

# Using Remote Sensing To Improve Geologic Mapping

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# IMAGE PROCESSING TO IMPROVE GEOLOGIC MAPPING



**DigitalGlobe Quickbird Natural Color Image  
Bands 3, 2, 1 as Red, Green, Blue**



# IMAGE PROCESSING TO IMPROVE GEOLOGIC MAPPING



**DigitalGlobe Quickbird Geologic Enhancement  
Near Infrared, Red, Green, Blue Bands Integrated**



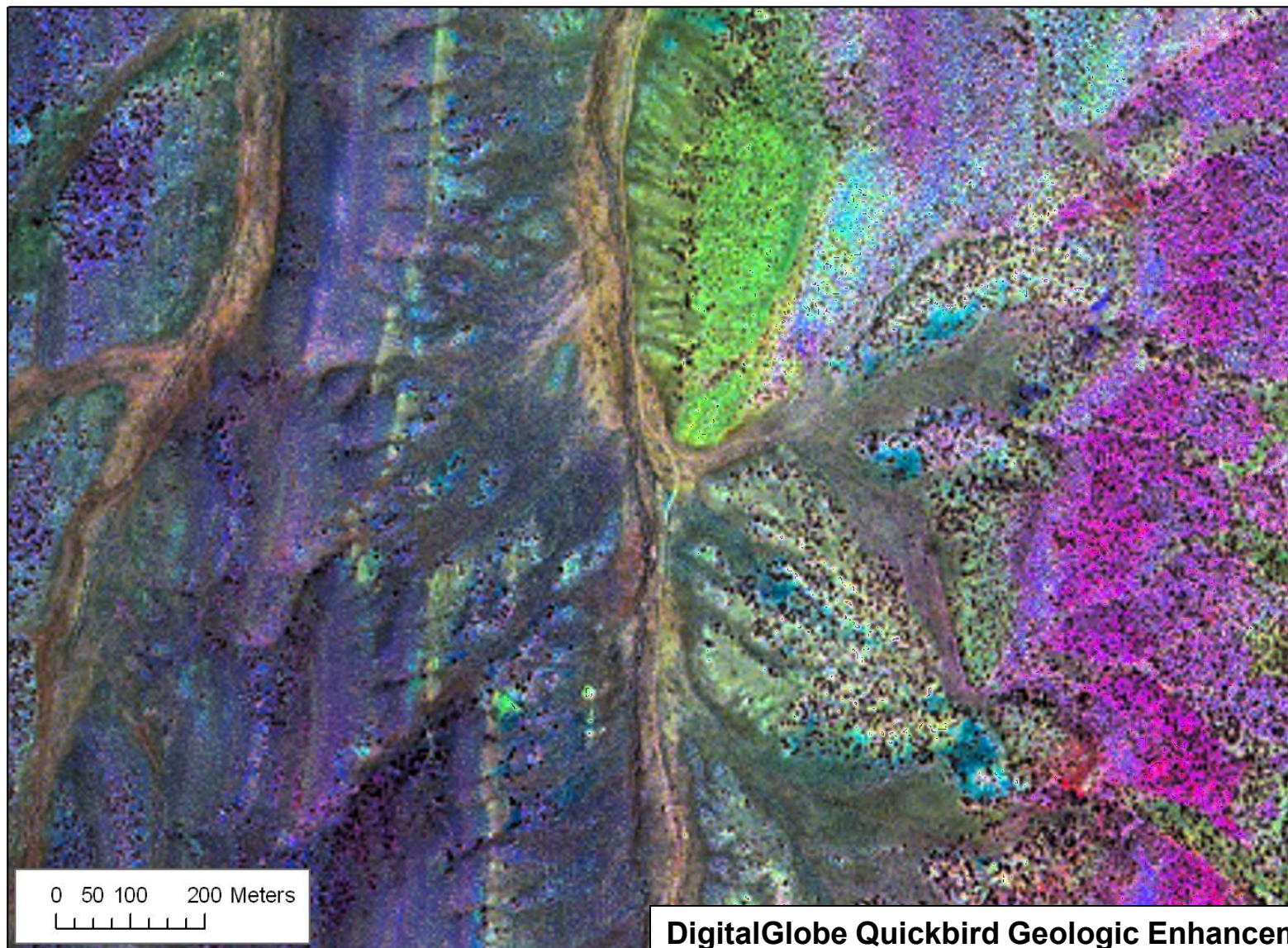
# IMAGE PROCESSING TO IMPROVE GEOLOGIC MAPPING



**DigitalGlobe Quickbird Natural Color Image  
Bands 3,2,1 as Red, Green, Blue**



# IMAGE PROCESSING TO IMPROVE GEOLOGIC MAPPING





# Image Processing in Arid Regions

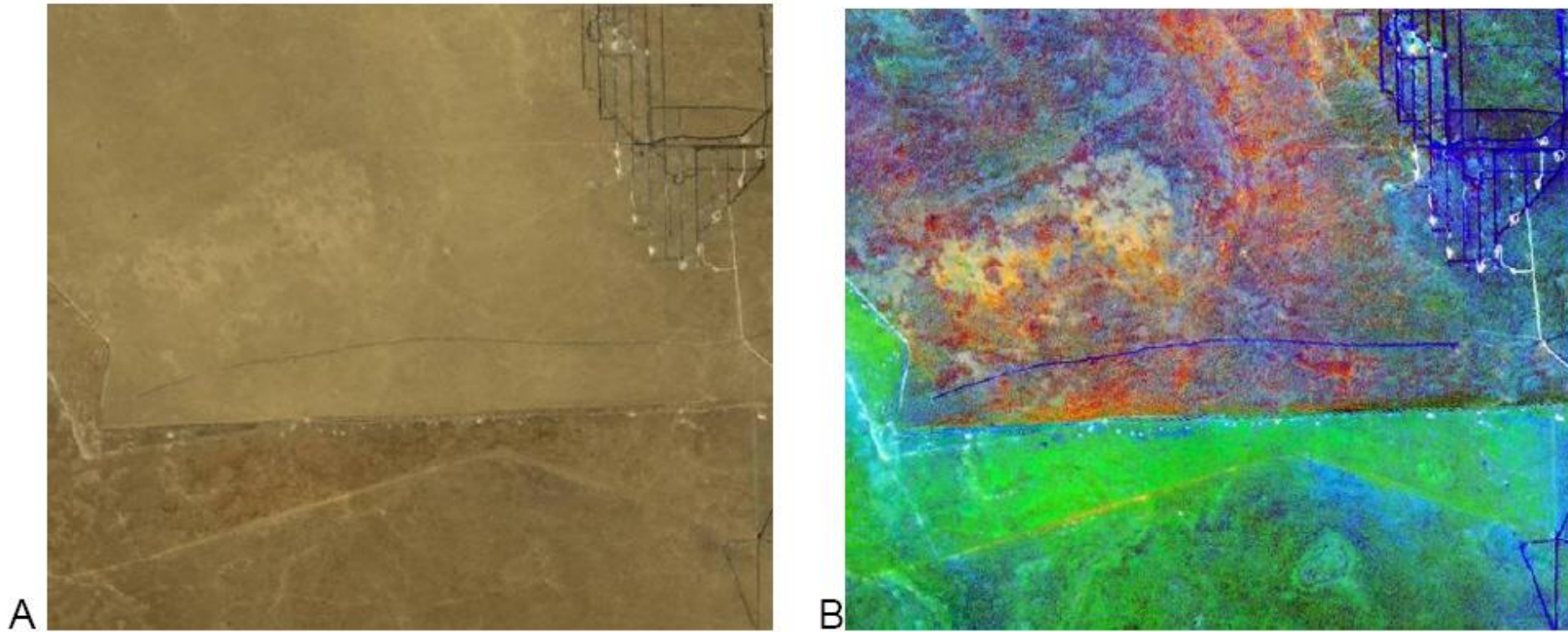


Figure 11. Original natural color Landsat (left) with enhanced for geology Landsat (right)



