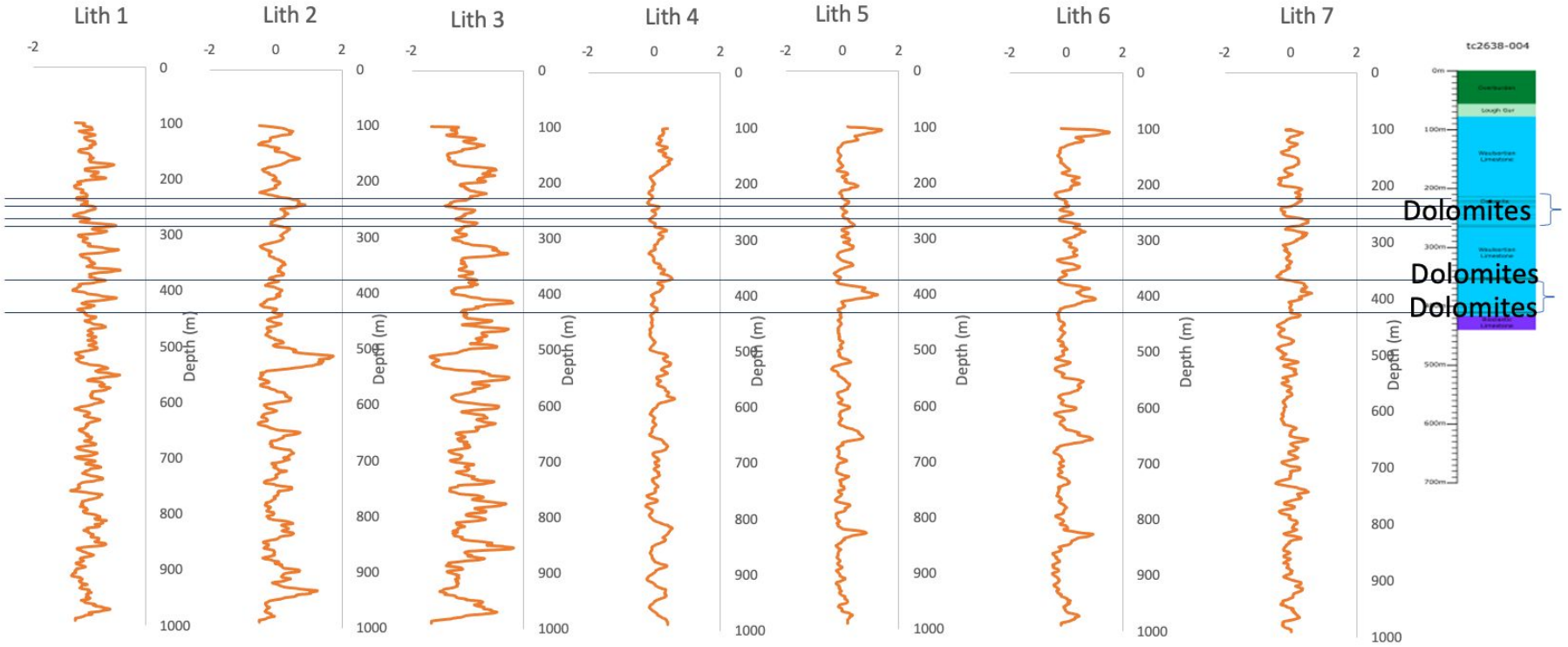
Seven Lithmetrics outputted from the script

Name	Formula
Lith_1	FADR*Fmean*EADR/Fgamma*FSD
Lith_2	Fgamma*Fmean*FSD/Emean*ESD
Lith_3	FADR*Egamma*Emean*ESD/Fgamma*FSD
Lith_4	FADR*EADR/Fmean*Emean*ESD
Lith_5	F-gamma*Egamma*Corr1-5/FSD*EADR*CorrSD1-5
Lith_6	FADR*Egamma*Corr1-5/Fgamma*CorrSD1-5
Lith_7	Fgamma*EADR*Corr5-10/FADR*Egamma*WMF

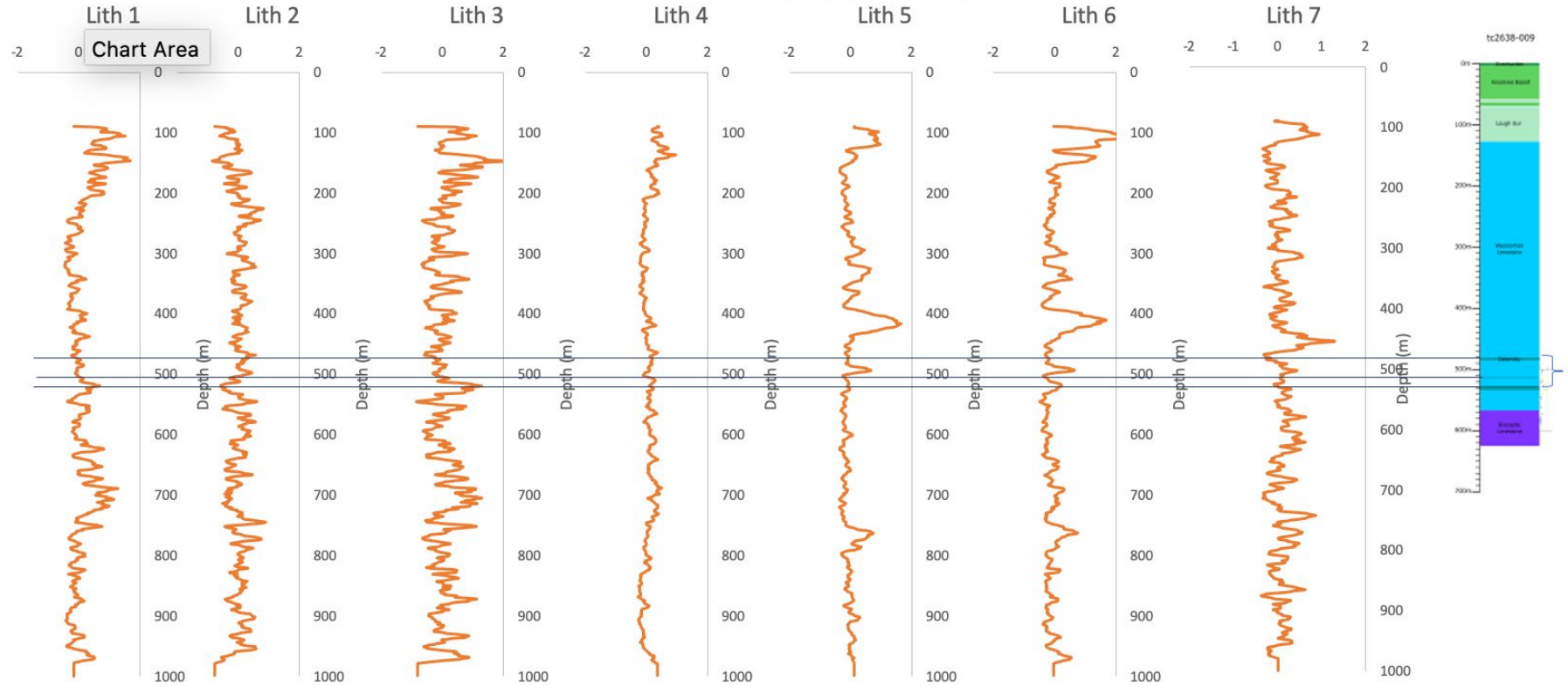
- All seven lithmetrics output by the lithmetrics script were compared with the training data to see if any parameters show any links with the training data.
- The majority of these use the harmonics dataset. However, Lith_5, Lith_6 & Lith_7 use either the correlation data or the weighted mean frequency data.

TC2638-04



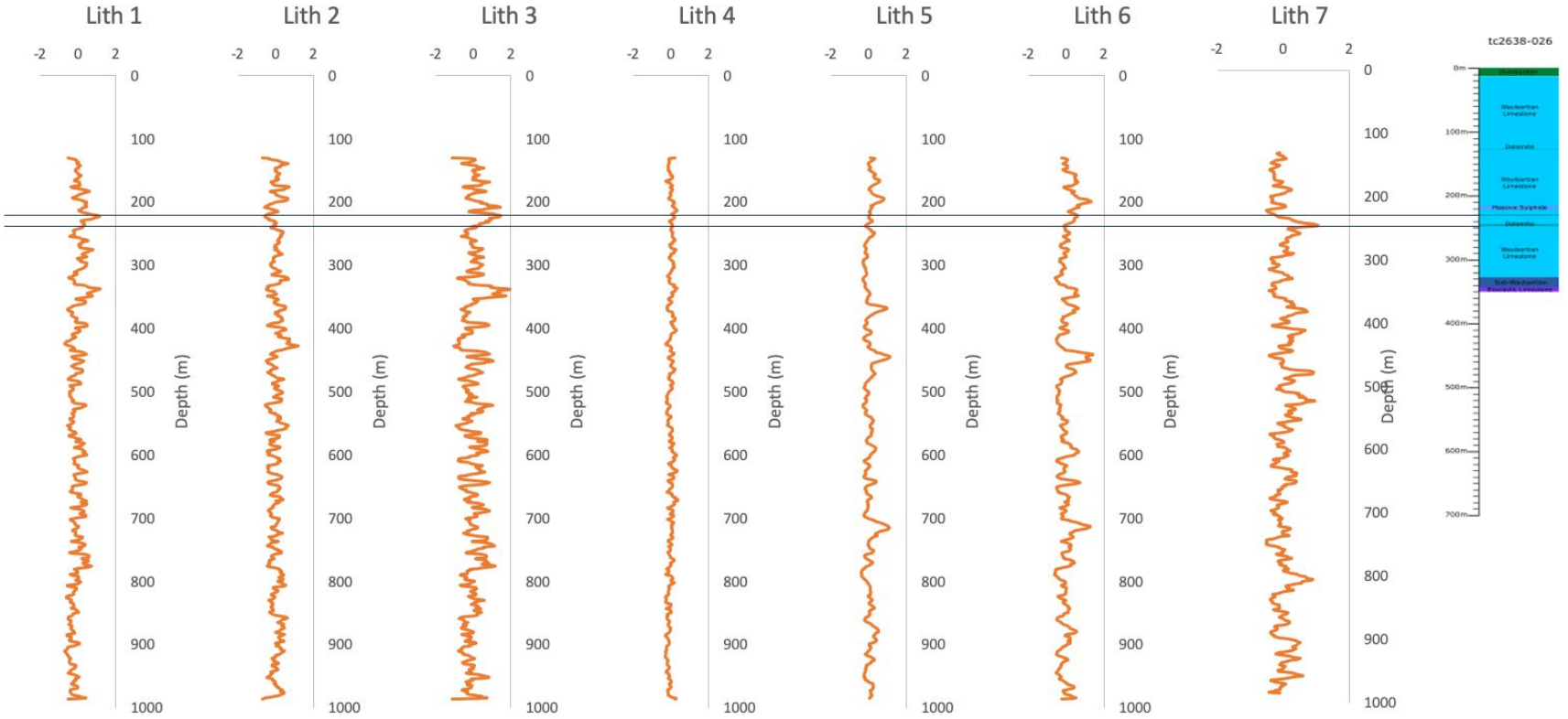
- In general peaks in Lith_7 are seen where dolomites are seen in the training log noted by the clustering at 200-280m and the relative absence of peaks between 280-360m.
- Lith_7 is the only one to show any kind of consistent relationship with the dolomites.

