Mapping mineralogical and structural relationships with satellite-borne ASTER and airborne geophysics at Broken Hill

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2 ERMapper, Perth

Objectives

- To describe the characteristics of the recently launched satellite-borne ASTER sensor

- Investigate the mapping potential of satellite-borne ASTER and airborne geophysical data to map compositional and structural elements of Broken Hill

ASTER

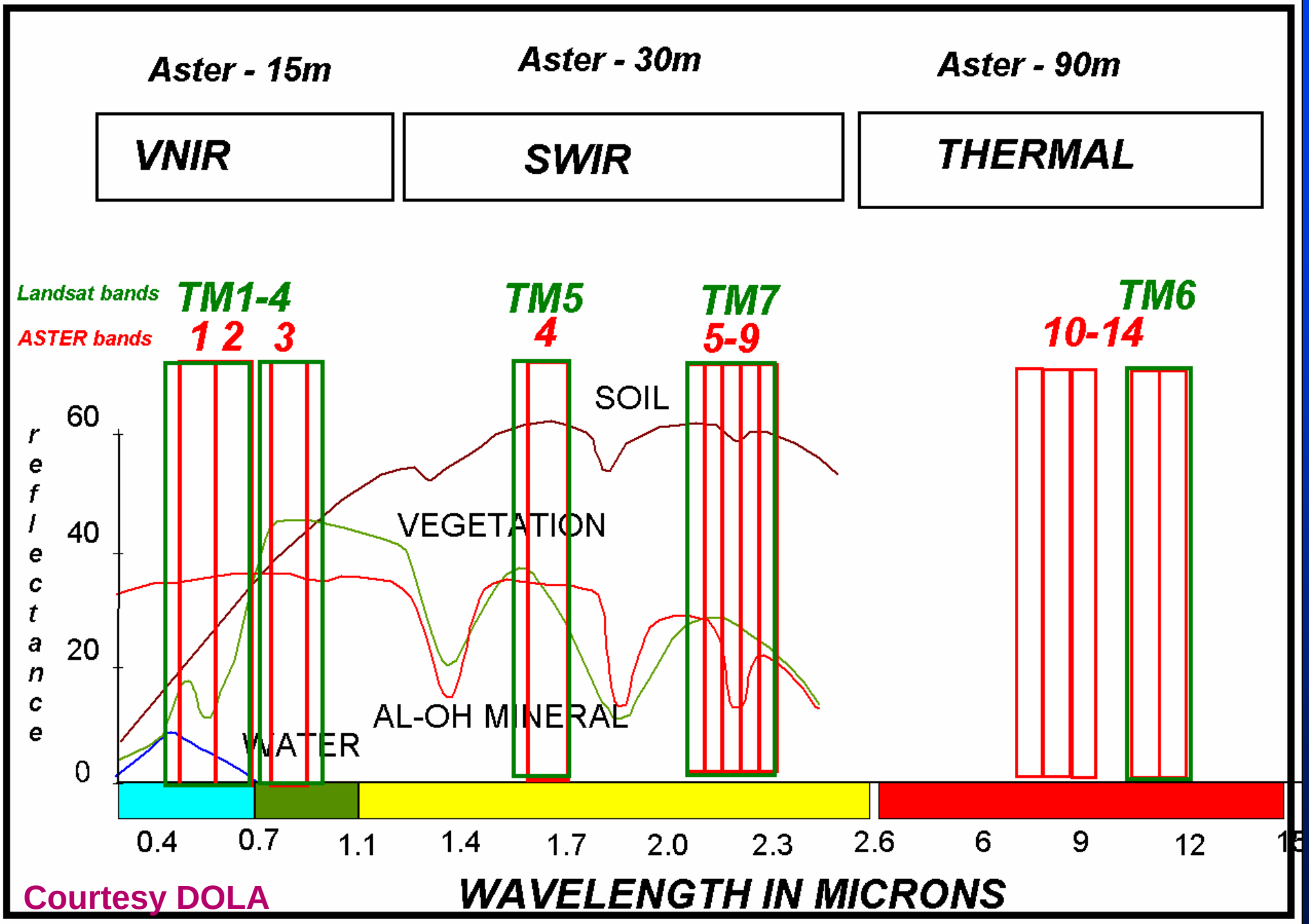
Advanced Spaceborne Thermal Emission and Reflection Radiometer

ASTER Orbit Parameters

Platform	Terra
Orbit	Sun Synchronous Descending Node
Time of Day	10:30 am
Altitude	705 km
Inclination	98.2^{o}
Repeat Cycle	16 days (+)

ASTER Instrument

- Advanced Spaceborne Thermal Emission and Reflection Radiometer
- launched December 1999 with planned five year life (extended to possibly 6-10 years)
- Joint Japan/US effort
- 60 km swath
- Not specifically multi-temporal (best acquisitions)
- 15 m visible-near infrared (VNIR)
- 30 m Shortwave infrared (SWIR)
- 90 m Thermal infrared (TIR)



Courtesy DOLA

Geometric accuracy of ASTER products

Intra-Telescope Registration : VNIR, SWIR, TIR < 0.1 pixels

[Pixel = image or "grid" cell]

Inter-Telescope Registration : SWIR vs VNIR < 0.2 pixels

TIR vs VNIR < 0.2 pixels

Stereo Pair System Error : Band 3B vs Band 3N < 0.2 pixels

Pixel Geolocation Error : Relative < 15 m

Absolute < 50 m

(Fujisada-san, Jan. 2000)

Useful Web Addresses

- http://terra.nasa.gov/
- http://asterweb.jpl.nasa.gov/
- http://earthobservatory.nasa.gov/

