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A quantitative analysis of alteration in the Carbon Leader Reef in the West Wits Line Goldfield: an application of Shortwave Infrared Reflectance Spectroscopy

Eliot, Adrienne

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Legend for Spectral Facies Images



Flat spectra (+pyrophyllite/chloritoid/silica/chlorite/white mica)
Silica

Pyrophyllite dominant



Pyrophyllite (prl)
Pyrophyllite + chloritoid (prl + ctd)
Pyrophyllite + chlorite (prl + chl)
Pyrophyllite + sericite (prl + ser)

Chloritoid dominant



Chloritoid (ctd)
Chloritoid + pyrophyllite (ctd + prl)
Chloritoid + sericite (ctd + ser)

Sericite dominant



Sericite (ser)
Sericite + chloritoid (ser + ctd)
Sericite + chlorite (ser + chl)

Chlorite dominant

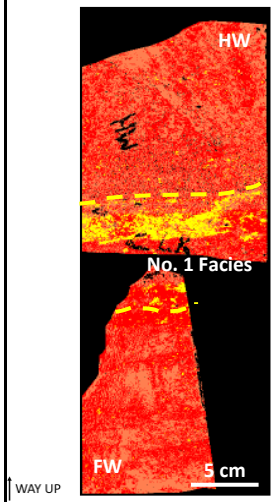
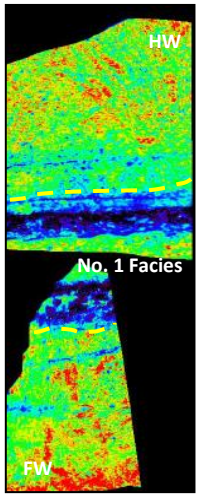
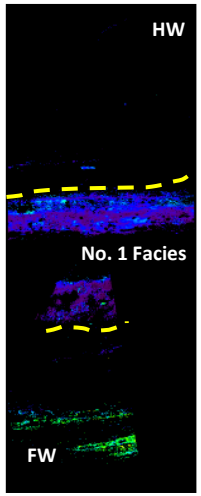
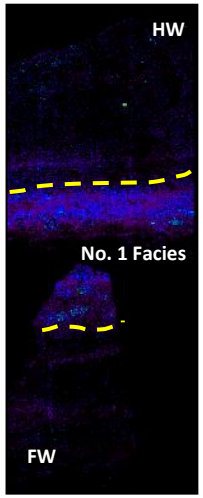
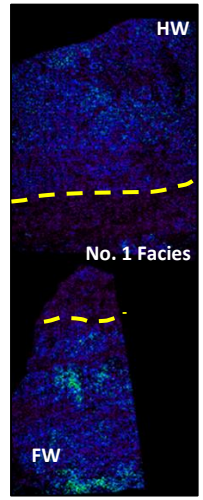
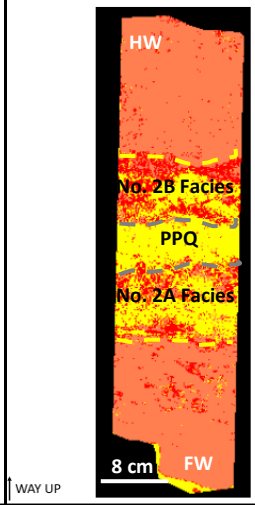
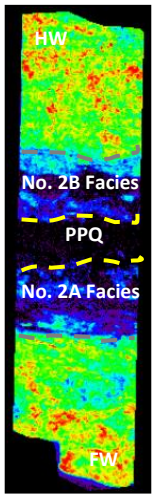
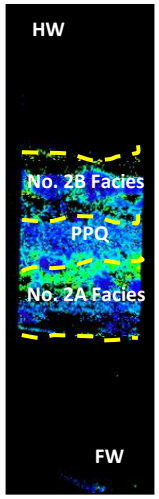
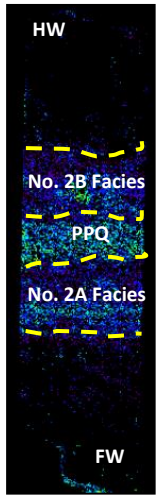
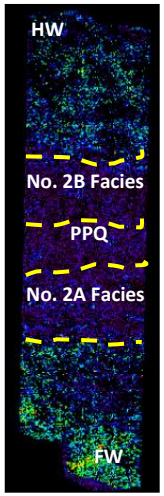


