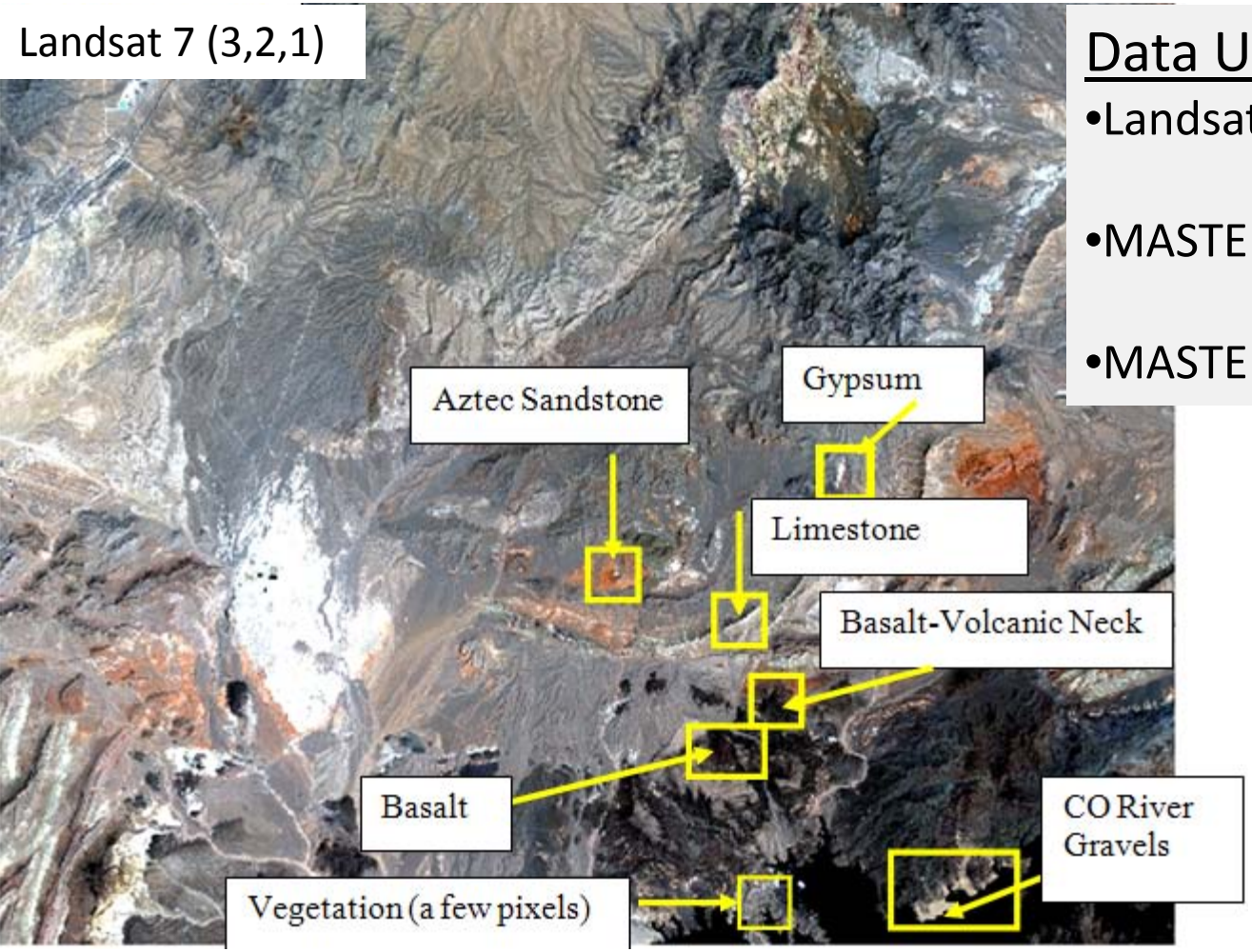
Investigating rock type and mineralogy using thermal imagery

Sarah Robinson

U.S. Air Force Academy

Lake Mead East of Las Vegas, NV

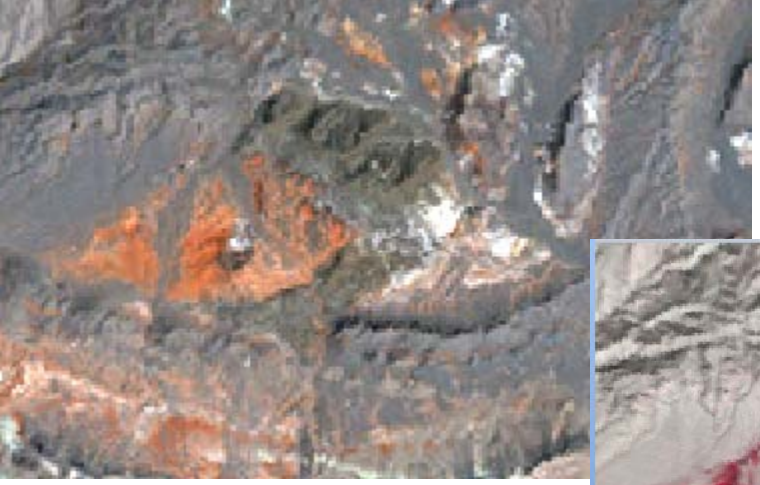
Landsat 7 (3,2,1)



Data Used:

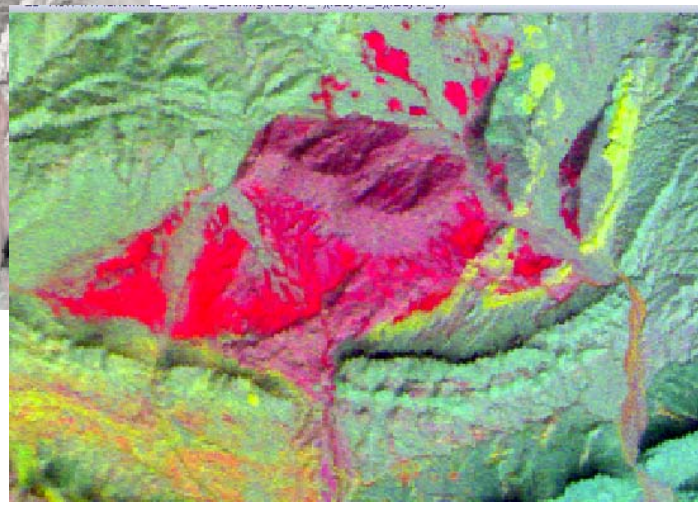
- Landsat Image
- MASTER Radiance Thermal Bands
- MASTER decorrelation stretch

	Left (um)	Right (um)
41	7.578	7.937
42	7.938	8.382
43	8.429	8.796
44	8.821	9.277
45	9.484	9.886
46	9.903	10.290
47	10.317	10.921
48	10.964	11.652
49	11.850	12.347
50	12.632	13.111



Landsat True Color

Master Thermal Radiance



Master Thermal
Decorrelation Stretch

Lab Part 1: Manipulate thermal imagery to look at rock types

Lab Part 2: Determine what wavelengths are appropriate for discriminating between rock types

Remote Sensing Course Goals

Solve a geospatial problem by asking:

- What is the question?
- Is remote sensing an appropriate tool?
- What data do you need?
- What enhancement could you use?
- How would you make a map?
- How would you assess your map/analysis?

Remote Sensing Course Goals

- What is the question?
- Is remote sensing an appropriate tool?
- What data do you need?
  - Spatial Resolution
  - Temporal Resolution
  - Radiometric Resolution
  - Spectral Resolution
- What enhancement could you use?
- How would you make a map?
- How would you assess your map/analysis?

Remote Sensing Course Goals

- What data do you need?
  - Spatial Resolution
  - Temporal Resolution
  - Radiometric Resolution
  - Spectral Resolution
    - VIS is sensitive to
    - NIR is sensitive to
    - SWIR is sensitive to
    - TIR is sensitive to
    - Radar is sensitive to

Remote Sensing Course Goals

- What data do you need?
  - Spatial Resolution
  - Temporal Resolution
  - Radiometric Resolution
  - Spectral Resolution
    - VIS is sensitive to cultural features, iron oxide
    - NIR is sensitive to vegetation, water/land boundary
    - SWIR is sensitive to
    - TIR is sensitive to
    - Radar is sensitive to