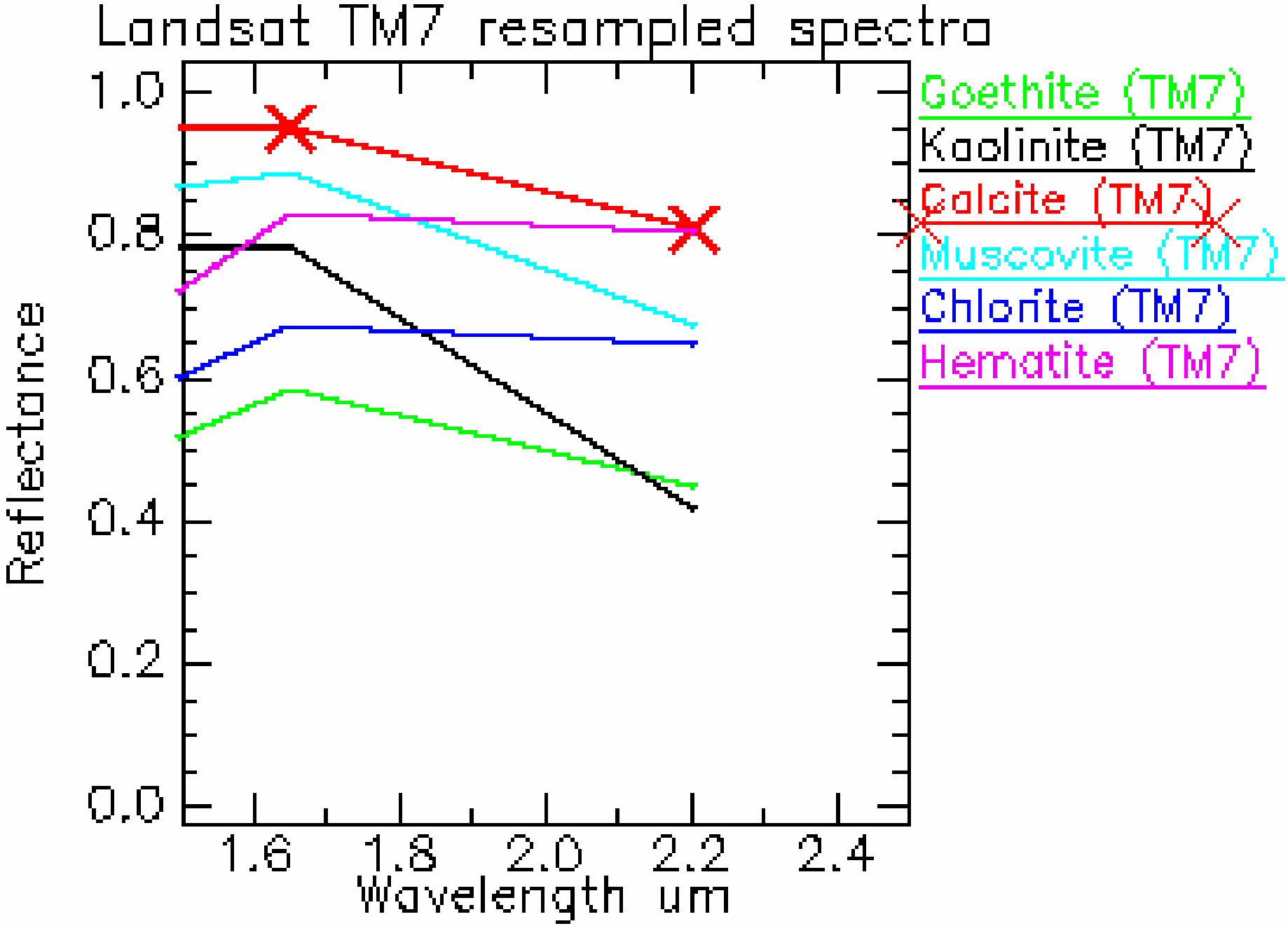
Data orders :

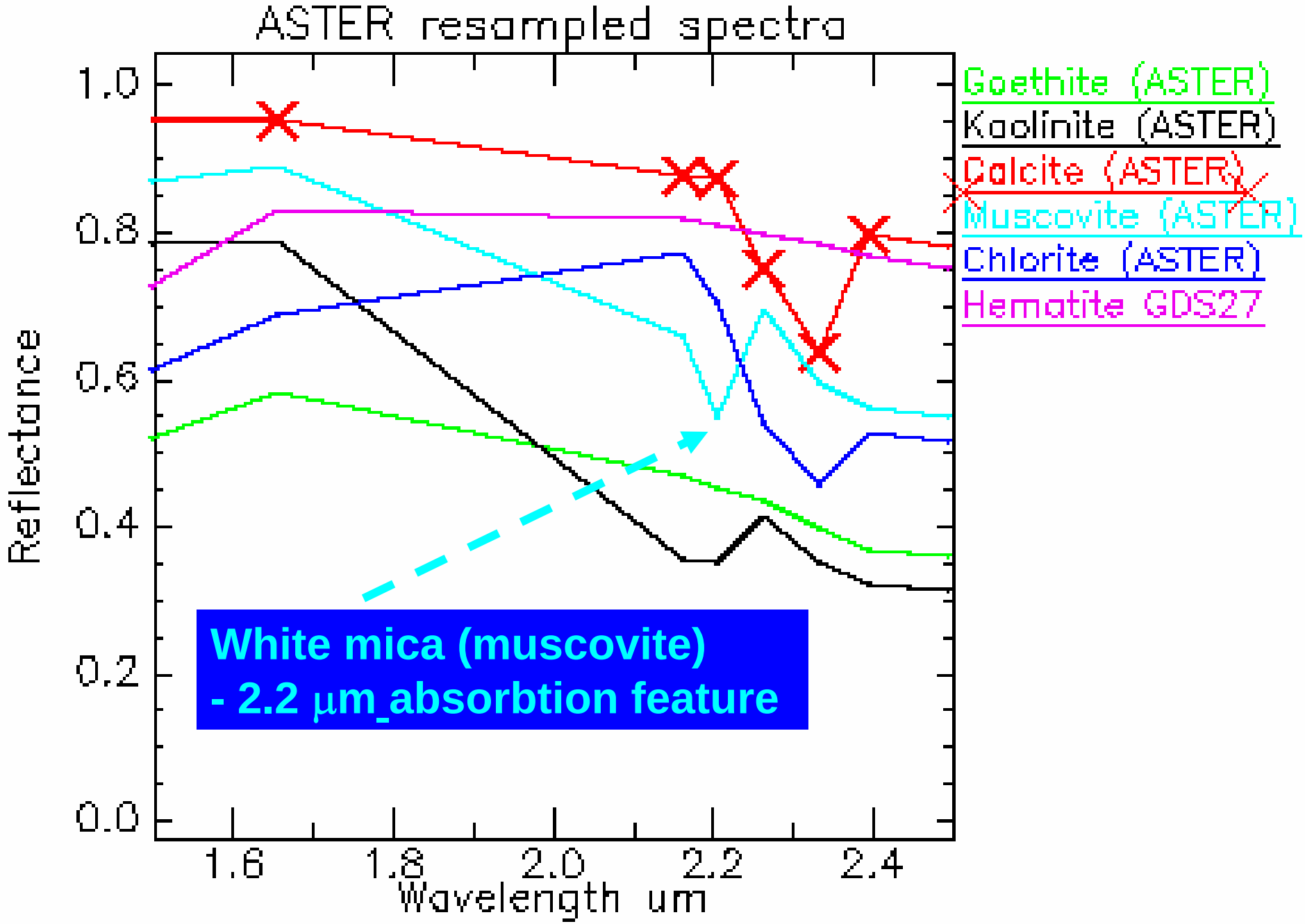
US/EDC:

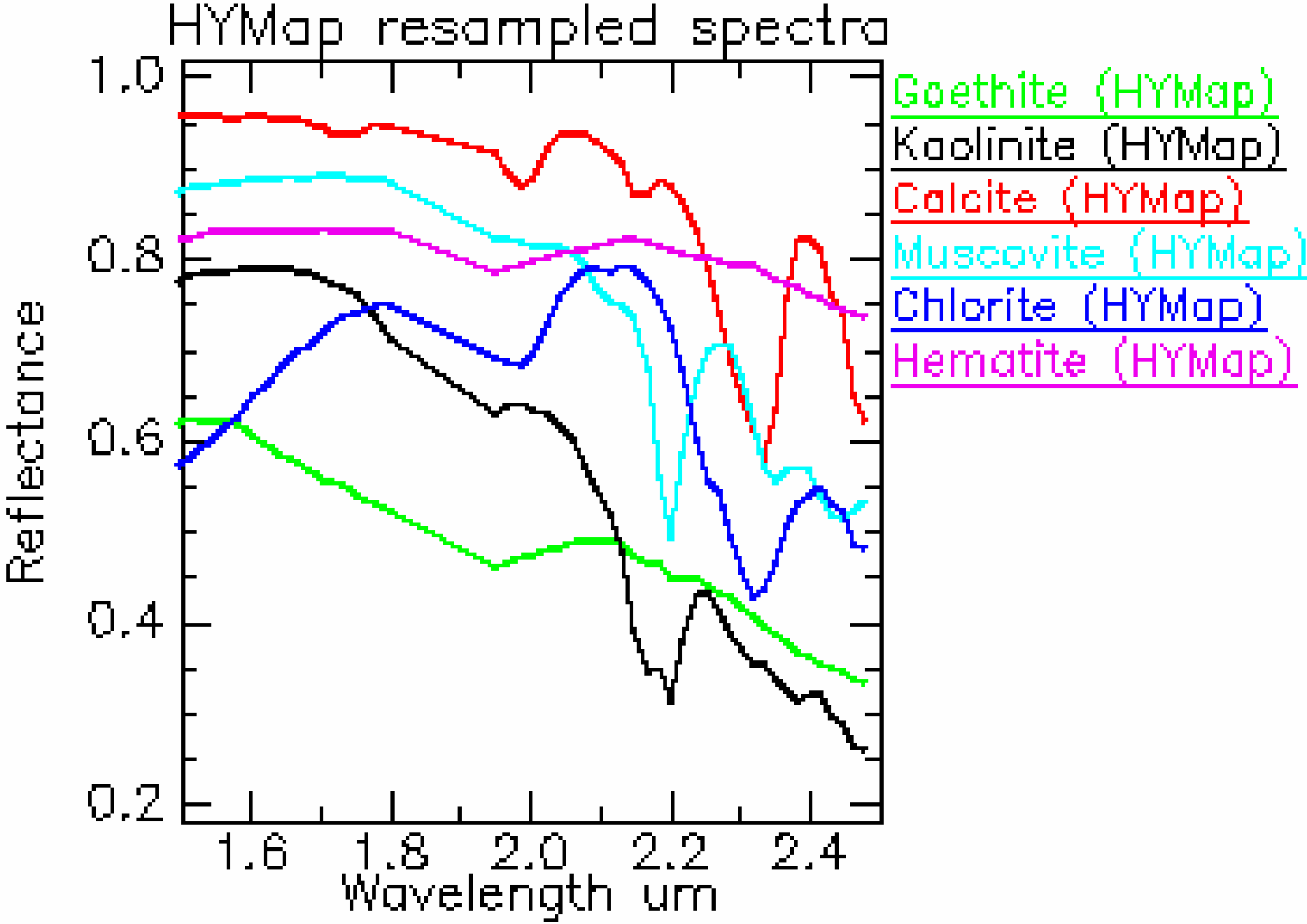
- http://asterweb.jpl.nasa.gov/gettingdata/

Japan/GDS:

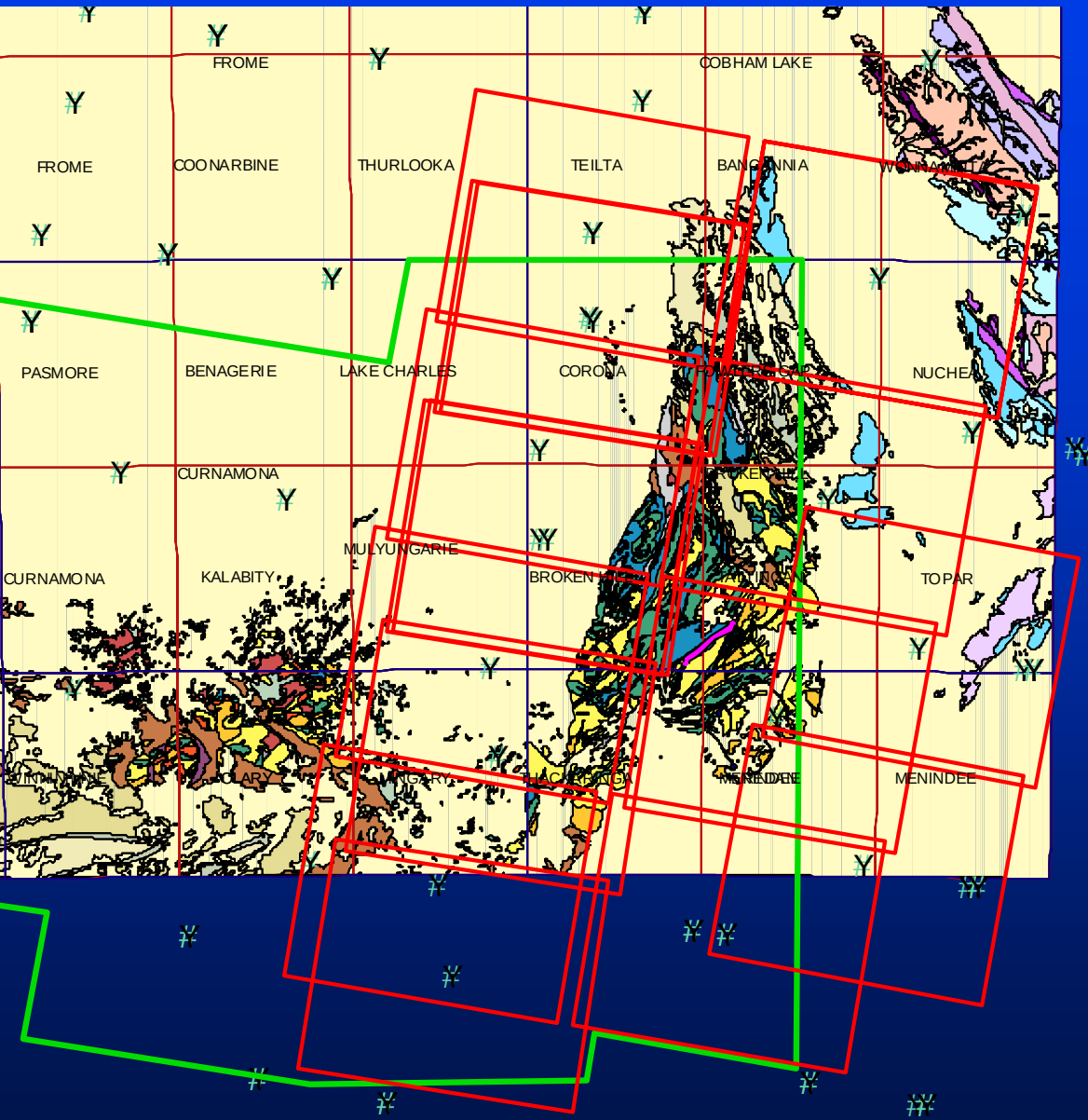
- http://www.ersdac.or.jp/eng/index.E.html