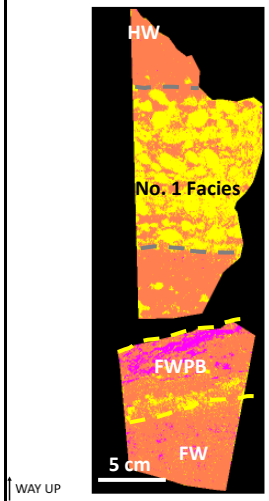
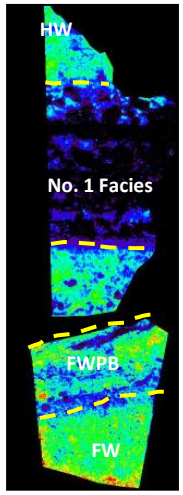
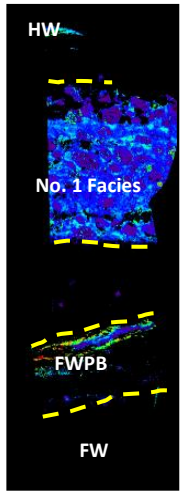
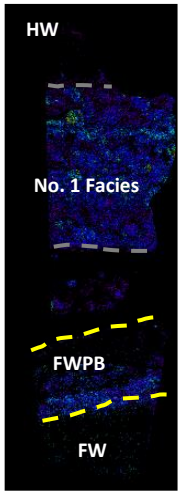
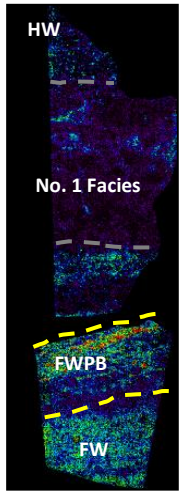
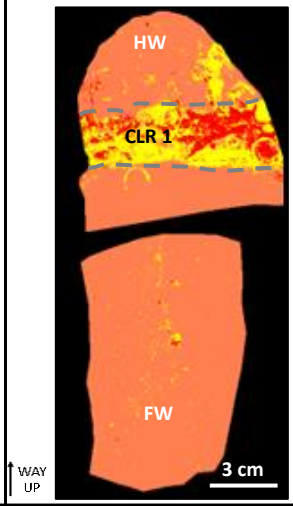
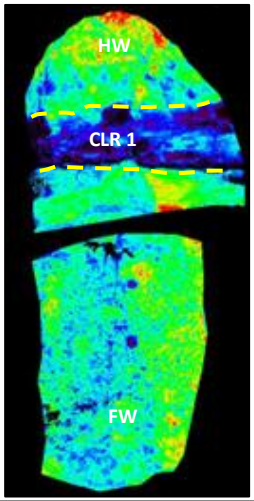
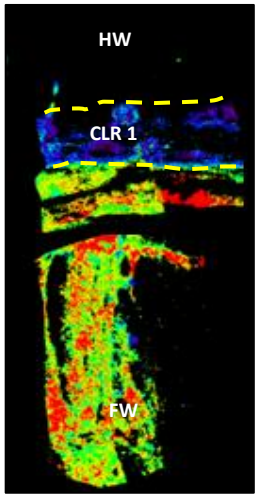
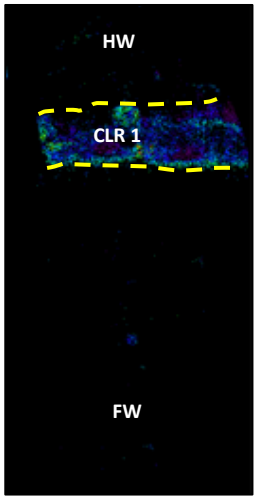
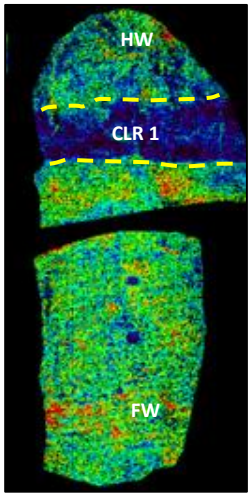
Chlorite (chl)
Chlorite + sericite (chl + ser)

