Multispectral imaging

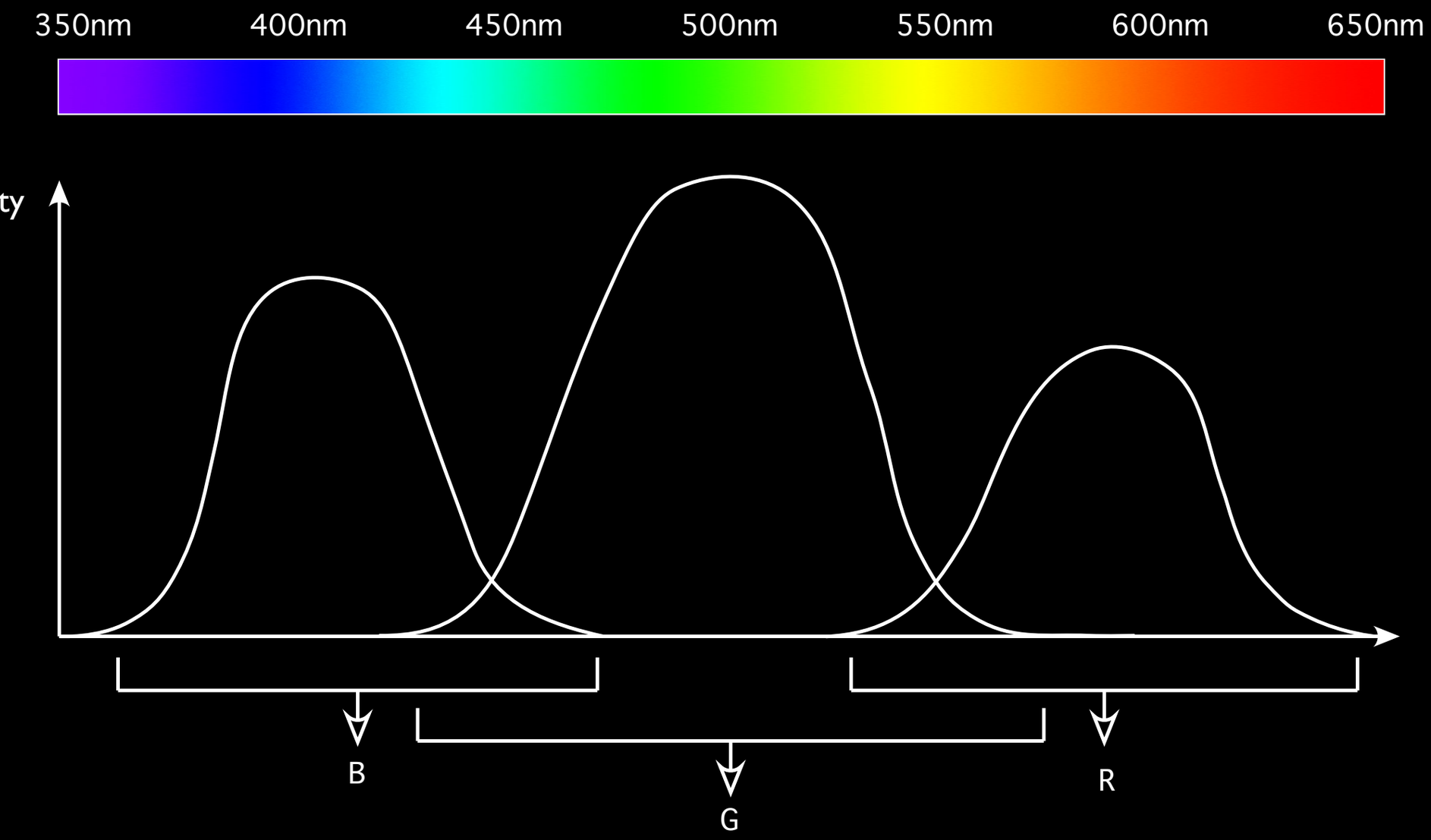
Rock art is often very obvious and interesting

