Title of your lab report

Introduction

You are going to write your lab report as an R Markdown document. Markdown is a simple formatting syntax that is used to write plain text documents that can be created and edited in many different programs and easily converted into HTML and PDF. You should open and edit this document in RStudio, which has many useful features for writing markdown. To learn more, click the **Help** toolbar button for more details on using R Markdown. It should take you five minutes to learn all about Markdown that you need to know to write your lab report. If you want to spend more than five minutes, you can read the detailed syntax here. When you click the **Knit HTML** button in RStudio, a web page will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

Background

The reason why we are using this exotic format for our lab report is to learn about reproducible research. Reproducible research is an approach to science that connects specific instructions to data analysis and empirical data so that scholarship can be recreated, better understood and verified. In practice, this means that all the results from a publication or report can be reproduced with the code and data available online. The advantages of this approach include:

- We can automatically regenerate documents when our code, data, or assumptions change. For example if we do further analysis of our samples we can just add it on to this report.
- We minimize or eliminate transposition errors that occur when copying results (eg from Excel) into documents.
- We preserve a detailed preserve contextual narrative about why analysis was performed in a certain fashion (ie. we don't have to search on our computer for all the files because everything is one file)
- Documentation for the analytic and computational processes from which conclusions are drawn. In case anyone wants to know *all* the details of our statistical methods, they can see them all in the code blocks here.

Our specific tool-kit for reproducible research is a very common one: R + RStudio + Markdown. Although it's common, it has a bit of a steep learning curve. There's a lot of documentation and examples on the web that can ease the frustration. You may never (want to) write another document using this tool-kit ever again, but I think it's important that you have an understanding of this approach to doing science, in the hope that some of the ideas will rub off to improve any kind of empirical work that you might do in the future. This approach to doing science is becoming widespread in computer science and some areas of biology and psychology. I expect it's part of a general shift in the way all sciences will be done, and will come to archaeology eventually.

When you write your report you should delete the above text and use this section to write about archaeological sites and environmental records that are relevant to understanding our lab data.

Methods and Materials

This would be a good place to mention the radiocarbon dates... and refer to the excavation report for details about the site and excavation methods.

Chemical analyses

Brief description of how you measured pH, EC, SOM , $CaCO_3$... The maximum value of organics was 9.74% at 1.6m below the surface

The maximum value of carbonates was 33.8% at 0.9m below the surface, approximately 4,800 BP

Physical analyses

Brief description of how you measured colour, magnetic suceptibility and particle size distributions...

Results

Your one or two sentence summary observations of the most striking changes in the sedimentary sequence at the site...

Chemical analyses

Now the details... pH, EC, SOM, $CaCO_3$ e.g. The pH values ranged from 8.67 to 6.93...

Physical analyses

Particle size distributions... lots of possible plots here, chose wisely!

Magnetic susceptibilty values ranged from 3146 to 46...

Discussion

Here's where you describe the implications of your data in terms of:

1. Past human behaviours
2. Past environments
3. Site formation processes

You will need to draw on previously published studies to make new connections with your data. Show how your data support or contradict previous claims.

You may want to make some connection to a change in our variables at say, sample 3.4 and other data from other sites. You'll want to refer to the age of sample 3.4, which you can compute like this, right in the middle of your sentence: "This substantial change in xxx occurs at about 4,050 cal years BP."

References

Use APA style, look on google scholar for the little 'cite' link that will generate nicely formatted references for you.

Tables and Figures

For convienence, let's put all the tables and figures at the end of the text. This is a common convention when preparing manuscripts for submission to journals or books for publication.

Do be careful to put the tables and figures in a logical order that reflects the order that you mention things in your text. And don't forget to edit the captions for your tables and figures to be richly detailed.

Tables first...

Here's what you'd do for a simple table. This style of table is for simple qualitative tables (ie. mostly text in the table, not numbers, read on for making tables of numbers...):

```
## Error: Pandoc does not support newlines in simple or Rmarkdown table
## format!
```

Or we can make a table from our data, so the table will update when we update our data (a much better approach! Do this for any lab data you want to tabulate). For example:

	DirectAMS.code	Submitter.ID	OxCal.median	OxCal.sigma
1	D-AMS 004027	SQB Spit 3	391	52
2	D-AMS 004028	SQB Spit 8	3615	36
5	D-AMS 004029	SQB Spit 10	4131	58
6	D-AMS 004030	SQB Spit 14	4085	56
9	D-AMS 004031	SQB Spit 16	4254	69
10	D-AMS 004032	SQB Spit 20	4359	52
17	D-AMS 004035	SQB Spit 31	6808	44
18	D-AMS 004036	SQB Spit 36	7013	71
20	D-AMS 004037	SQB Spit 45	7426	46
22	D-AMS 004038	SQB Spit 53	8839	96
26	D-AMS 004040	SQB Spit 56	9515	21
28	D-AMS 004041	SQB Spit 61	4071	58
30	D-AMS 004042	SQB Spit 64	9699	86
32	D-AMS 004043	SQB Spit 71	19122	109
34	D-AMS 004044	SQB Spit 73	13528	59

Table 1: My great data

Don't forget to edit the table captions...