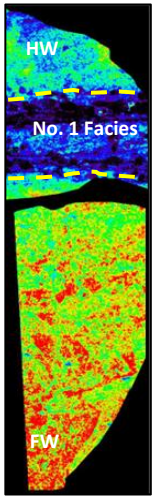
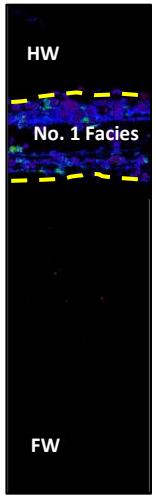
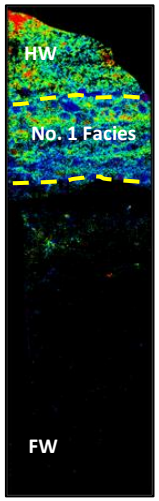
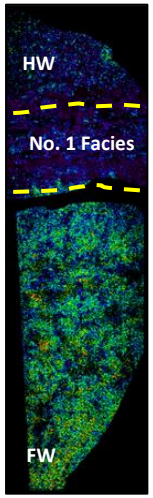
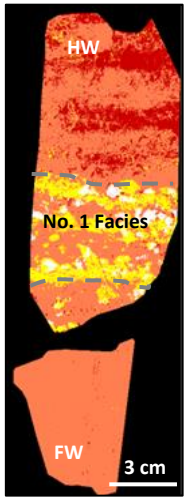
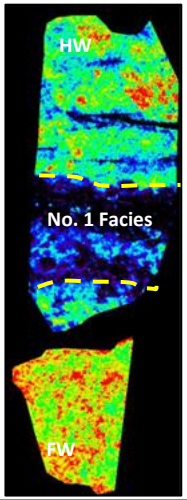
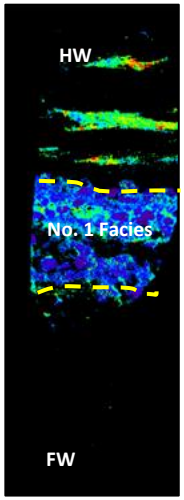
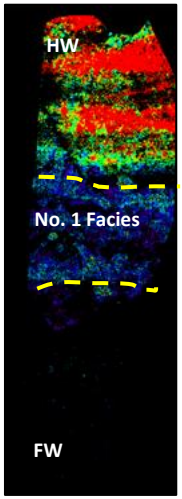
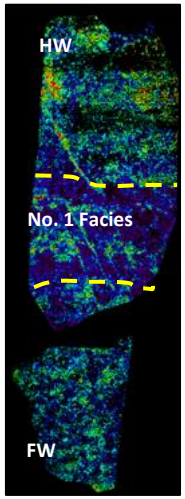
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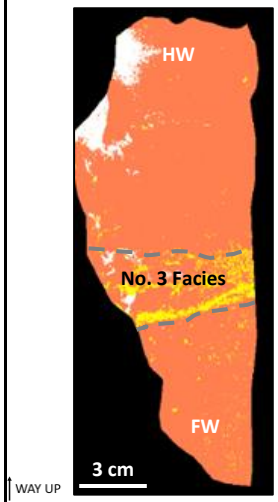
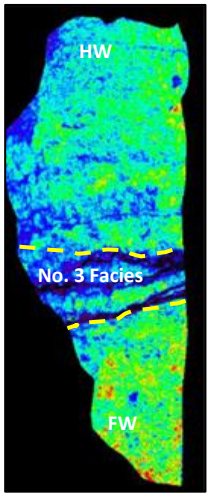
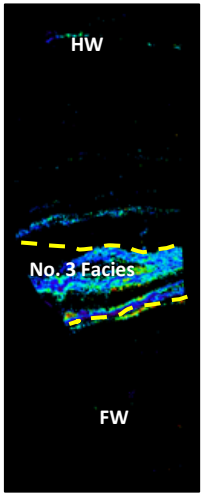
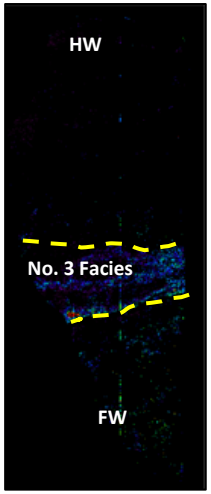
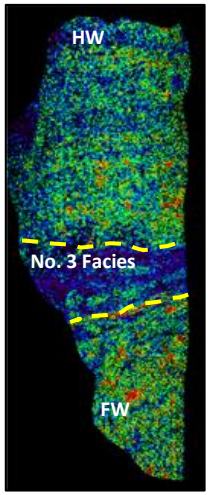
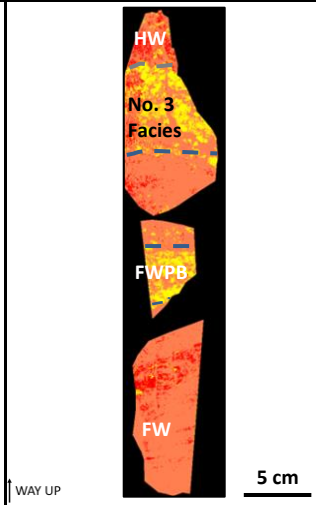
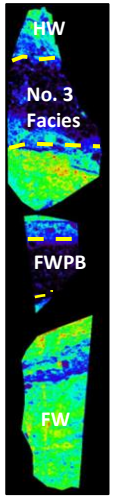
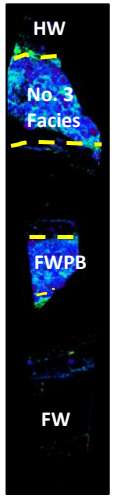
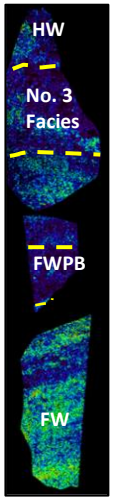
HW	Hangingwall
FW	Footwall
FWPB	Footwall Pebble Band
PPQ	Pale Pebbly Quartzite
BOAZ	Brown-Orange Argillaceous Zone
IQ	Internal Quartzite

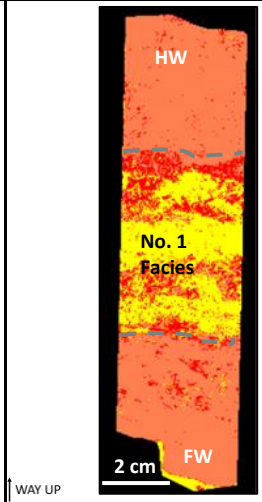
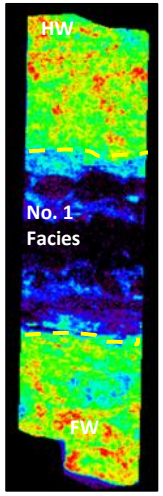
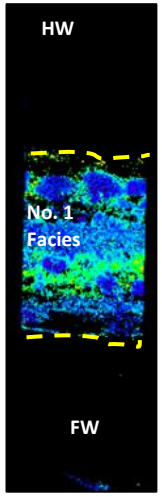
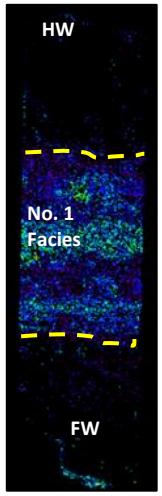
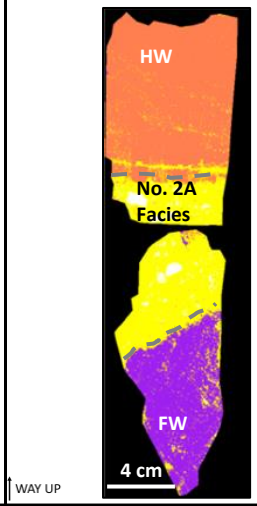
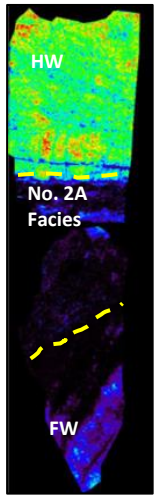
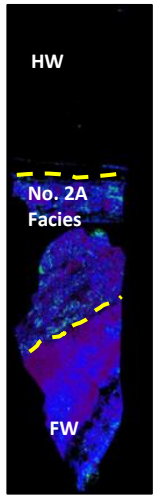
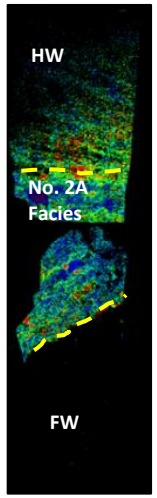
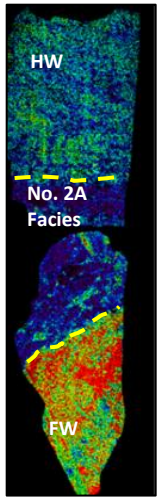
*For the feature extraction images: cooler colours (shades of dark purple and blue) indicate a low response to the feature extraction, and warmer colours (shades of green, orange and red) indicate a moderate to high response to the feature extraction.