# Image Processing in Arid Regions

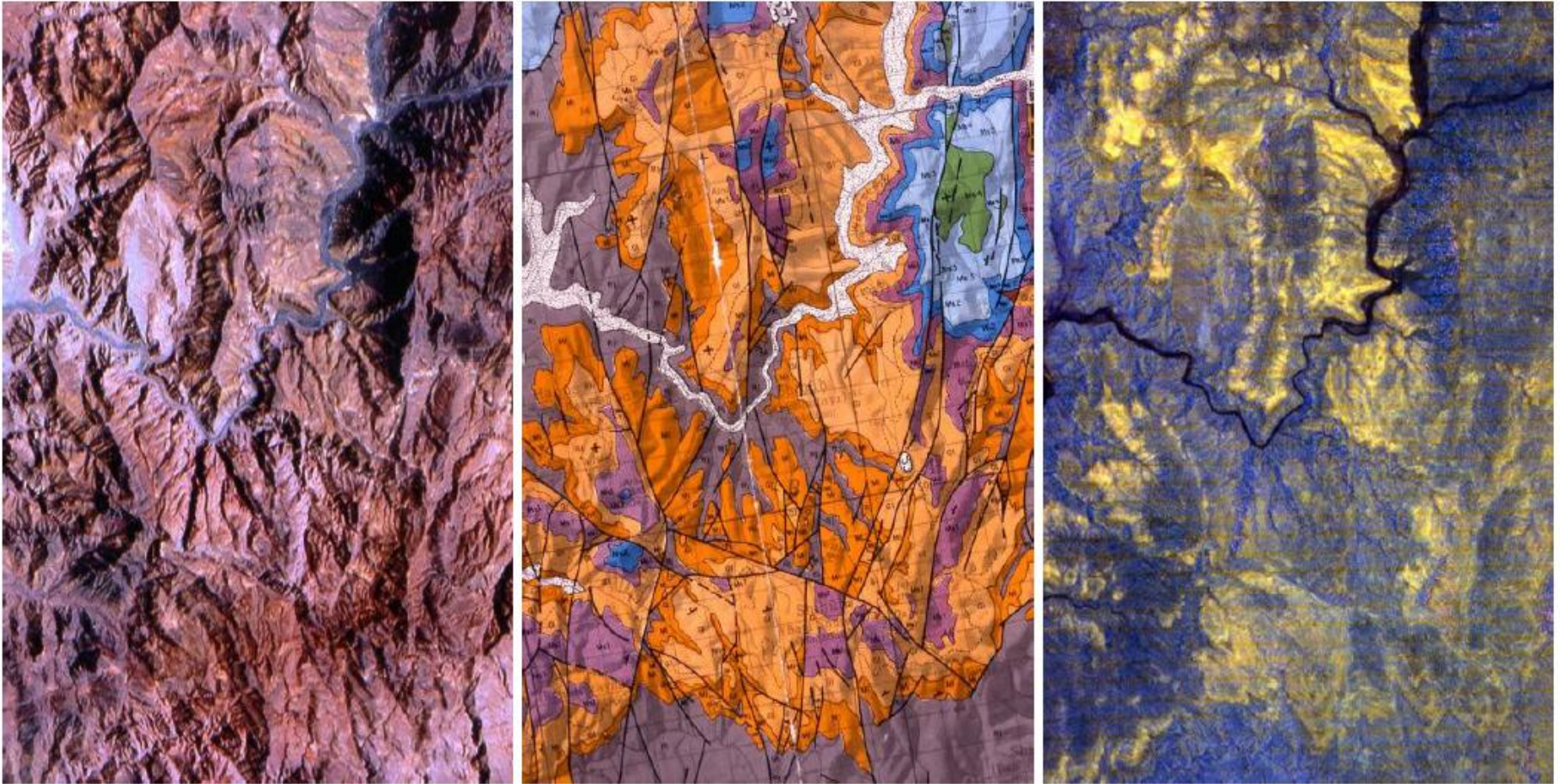


Figure 12. Landsat TM natural color (left), published geologic map (center), and marker bed derived from Landsat TM imagery with image processing techniques. Oman



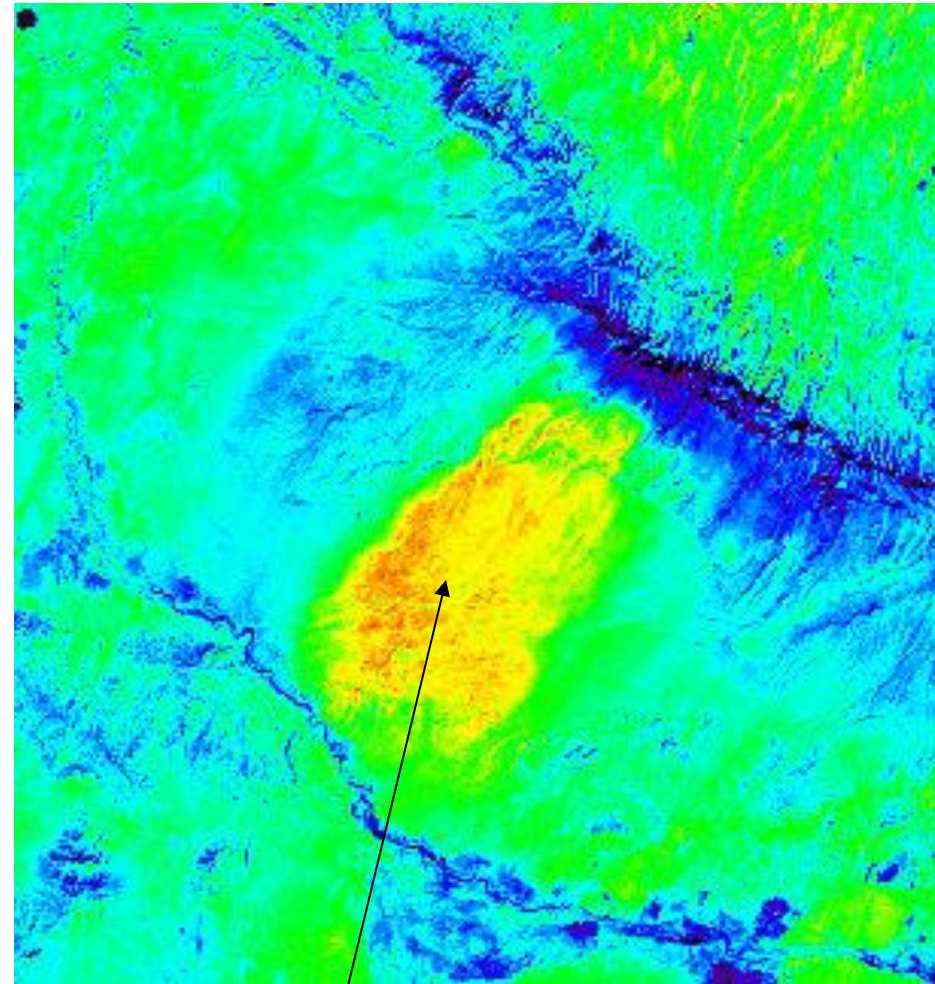
# Published Maps compared with Imagery



Figure 13. Published geologic map (left) with enhanced Landsat TM image (bands 741 as RGB). Yemen