Other times less so

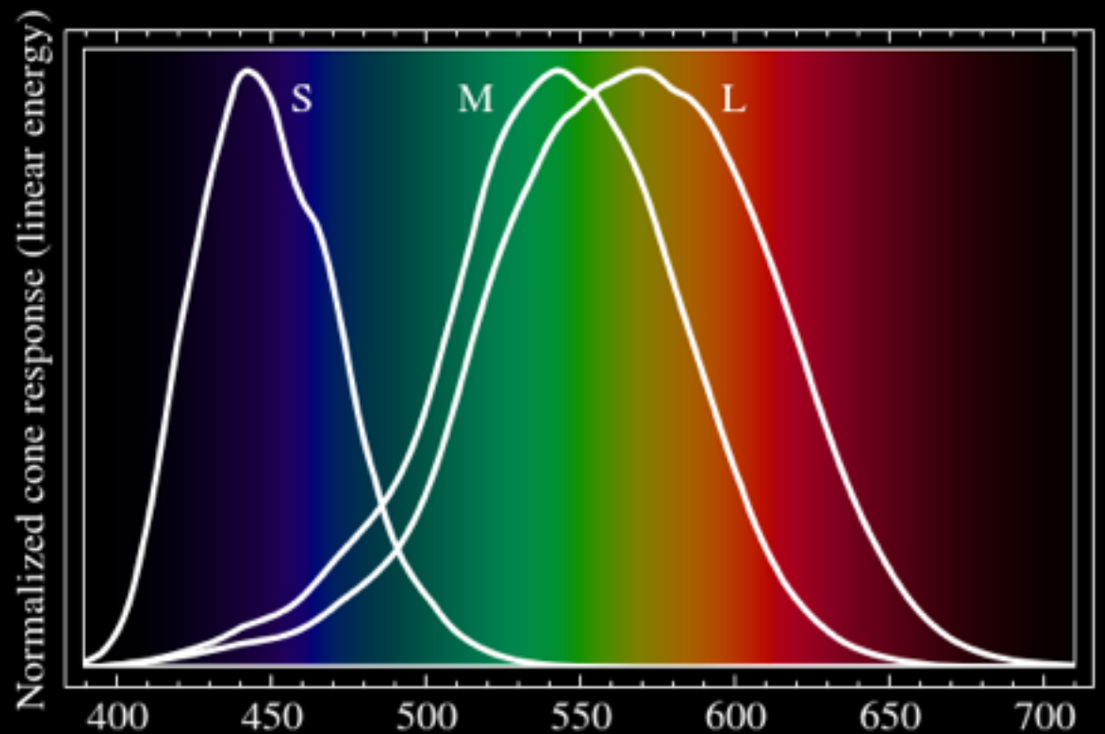
iVEC @UWA

Concept

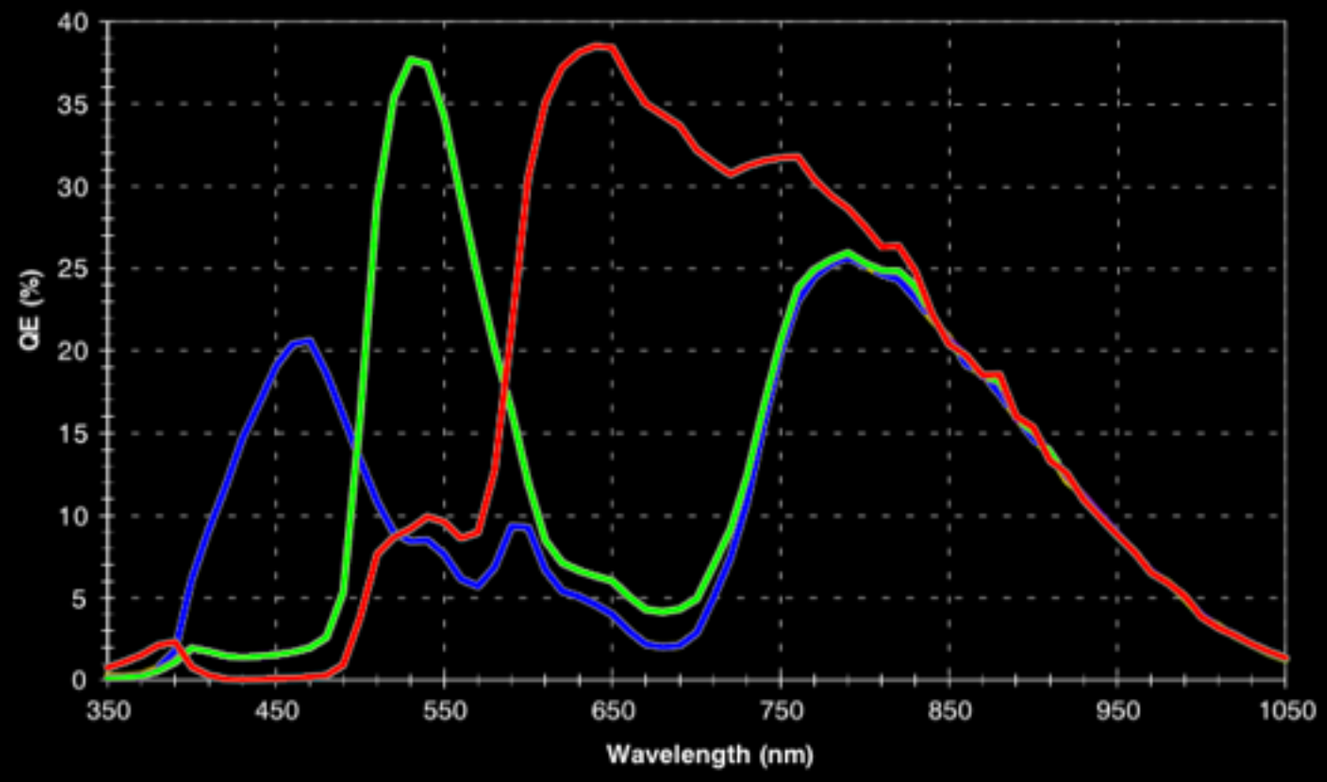
- A normal photograph is throwing away a huge amount of information.
- The energy across a range of wavelengths is being (weighted summed) into just 3 numbers, single R,G,B values.
- Can imagine materials that reflect strongly in different wavelengths but appear to be the same colour.