Landsat TM7 resampled spectra
Reflectance
1.0
0.8
0.6
0.4
0.2
0.0
1.6
1.8
2.0
2.2
2.4
Wavelength um
Goethite (TM7)
Kaolinite (TM7)
Calcite (TM7)
Muscovite (TM7)
Chlorite (TM7)
Hematite (TM7)


ASTER resampled spectra
Reflectance
1.0
0.8
0.6
0.4
0.2
0.0
1.6
1.8
2.0
2.2
2.4
Wavelength um
Goethite (ASTER)
Kaolinite (ASTER)
Calcite (ASTER)
Muscovite (ASTER)
Chlorite (ASTER)
Hematite GDS27
White mica (muscovite)
- 2.2 µm absorbtion feature


HYMap resampled spectra
Reflectance
1.0
0.8
0.6
0.4
0.2
1.6
1.8
2.0
2.2
2.4
Wavelength um
Goethite (HYMap)
Kaolinite (HYMap)
Calcite (HYMap)
Muscovite (HYMap)
Chlorite (HYMap)
Hematite (HYMap)

Broken Hill ASTER



PIRSA Curnamona ASTER Project

Entire Study Area ____

Technical Study ASTER scenes ___

PIRSA's ASTER library scene centres ⊙

Curnamona GIS and 100 k map sheets (30'x30')

BH lode ___

Broken Hill ASTER

Part of CRC PMD & Glass Earth Curnamona Projects
- integration with geophysics / geochemistry

