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DEPARTMENT:

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PROJECT TITLE:

Clay Mineralogy of the Molina Member of the Wasatch Formation: Recognition of the PETM

Clay Mineralogy of the Molina Member of the Wasatch Formation: Recognition of the PETM

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Abstract

During the Paleocene and Eocene epochs, we saw a thermal event occur which changed the environment. By studying the clays minerals that are within the Molina Member of the Wasatch Formation we will see how the change in environment affected the clay minerals. The study area is located between De Beque, Colorado and Molina, Colorado just off 45 ½ road in an area called Atwell Gulch. The unit that is involved in this study is the Wasatch Formation with its three members: Atwell Gulch, Molina, and Shire. The two main units that were focused on were Atwell Gulch and Molina with a total of 17 samples taken from the Atwell Gulch study area. Three samples were collected from the Shire member to establish an area of decrease in the mineral kaolinite. The samples were then taken back to the lab and were analyzed for minerals that may have been affected by the change in the environment. When looking for the change in the clays we ay an increase in the kaolinite starting at WP15_M10 to WP17_M12. The sudden increase shows that something dramatic occurred. We can see that the environmental change caused a subsequent change in the clay minerals and we can use this study as a basis for what the future environment may look like if we reach another thermal maximum time.

Purpose

The purpose of the project is to determine if the PETM interval (Zachos et al, 2008) can be found in the Molina member by comparing the clay mineralogy of the Molina member with the clay minerals within the Atwell Gulch and Shire members. We plan to find an increase in the amount of kaolinite form the Atwell gulch through the Molina member and then a decrease in the Shire member. Theoretically, there should be an increase due to the PETM interval that was found within the Molina member from the previous work by Zachos.