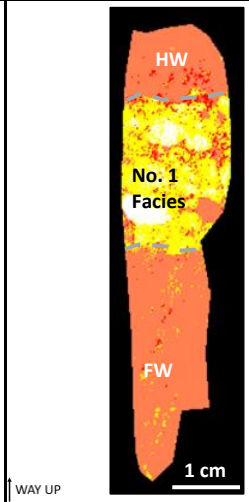
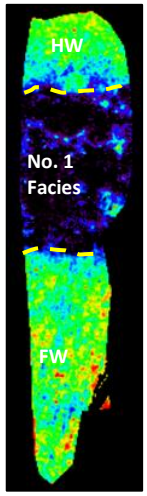
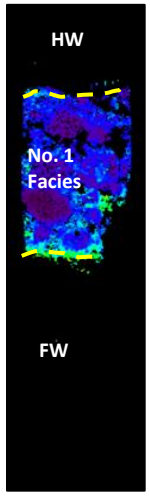
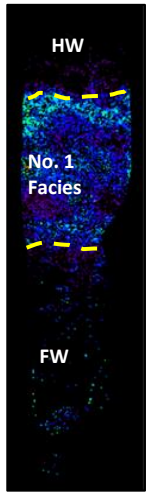
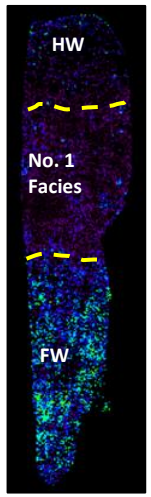
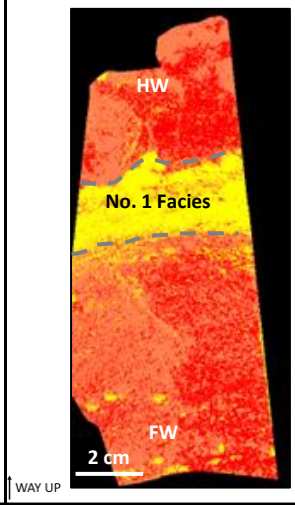
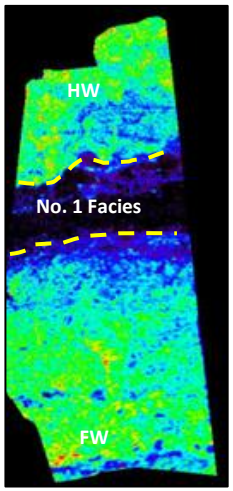
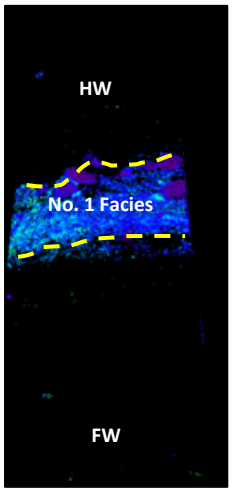
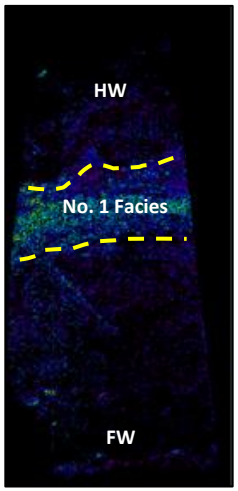
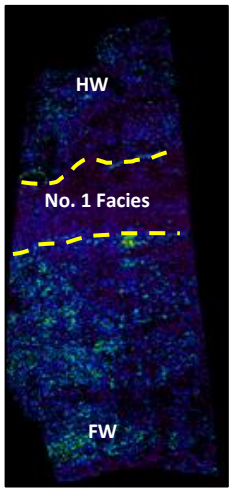
Sample ID	Spectral Images					
Name	Image Type	Spectral Facies	Pyrophyllite (λ = 2165 nm)	Sericite (λ = 2200 nm)	Chlorite (λ = 2250 nm)	Chloritoid (λ = 2390 nm)
Sample 1 94-94 E1	Scanned Image					
	Reef Description	Prl + ctd and prl + chl combinations present. Flat spectra indicative of silica/prl/ctd/chl/white mica within sample (no clear indication with the feature extractions).	Prl is present within the reef band however not in large amounts such as those seen in the hangingwall and footwall.	The ser feature extraction indicates a small amount of ser is present within the reef band.	Chl is present in the reef band however in minimal amounts.	Very little response from the ctd feature extraction - suggesting that very little ctd is present in the reef band.
Sample 2 99-94 E2	Scanned Image					
	Reef Description	Ser-dominant with prl + ctd and prl + chl present. Prl is concentrated at top contact of the reef.	The prl feature extraction shows prl is not highly responsive, suggesting that there is a moderate amount of prl at the top and bottom contacts of the reef.	Ser is somewhat responsive in the reef band, indicating a small amount of ser is present within the reef.	The chl feature extraction shows the chl is responsive, suggesting a presence of chl in the reef.	Ctd is not extremely responsive in the reef band indicating that there is a low amount of ctd present within the reef band.