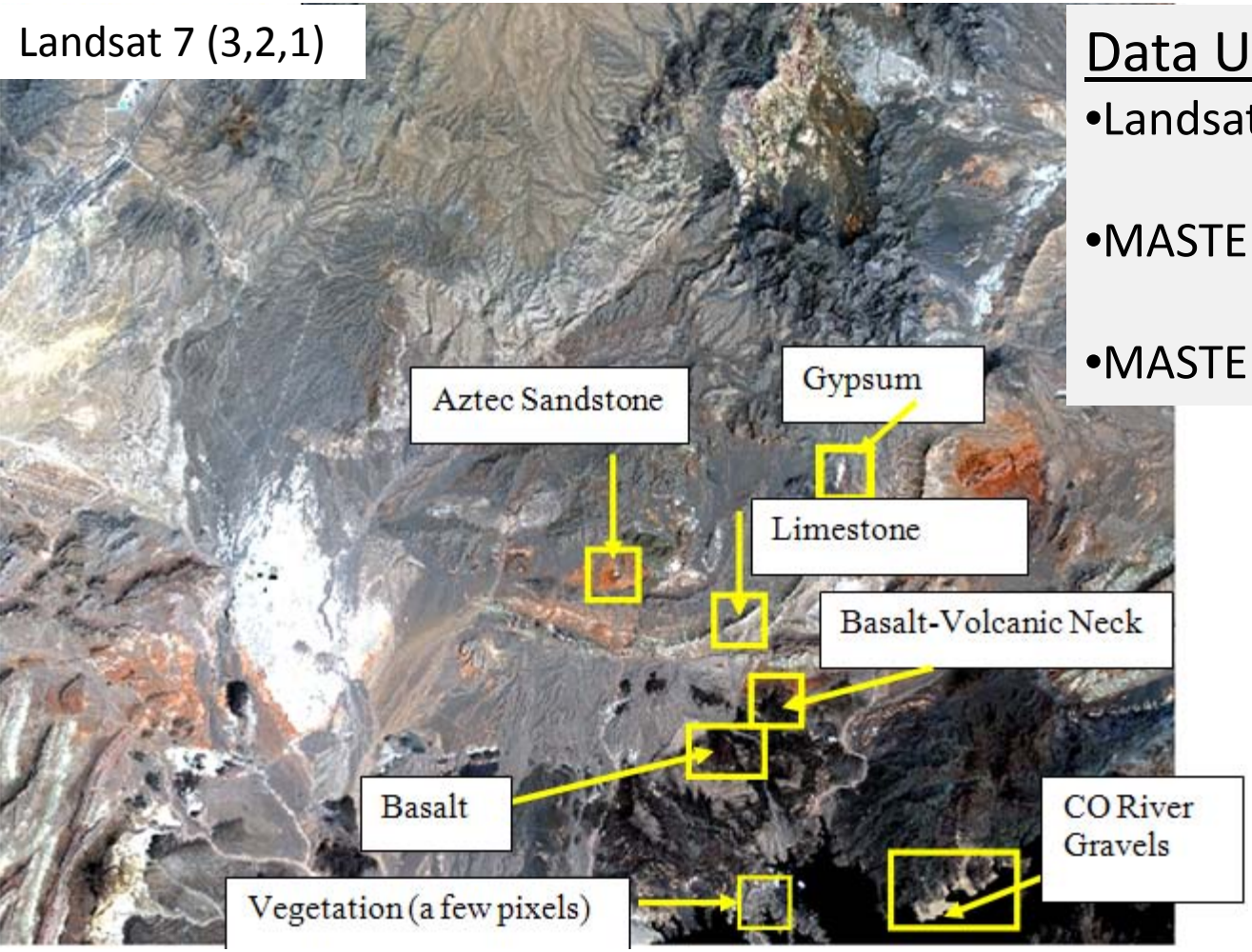
Lab Goals

- Part 1
  - Demonstrate the similarities between analysis of VIS/NIR/SWIR and TIR imagery
  - Review TIR specific attributes

- Part 2
  - Choose the appropriate spectral wavelengths to differentiate between geologic units/materials

Lake Mead East of Las Vegas, NV

Landsat 7 (3,2,1)



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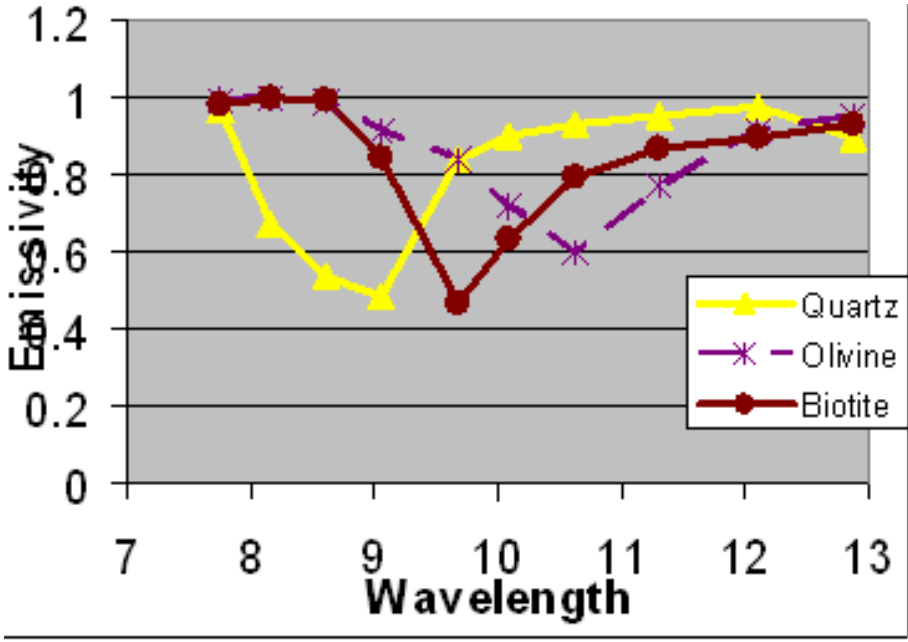
47	10.317	10.921
48	10.964	11.652
49	11.850	12.347
50	12.632	13.111

Lab Goals

- Show similarities between analysis of VIS/NIR/SWIR and TIR imagery
  - RGB combinations work the same in TIR as in VIS/NIR/SWIR

4. *If you created a MASTER (743) image, what color would quartz rich materials appear? (Use the table of band wavelengths above)*

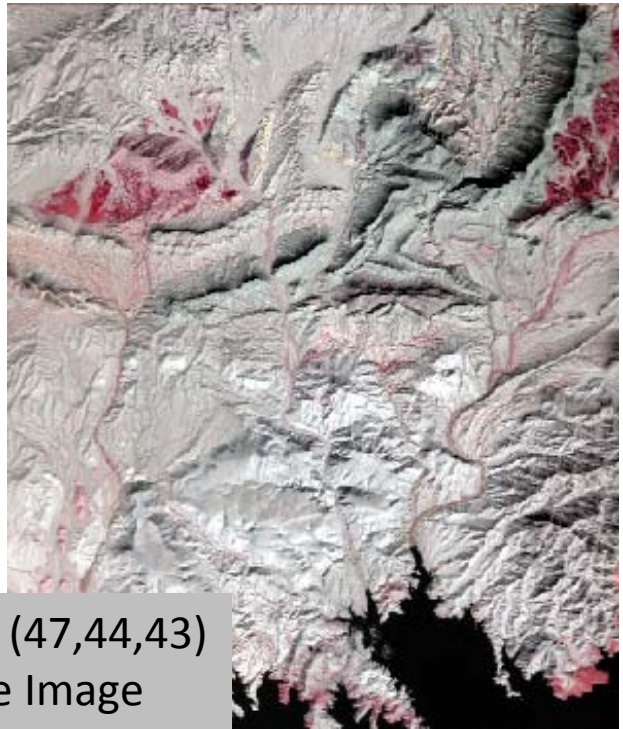
✓ *Create a 743 image of the TIR radiance image*