TC2638-09



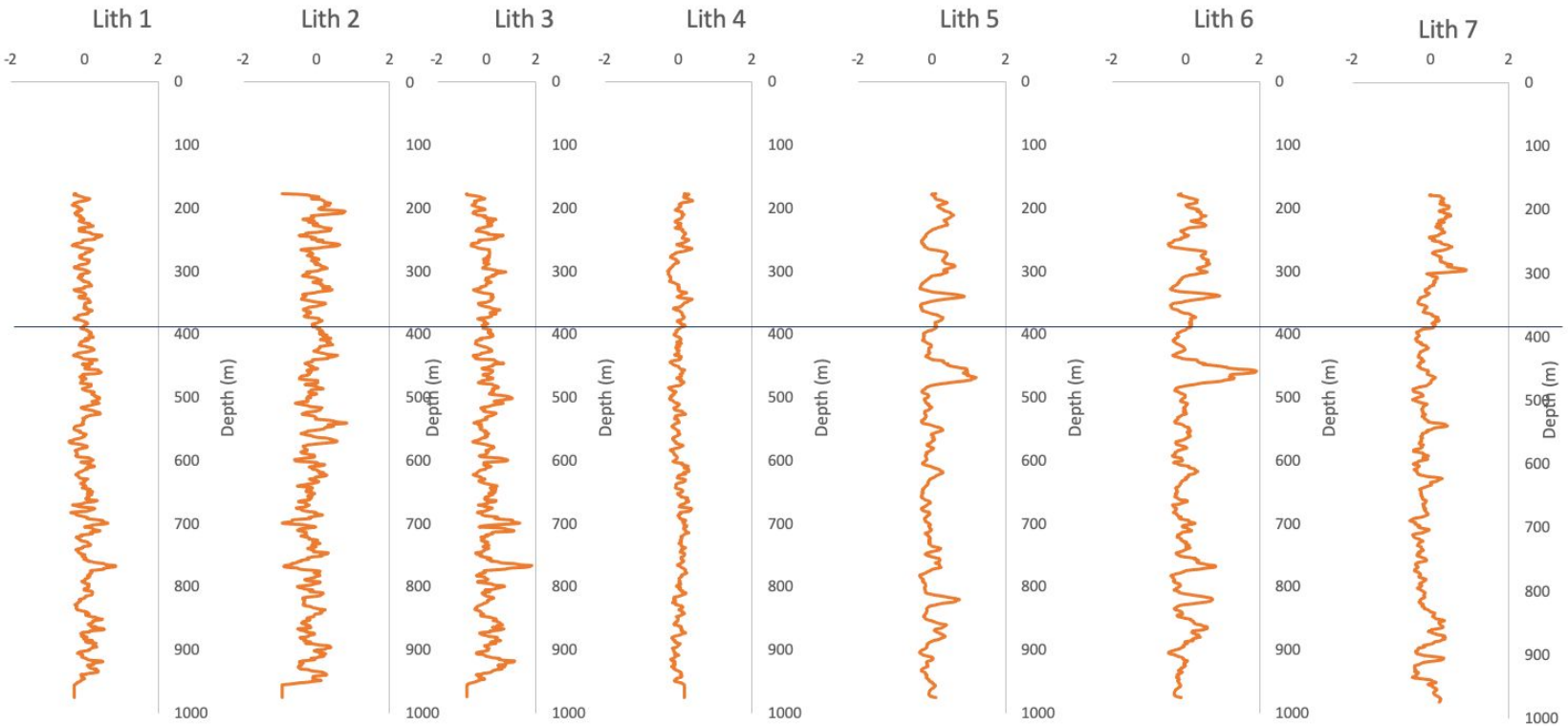
- The main area of dolomite is seen between 490-520m. This is matched by peaks in Lith_5 and Lith_6.
- According to the training data, cemented dolomite is seen at 440m. This closely matches the largest peak in Lith_7.

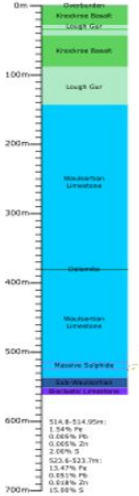
TC2638-26



- The main area of dolomite is seen between 240-260m. This is matched by a peak in Lith_7.
- This is also seen in Lith_3. However in Lith_3 a larger peak is seen in 320-330m which is not seen in Lith_7.

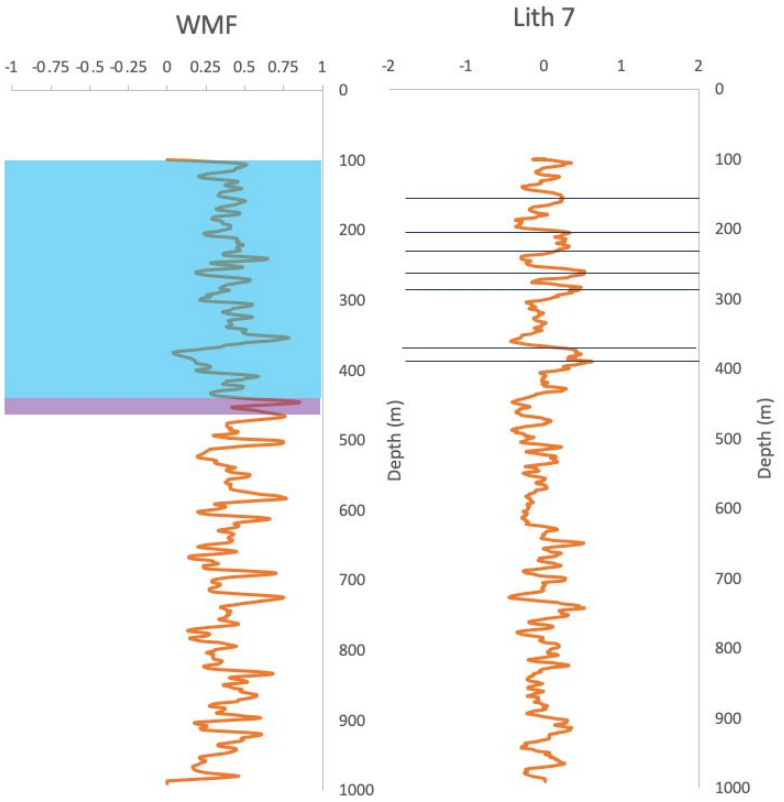
TC2638-30



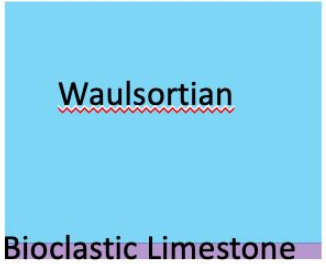


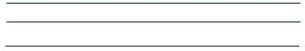
- The main area of dolomite is seen at 380m. This is matched by a peak in Lith_7 and according to the training data there is also dolomite at 300-310m again picked out by dolomite.
- Larger peaks are seen in Lith_5, Lith_6 at 450m but this is not associated with dolomite.

Summary



- Consistent matches between Lith_7 and dolomite are shown and so this will be used going forward. The remaining 6 calculated Lithmetrics will be discontinued.
- Sometimes low values for WMF correspond to dolomite.
- Based on the four training sites peaks in WMF above 0.25 sometimes correspond to base of the Waulsortian providing values drop to 0 immediately below the peak.
- A threshold value can be used for defining dolomite. For this project, a threshold of -0.25 is used for WMF and +0.25.





Dolomites

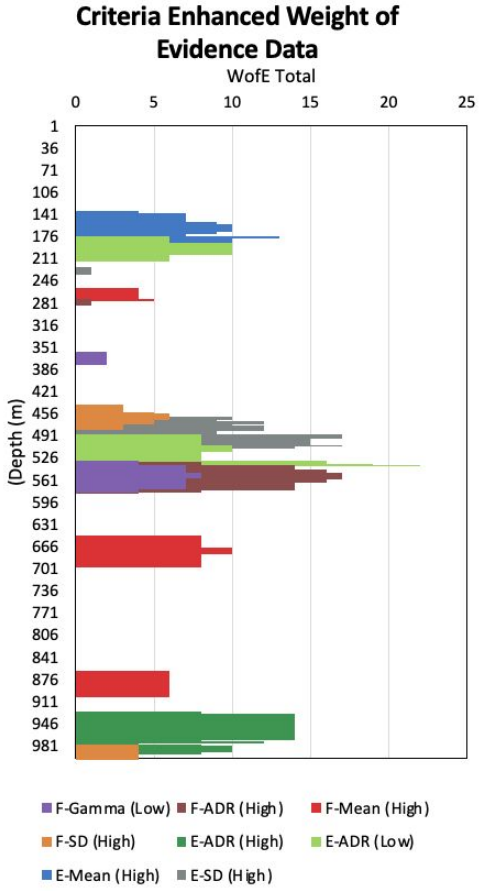
Interpretation Methodology

- Using findings from the training data results, the following criteria was used for identifying sulphides and dolomites in the blind holes.
- A criteria for identifying the base of the Waulsortian is also applied to the blind holes.

Weighted Sulphide Criteria	WMF criteria for base Waulsortian	WMF threshold for Dolomite	Lith_7 threshold for Dolomite
Multiple parameters congregating at over 50m interval. Values greater than 20 are considered sulphides.	Depth between 350-450m area where peak above 0.25 followed by a trough below 0.	Values smaller than -0.25 considered dolomites	Values greater than 0.25 considered dolomites.