- Most SLR cameras use a Bayer filter, each RGB filter has it's own response curve.
- Also applies to the human eye which has cones that respond to different wavelength bands.



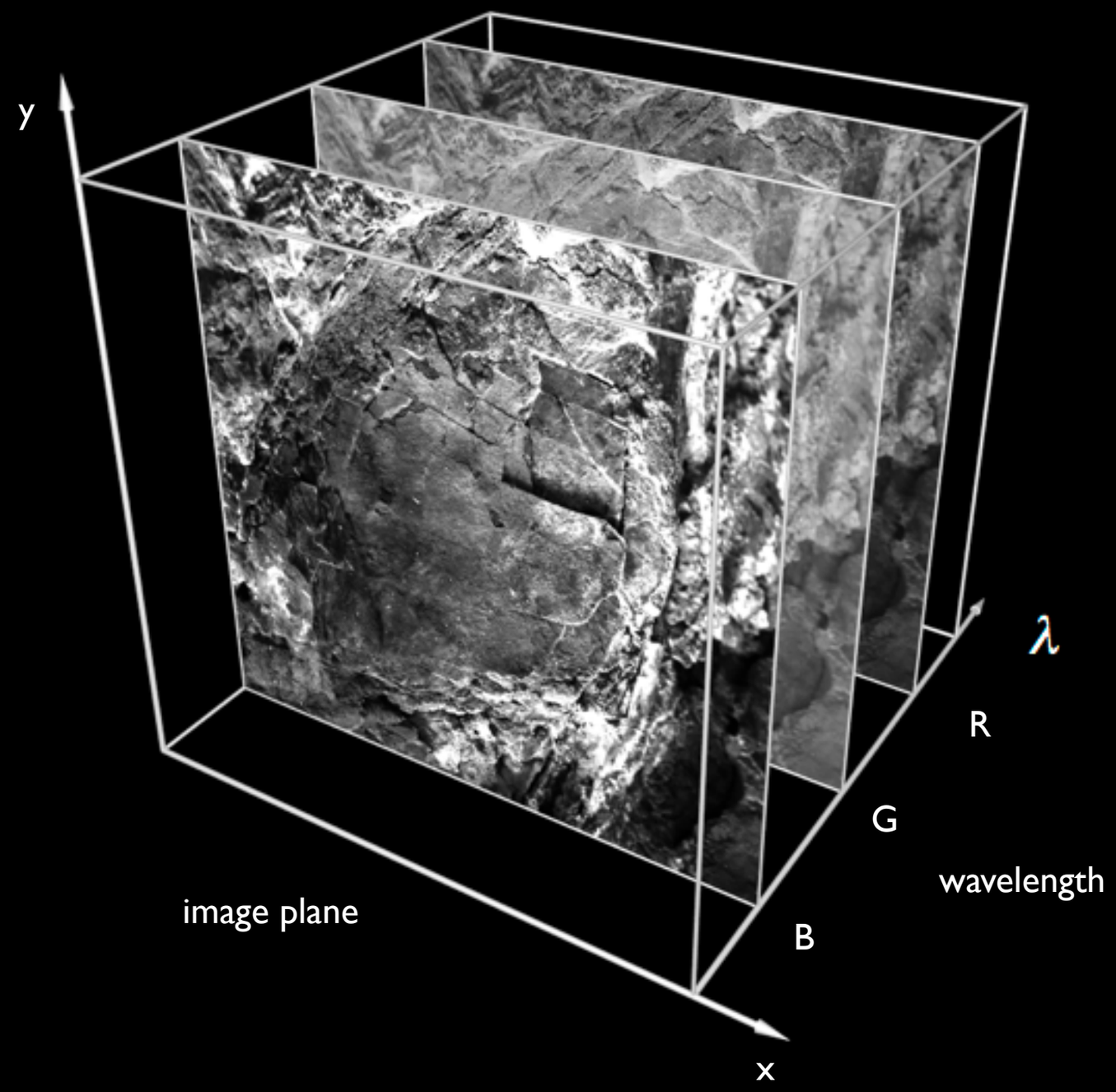