Study Area

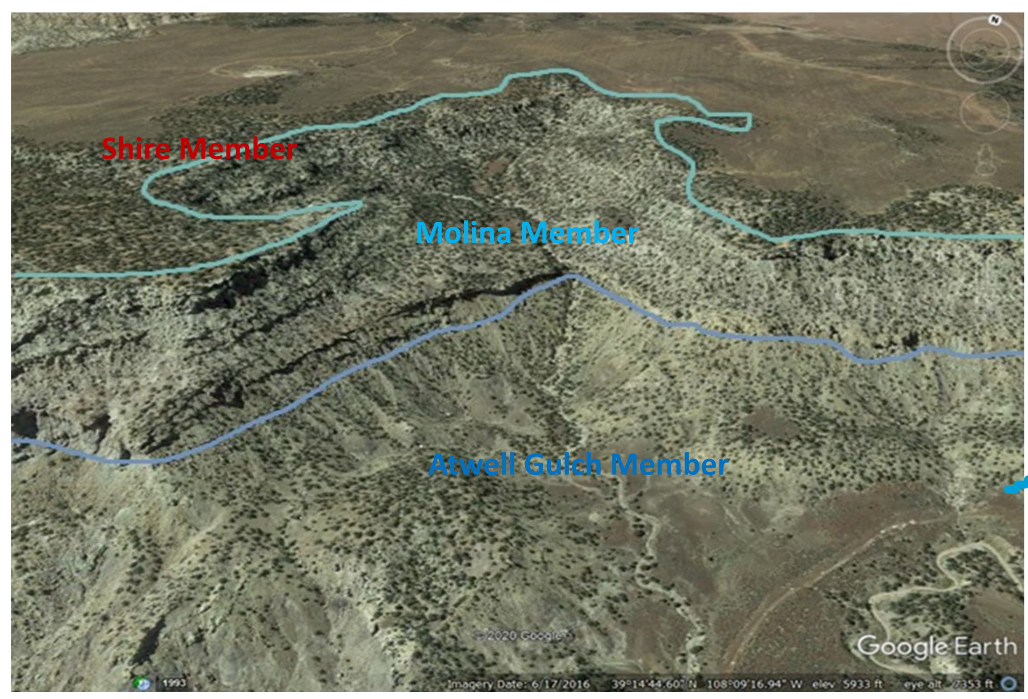
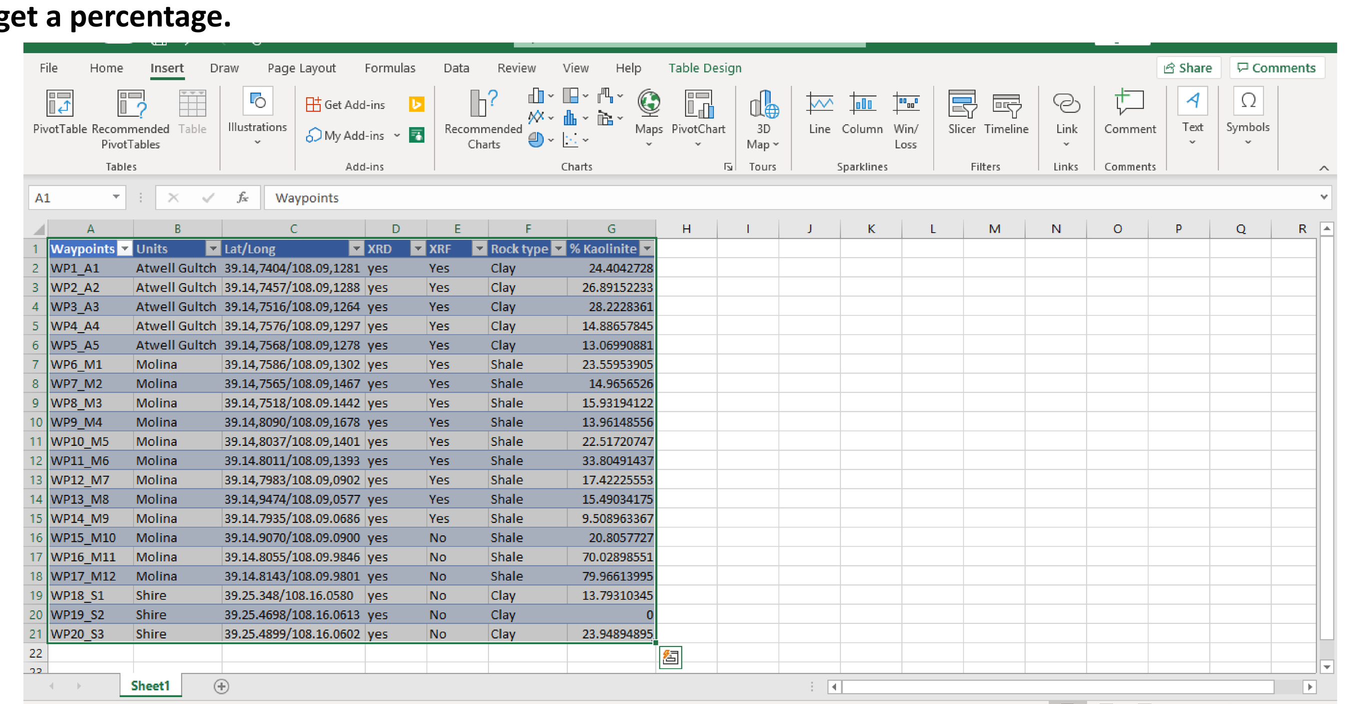


Figure 1. An aerial view of the study area with labeled sections of the Wasatch Formation

Figure 2. Close up image of the study area.

Methods

The methods that were used in the project are XRD and some XRF data analysis. To get he data though we had to grind the samples in to fine material for the XRD to pick up some of the clay material. WE then separated the clay using a mixture of Calgon and magnesium chloride. We let the samples dry and run them three different times through the XRD as a normal smear mount to a glycolate mount then finally to a furnace mount. We take the data and calculate the percent of kaolinite there is in each of the samples. The methods that were used to calculate the percent of kaolinite was using the data that was given by the XRD for each of the samples. I then took the integrated intensity numbers (Int. I) for the 14, 12.5, 10 and 7 angstrom peaks and added them together. I then divided the sum by the Int I. 7.2 angstrom peak, after the answer was calculated I then took that number and multiplied it by 100 to get a percentage.