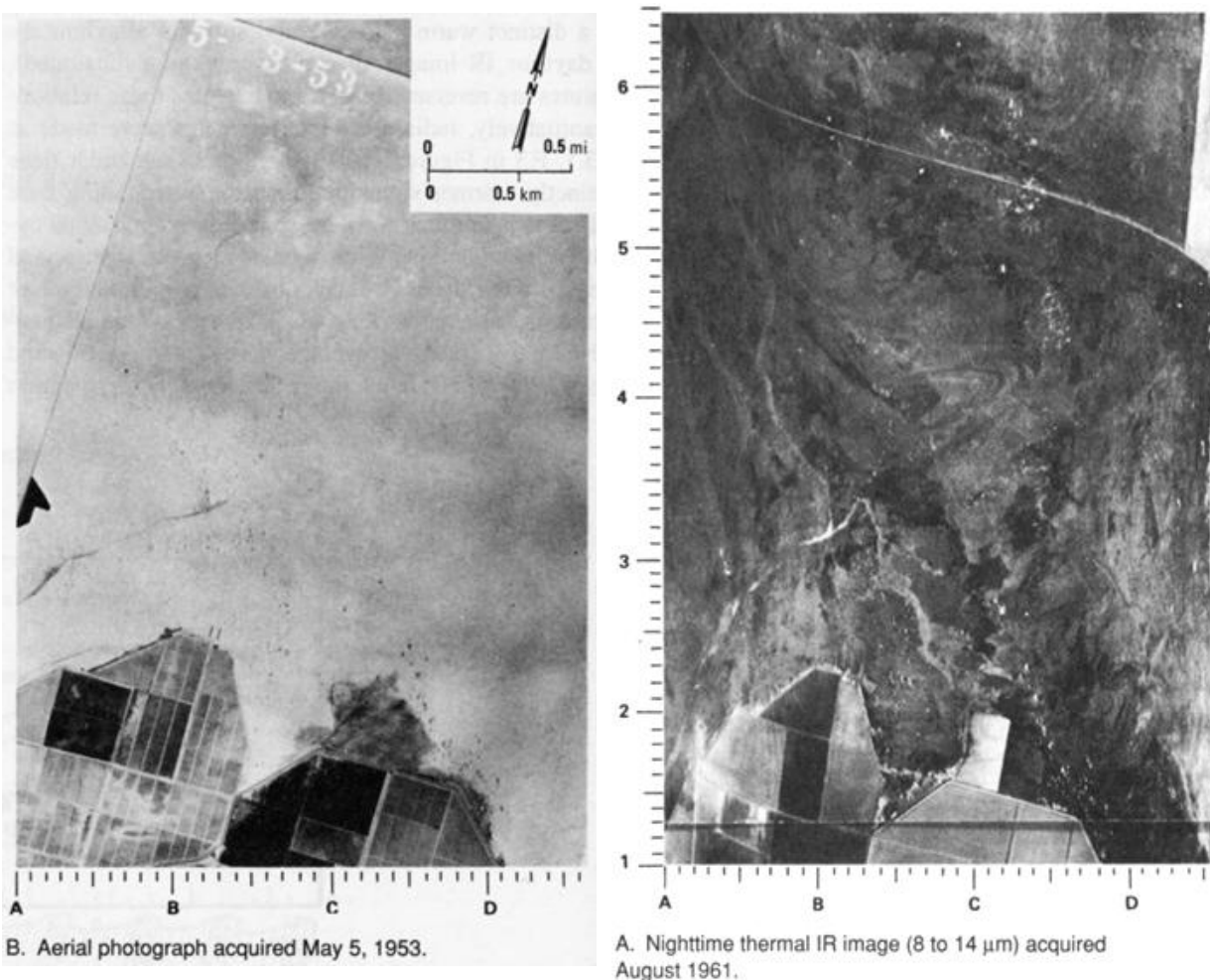
# Daytime Thermal – Landsat Band 6



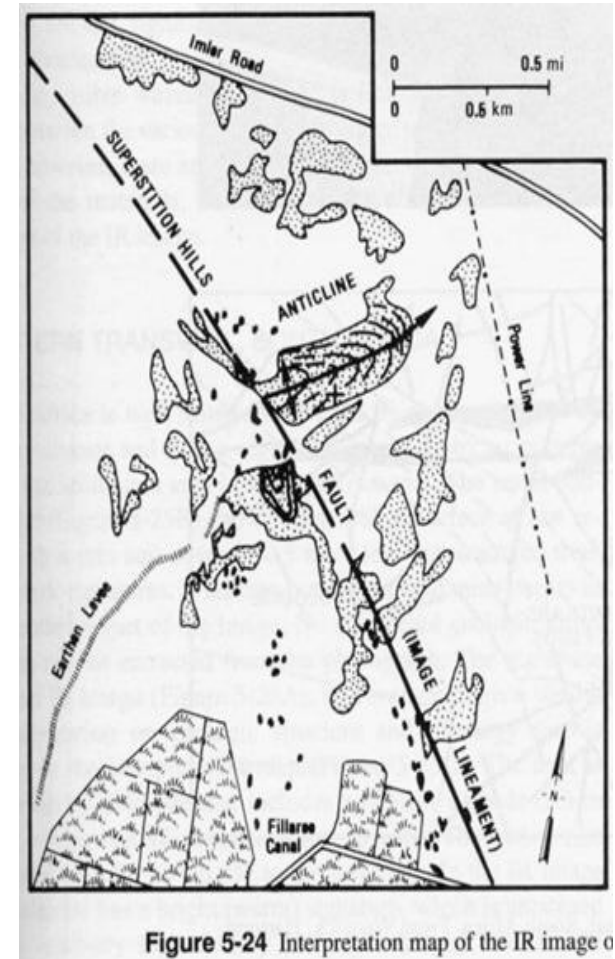
**Thermal Anomaly**



# Airborne Nighttime Thermal



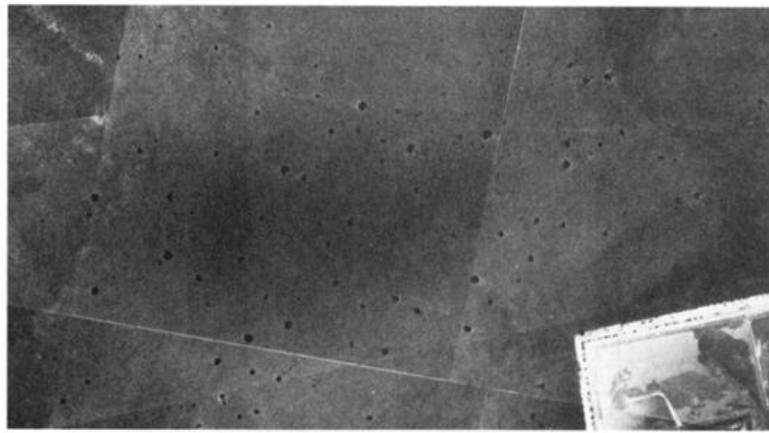
**Figure 5-23** Images of the Imler Road area, Imperial County, California. From Sabins (1969, Plate 1).