Human visual system, response of cones



CMOS sensor with standard RGB Bayer filters

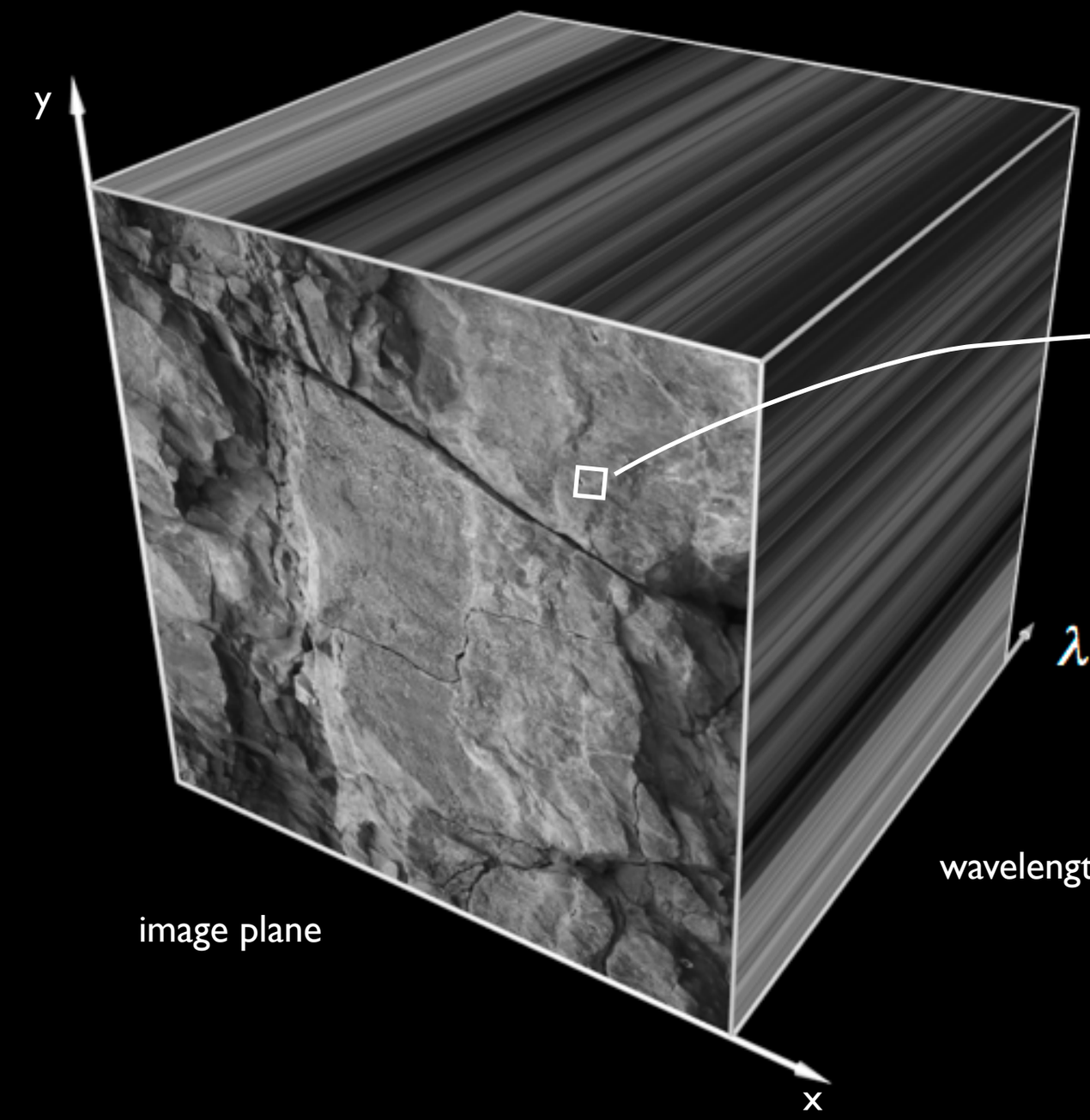
Image cube (x,y,λ)

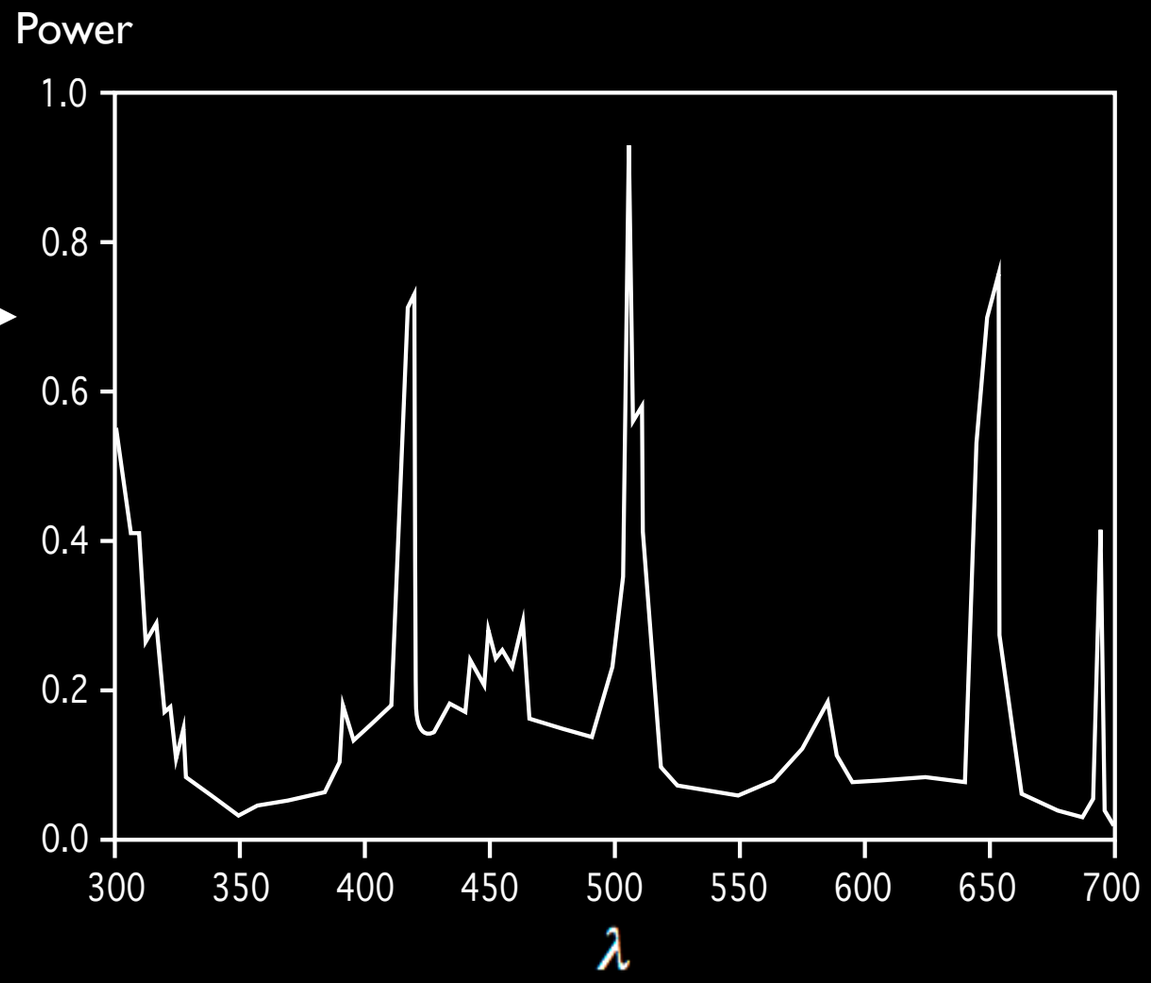
Hand print, West Angeles rock shelter.