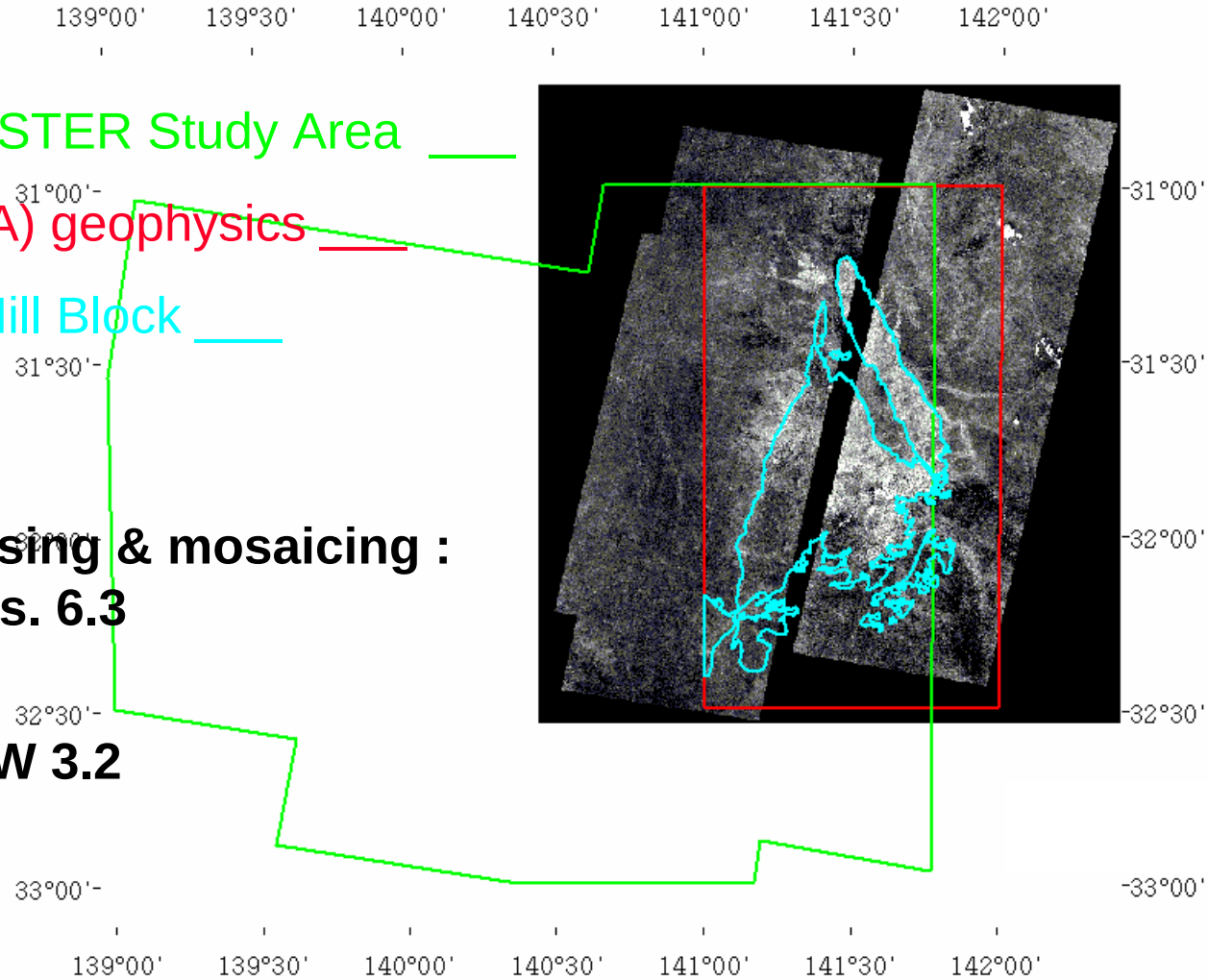
PIRSA ASTER Study Area ___

BHEI (GA) geophysics ___

Broken Hill Block ___

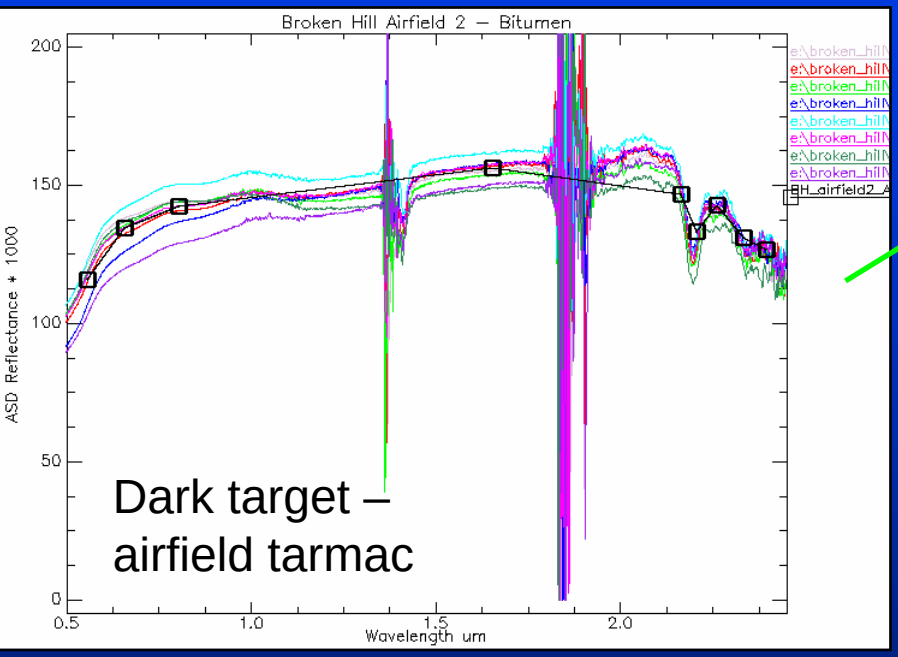
Tools
- Processing & mosaicing :
ERM vers. 6.3

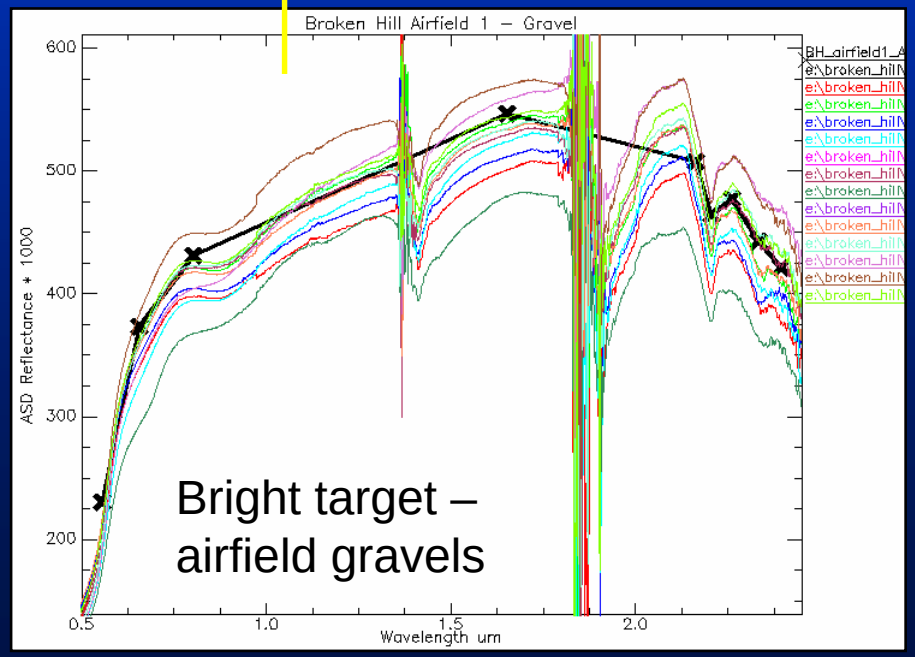
- GIS :
ARCVIEW 3.2



Broken Hill field ASTER validation study :