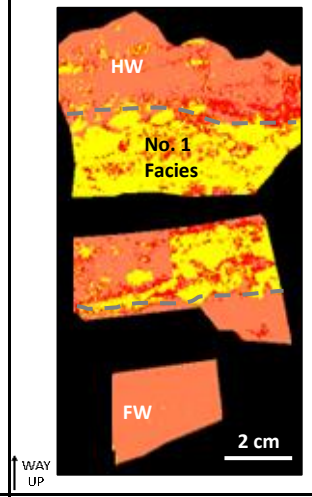
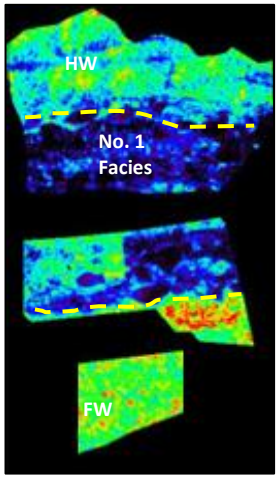
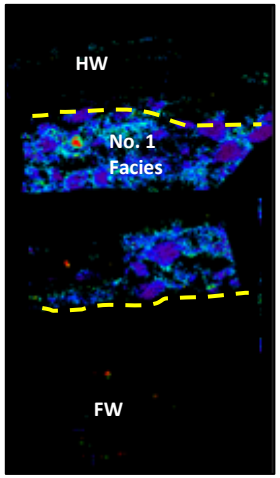
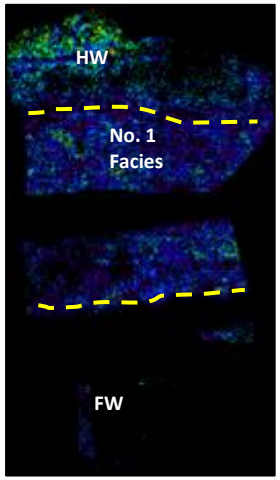
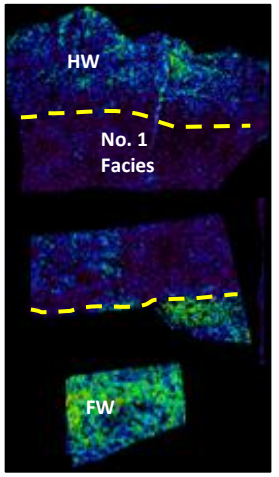
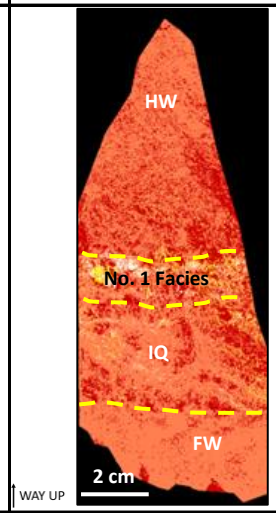
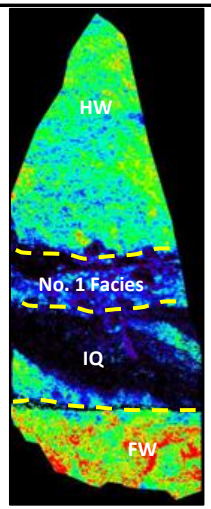
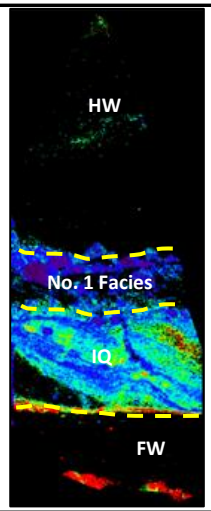
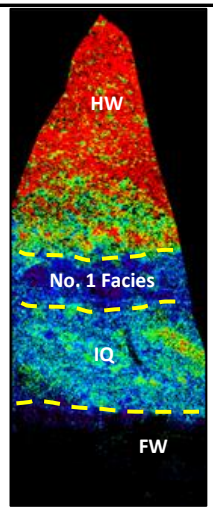
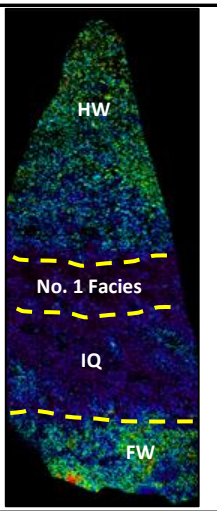
Sample ID	Spectral Images					
Name	Image Type	Spectral Facies	Pyrophyllite (λ = 2165 nm)	Sericite (λ = 2200 nm)	Chlorite (λ = 2250 nm)	Chloritoid (λ = 2390 nm)
Sample 3 104-88 W6	Scanned Image					
	Reef Description	Prl + ctd interstitially between silica-rich clasts set within a ser-rich matrix.	Prl has a low response to the feature extraction but can clearly be seen as a part of the matrix, forming interstitially between clasts.	Moderate response of the ser feature extraction is observed, which suggests less abundance of ser within the reef.	Chl is somewhat responsive to the feature extraction, suggesting small amounts of chl in the reef band.	Ctd is not very responsive indicating that very little ctd is present within the reef band.
Sample 5 112-83 W3	Scanned Image					
	Reef Description	Prl-dominant throughout the reef. Lesser amounts of interstitial prl + chl and prl + ctd.	Prl is responsive to the feature extraction, and is clearly seen as part of the matrix existing interstitially between clasts.	Ser is somewhat responsive to the feature extraction, indicating that ser is present within the reef band.	The chl feature extraction shows the chl is slightly responsive, suggesting very little chl is present in the reef.	The ctd feature extraction shows a small amount of responsiveness, indicative of a small amount of ctd present within the reef.