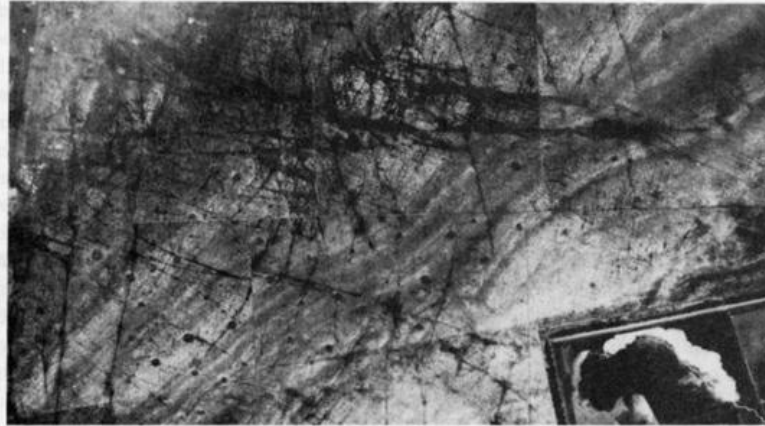
**Figure 5-24** Interpretation map of the IR image of



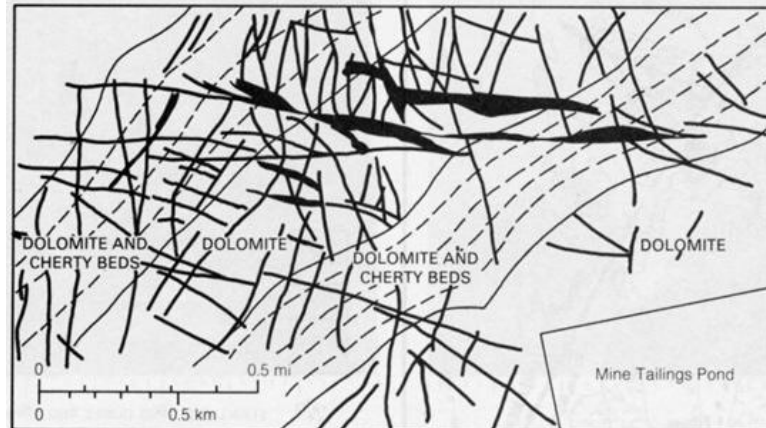
# Airborne Nighttime Thermal



B. Aerial photograph.



A. Nighttime thermal IR image (8 to 14  $\mu\text{m}$ ).



C. Interpretation map of thermal IR image.

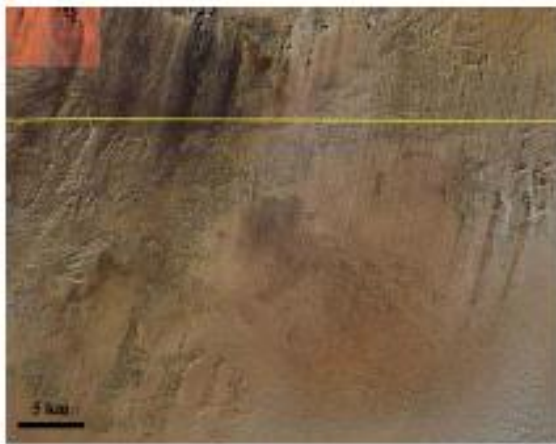
From: Floyd F. Sabins, 1997,  
Remote Sensing Principles and  
Interpretation: 3<sup>rd</sup> edition,  
Waveland Press, Inc.  
NY, 494 p.

(Dr. Sabins former Senior Research  
Scientist at Chevron (COFRC,  
La Habra, CA))

Stilfontein area, western Transvaal,  
South Africa. From Warwick,  
Hartopp, and Viljoen (1979, Figures  
8 and 9)

# Long Wavelength Radar in Arid Regions

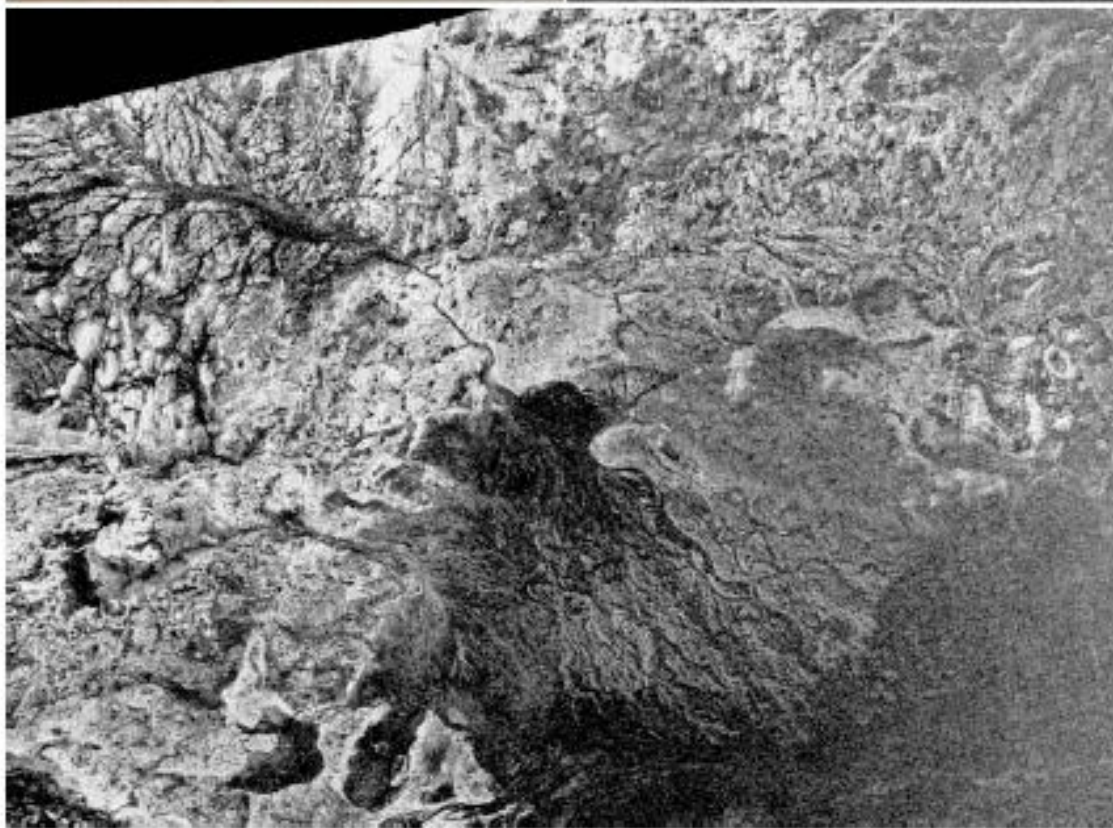
Landsat



Short Wavelength Radar (JERS-1)



Long Wavelength Radar (PALSAR)



Palou, 2009? CNES

EORC JERS-1  
PALSAR

Figure 3. Landsat (top left), JERS-1 (top right) and PALSAR image (bottom) of a region located around 21°55'N, 26°36'E. PALSAR much better reveals paleodrainage channels in the lower part of the scene (JAXA/METI ).