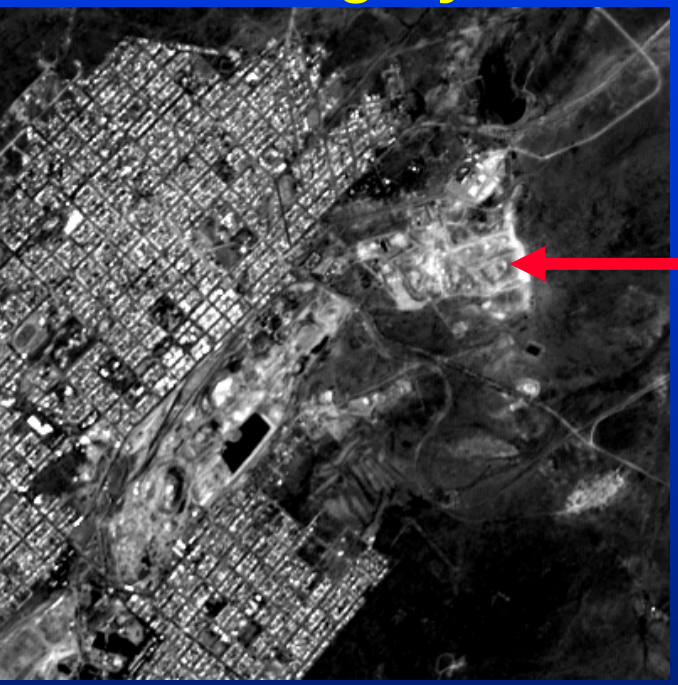
Broken Hill Airfield



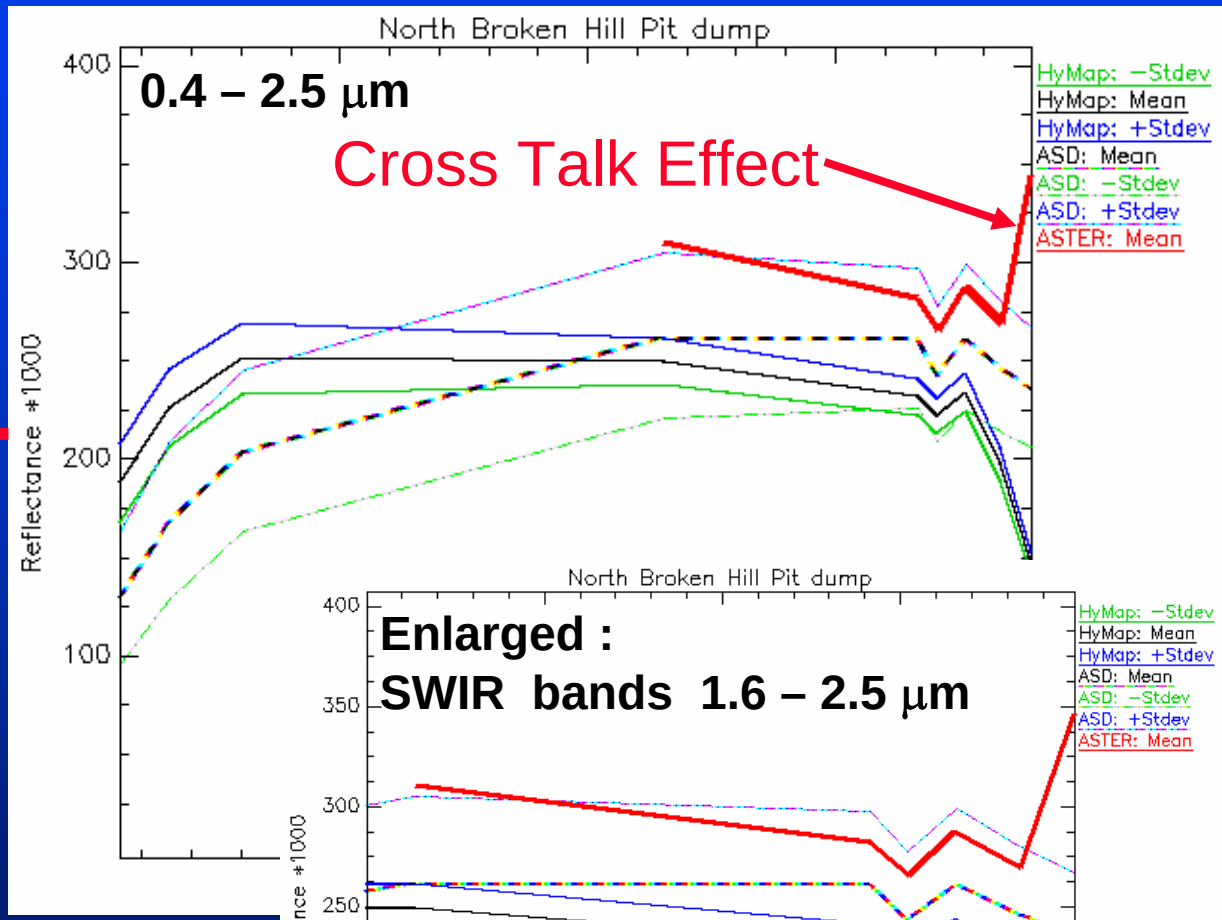


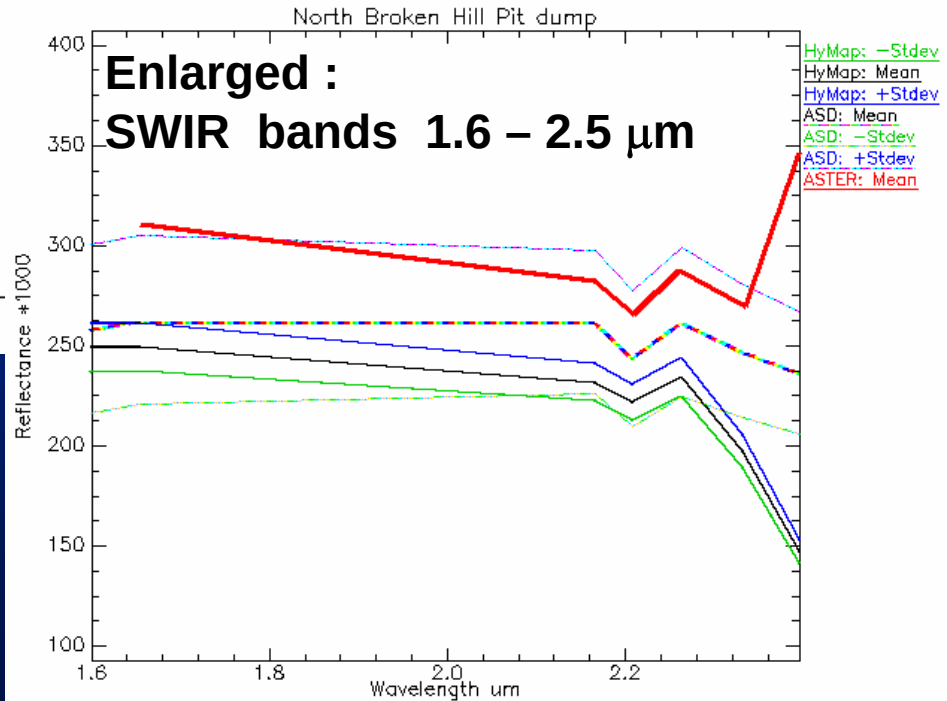
Broken Hill ASTER validation study :

HyMap airborne imagery



(Acquired 1998)