“Continuous” wavelength multispectral cameras

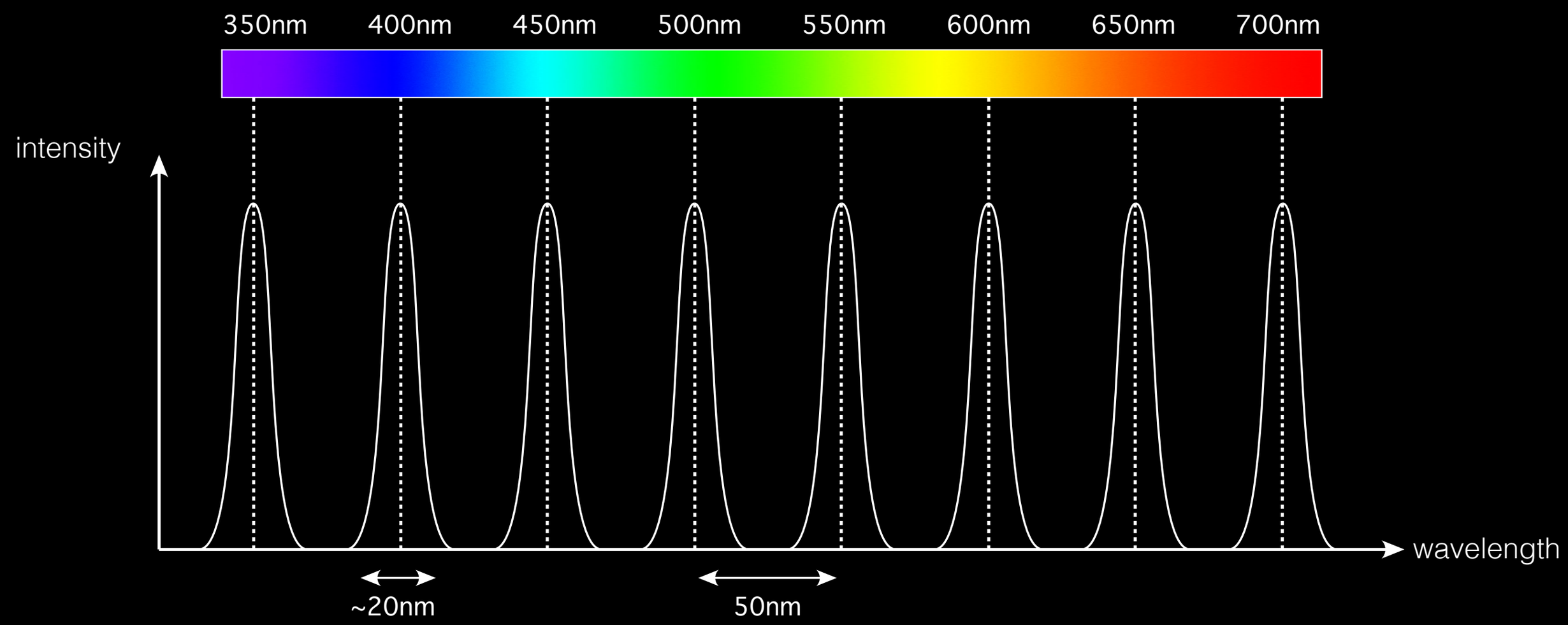
- Generally a line scan camera + a diffraction grating, or similar wavelength splitting device.
- See also “pushbroom” multispectral cameras.
- Increasingly being used in the mining industry with mineral signature databases.