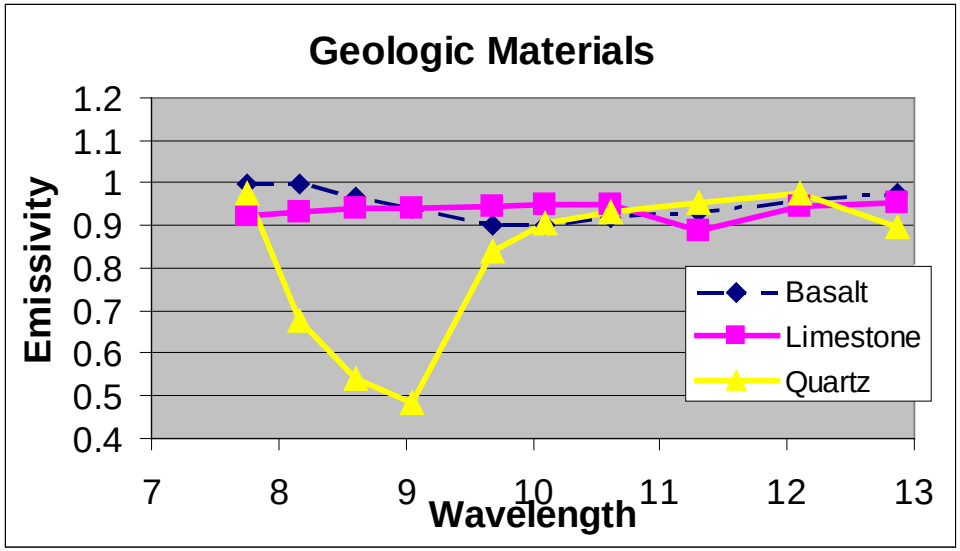
Lab Goals

2. Review TIR specific attributes
   - Radiance value reflects emissivity and temp
   - Sensitive to Si-O bond
   - Linear Mixing/bulk composition
   - Similar emissivity values cause highly correlated bands

TIR is more than just about temperature!