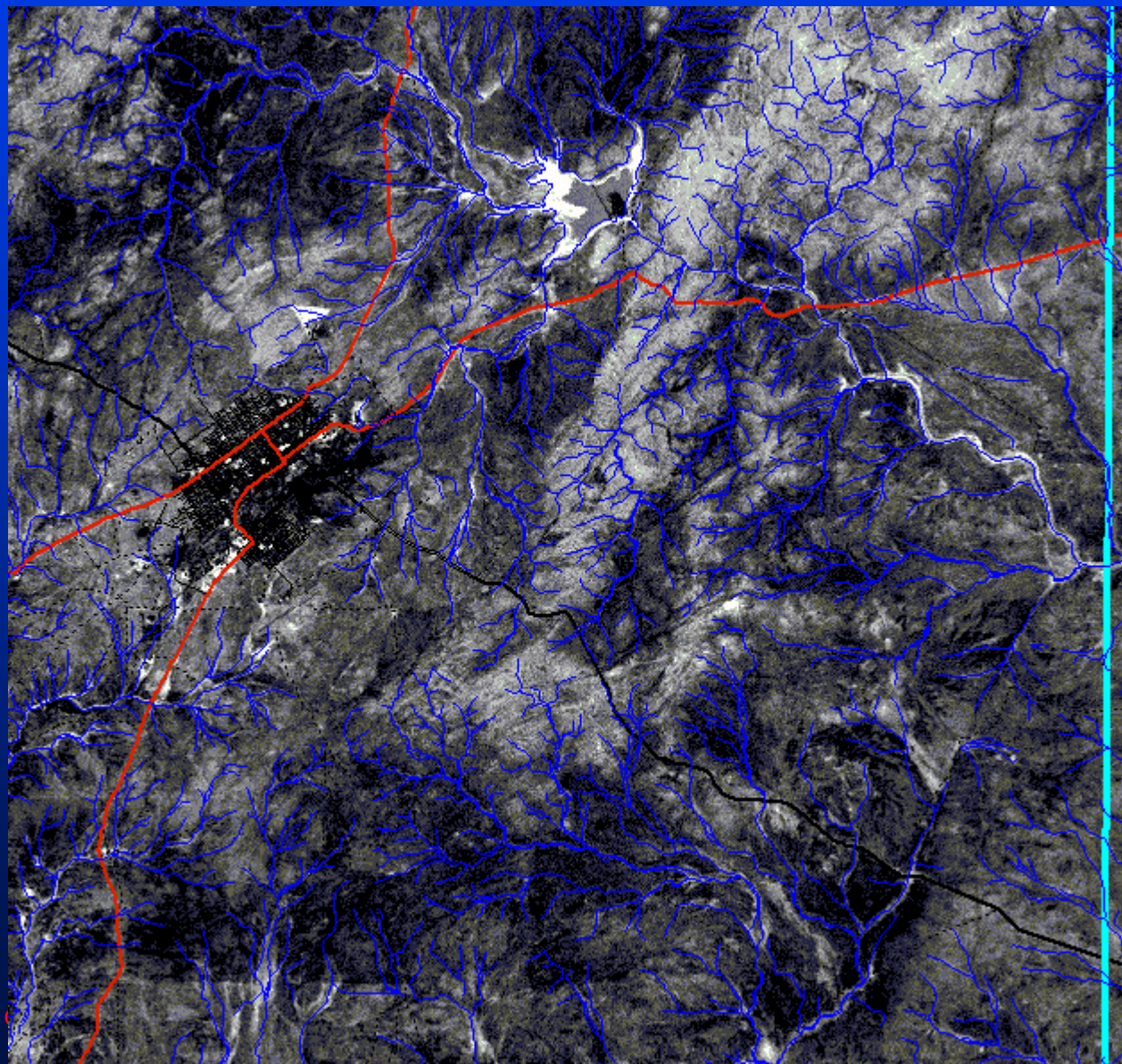




Broken Hill ASTER

ASTER spatial registration : ± 50 metres

SWIR image (30 m)
+ drainage
+ roads



Broken Hill ASTER

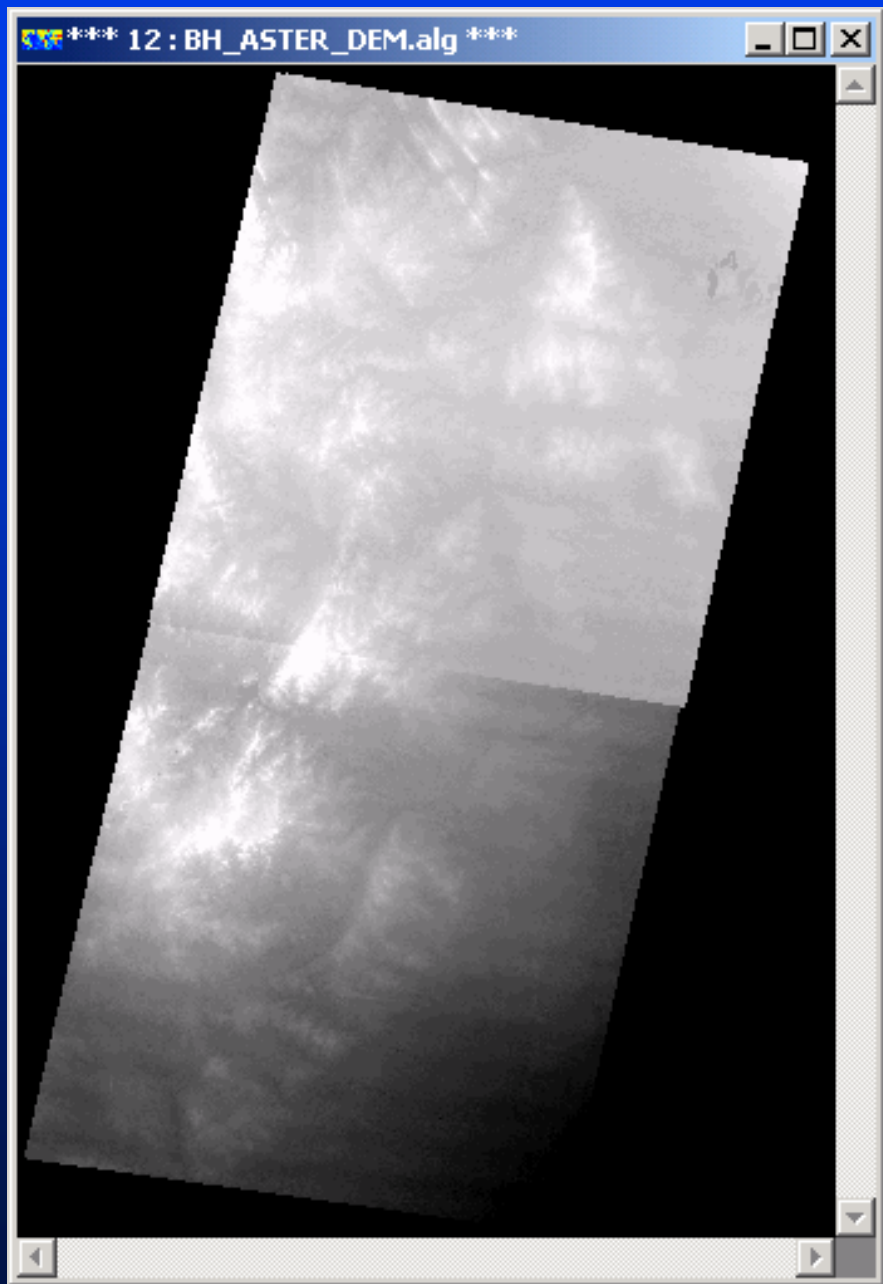
ASTER derived DEM:
Mosaiced two scenes
(E & NE of Broken Hill)