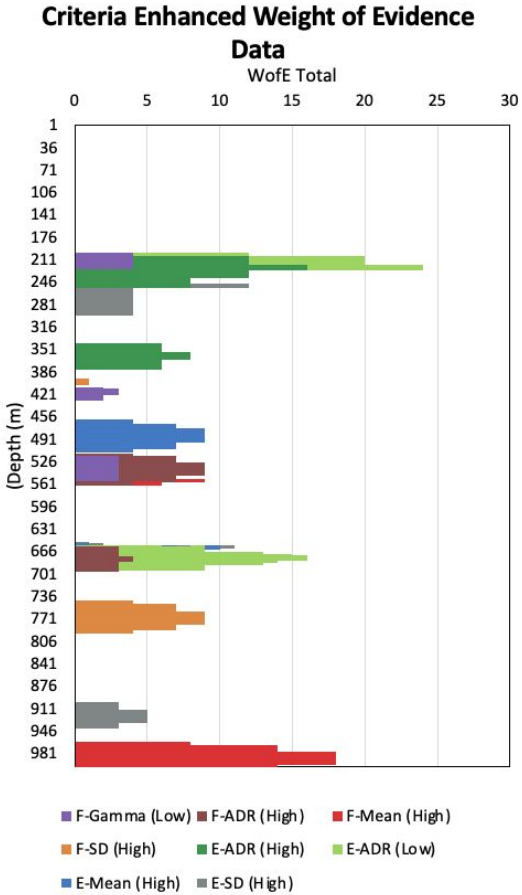
Blind Holes WSCC

L004



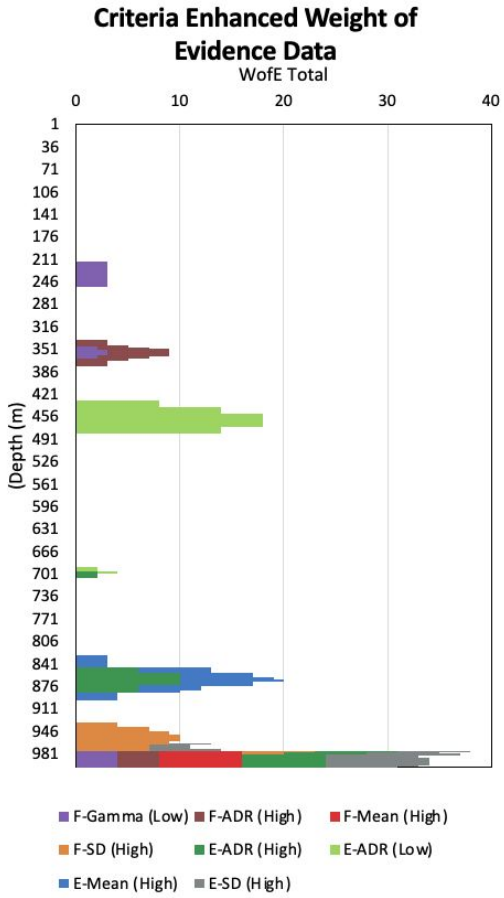
- Using the Criteria Enhanced Weight of Evidence Data, there is a concentration of peaks between 140-220m, 430-570m and 930-1000m.
- The weights for two of the three key parameters E-ADR high, and F-Mean high are only associated with the 930-1000m peak concentration.
- E-ADR low concentrates principally around 491-525m and corresponds the most with other harmonic parameters.
- This suggests the most concentrated occurrence of breccias or sulphides is between 430-570m.

L009



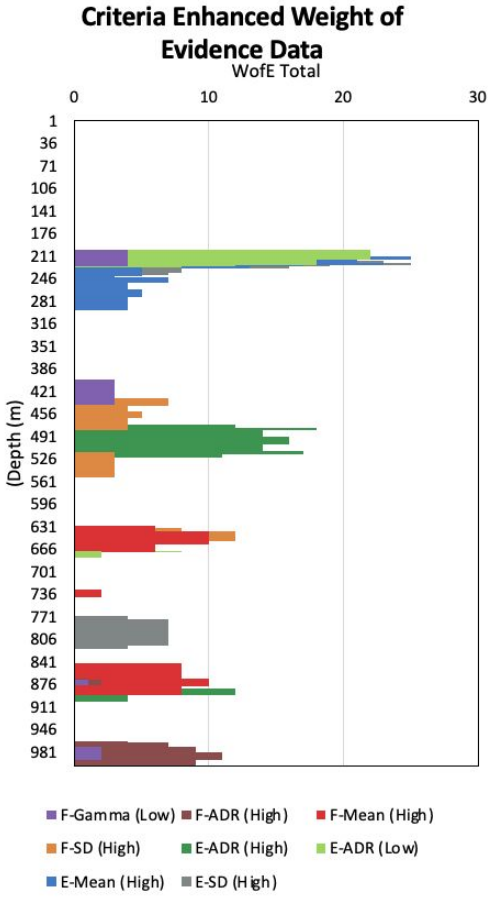
- Using the Criteria Enhanced Weight of Evidence Data, there appears to be a concentration of peaks between 210-290m, 460-560m and 640-700m.
- The weights for two of the three key parameters E-ADR high, and E-ADR low are associated with the 210-290m though some of the E-ADR low is associated with the 640-700m peak.
- The F-Mean high is seen between 530-560m and below 970-1000m.
- The results suggests regular occurrences of either sulphides or breccias but only at 210-250m are values above 20.

L030



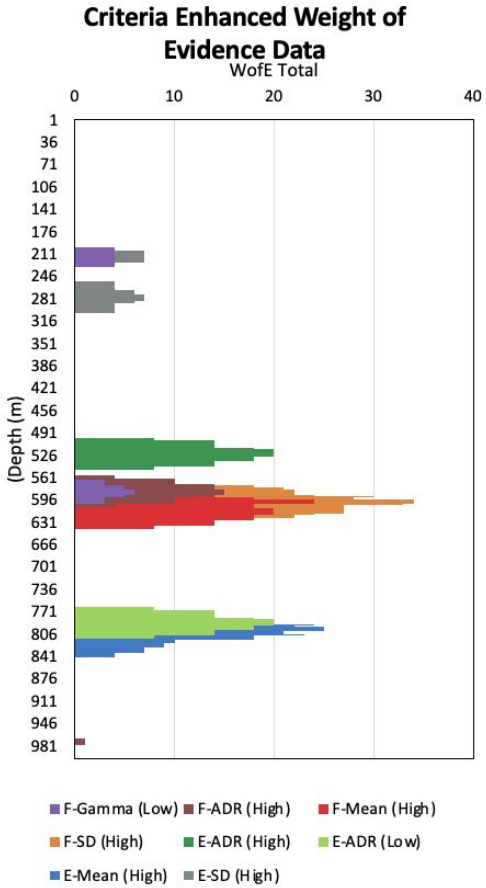
- Using the Criteria Enhanced Weight of Evidence Data, there are peaks below 940-1000m.
- Of the three key criteria only E-ADR low is seen above 700m, with values above 10 seen between 430-480m.
- All the rest of the key parameters are seen below 700m.
- The results suggests the majority of breccias or sulphides occur below 840-1000m with sulphides possible between 430-480m.

P1



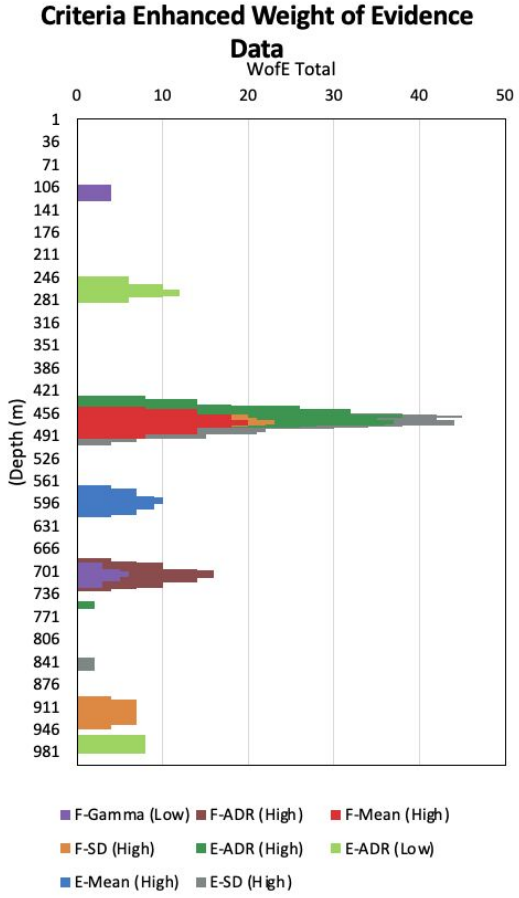
- Using the Criteria Enhanced Weight of Evidence Data, there are peaks between 200-300m, 390-550m, 630-670m, 771-810m, 841-900m and 970-1000m.
- Of the three key criteria E-ADR low is seen at 200m, while E-ADR high mostly concentrates 480-530m, while F-Mean concentrates 630-660m and 850-900m.
- The results suggests regular occurrences of breccia but there is no clear presence of sulphides. The most likely occurrence of sulphides between 210-230m.

P2



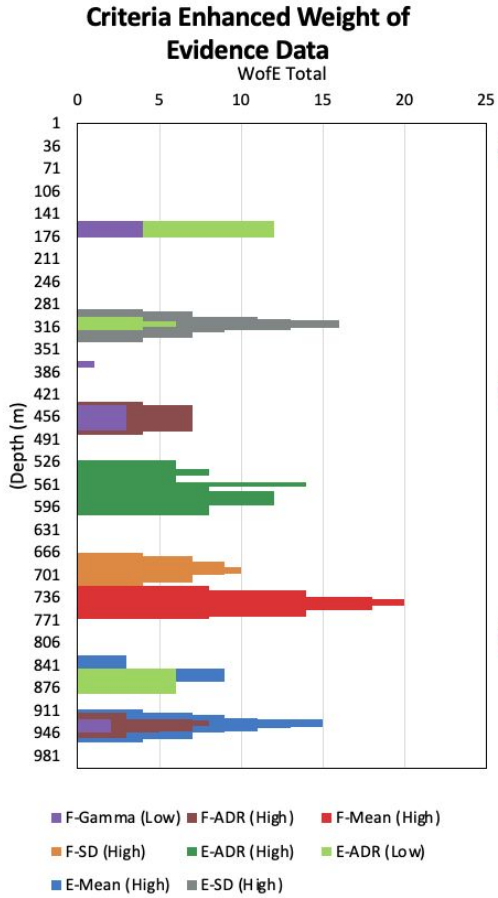
- Using the Criteria Enhanced Weight of Evidence Data, there are peaks at 500-630m and 770-840m.
- Of the three key criteria, E-ADR(high) is seen at 500-540m, F-Mean(high) is seen at 600-635m, while E-ADR(low) is seen at 770-800m.
- The results suggests a concentration sulphides most probably at 500-635m, while breccias occur between 210-300m.

TC2638-036



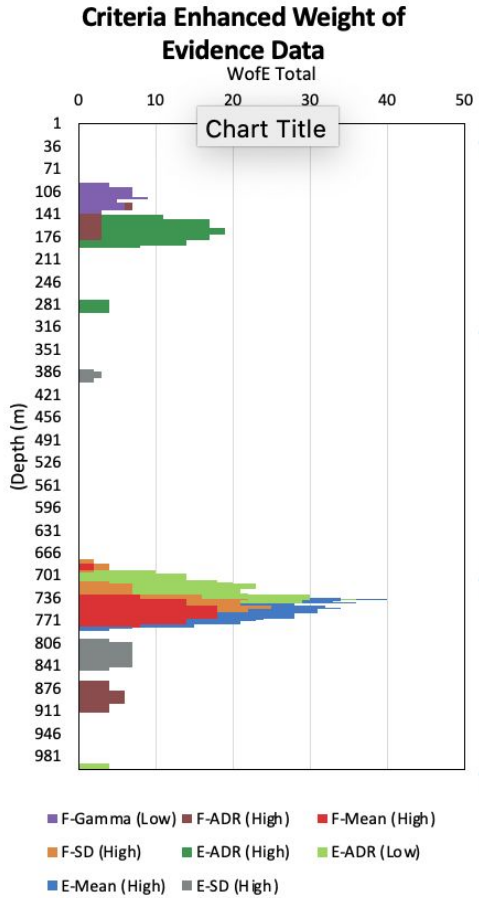
- Using the Criteria Enhanced Weight of Evidence Data, there are peaks at 250-280m, 425-500m, 565-610m, 675-720m, 900-940m and 950-980m.
- Of the three key criteria, E-ADR(high) is seen at 425-480m, F-Mean(high) is seen at 450-500m, while E-ADR(low) is seen at both 240-280m and 950-975m.
- The results suggests a concentration sulphides most probably at 425-500m with other peaks associated with breccias.