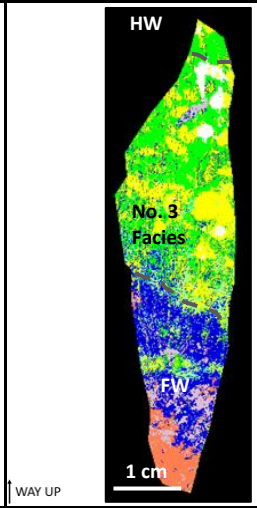
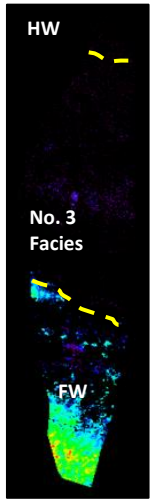
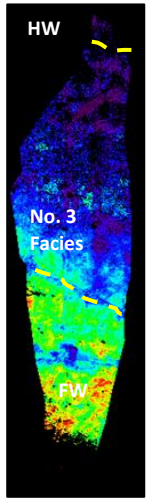
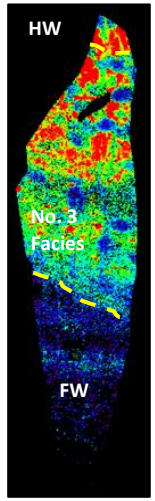
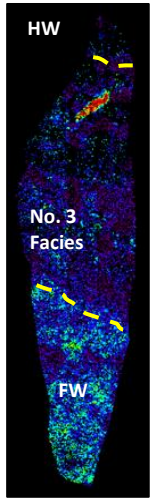
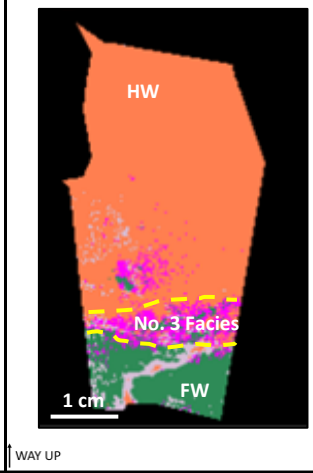
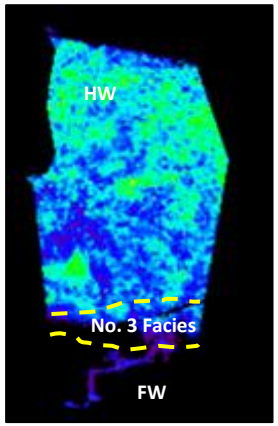
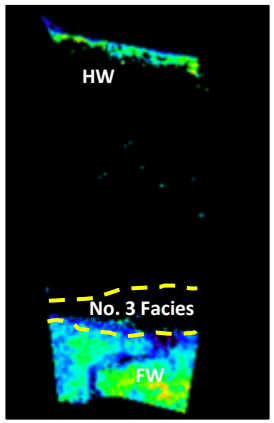
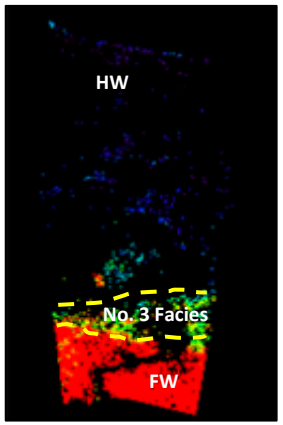
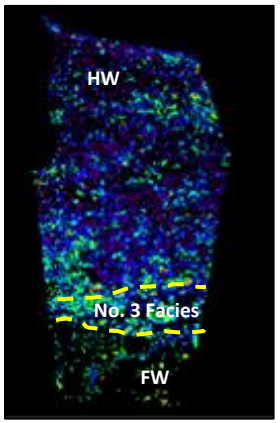
Sample ID	Spectral Images					
Name	Image Type	Spectral Facies	Pyrophyllite (λ = 2165 nm)	Sericite (λ = 2200 nm)	Chlorite (λ = 2250 nm)	Chloritoid (λ = 2390 nm)
Sample 6 112-83 W4	Scanned Image					
	Reef Description	Reef is dominated by prl + ctd as well as chl. Prl on its own is seen at footwall contact. Prl + chl is also present in lesser amounts.	Prl is seen to be responsive to the feature extraction at the bottom portion of the reef.	The ser feature extraction indicates a small amount of ser is present within the reef band.	Responsive chl is seen within the reef band, indicating a moderate amount of chl is present.	Ctd has a minor response in the reef band indicating that there is a low amount of ctd present within the reef band.
Sample 7 114-78 E1	Scanned Image					
	Reef Description	Silica-rich clasts set within a ser-dominant and prl + ctd matrix.	The bottom contact of the reef is highly responsive to the feature extraction for prl, indicating a concentration of prl.	The matrix is responsive to the ser feature extraction, suggesting that there is a moderate amount of ser present within the matrix.	The chl feature extraction shows the chl has a minor response, suggesting a small presence of chl in the reef.	The ctd feature extraction shows a small amount of responsiveness, indicative of a small amount of ctd present within the reef.