Waypoints	Units	Lat/Long	XRD	XRF	Rock type	% Kaolinite
WP1_A1	Atwell Gultch	39.14,7404/108.09,1281	yes	Yes	Clay	24.4042728
WP2_A2	Atwell Gultch	39.14,7457/108.09,1288	yes	Yes	Clay	26.89152233
WP3_A3	Atwell Gultch	39.14,7516/108.09,1264	yes	Yes	Clay	28.2228361
WP4_A4	Atwell Gultch	39.14,7576/108.09,1297	yes	Yes	Clay	14.88657845
WP5_A5	Atwell Gultch	39.14,7568/108.09,1278	yes	Yes	Clay	13.06990881
WP6_M1	Molina	39.14,7586/108.09,1302	yes	Yes	Shale	23.55953905
WP7_M2	Molina	39.14,7565/108.09,1467	yes	Yes	Shale	14.9656526
WP8_M3	Molina	39.14,7518/108.09.1442	yes	Yes	Shale	15.93194122
WP9_M4	Molina	39.14,8090/108.09,1678	yes	Yes	Shale	13.96148556
WP10_M5	Molina	39.14,8037/108.09,1401	yes	Yes	Shale	22.51720747
WP11_M6	Molina	39.14.8011/108.09,1393	yes	Yes	Shale	33.80491437
WP12_M7	Molina	39.14,7983/108.09,0902	yes	Yes	Shale	17.42225553
WP13_M8	Molina	39.14,9474/108.09,0577	yes	Yes	Shale	15.49034175
WP14_M9	Molina	39.14.7935/108.09.0686	yes	Yes	Shale	9.508963367
WP15_M10	Molina	39.14.9070/108.09.0900	yes	No	Shale	20.8057727
WP16_M11	Molina	39.14.8055/108.09.9846	yes	No	Shale	70.02898551
WP17_M12	Molina	39.14.8143/108.09.9801	yes	No	Shale	79.96613995
WP18_S1	Shire	39.25.348/108.16.0580	yes	No	Clay	13.79310345
WP19_S2	Shire	39.25.4698/108.16.0613	yes	No	Clay	0
WP20_S3	Shire	39.25.4899/108.16.0602	yes	No	Clay	23.94894895