TC2638-070



- Using the Criteria Enhanced Weight of Evidence Data, there are peaks at 150-170m, 290-330m, 425-480m, 525-600m, 670-770m, 825-880m, 910-950m.
- Of the three key criteria, E-ADR(high) is seen at 525-600m, F-Mean(high) is seen at 730-770m, while E-ADR(low) is seen at 150-160m, 300-320m, 850-880m.
- The results suggests the most likely mineralisation is at 730-770m, though it is also likely to occur at 525-600m. The remaining peaks are likely to be breccias.

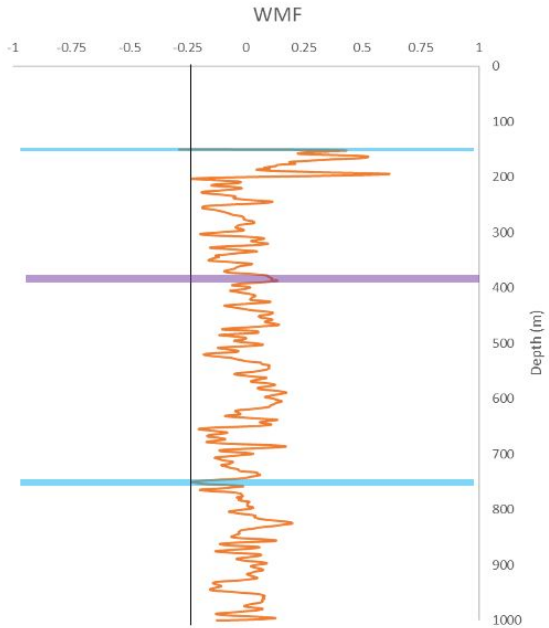
TC2638-P01

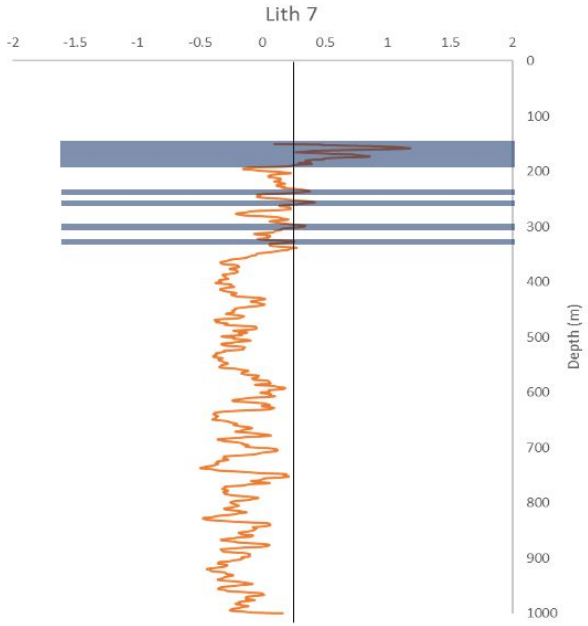


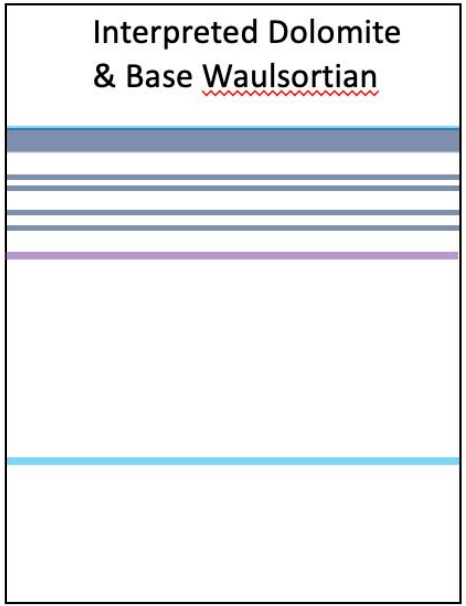
- Using the Criteria Enhanced Weight of Evidence Data, there are peaks at 100-190m, 670-775m and 800-900m.
- Of the three key criteria, E-ADR(high) is seen at 150-200m, F-Mean(high) is seen at 730-770m, while E-ADR(low) is seen at 700-735m.
- The results suggests the most likely mineralisation is at 700-775m, with the other peaks likely to be breccias.
- Overall the results are inconclusive because different parameters appear at very different depths at each site.

Blind Holes Lith_7 & WMF

L004



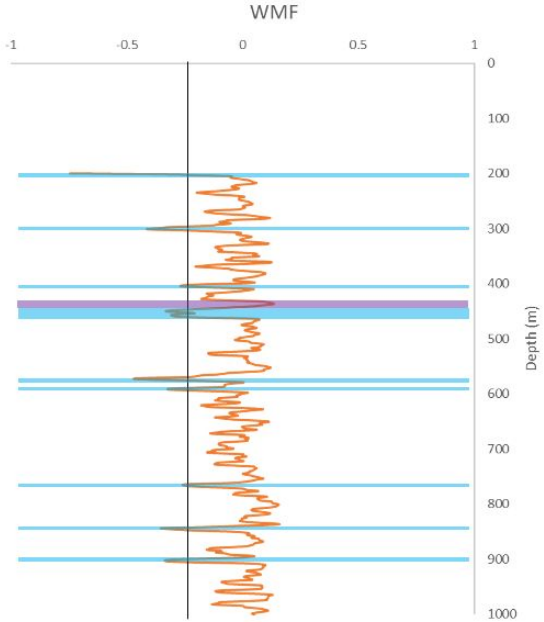


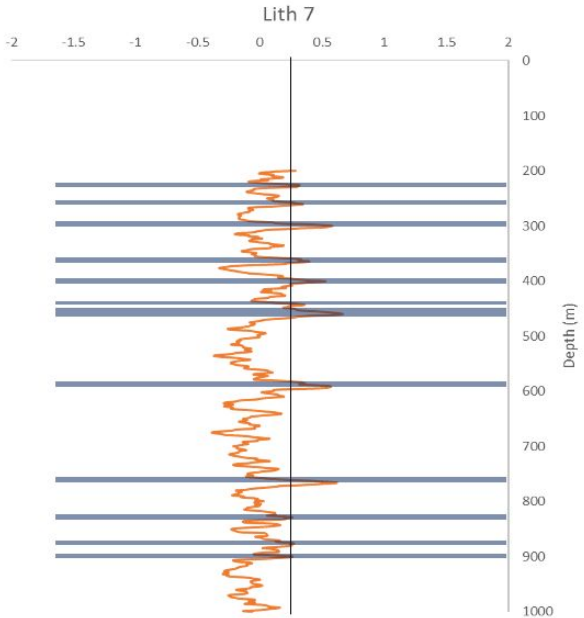


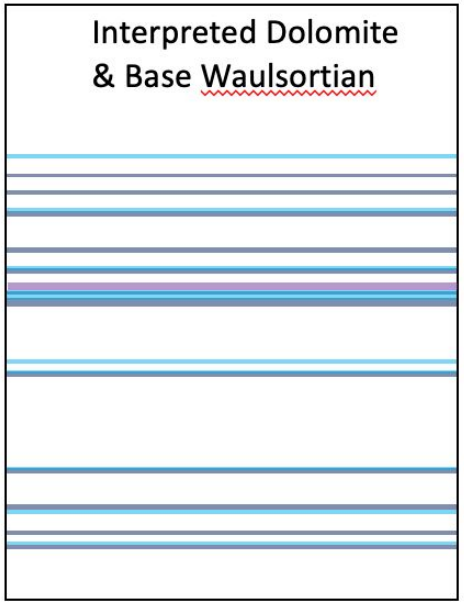
- When a threshold value of -0.25 for WMF and +0.25 for Lith_7 is applied, dolomite is identified regularly between 150-200m and further occurrences between 230-250m and 300-325m.
- The Base Waulsortian is identified by a broad peak at 390m.

Dolomite from WMF
Dolomite from Lith_7
Base Waulsortian

L009



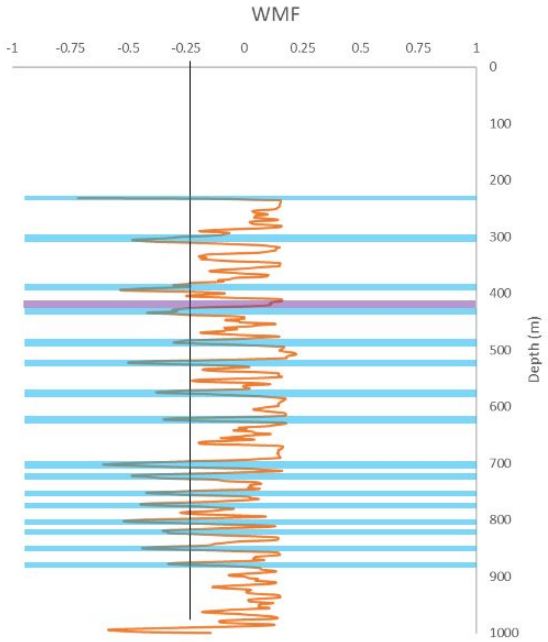


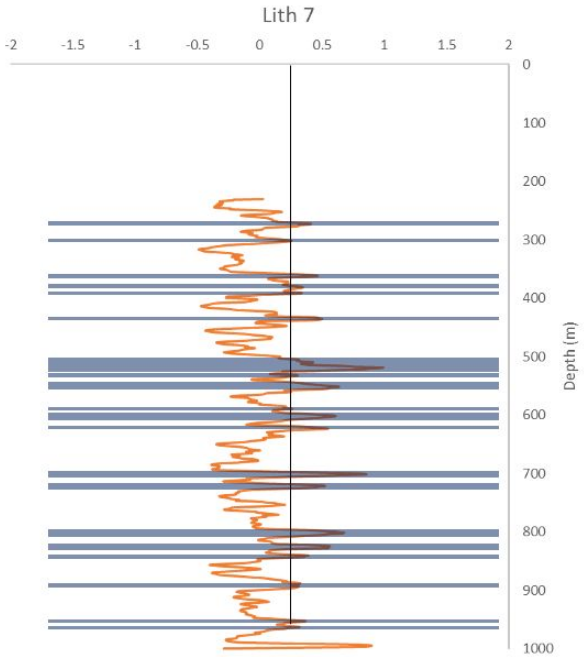


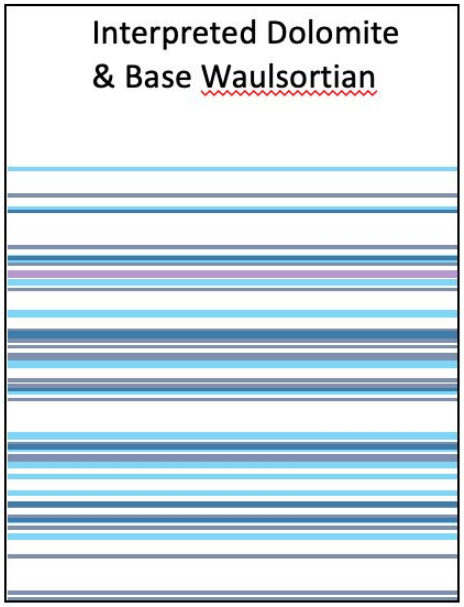
- When a threshold value of -0.25 for WMF and +0.25 for Lith_7 is applied, dolomite is seen regularly at 200-300m, 370-430m, 580-600m, 770-900m.
- The Base Waulsortian is located at approximately 420m.