# Radar in Arid Regions

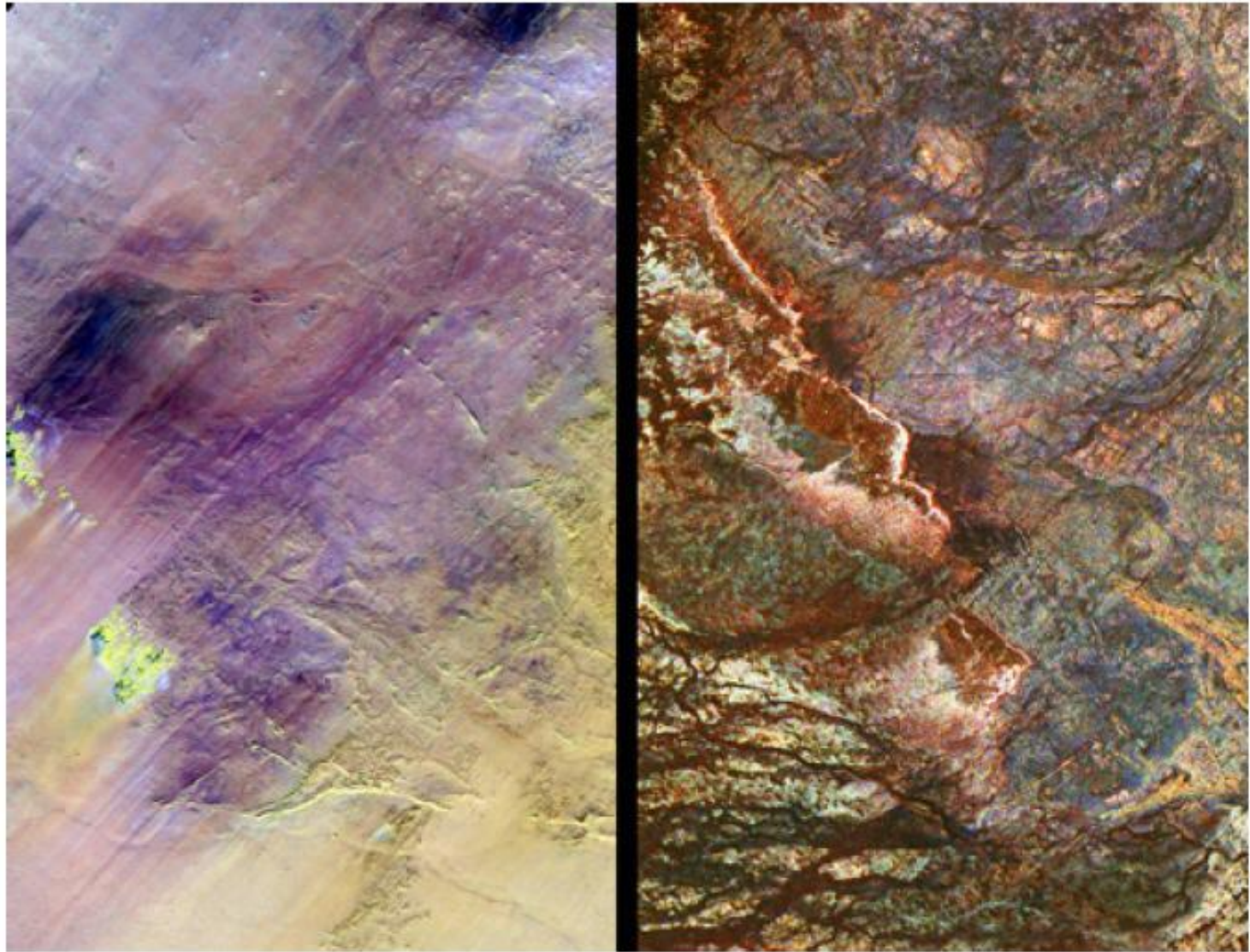


Figure 4. Example of penetrating thin sand cover with radar, Salsaf Oasis, Egypt. Left image: Landsat TM image. Right image: Spaceborne Imaging Radar SIR-C mission X-band radar.



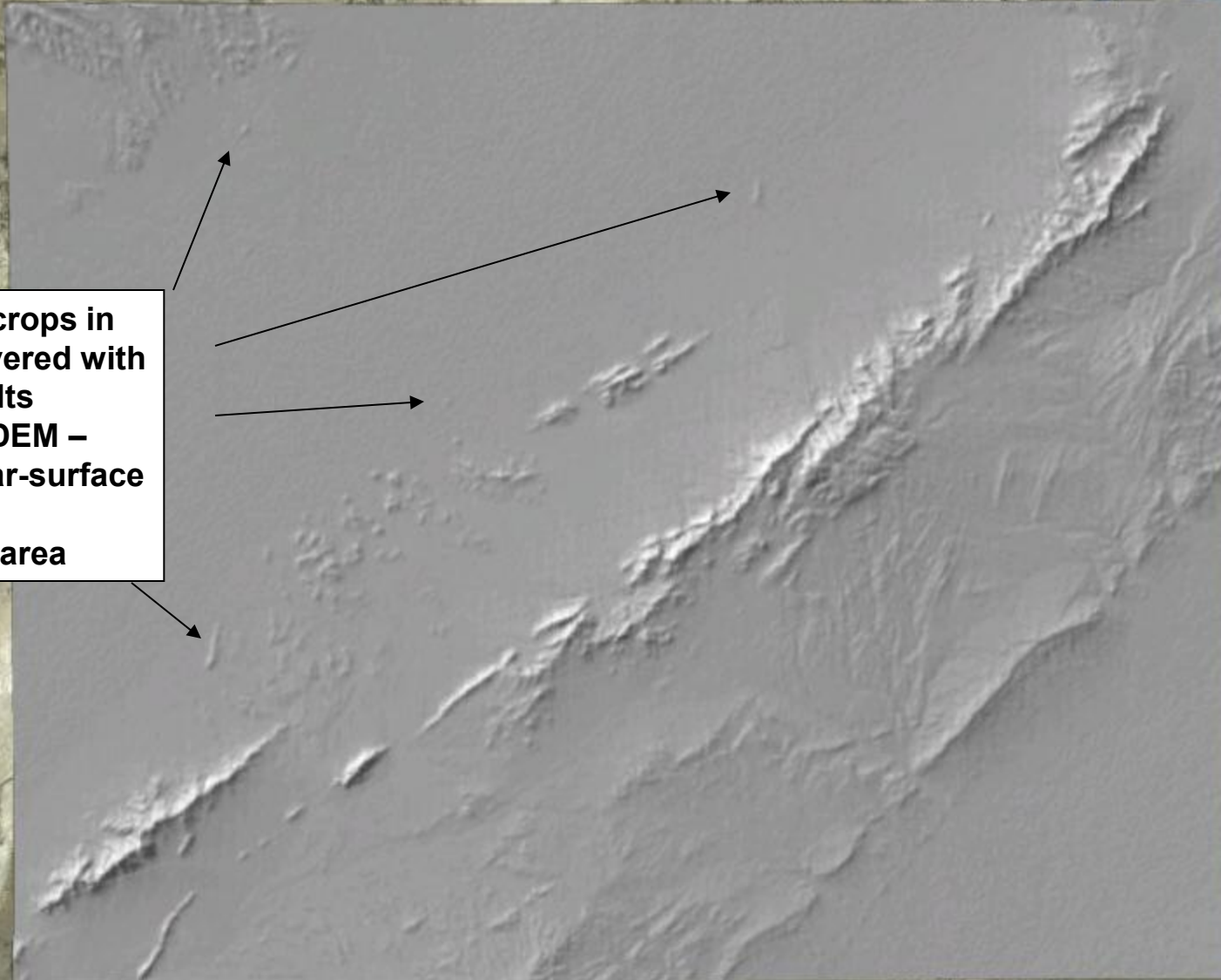
# Arid Region Example – GoogleEarth Image