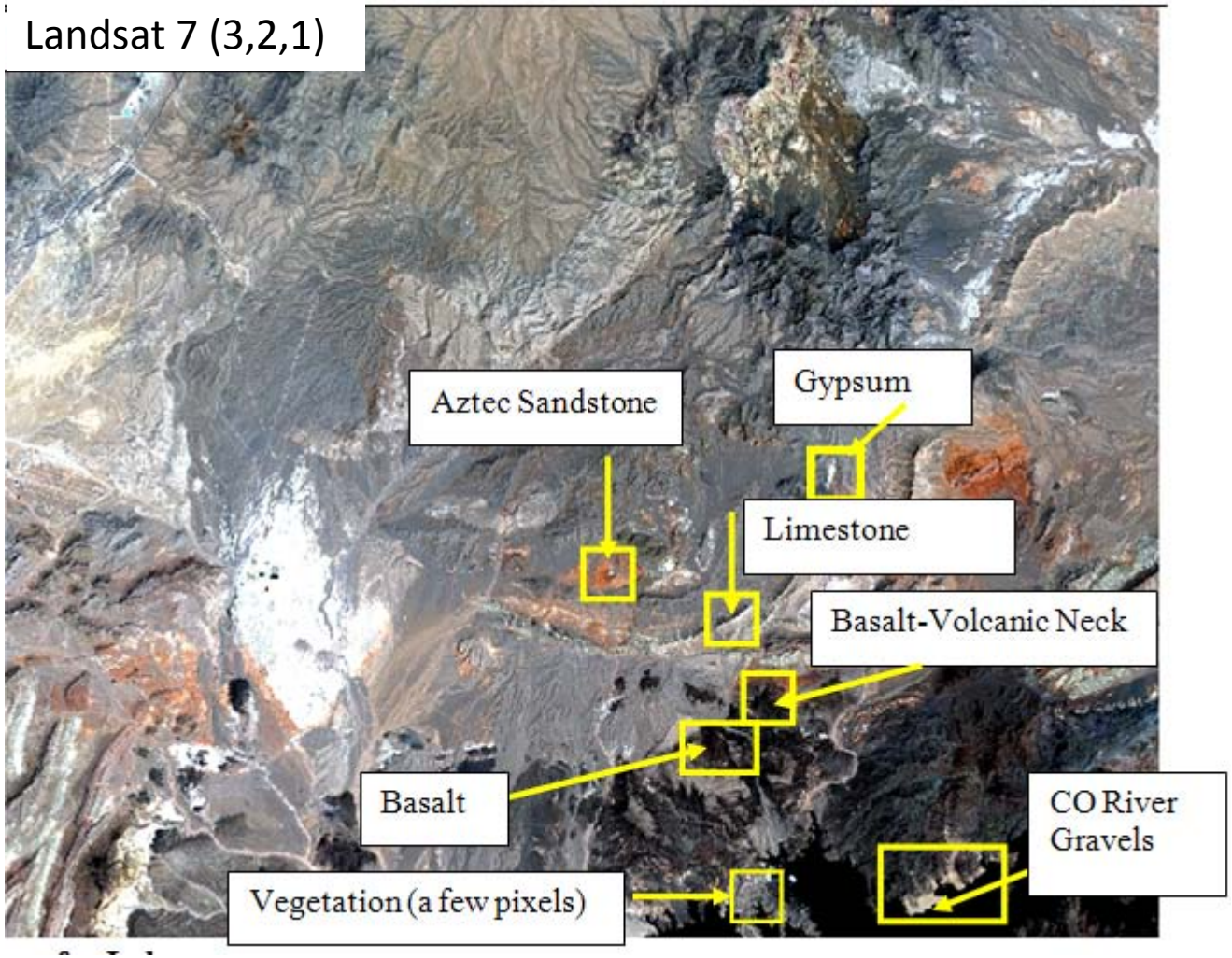
MASTER (47,44,43)
Radiance Image



Lab Goals

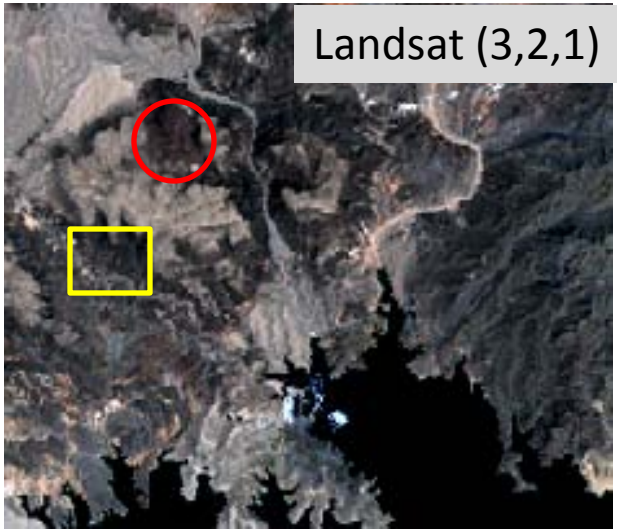
3. Choose the appropriate wavelengths to differentiate between materials
   - Develop “Rules of thumb” for TIR imagery

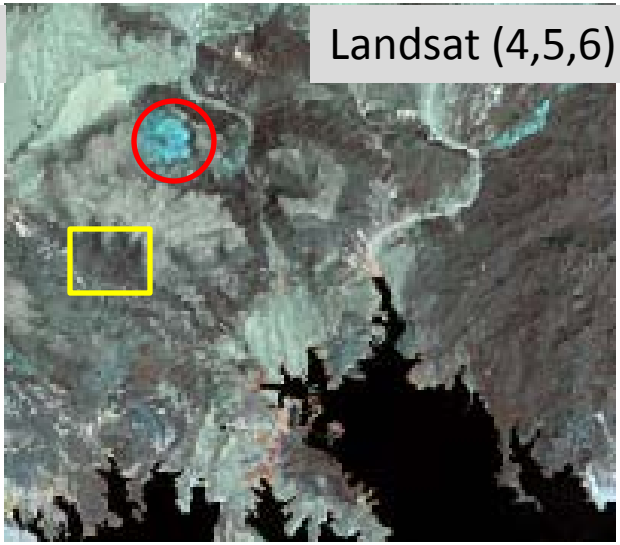
- What data do you need?
  - Spatial Resolution
  - Temporal Resolution
  - Radiometric Resolution
  - Spectral Resolution
    - VIS is sensitive to cultural features, iron oxide
    - NIR is sensitive to vegetation, water/land boundary
    - SWIR is sensitive to
    - TIR is sensitive to
    - Radar is sensitive to

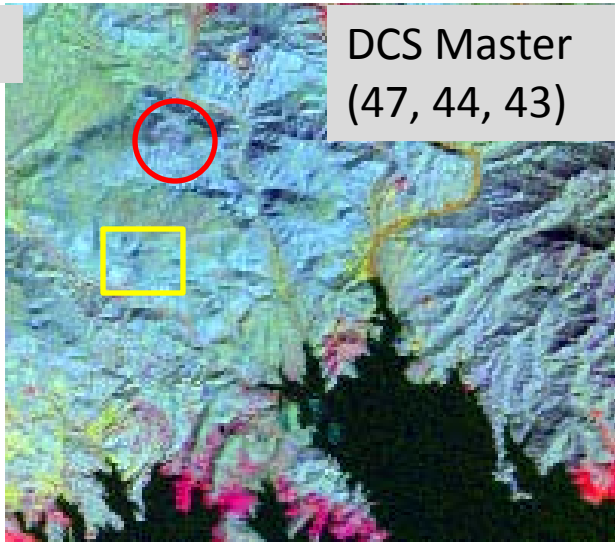


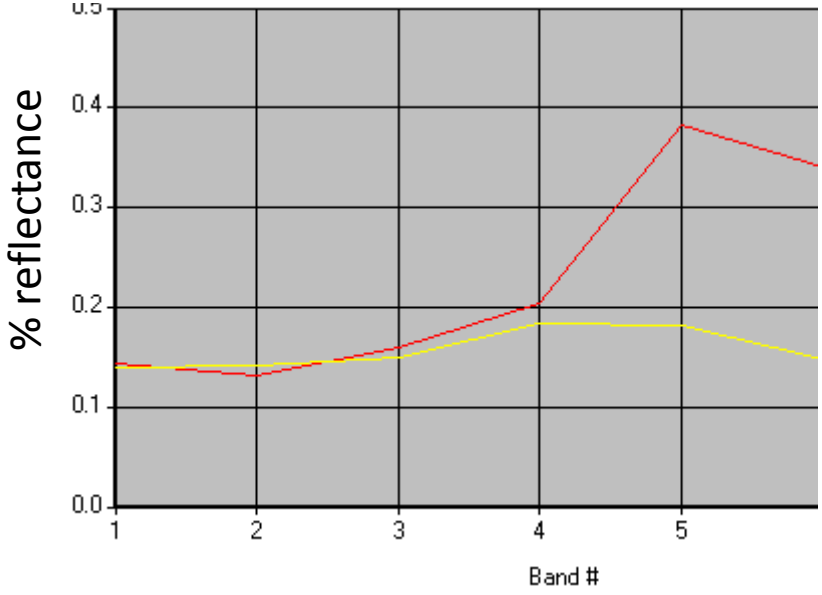
	Visible (321)	NIR/SWIR (456)	TIR
Basalt vs. Volcanic Neck	?	?	?