Dolomite from WMF
Dolomite from Lith_7
Base Waulsortian

L030



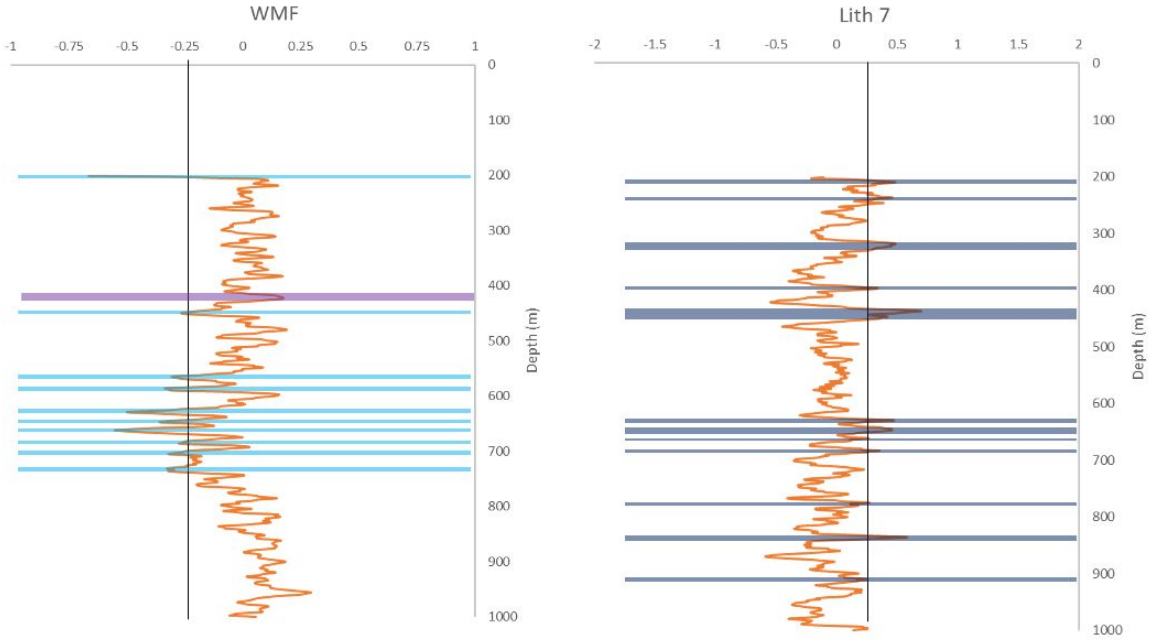


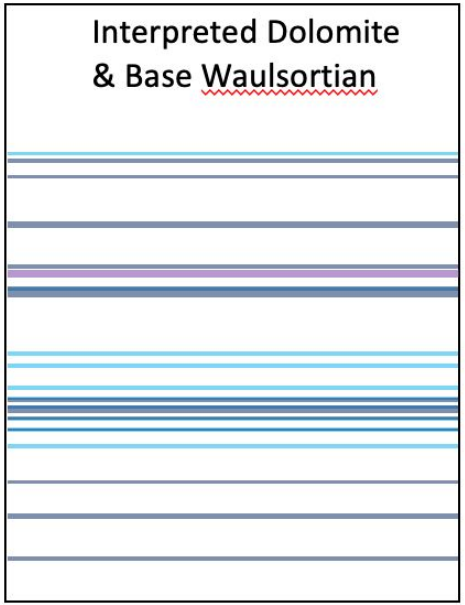


- When a threshold value of -0.25 for WMF and +0.25 for Lith_7 is applied, dolomite is seen regularly. Dolomite is mostly commonly seen at 200-300m, 370-450m, 500-600m, 700-880m.
- The Base Waulsortian is located at approximately 410m.

Dolomite from WMF
Dolomite from Lith_7
Base Waulsortian

P1

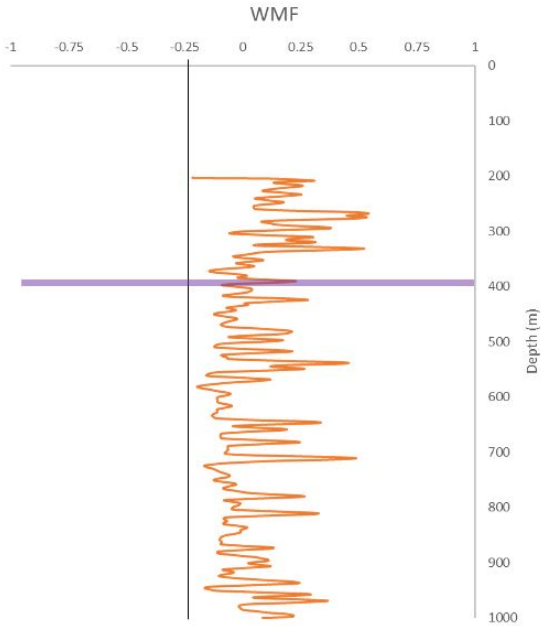


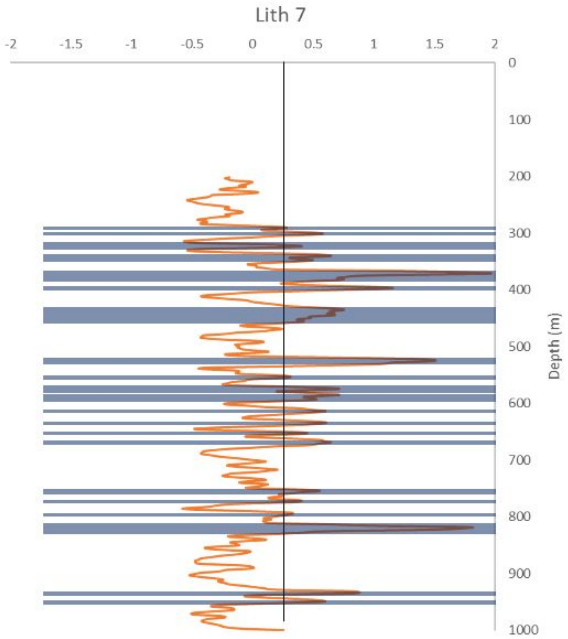


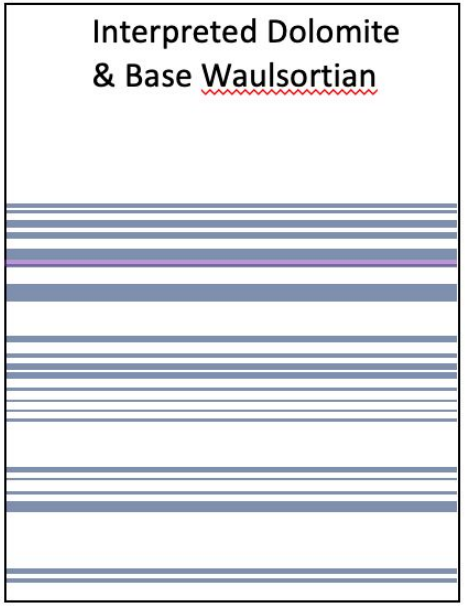
- When a threshold value of -0.25 for WMF and +0.25 for Lith_7 is applied, dolomite is seen regularly. Dolomite is mostly commonly seen at 200-230m, 310-430m, 550-700m.
- The Base Waulsortian is located at approximately 410m.

Dolomite from WMF
Dolomite from Lith_7
Base Waulsortian

P2



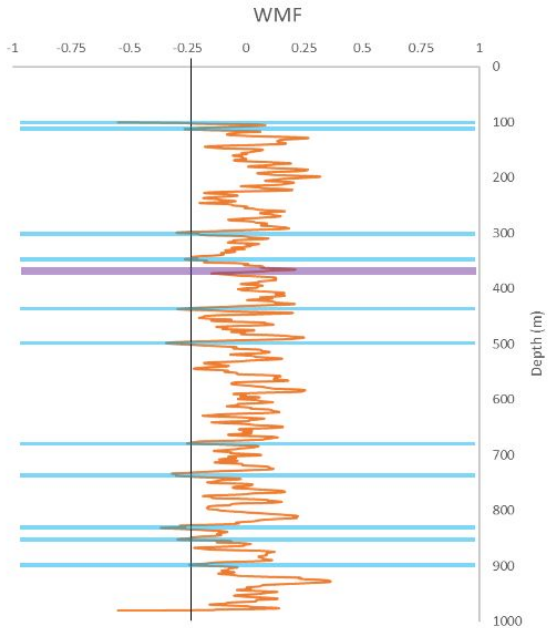


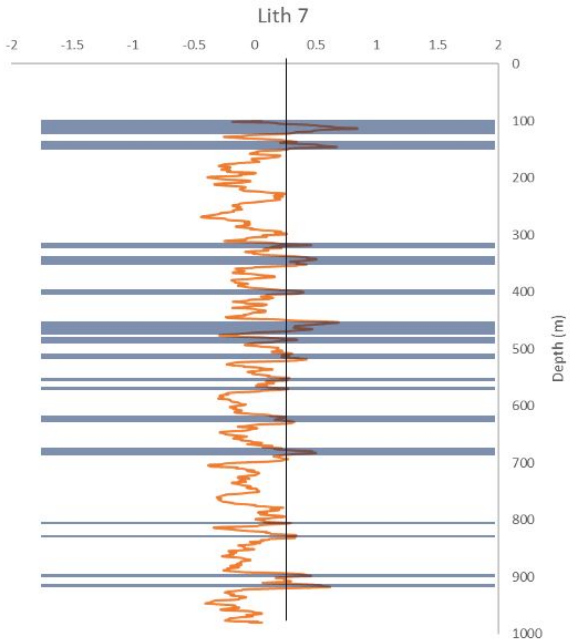


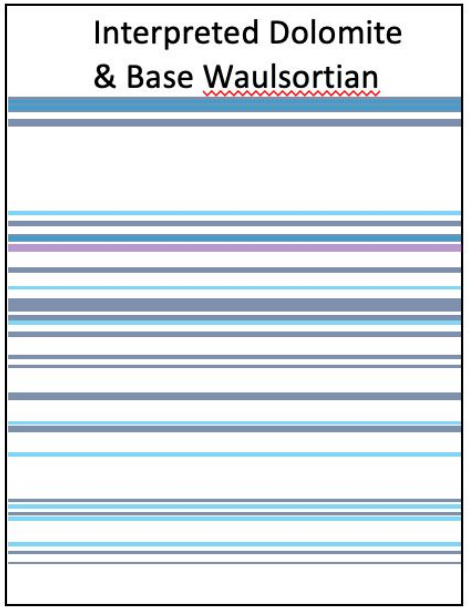
- When a threshold value of -0.25 for WMF and +0.25 for Lith_7 is applied, dolomite is seen regularly. Dolomite is mostly commonly seen at 290-400m, 510-650m and 750-810m.
- No values below -0.25 for WMF are seen.
- The Base Waulsortian is located at approximately 390m.