## Arid Region Example – Hillshade DEM with outliers

**Bedrock outcrops in lowlands covered with sands and silts revealed by DEM – indicates near-surface bedrock in surrounding area**



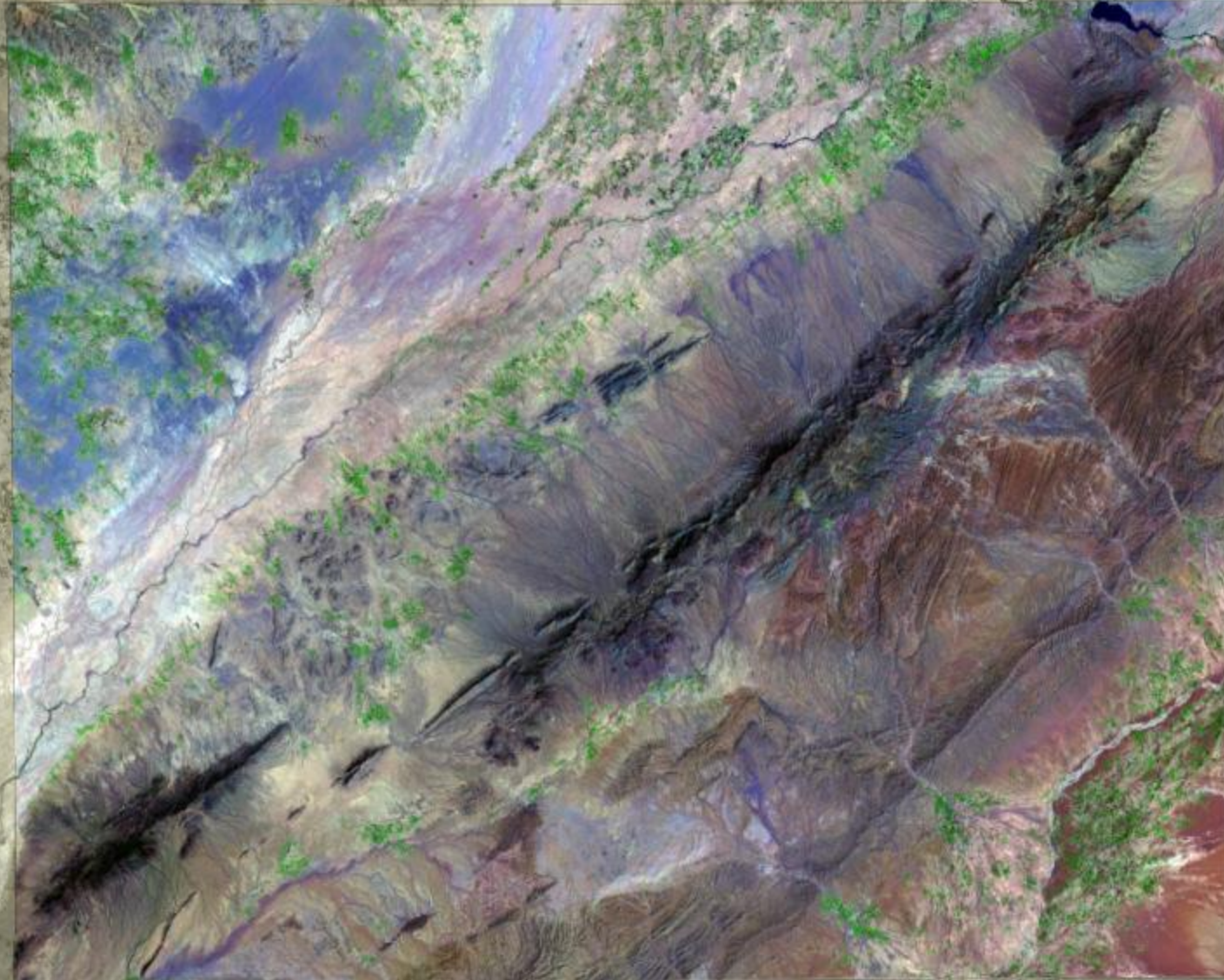
14.9 km

© 2013 Cnes/Spot Image

Google earth



## Arid Region Example – Enhanced Landsat Color Image



14.9 km

© 2013 Cnes/Spot Image

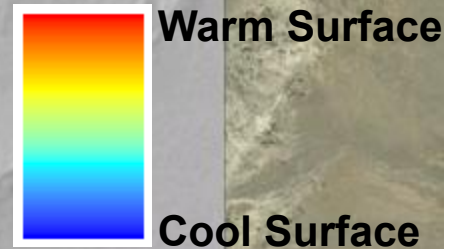
Google earth



## Arid Region Example – ASTER Thermal Image

Same outcrop pattern, but different thermal pattern – underlying bedrock depth different?

Same outcrop pattern, but different thermal pattern – underlying bedrock depth different?



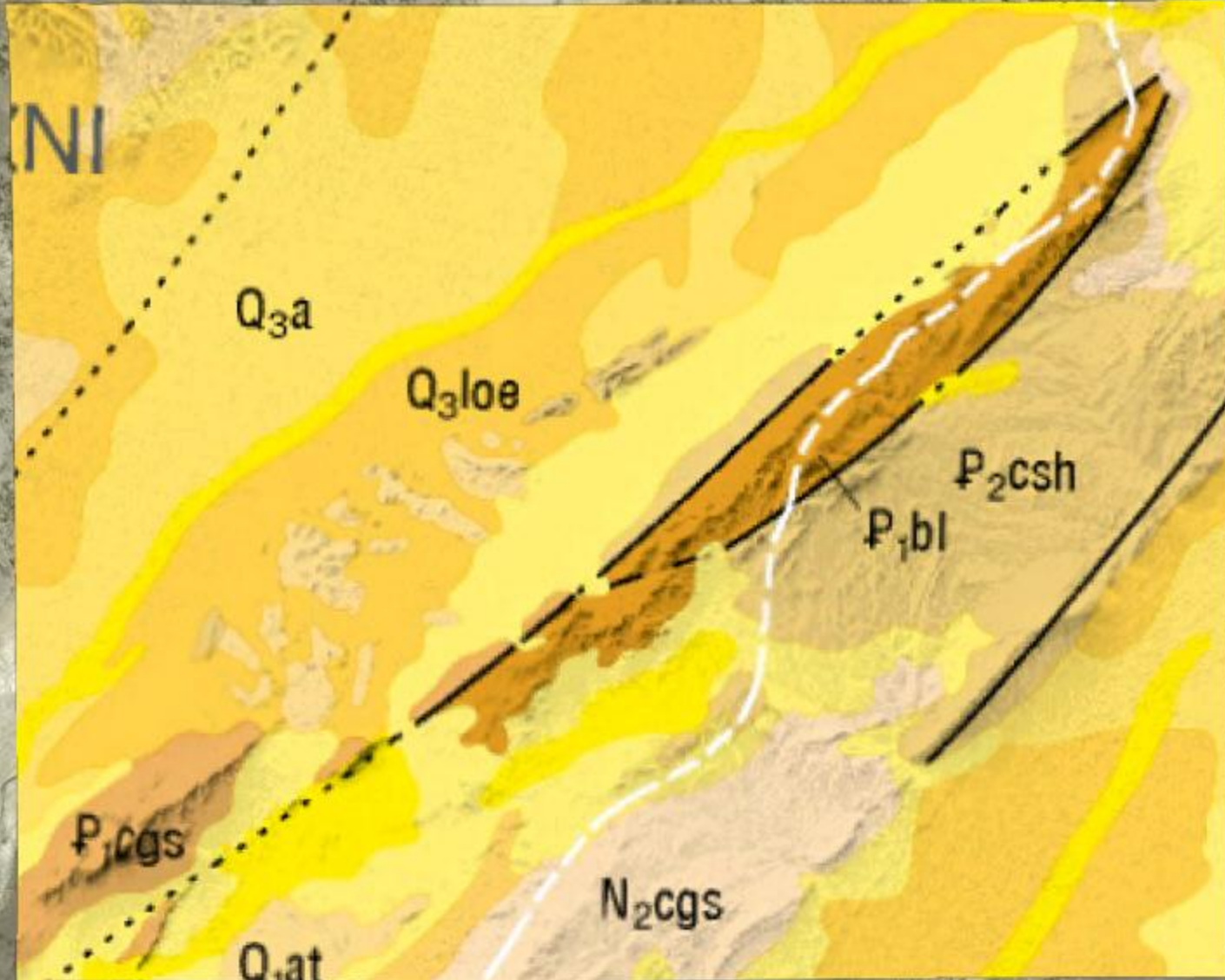
Cool rugged outcrops (shadows) with varying temperature in agricultural and lowland terrain – differences in groundwater, depth to bedrock, change in underlying bedrock?