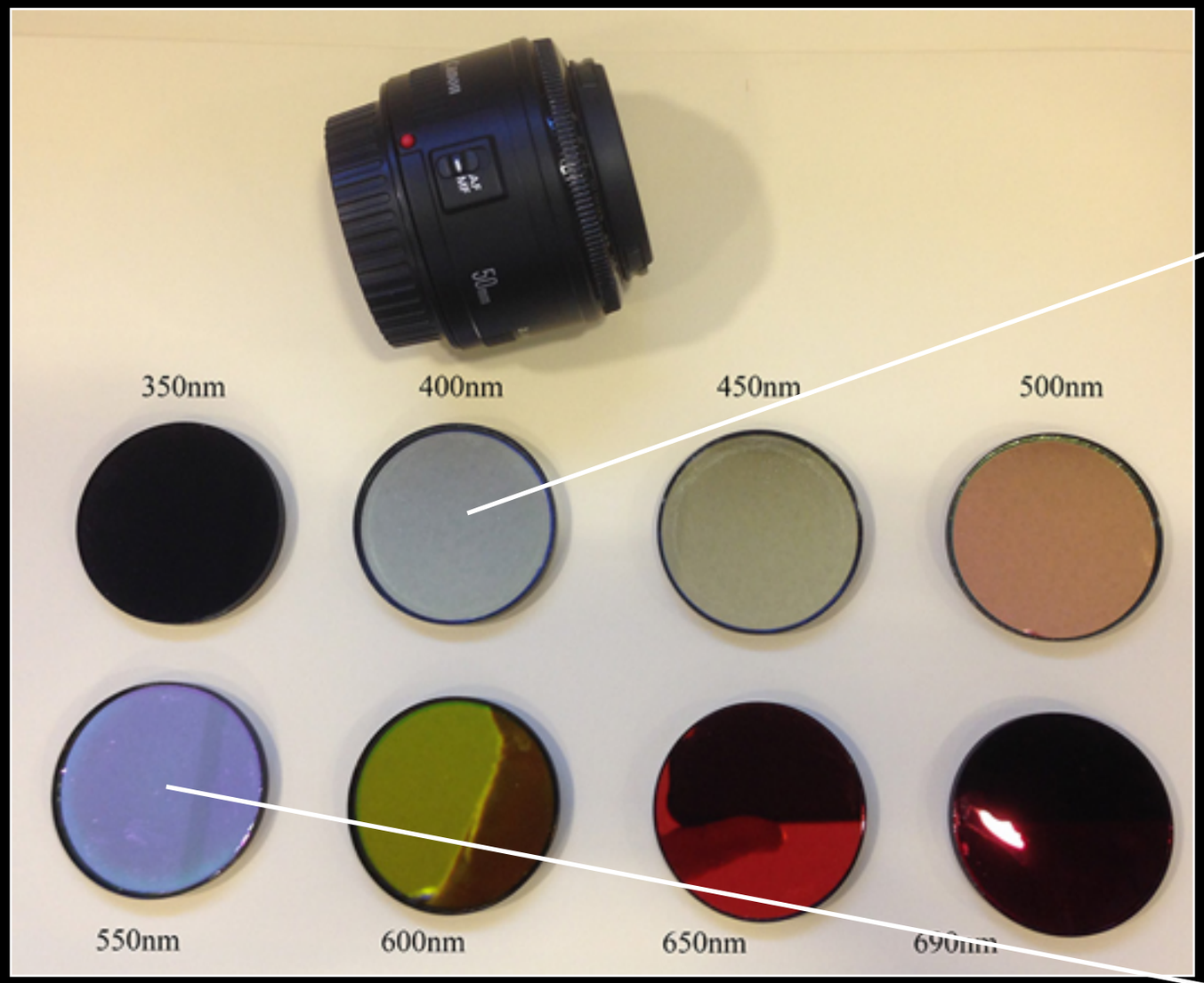


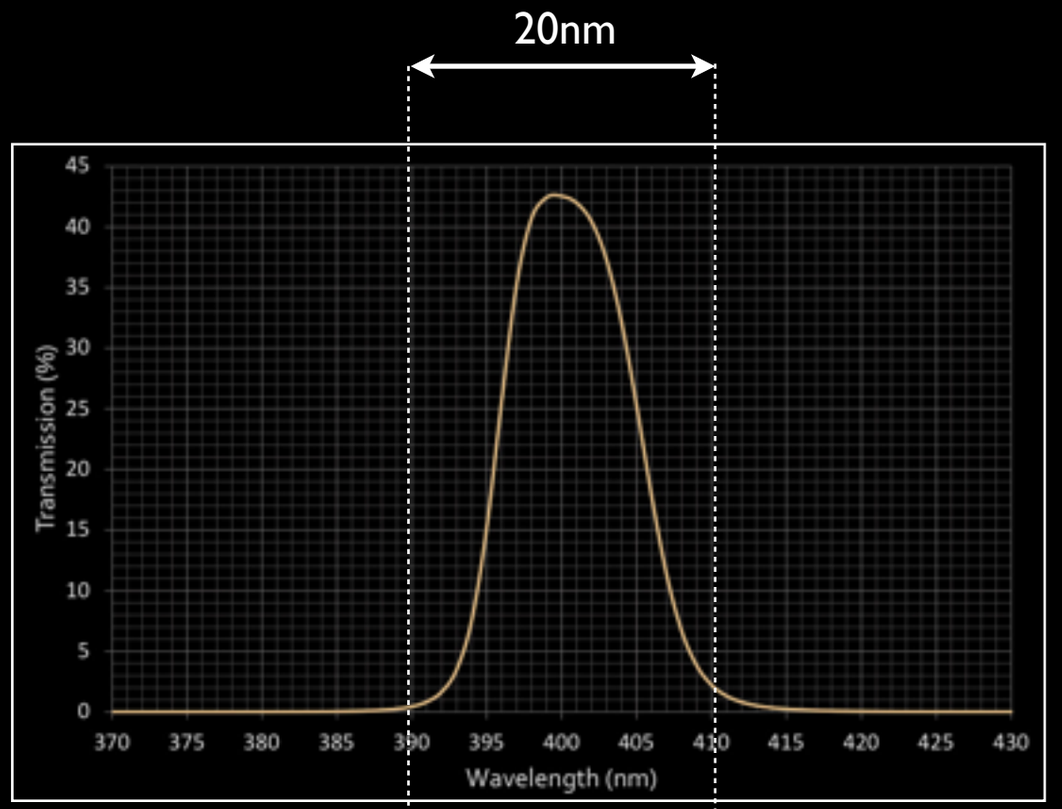
Low cost alternative

- Capture narrow wavelength ranges.
- For this initial experiment used 8 interference bandpass filters across the visible range. 350nm to 700nm.
- Filter banks 50nm apart and 20nm wide.