Dolomite from WMF
Dolomite from Lith_7
Base Waulsortian

TC2638-036



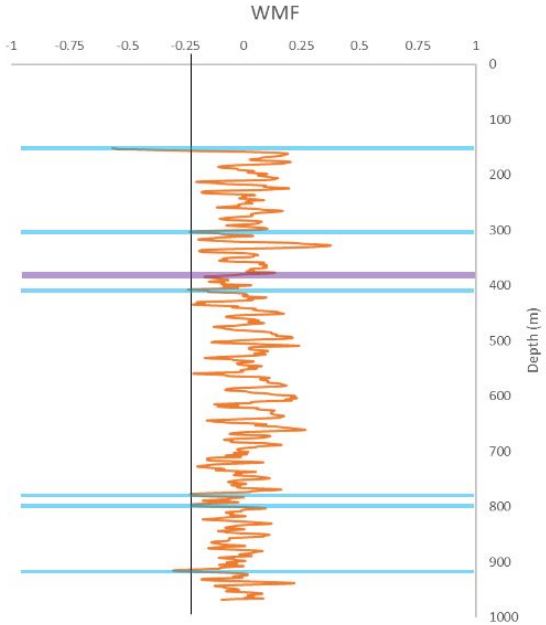


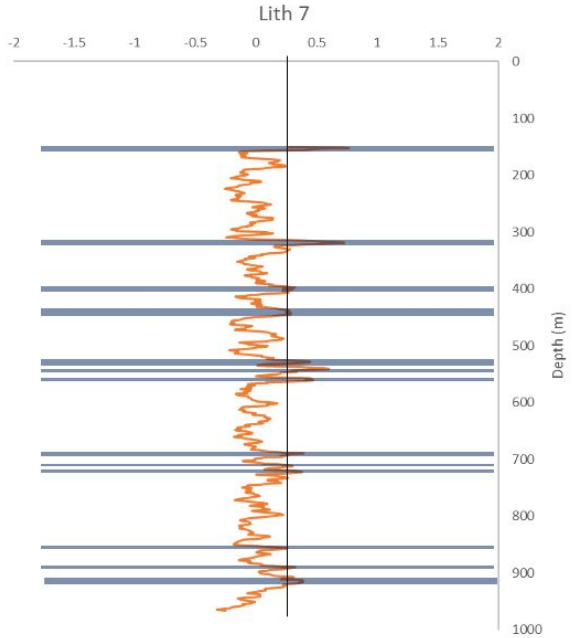


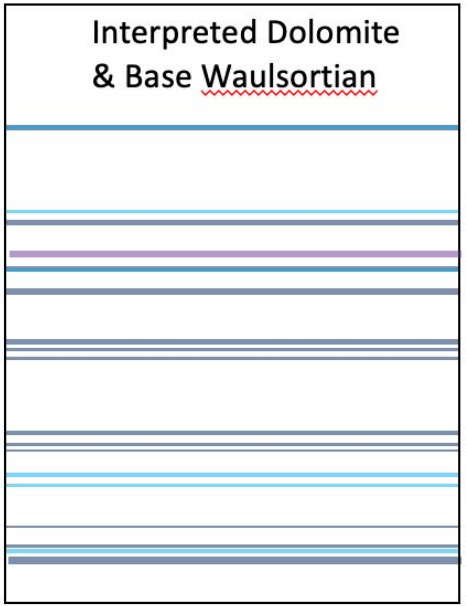
- When a threshold value of -0.25 for WMF and +0.25 for Lith_7 is applied, dolomite is seen regularly. Dolomite is mostly commonly seen at 100-130m, 300-340m, 400-550m, 600-680m,800-830m and 900-920m.
- The Base Waulsortian is located at approximately 350m.

Dolomite from WMF
Dolomite from Lith_7
Base Waulsortian

TC2638-070



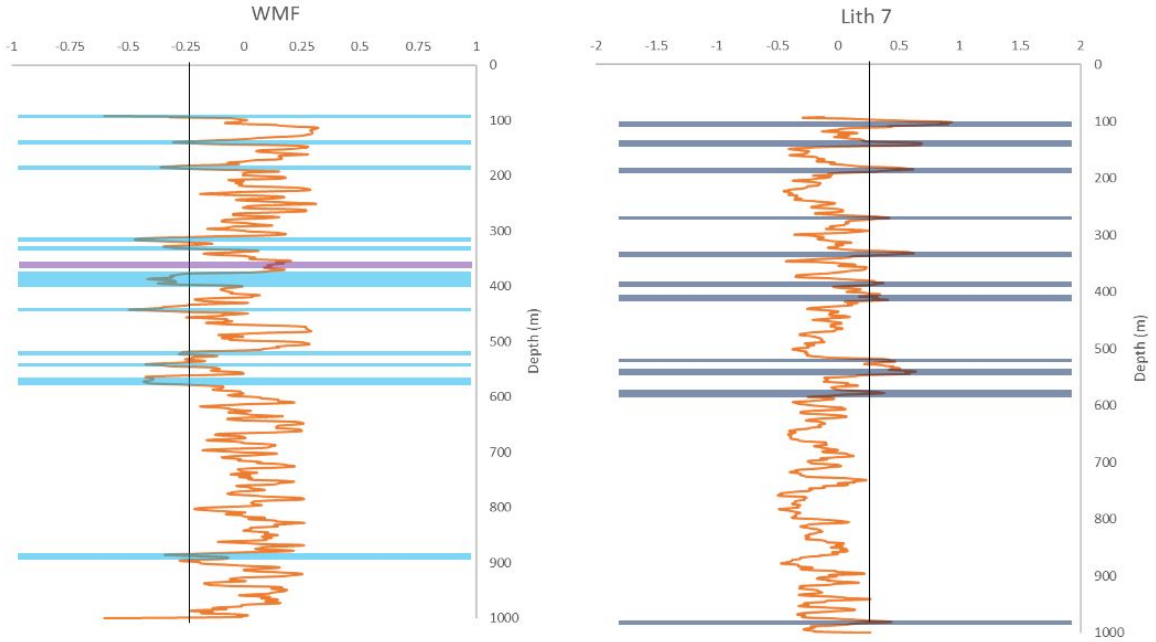


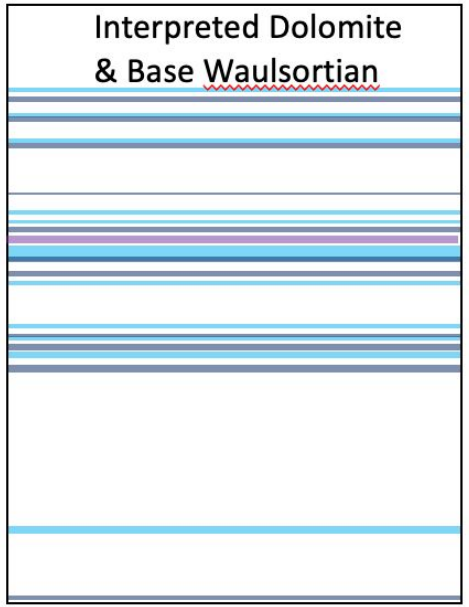


- When a threshold value of -0.25 for WMF and +0.25 for Lith_7 is applied, dolomite is seen regularly. Dolomite is mostly commonly seen at 140m, 300-320m, 400-430m, 510-540m, 690-740m and 850-910m.
- The Base Waulsortian is located at approximately at 320m.