14.9 km

© 2013 Cnes/Spot Image



# Arid Region Example – 1:250,000 Published Geologic Map



14.9 km

© 2013 Cnes/Spot Image

Google earth



# Arid Region Example – Landsat Data Processed for Spectral Patterns

**Similar Geology**

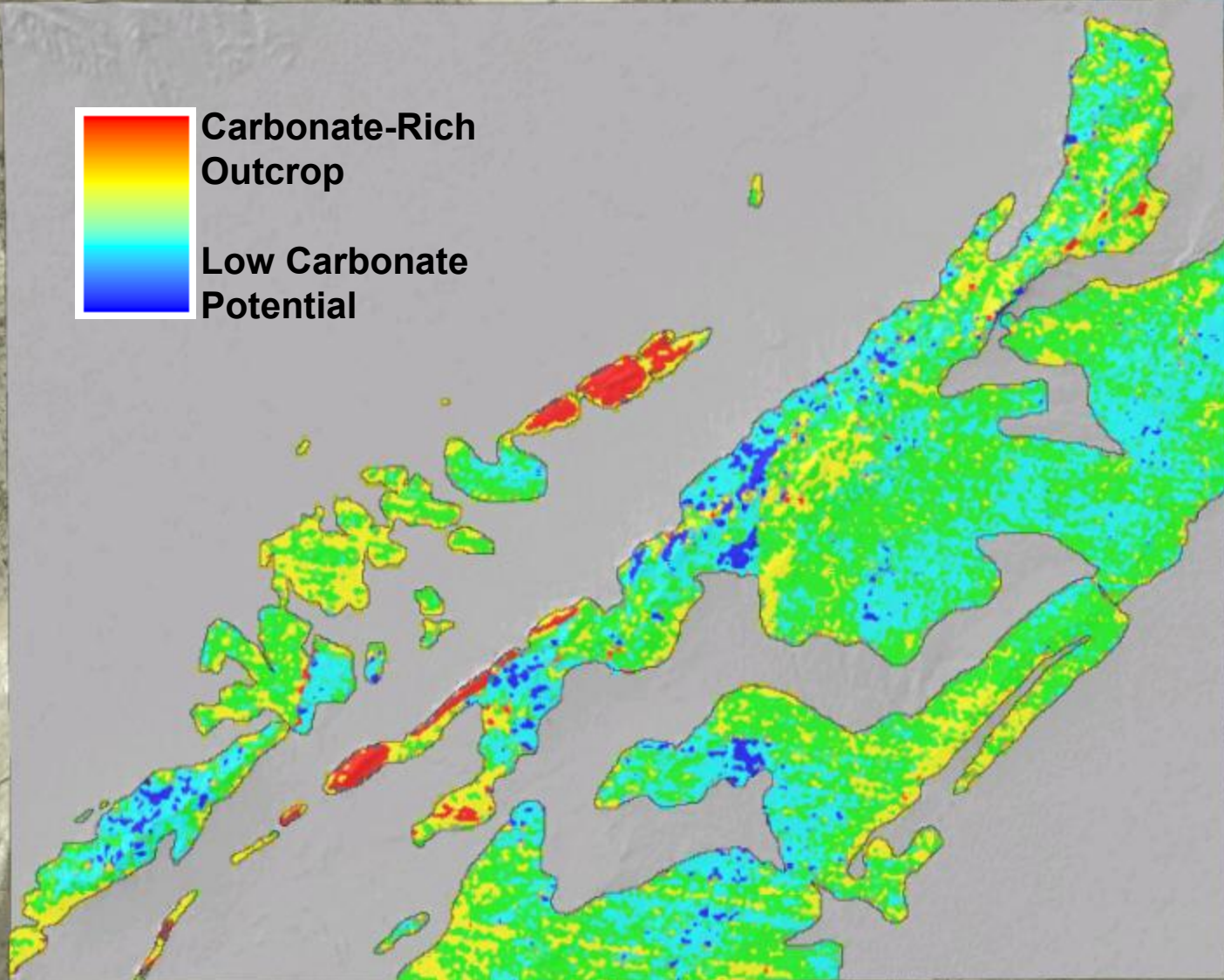
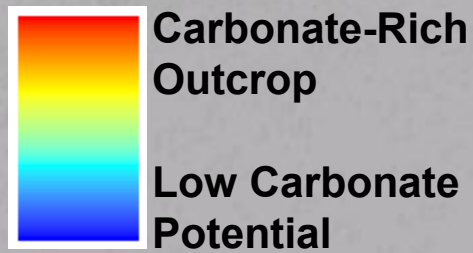
?