8 interference bandpass filters





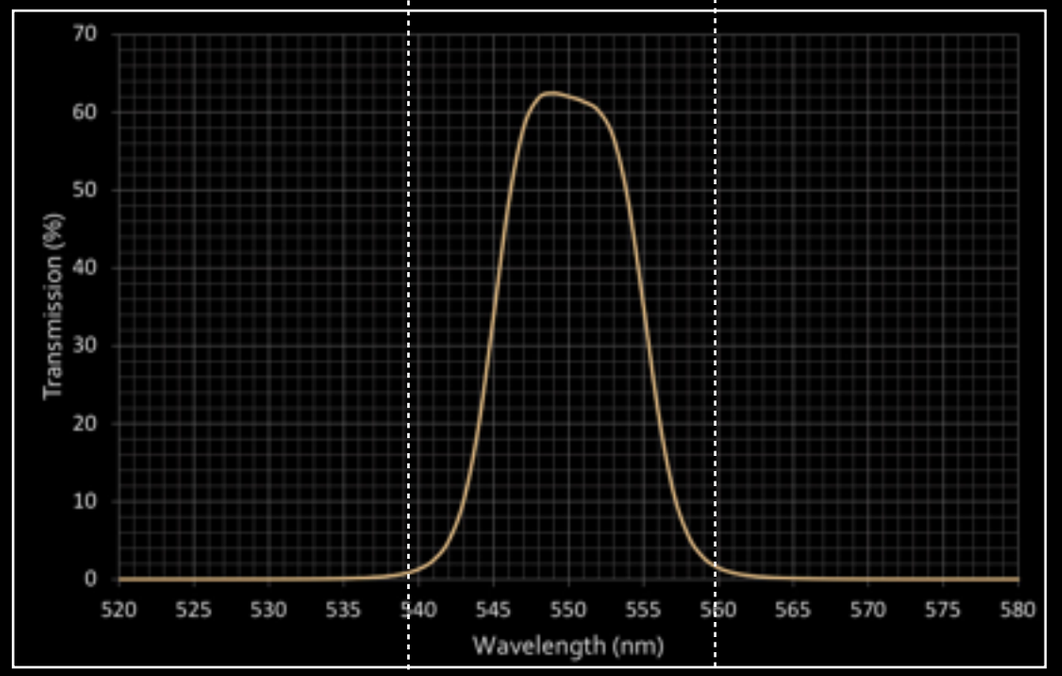
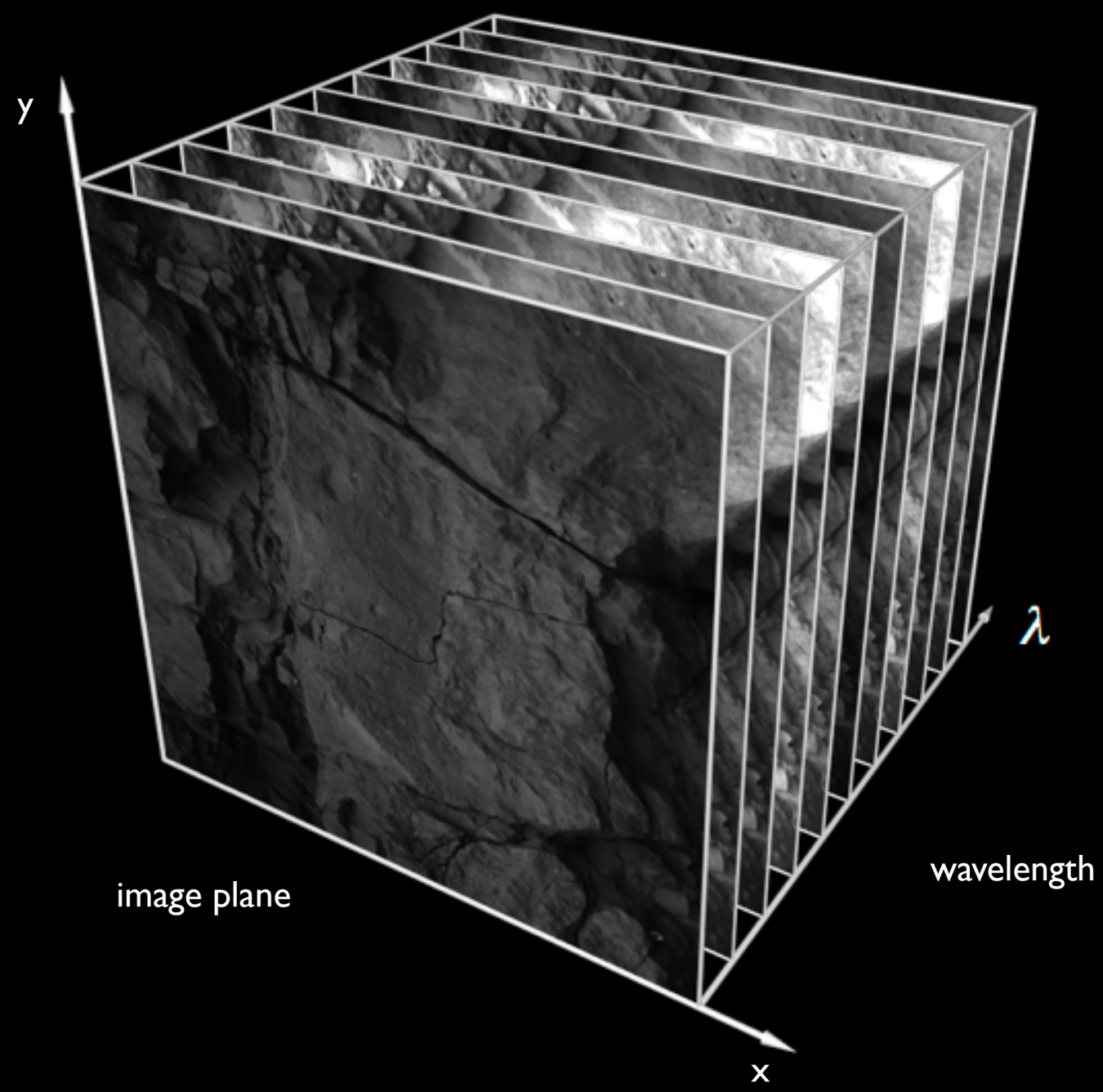
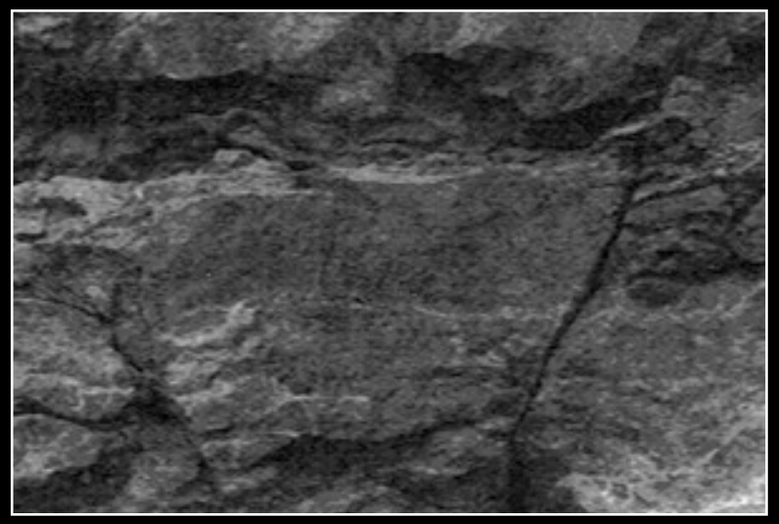


Image cube (x,y,λ)



Example



400nm

450nm

500nm

550nm

600nm

650nm

- Might imagine multiplying 500nm and 550nm and subtracting 650nm.
- Note that here we are interested in identification, much of multispectral imaging is more about quantitative analysis.

Future work

- Demonstrated the potential with two of three images from the West Angeles rock shelters.
- Next test will be 16 filters and a more convenient means of changing filters.
- Develop algorithms to optimally combine slices to identify features.
- Employ higher dynamic range B/W camera.
  Avoid multiplicative response curves of Bayer filter.