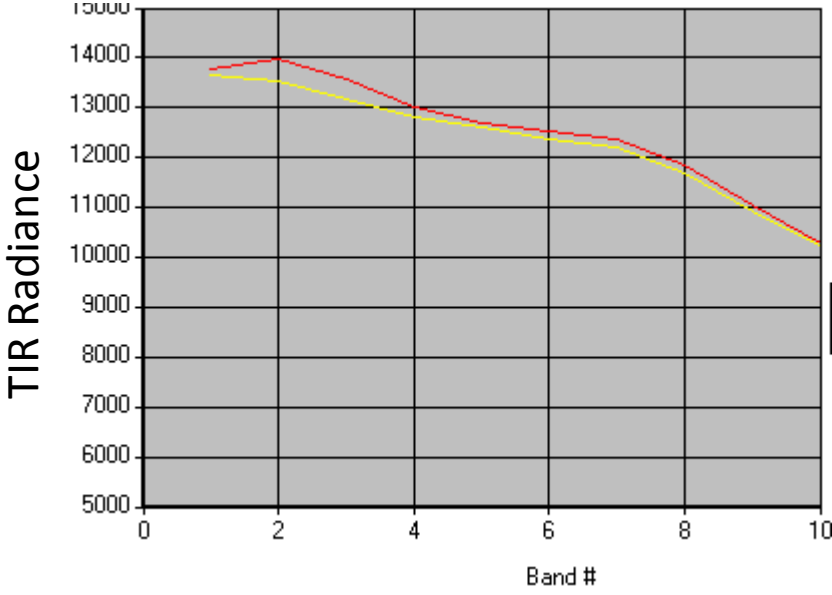
	Visible (321)	NIR/SWIR (456)	TIR
Basalt vs. Volcanic Neck	No	Yes	No





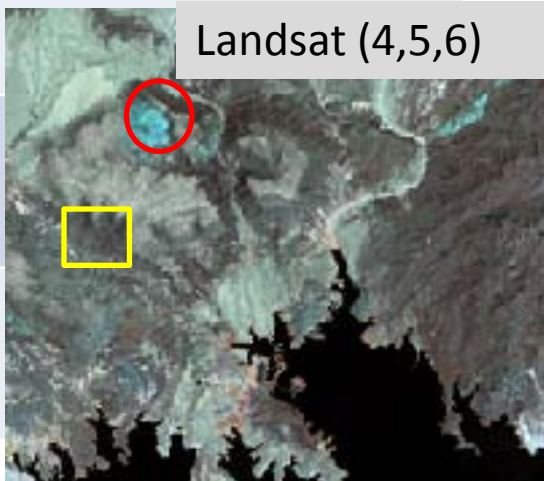


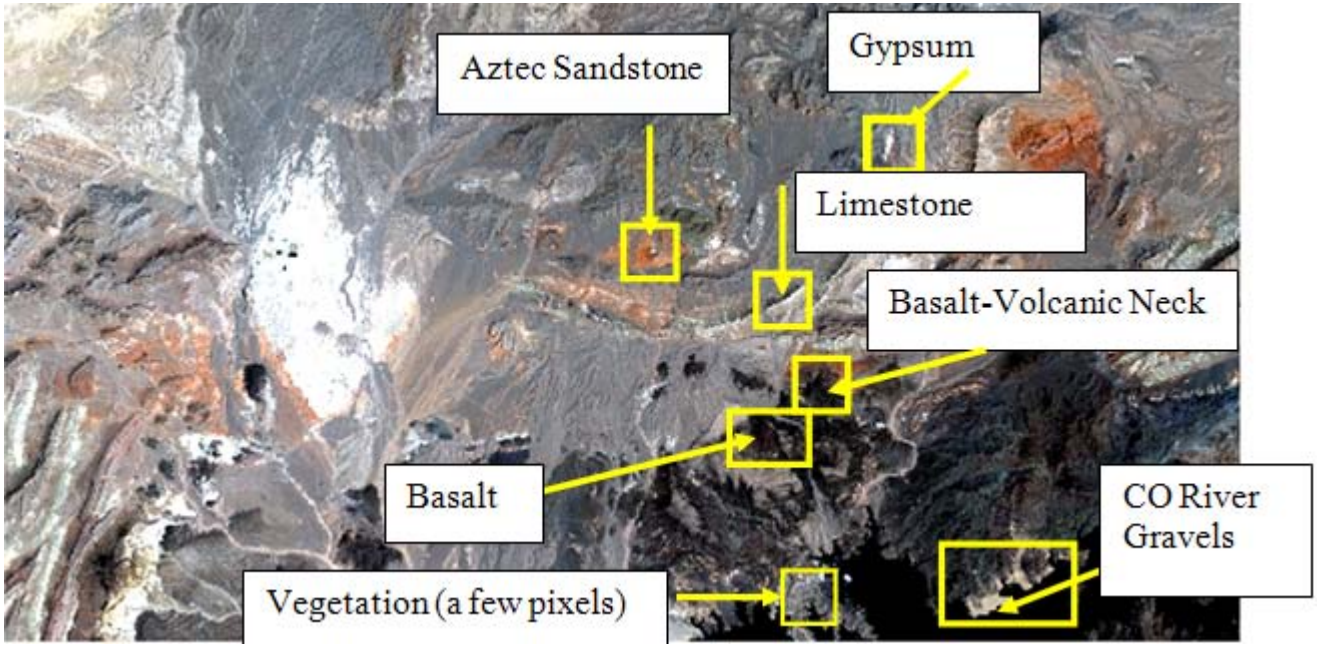




Remote Sensing Analysis Steps

What is the question?	How do you differentiate Basalt vs. a Basaltic Volcanic Neck
Is remote sensing an appropriate tool?	Yes
What data do you need?	NIR/SWIR-because sensitive to ferrous iron
What enhancement could you use?	RGB Combinations
How would you make a map?	NA
How would you assess your map/analysis?	NA