Table 1. Data that was collected throughout the data and at sample sites

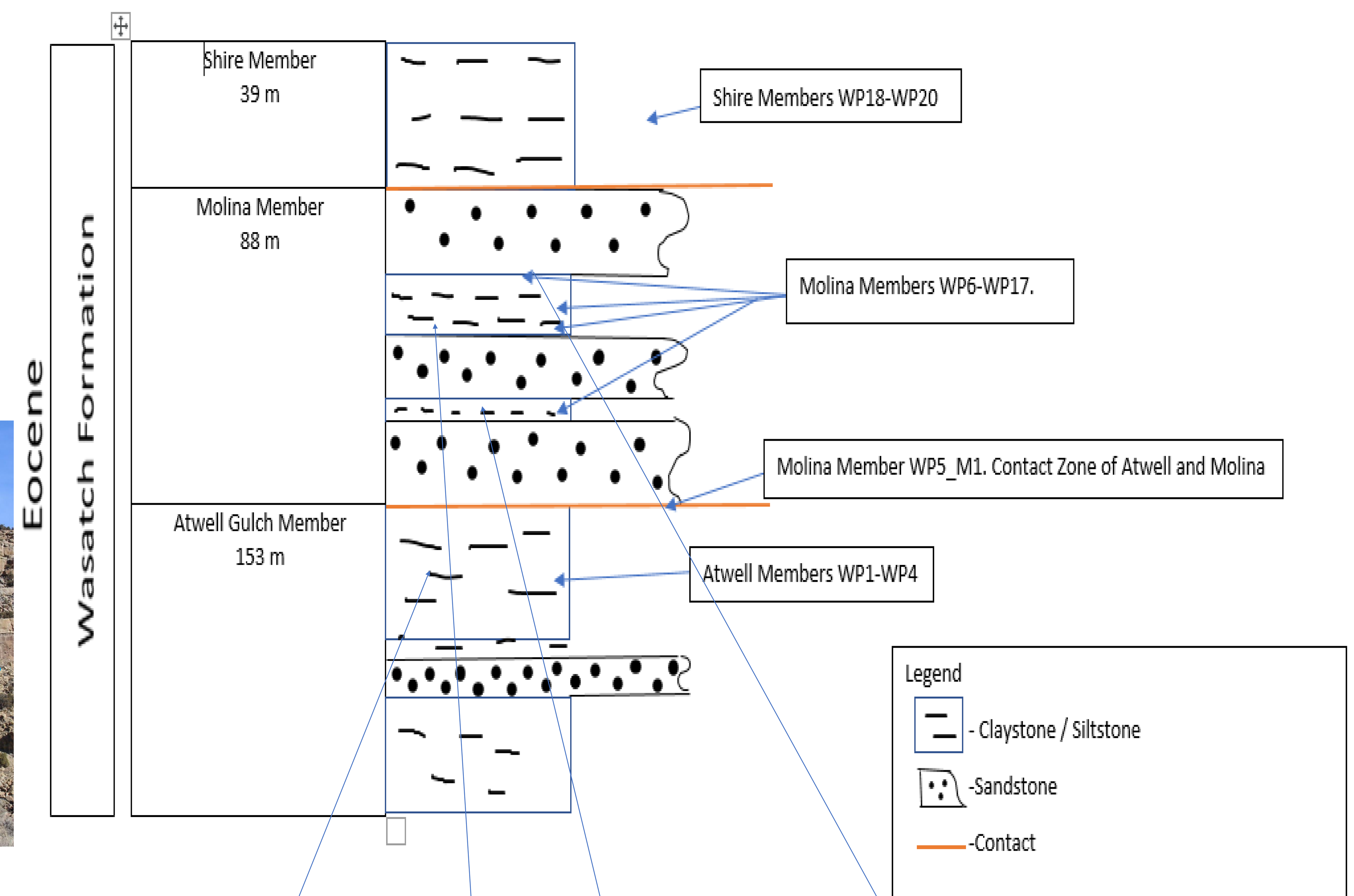


Figure 3. WP2_A2

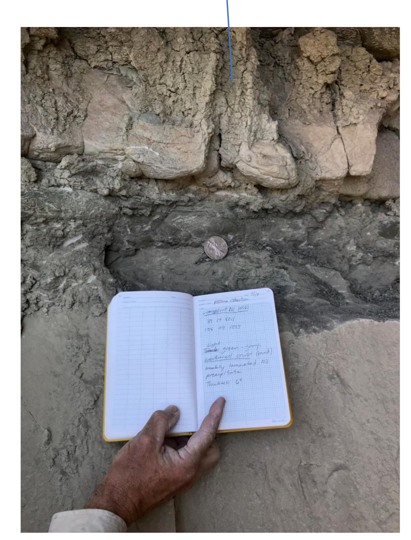


Figure 5. WP11_M6

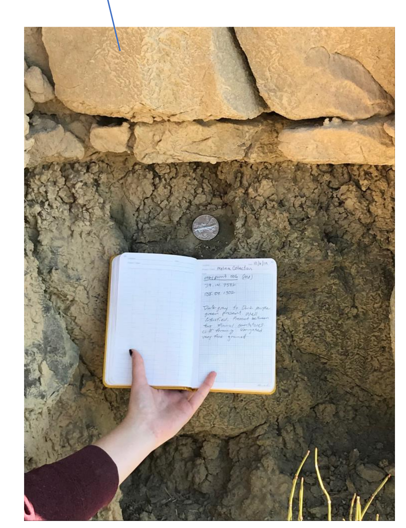


Figure 4. WP6_M1

Figure 6. WP16_M11

Results

The results showed that the percent of kaolinite had an increase that started after the middle and into the end of the Molina Member. The spike then drastically drops at the beginning of the Shire member. Kaolinite is a mineral that is found in very wet environments. With the data that has been collect we can assume that the environment during the Molina was a wet and humid environment. This is also consistent with braided river channel system that is found within the lithology of the sandstone bodies of the Molina Member.