	Sample.ID	mean.pH	mean.EC	mean.MS.LF	mean.MS.FD	mean.Organic	mean.CaCO3
1	0.1	7.53	514.3	2599	29.9	4.33	17.2
2	0.2	8.63	139	2303	6.744	5.03	18.19
5	0.3	8.03	115	2188	8.255	4.5	15.94
6	0.4	8.27	182.7	2509	7.98	5.38	21.19
9	0.5	8.2	223.3	1957	18.78	4.65	18.85
10	0.6	8.6	164	2035	3.691	5.37	18.69
13	0.7	8.1	116.7	2365	7.917	4.39	25.21
14	0.8	8.27	171	2448	7.941	5.32	18.6

17	0.9	8.37	212	2280	-13.93	4.71	33.8
18	1	8.63	150.7	2365	15.36	4.8	21.26
20	1.1	8.2	114.7	2294	7.832	4.26	19.57
22	1.2	8.43	165.7	2200	8.033	4.38	21.23
25	1.3	8.5	196	2427	12.93	4.08	18.8
26	1.4	8.67	137.7	2489	25.23	4.17	18.07
28	1.5	8.2	119.7	1780	7.009	2.94	26.12
30	1.6	8.6	134.3	3146	6.134	9.74	17.32
32	1.7	8.5	227.7	2145	-1.814	4.04	18.54
34	1.8	8.53	142	2255	-7.703	4.26	18.84
37	1.9	8.4	99.7	2370	7.553	4.92	17.46
38	2	8.43	152	2487	7.485	3.23	20.23
40	2.1	8.5	182.7	2217	15.92	3.94	17.5
43	2.2	8.57	133	1924	-7.446	4.76	17.66
45	2.3	8.33	90.7	2202	7.072	4.07	17.28
46	2.4	8.37	130.7	2973	8.304	4.25	17.31
48	2.5	8.5	180.7	2213	16.85	3.37	16.86
50	2.6	8.5	132.7	2421	6.48	4.03	18.2
52	2.7	8.13	107	2904	7.592	3.39	18.66
54	2.8	8.17	123.3	2403	8.388	3.19	22.44
57	2.9	8.57	170	2498	-2.439	3.22	22.08
58	3	8.4	130.3	2306	-2.625	4.34	17.45
60	3.1	8.03	102.7	2137	25.44	3.59	19.36
62	3.2	7.97	214.3	845.1	8.97	7.3	3.76
66	3.3	8.1	202.3	362.1	9.316	7.43	3.78
67	3.4	8.3	103	167.7	7.65	7.04	4.03
69	3.5	7.7	119.7	88.05	-9.524	7.02	4.1
71	3.6	7.83	139	262.9	7.854	7.62	4.73
74	3.7	6.93	120.7	45.75	12.93	6.78	3.94
76	3.8	8.1	90.3	53.23	0.8621	6.3	4.2
79	3.9	7.67	102	50.91	-24.1	7.21	4.16
80	4	7.77	205	85.51	4.889	7.66	3.84
83	4.1	7.1	183	123.1	-15.25	6.51	3.93

Table 2: My great data

You might just want to have a table of sediment munsell colour values. . .

	Sample.ID	Dry.Color.ID	Dry.Color.nomenclature	Wet.Color.ID	Wet.Color.Nomenclature
1	0.1	10YR 3/6	dark yellowish brown	10YR 2/2	very dark brown
2	0.2	10YR 3/6	dark yellowish brown	10YR 2/2	very dark brown
5	0.3	5YR 3/3	dark reddish brown	10YR 3/4	dark yellowish brown
6	0.4	10YR 2/2	very dark brown	10YR 2/2	very dark brown
9	0.5	10 YR 3/3	dark brown	10YR 2/2	very dark brown
10	0.6	10YR 3/3	dark brown	10YR 2/2	very dark brown
13	0.7	10YR 2/2	very dark brown	10YR 2/2	very dark brown
14	0.8	10YR 2/2	very dark brown	10YR 2/2	very dark brown
17	0.9	10YR 2/2	very dark brown	10YR 3/2	very dark greyish brown
18	1	10YR 3/3	dark brown	10YR 3/2	very dark greyish brown
20	1.1	10YR 3/4	dark yellowish brown	5YR 3/2	dark reddish brown
22	1.2	10YR 2/2	very dark brown	10YR 2/2	very dark brown
25	1.3	5YR 2.5/2		10 YR 2/2	very dark brown
26	1.4	10YR 3/3	dark brown	10YR 3/2	very dark greyish brown
28	1.5	10YR 3/4	dark yellowish brown	10YR 3/6	dark yellowish brown
30	1.6	10YR 2/2	very dark brown	10 YR 2/2	very dark brown
32	1.7	10YR 2/2	very dark brown	10YR 2/2	very dark brown
34	1.8	10YR 2/2	very dark brown	10YR 2/2	very dark brown
37	1.9	5YR 3/3	dark reddish brown	10YR 3/4	dark yellowish brown
38	2	5YR 2.5/2		7.5YR 3/4	
40	2.1	7.5YR 2.5/2		10YR 2/2	very dark brown
43	2.2	10YR 2/2	very dark brown	10YR 2/2	very dark brown
45	2.3	10YR 3/4	dark yellowish brown	10YR 3/3	dark yellowish brown
46	2.4	10YR 2/2	very dark brown	10YR 2/2	very dark brown
48	2.5	7.5YR 2.5/2		7.5YR 2.5/2	