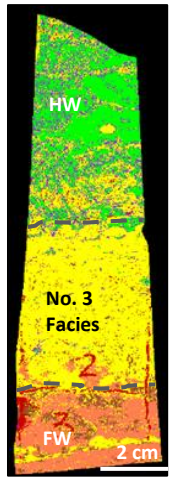
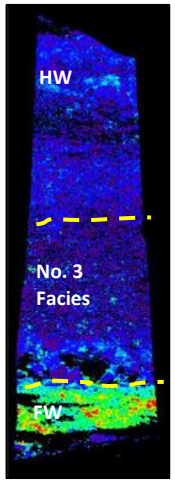
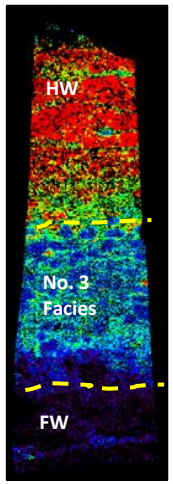
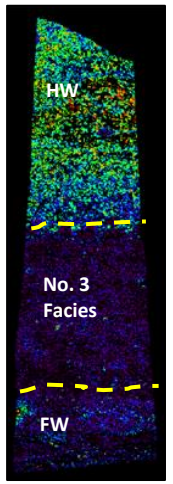
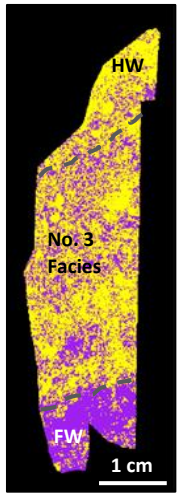
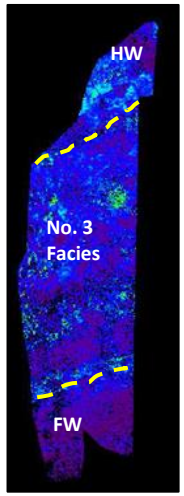
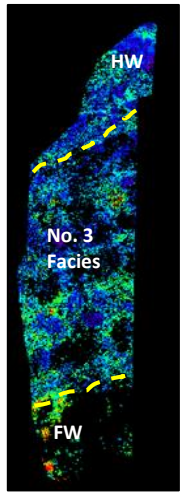
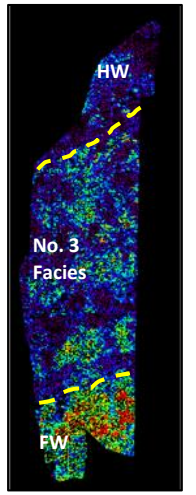
Sample ID	Spectral Images					
Name	Image Type	Spectral Facies	Pyrophyllite (λ = 2165 nm)	Sericite (λ = 2200 nm)	Chlorite (λ = 2250 nm)	Chloritoid (λ = 2390 nm)
Sample 8 120-55 W4	Scanned Image					
	Reef Description	Prl + ctd-rich with ser reef band with lesser amounts of silica clasts.	The small internal quartzite within the reef is highly responsive in comparison to the matrix of the reef, indicating a prl-dominant IQ and prl-poor matrix.	Ser is moderately responsive in the matrix of the reef, indicating a moderate amount of ser is present within the reef.	The chl in the reef is almost non-responsive, indicating that there is minimal chl present.	The ctdd feature extraction shows that the ctd is somewhat responsive, suggesting that there is ctd within the reef.
Sample 9 120-77 S1	Scanned Image					
	Reef Description	The matrix is ser and prl + ctd-rich. Top reef band as well as IQ has prl and prl + chl present.	The FW quartzite between the reef and FWPB is highly responsive to the prl feature extraction, indicating a prl-rich FW.	The reef band is highly responsive to the ser feature extraction, indicating a large presence of ser within the reef.	The FW quartzite is non-responsive, and the reef band is somewhat responsive to the chl feature extraction.	The FW quartzite is more responsive to the ctd feature extraction than the reef band, indicating a higher amount of ctd is present than within the reef.

Sample ID	Spectral Images					
Name	Image Type	Spectral Facies	Pyrophyllite (λ = 2165 nm)	Sericite (λ = 2200 nm)	Chlorite (λ = 2250 nm)	Chloritoid (λ = 2390 nm)
Sample 10 96-94 E2	Scanned Image					
	Reef Description	Ser-dominant throughout the reef matrix with prl. Lesser amounts of interstitial prl + chl and prl + ctd.	Prl is seen to be responsive to the feature extraction at the top and bottom contacts of the reef.	Ser has a moderate response in the reef band, indicating a moderate amount of ser is present within the reef.	Chl is somewhat responsive to the feature extraction, suggesting small amounts of chl in the reef band.	Ctd is not extremely responsive in the reef band indicating that there is a low amount of ctd present within the reef band.
Sample 11 100-92 Wze	Scanned Image					
	Reef Description	Chl-rich reef with negligable amounts of prl within the matrix as well as the presence of silica-rich clasts.	The top contact of the reef is highly responsive to the feature extraction, indicating a larger concentration of prl at the top of the reef.	Ser has a low response to the feature extraction, suggesting that there is a low concentration of ser within the reef.	The chl feature extraction shows the chl is somewhat responsive, suggesting a presence of chl in the reef.	The ctd feature extraction shows that the ctd is somewhat responsive, suggesting that there is ctd within the reef.