Dolomite from WMF
Dolomite from Lith_7
Base Waulsortian

TC2638-P01



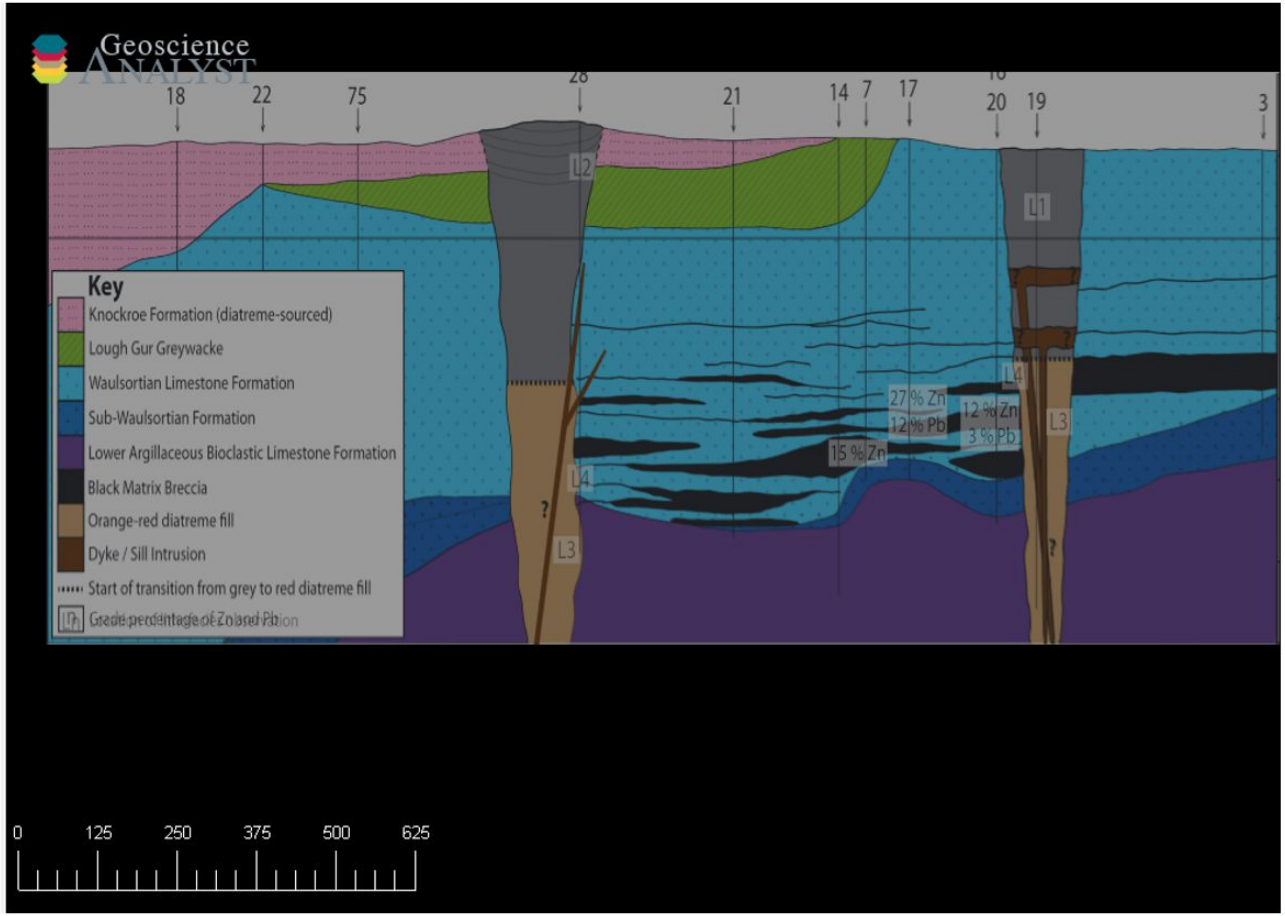


- When a threshold value of -0.25 for WMF and +0.25 for Lith_7 is applied, dolomite is seen regularly. Dolomite is mostly commonly seen at 100-200m, 270-410m, 500-580m.
- The Base Waulsortian is located at approximately 350m.
- In order to verify the data, the results are compared with the cross sections included in the Geoscience Analyst model.
- Because no full dolomite data is included in the Gesocience model, the focus will be on the base of the Waulsortian and on the relationship with breccias.

Dolomite from WMF
Dolomite from Lith_7
Base Waulsortian

Cross-sections

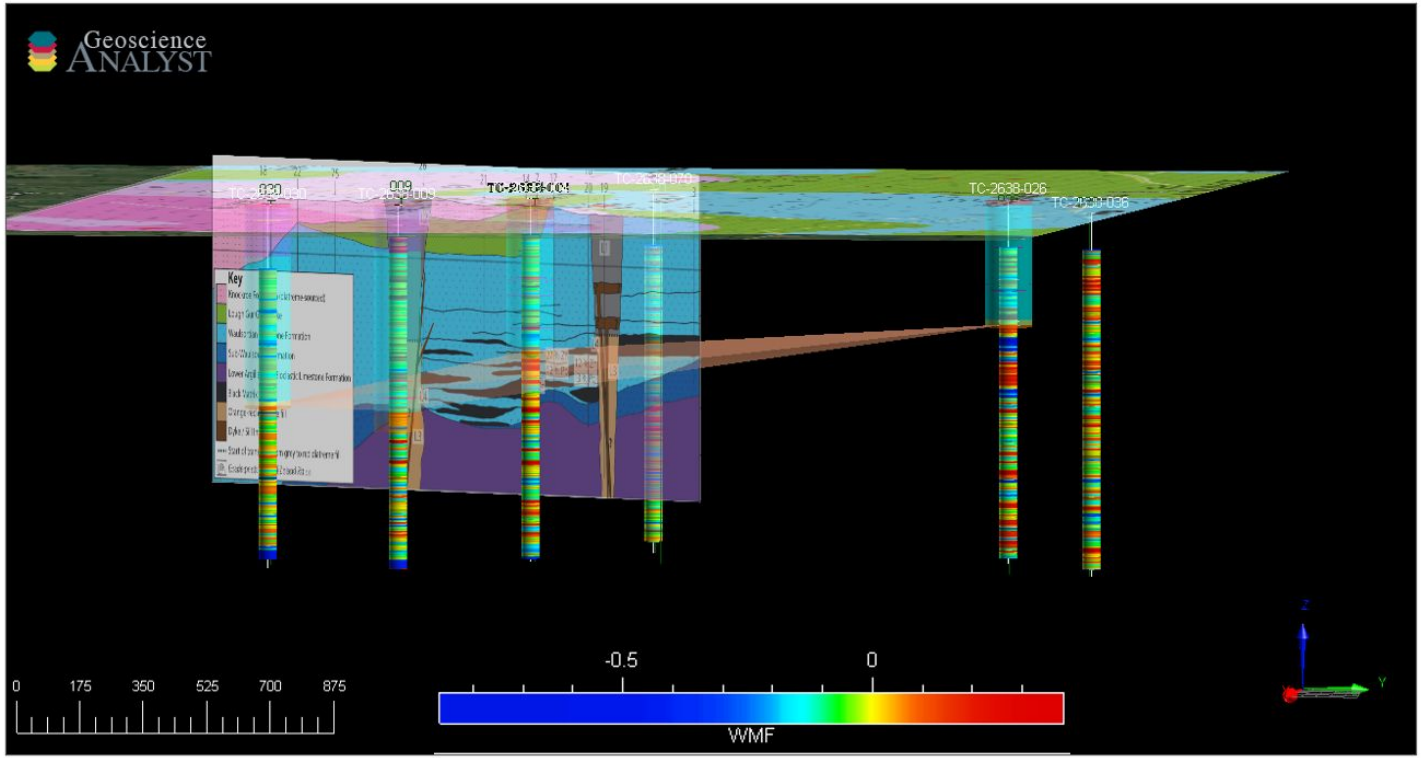
- A detailed lithology cross-section has been provided and the WMF and Lith_7 results are now compared with this.
- This information means an interpolation of the WMF and Lith_7 results can be completed against the breccias and the boundaries of the key limestone units such as the Sub-Waulsortian Formation and the Lower Argillaceous Bioclastic Limestone.
- The drill hole data from the training sites is also plotted alongside the cross-section.



Weighted Mean Frequency looking West

South

North

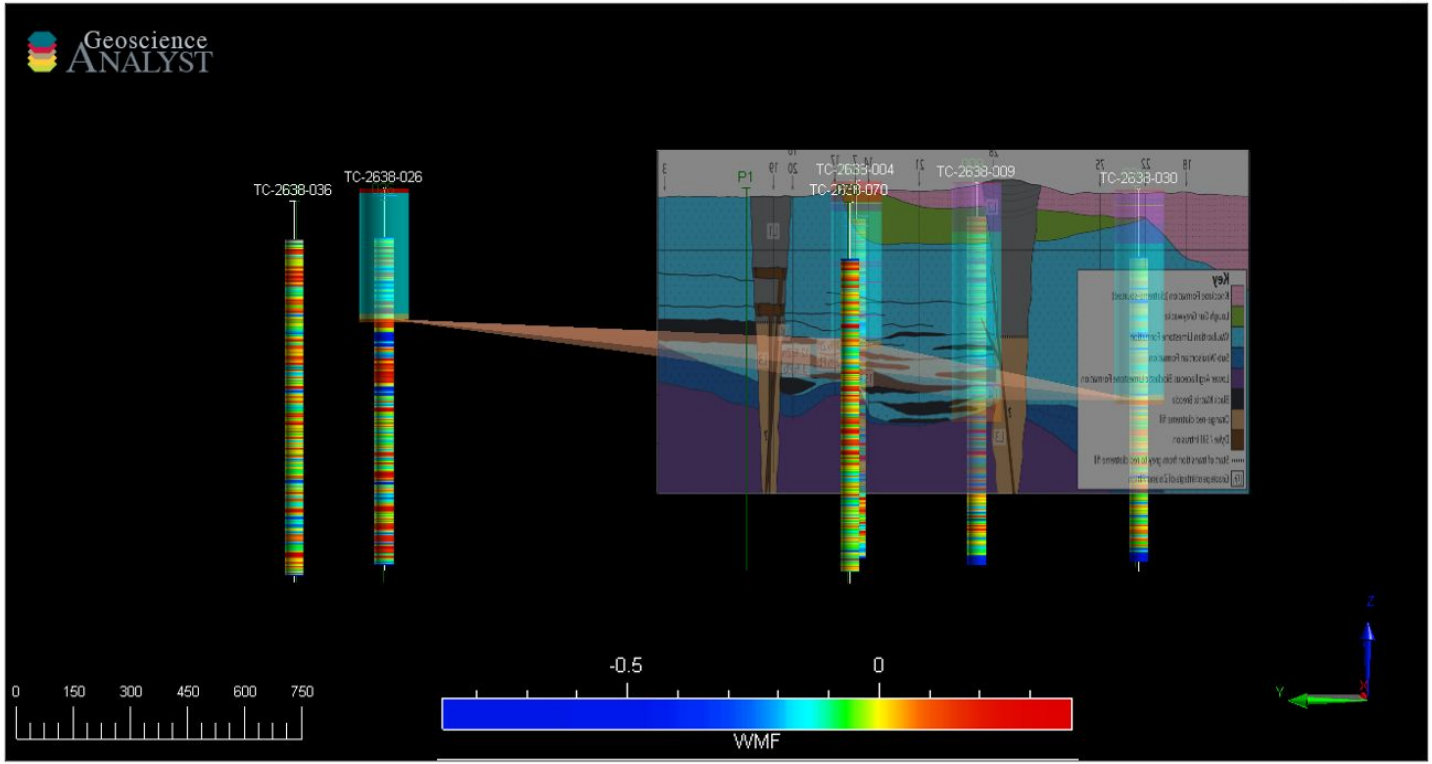


- When WMF is compared to the known lithology data, many of the highs appear to be associated with breccias.
- The Base of the Waulsortian still appears to be marked by highs, but there doesn't appear to be lows corresponding to the base apart from site TC-2638-030 which is located south of the diatremes where breccias are not observed.