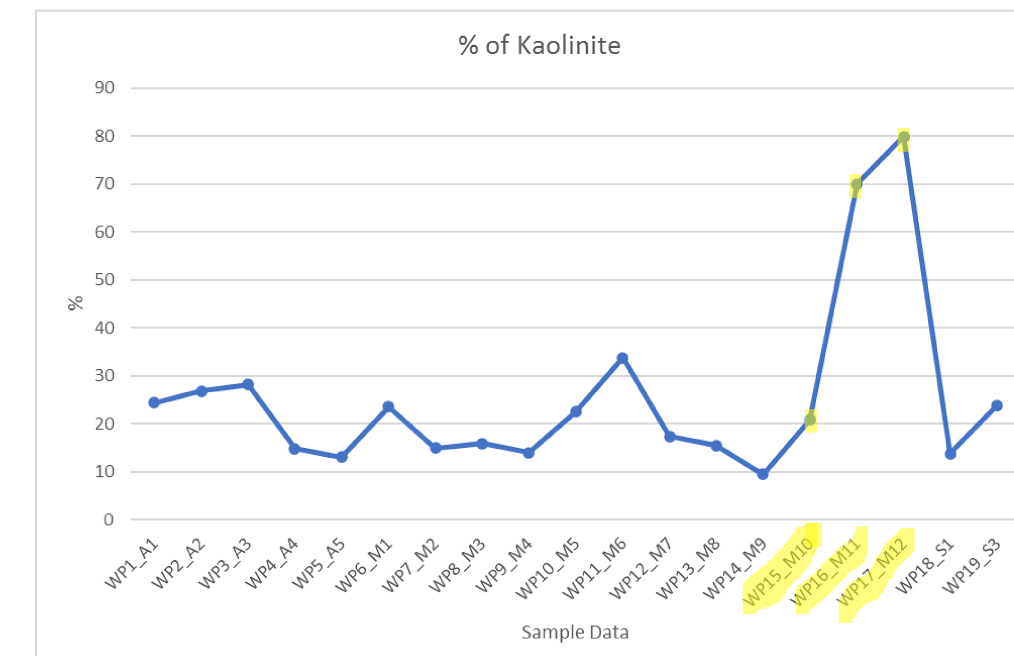


Figure 8. This graph shows the percent of kaolinite in each of the samples starting from the oldest member to the youngest member

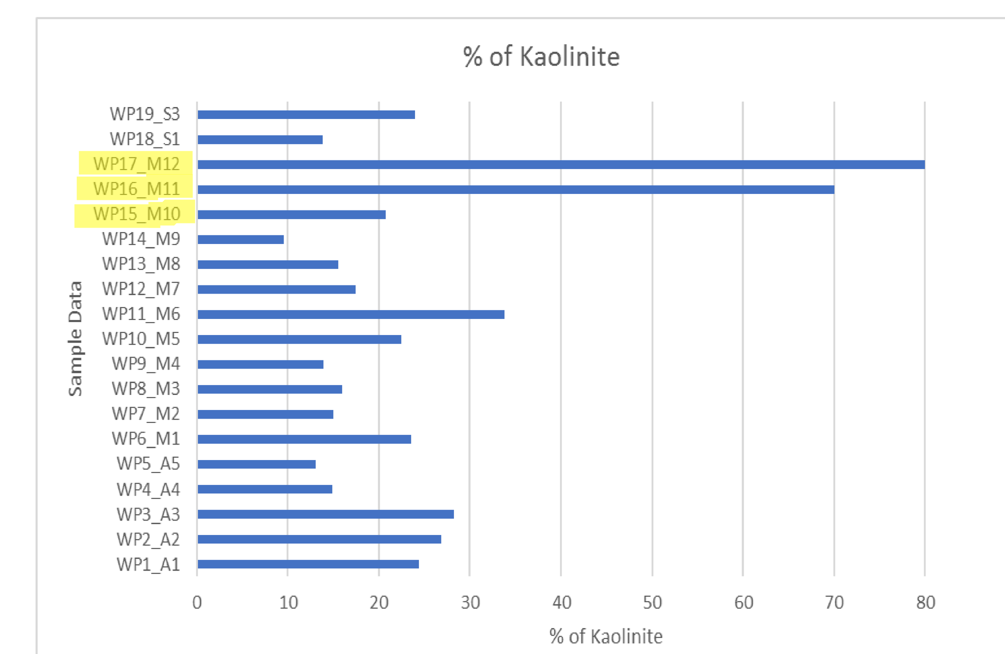


Figure 9. this graph represents the samples in order from the oldest member at the bottom to the youngest member at the top. The chart also corresponds to the stratigraphic column.

Conclusions

From the data that was collected form analyzing the samples we can confirm that there is a PETM value within the Molina Member. We can say that at this spot the environment changed so much so that it changed the chemistry of the clay minerals.

Acknowledgements

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