Sample ID	Spectral Images					
Name	Image Type	Spectral Facies	Pyrophyllite (λ = 2165 nm)	Sericite (λ = 2200 nm)	Chlorite (λ = 2250 nm)	Chloritoid (λ = 2390 nm)
Sample 12 104-88 E1A	Scanned Image					
	Reef Description	Silica-rich clasts present within ser-rich matrix as well as interstitial prl and prl + ctd.	Small portions of the reef band are more responsive to the prl extraction feature, with the rest of the reef not very responsive indicating concentrated areas of prl.	The lower portion of the reef and bottom contact are more responsive to the ser feature extraction, suggesting higher amounts of ser are concentrated lower in the reef.	The upper portion of the reef is responsive to the chl feature extraction, indicative of a higher concentration of chl in the upper portion of the reef.	The reef is poorly responsive to the ctd extraction feature, suggesting low amounts of ctd within the reef.
Sample 13 104-88 W7	Scanned Image					
	Reef Description	Interstitial prl + ctd present within a ser-rich matrix.	The reef is more responsive to the prl feature extraction on the outer edges, suggesting higher amounts of prl closer to the top and bottom contacts of the reef.	The reef is responsive to the ser feature extraction, indicating a ser-rich matrix.	The reef is somewhat responsive to the chl feature extraction, indicating that there is a small concentration of chl within the reef.	The ctd extraction feature shows the reef is poorly responsive and this is indicative of low amounts of ctd within the reef.

Sample ID	Spectral Images					
Name	Image Type	Spectral Facies	Pyrophyllite (λ = 2165 nm)	Sericite (λ = 2200 nm)	Chlorite (λ = 2250 nm)	Chloritoid (λ = 2390 nm)
Sample 14 109-87 E2	Scanned Image					
	Reef Description	Prl, prl + chl and prl + ctd occur interstitially within a ser-rich matrix.	The reef is divided by IQ which is much more responsive than the reef bands - suggesting higher amounts of prl are present in the IQ.	The reef is less responsive to the ser feature extraction, indicating less amounts of ser. The IQ is not responsive, suggesting a very little to no concentration of ser.	The reef is somewhat responsive, suggesting very little chl is present within the sample. The reef bands are more responsive than the IQ.	The reef is poorly responsive suggesting low amounts of ctd within the reef, however the IQ is more responsive indicating a higher amount of ctd.
Sample 15 112-84 Rse	Scanned Image					
	Reef Description	Reef is dominated by prl + ctd. Silica-rich clasts are set within a ser-rich and prl + chl matrix.	Small portions of the reef band are highly responsive to the prl extraction feature, with the rest of the reef not very responsive.	The IQ is highly responsive to the ser feature extraction, suggesting higher amounts of ser are concentrated in the IQ.	The IQ is highly responsive to the chl feature extraction, indicative of higher amounts of chl concentrated in the IQ.	The reef is poorly responsive throughout, indicative of a poor concentration of ctd within the reef.

Sample ID	Spectral Images					
Name	Image Type	Spectral Facies	Pyrophyllite (λ = 2165 nm)	Sericite (λ = 2200 nm)	Chlorite (λ = 2250 nm)	Chloritoid (λ = 2390 nm)
Sample 16 120-55 NE7	Scanned Image					
	Reef Description	Reef has a chl-dominant matrix with possibly silica-rich clasts set within.	The bottom contact of the reef is responsive to the feature extraction for prl, indicating a concentration of prl. The remainder of the reef is unresponsive.	The lower portion of the reef and bottom contact are highly responsive to the ser feature extraction, suggesting higher amounts of ser are concentrated lower in the reef.	The reef is highly responsive with a greater response nearer to the top portion of the reef. This indicates there is a higher amount of chl at the top of the reef.	The reef is poorly responsive, indicative of a poor concentration of ctd. There appears to be a ctd vein that is highly responsive at the top of the reef package.
Sample 17 120-55 W5	Scanned Image					
	Reef Description	Reef matrix is chl-dominant with ctd + prl as well as chl + ser occurring interstitially.	The reef is responsive in small portions of the reef, indicative of a small concentration of prl within the reef.	The bottom contact of the reef is responsive to the ser extraction feature, indicating a concentration of ser at the reef-footwall contact.	The reef is highly responsive throughout the reef, indicative of a concentration of chl within the reef.	The reef is somewhat responsive to the ctd feature extraction, suggesting a small amount of ctd is present.

Sample ID	Spectral Images					
Name	Image Type	Spectral Facies	Pyrophyllite (λ = 2165 nm)	Sericite (λ = 2200 nm)	Chlorite (λ = 2250 nm)	Chloritoid (λ = 2390 nm)
Sample 18 120-55 W7	Scanned Image					
	Reef Description	Matrix is chl-rich with prl + ctd occurring interstitially.	The base of the reef is moderately responsive, indicating a concentration of prl at the base of the reef.	The reef package is somewhat responsive, with a higher response at the base indicative of a higher concentration of ser at the base.	The reef is highly responsive throughout the reef, indicative of a concentration of chl within the reef.	Throughout the reef the response is poor, suggesting a low concentration of ctd.
Sample 19 120-70 W1	Scanned Image					
	Reef Description	Ctd and chl-dominated matrix supported reef.	A very poor response is seen throughout the reef, indicating very little prl is present.	The moderate response of the reef suggests there is a presence of ser.	The reef is moderately responsive, suggesting small amounts of chl within the reef package.	The reef is moderately responsive, indicative of small amounts of ctd within the reef.