Weighted Mean Frequency looking East

North

South

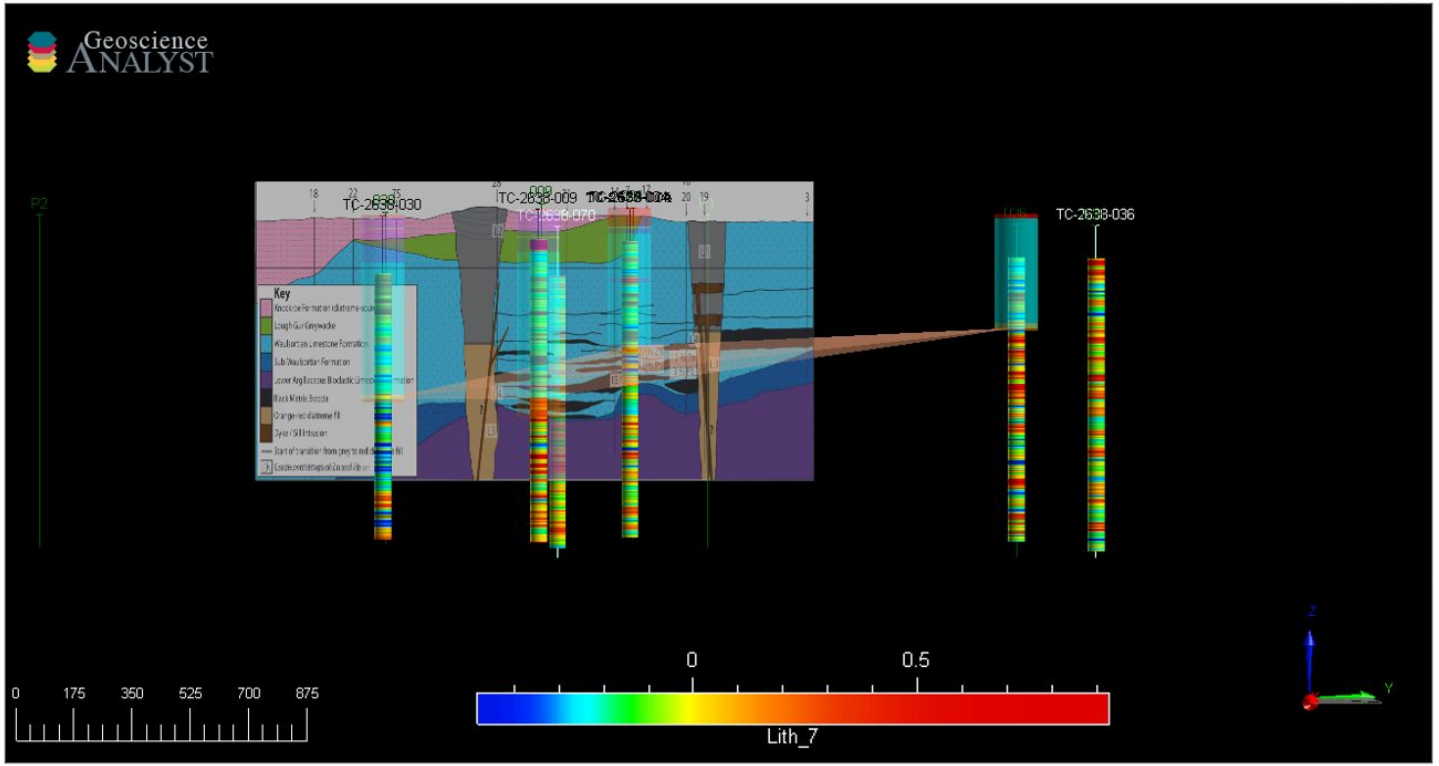


- When looking east, highs in the blind hole TC2638-070 also seem to correspond to breccias .
- Assuming lateral continuation to the east then there is good correspondence between high WMF and the presence of breccia.
- In each example highs in WMF are seen within the Lower Argillaceous Limestone and the Bioclastic Limestone.

Lith_7 looking West

South

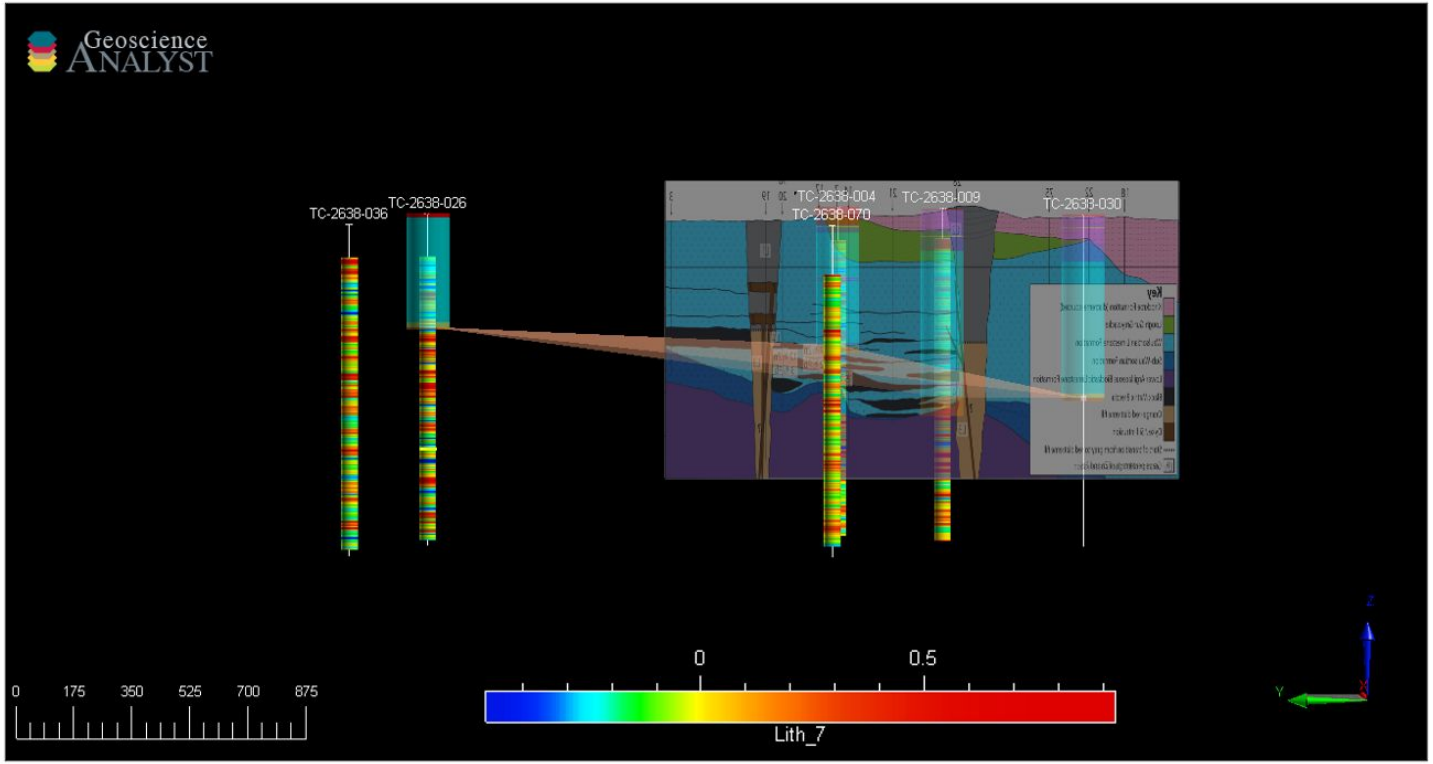
North



- When Lith_7 is compared to the known lithology data, some highs corresponding to breccias are seen, especially in TC-2638-009.
- Unlike WMF, high Lith_7 values are seen to the south of diatreme, adding further evidence to the idea that there is no correspondence with the breccia.
- In each V-bore the base of the Waulsortian is marked by highs in Lith_7 values.

Lith_7 looking East

North South

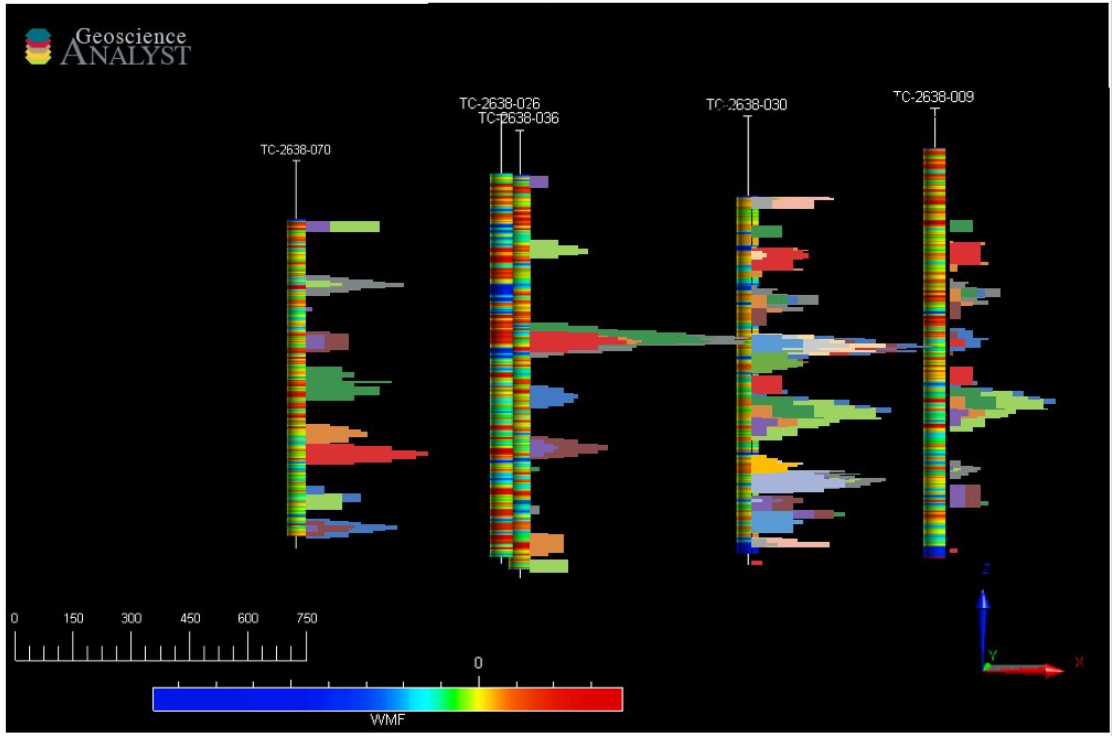


- When looking east, highs in the blind hole TC2638-070 also seem to correspond to breccias. However when looking across the section, there does appear to be multiple false positives where Lith_7 doesn't appear to correspond to any breccia.
- Furthermore TC-2638-004 does not show a positive response for Lith_7 on the boundary between the Waulsortian and the Sub-Waulsortian.

Conclusions

- In addition to the usual weight of evidence tests, several new tests were devised.
- The most promising of all of them was the difference from the median method for both weighted mean frequency and the Lith_7 lithmetrics.
- Lows in weighted mean frequency might correspond to dolomites and highs in weighted mean frequency shows some good matches with breccias and lower values are seen in TC-2638-030 where breccias are less common.
- Although there is no clear relationship between breccias and Lith_7, the training data suggests a possible relationship between positive values in Lith_7 and the presence of dolomite.
- The weight of evidence method did not clearly separate sulphides from breccias in the training data and this made it difficult to predict sulphide presence with any degree of confidence. As shown in the image there is no relationship to WMF.

Image facing north to north-east



Full weight of evidence criteria plots for selected holes alongside the difference from the median for weighted mean frequency.

What does this mean for Adrok?

What worked well

- The Lith_7 lithmetric has potential to be used as tool for identifying dolomite and should be tested further.
- Lows in Weighted Mean Frequency could also be used as a tool for identifying dolomite and should be tested further. This could be combined with the Lith_7 lithmetric to build a dolomite finding tool.
- Highs in Weighted Mean Frequency could be used as a tool for identifying breccias and this also needs to be investigated further.

What didn't worked well

- Lith_1 to Lith_6 which used the correlation and harmonics datasets did not show any trends with lithology change.
- Although values above 20 in the WSCC are rare, peaks are common at various depths.
- Neither the e-logs or the correlation showed a clear response to lithology, or formation boundaries.