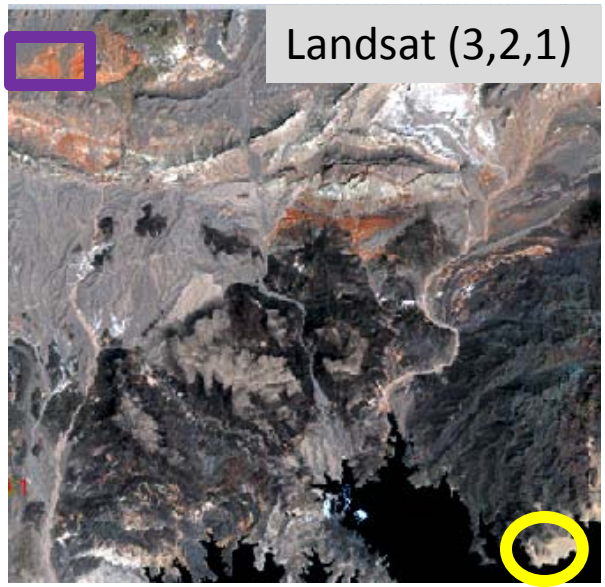


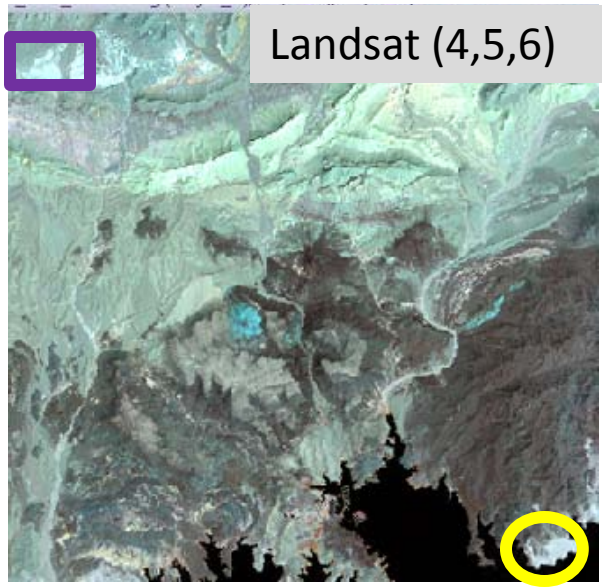


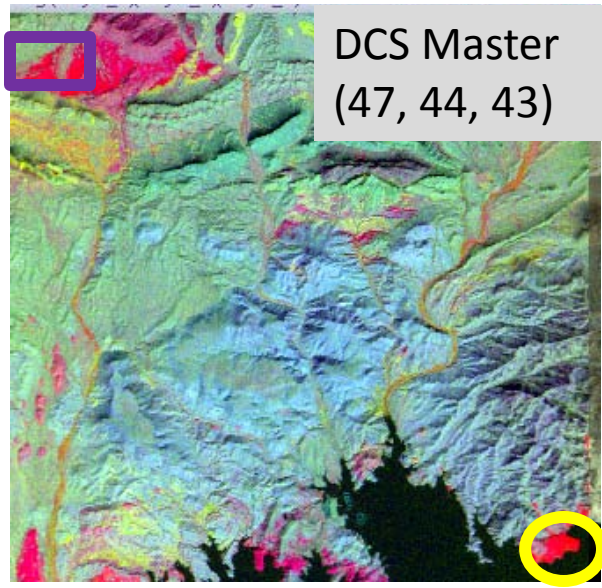
	Visible (321)	NIR/SWIR (456)	TIR
Aztec Sandstone vs. Colorado River Gravels			

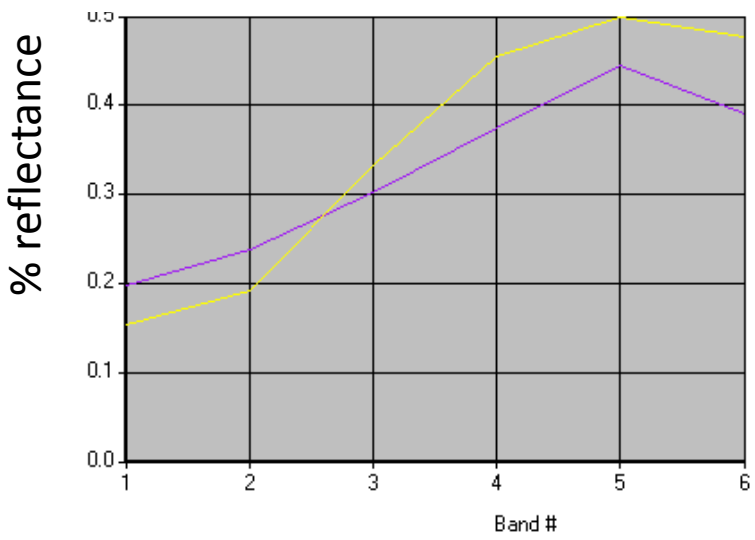
	Visible (321)	NIR/SWIR (456)	TIR
Limestone vs. Colorado River Gravels			