14.9 km

© 2013 Cnes/Spot Image

Google earth

# Arid Region Example – ASTER Thermal Processed for Mineralogy



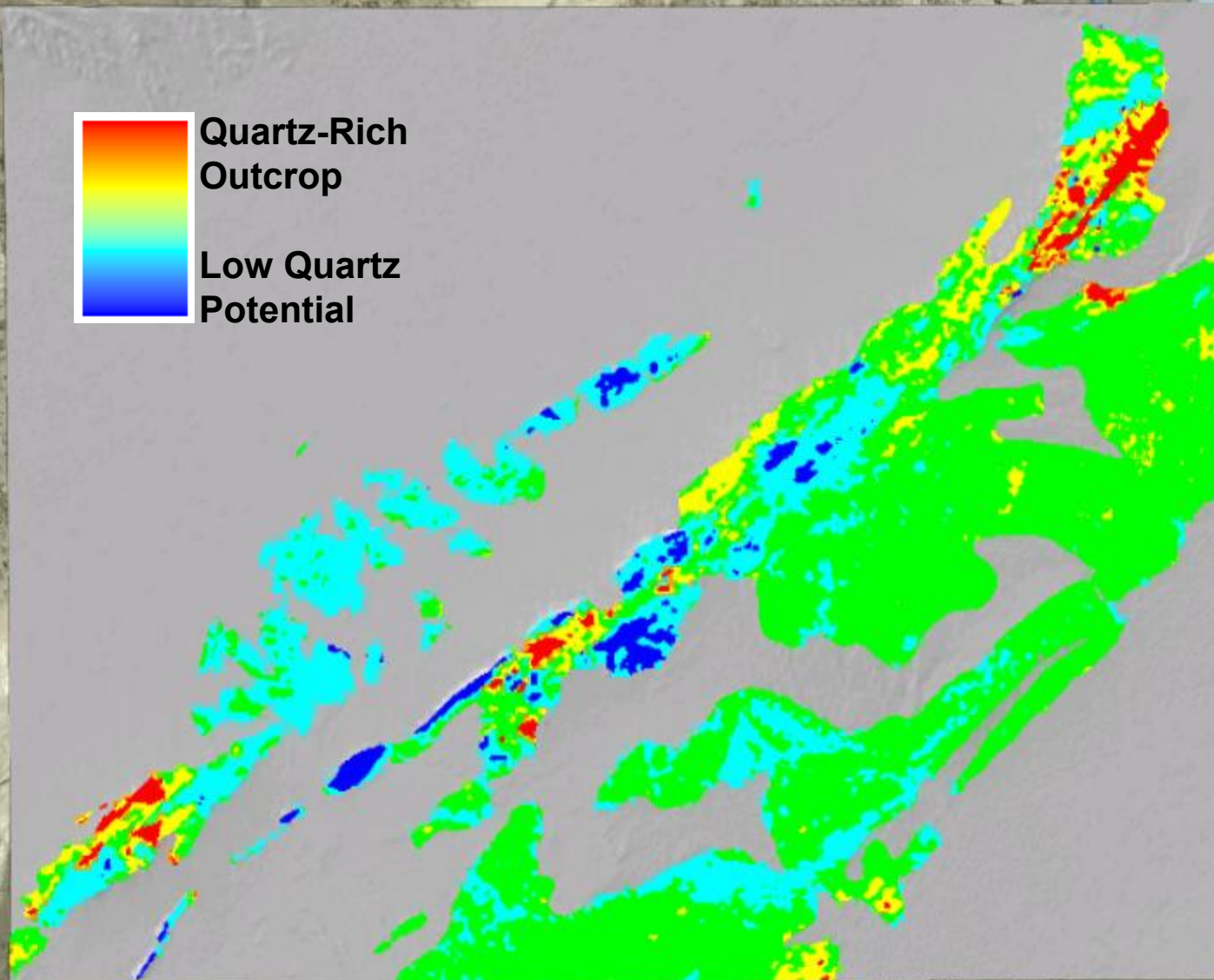
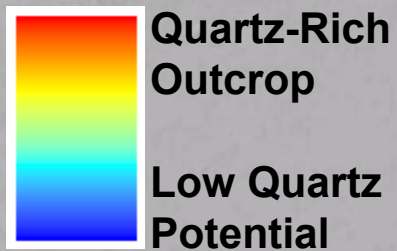
14.9 km

© 2013 Cnes/Spot Image

Google earth



# Arid Region Example – ASTER Thermal Processed for Mineralogy

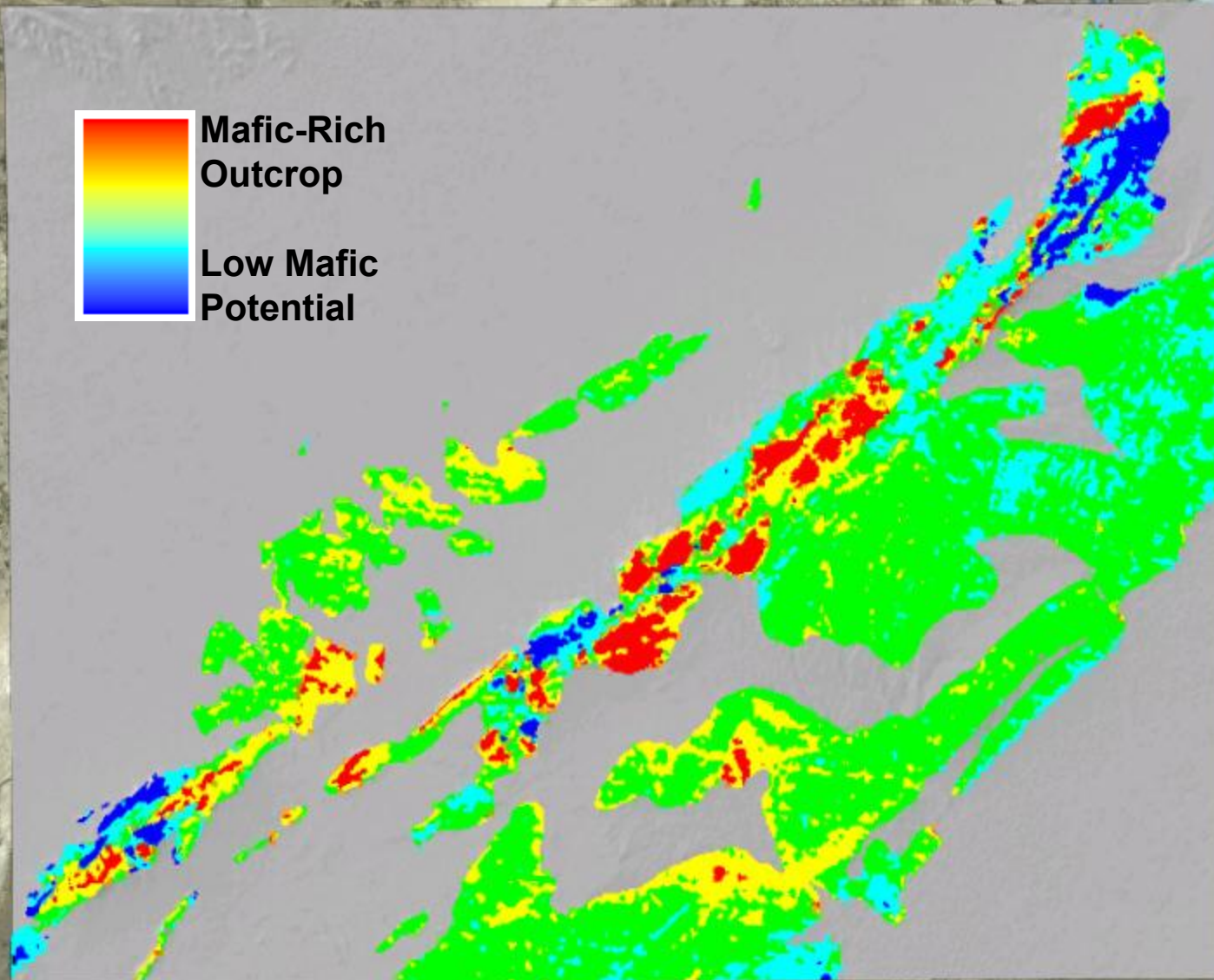
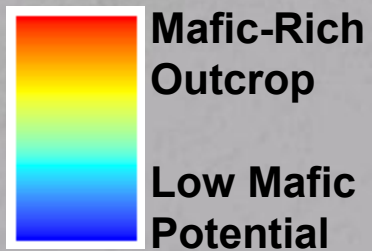


14.9 km

© 2013 Cnes/Spot Image

Google earth

# Arid Region Example – ASTER Thermal Processed for Mineralogy



14.9 km

© 2013 Cnes/Spot Image

Google earth