EDC/USGS product

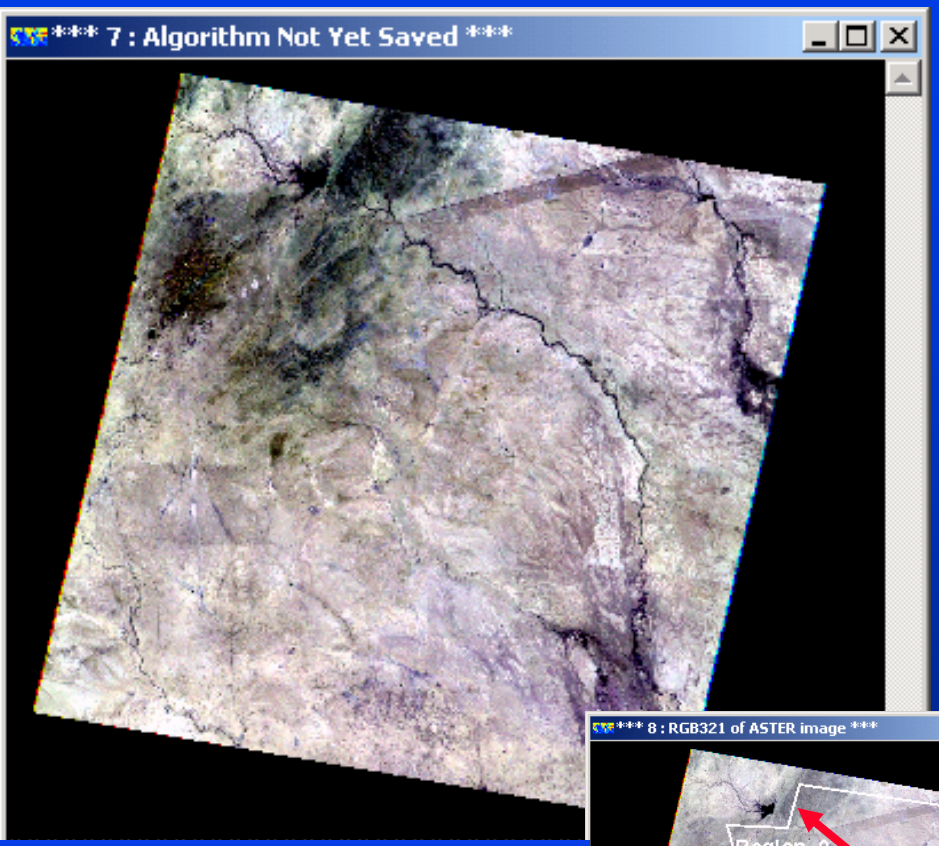
Band 3N (nadir)
Band 3B (backward)

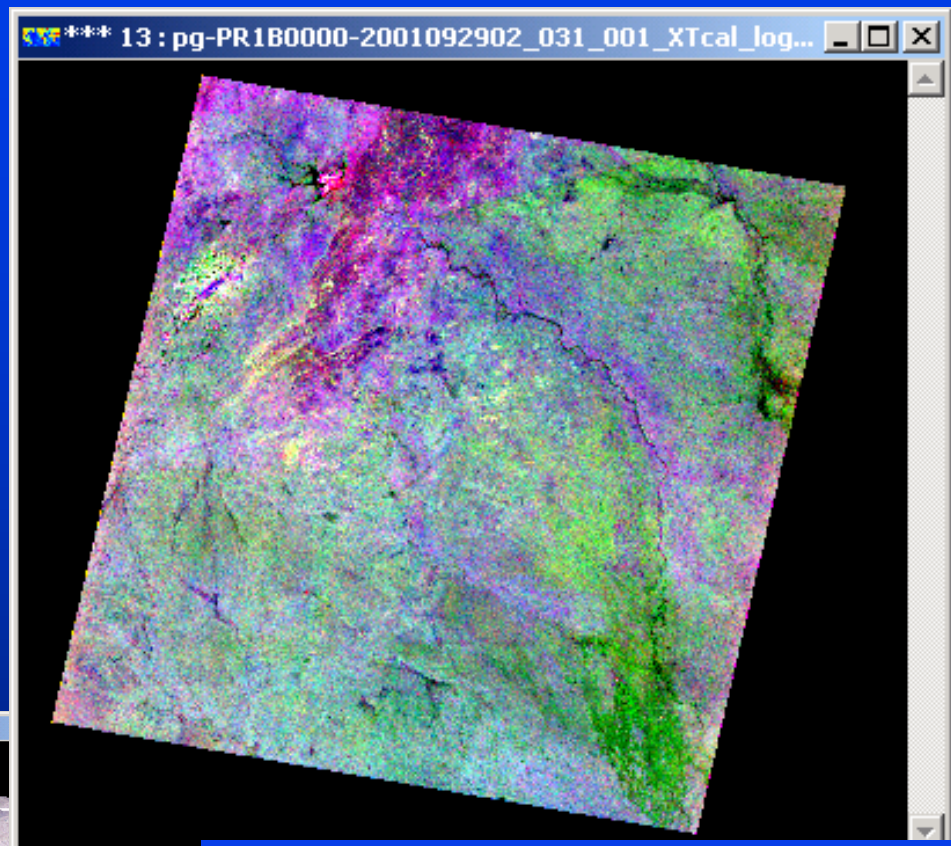
Relative DEM
(5-20 m accuracy after calibration with surveyed coords)

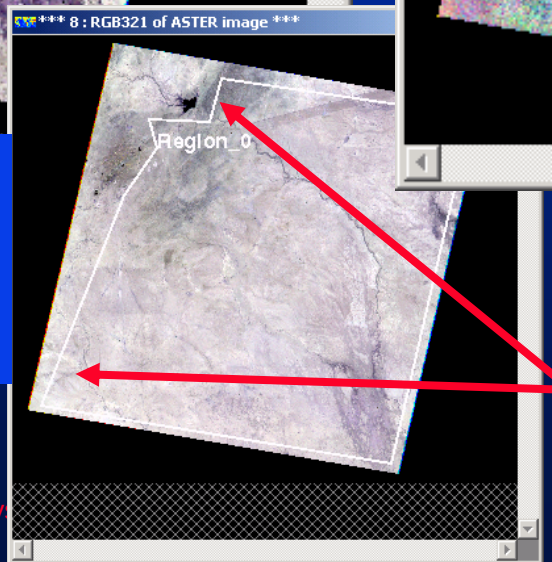
30 m X, Y resolution



Broken Hill ASTER







ASTER radiance imagery
RGB : b5 b6 b7

Log residuals imagery
RGB : b5 b6 b7

Note : Importance of training area used for log residual statistics