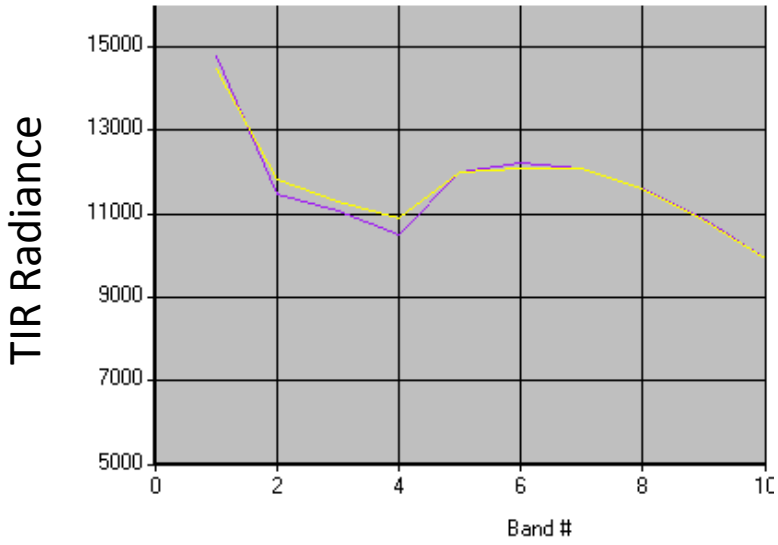
	Visible (321)	NIR/SWIR (456)	TIR
Aztec Sandstone vs. Colorado River Gravels	YES	NO	NO









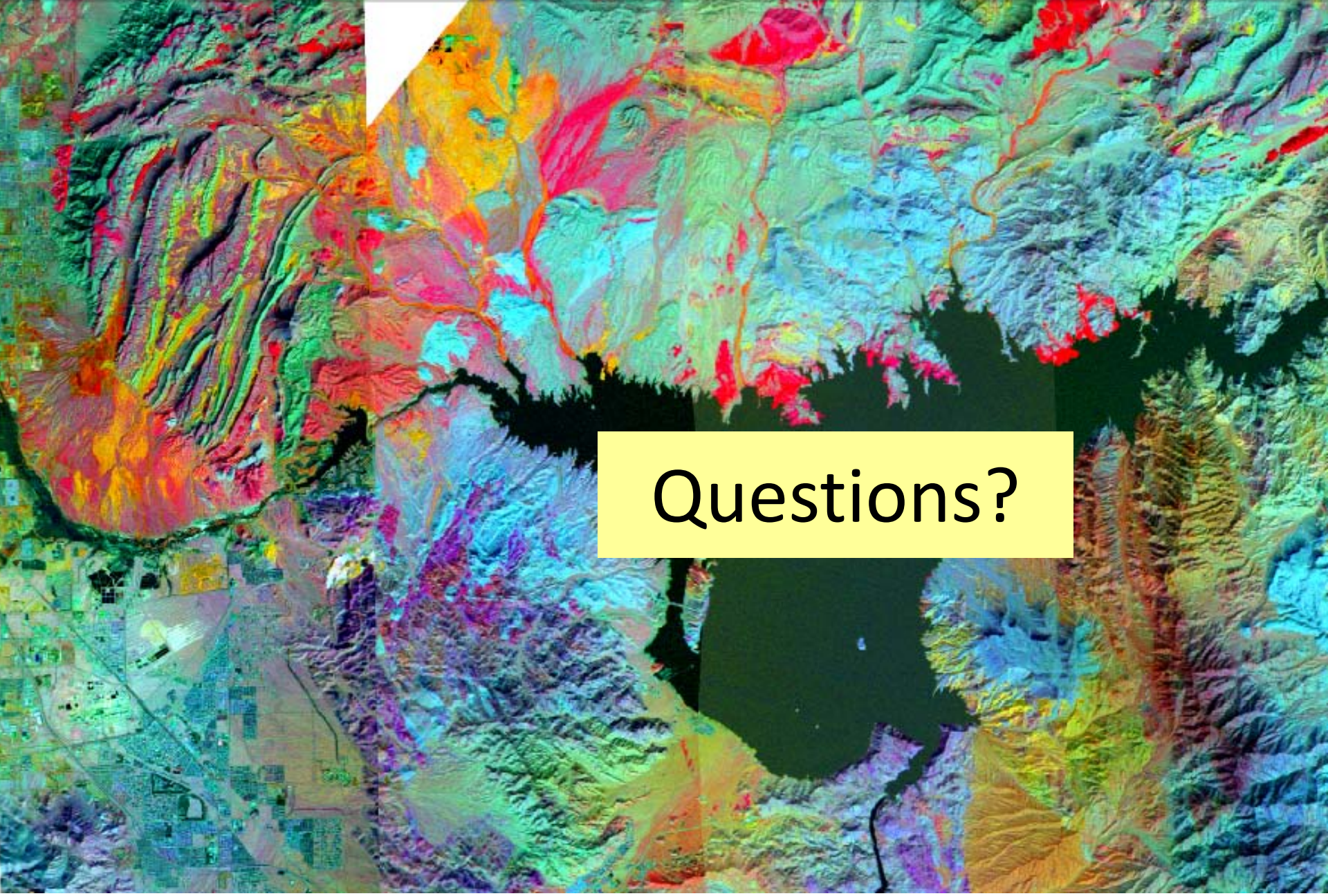


TIR “Rules of thumb” to walk away with at the end of lab

- TIR is good to use when:
  - Materials can be differentiated on bulk geologic compositions (i.e. linear mixing)
  - When you are looking for geologic categories such as quartz rich, mafic, or metamorphic.
- TIR is challenging when:
  - Small components are the basis of differentiation

Remote Sensing Course Goals

- What data do you need?
  - Spatial Resolution
  - Temporal Resolution
  - Radiometric Resolution
  - Spectral Resolution
    - VIS is sensitive to cultural features, iron oxide
    - NIR is sensitive to vegetation, water/land boundary
    - SWIR is sensitive to Iron, clay
    - TIR is sensitive to bulk composition, geologic rock types
    - Radar is sensitive to



Lake Mead, MASTER (47,44,43)
Decorrelation Stretch Mosaic