50	2.6	10YR 3/4	dark yellowish brown	10YR 3/2	very dark greyish brown
52	2.7	10YR 3/3	dark brown	10YR 4/3	brown / dark brown
54	2.8	7.5YR 3/4		5YR 3/2	dark reddish brown
57	2.9	7.5YR 2.5/2		10YR 3/4	dark yellowish brown
58	3	10YR 3/6	dark yellowish brown	10YR 3/4	dark yellowish brown
60	3.1	7.5YR 3/4	dark brown	10YR 3/4	dark yellowish brown
62	3.2	10YR 4/4		10YR 4/4	
66	3.3	10YR 3/6	dark yellowish brown	10YR 4/6	dark yellowish brown
67	3.4	10YR 4/6	dark yellowish brown	10YR 4/6	dark yellowish brown
69	3.5	10YR 4/6	dark yellowish brown	10YR 5/8	yellowish brown
71	3.6	10YR 4/4		10YR 4/4	
74	3.7	7.5YR 3/4	dark brown	10YR 4/6	dark yellowish brown
76	3.8	10YR 4/4	dark yellowish brown	10YR 4/6	dark yellowish brown
79	3.9	10YR 3/6	dark yellowish brown	10YR 3/6	dark yellowish brown
80	4	7.5YR 2.5/3	very dark brown	10YR 3/4	dark yellowish brown
83	4.1	10YR 3/3	dark brown	10YR 3/4	dark yellowish brown

Table 3: My great data

And a table summarising the particle size distributions

	mean.arith.um	sd.arith.um	skewness.arith.um	kurtosis.arith.um
0.1	512.7	548.5	0.912	2.575
0.2	250.6	318.9	2.814	11.9
0.3	346.5	386.1	1.902	6.535
0.4	363.5	455.1	1.829	5.491
0.5	356.3	405.2	1.822	6.014
0.6	304.4	376.2	2.277	8.149
0.7	337.6	429	1.866	5.865
0.8	347.8	458.6	1.794	5.319
0.9	287.1	393.2	2.266	7.775

1	296.6	385.6	2.352	8.31
1.1	581	572.6	0.792	2.32
1.2	228.6	351.5	2.922	11.45
1.3	272.3	429	2.389	7.734
1.4	270.5	370.9	2.561	9.423
1.5	406.5	448	1.684	5.091
1.6	327.5	420.1	2.037	6.54
1.7	588.6	670.6	0.718	1.821
1.8	351.1	439.2	1.923	5.948
1.9	382.6	448.2	1.819	5.54
2	318	420.6	2.159	7.023
2.1	564.8	664.4	0.787	1.931
2.2	406.1	493.9	1.649	4.609
2.3	463.7	493.5	1.422	4.005
2.4	477	618.9	1.181	2.717
2.5	476.5	595.5	1.205	2.901
2.6	405.6	531.4	1.558	4.081
2.7	594.8	606.8	0.873	2.28
2.8	383.2	518.5	1.645	4.391
2.9	447.7	581	1.309	3.199
3	463.2	568.9	1.291	3.227
3.1	607.1	659.8	0.748	1.919
3.2	186.2	384.5	3.343	12.91
3.3	130.6	274	4.839	26.39
3.4	136.6	285.3	4.678	24.65
3.5	126.2	258.4	5.215	30.59
3.6	162.6	341.2	3.874	17.07
3.7	110.8	212.4	6.221	44.1
3.8	142	291.9	4.513	23.08
3.9	185.2	371.9	3.355	13.17
4	316.1	530.1	1.924	5.091
4.1	122.9	250.4	5.43	33.08

Table 4: My great data

And now Figures. . .

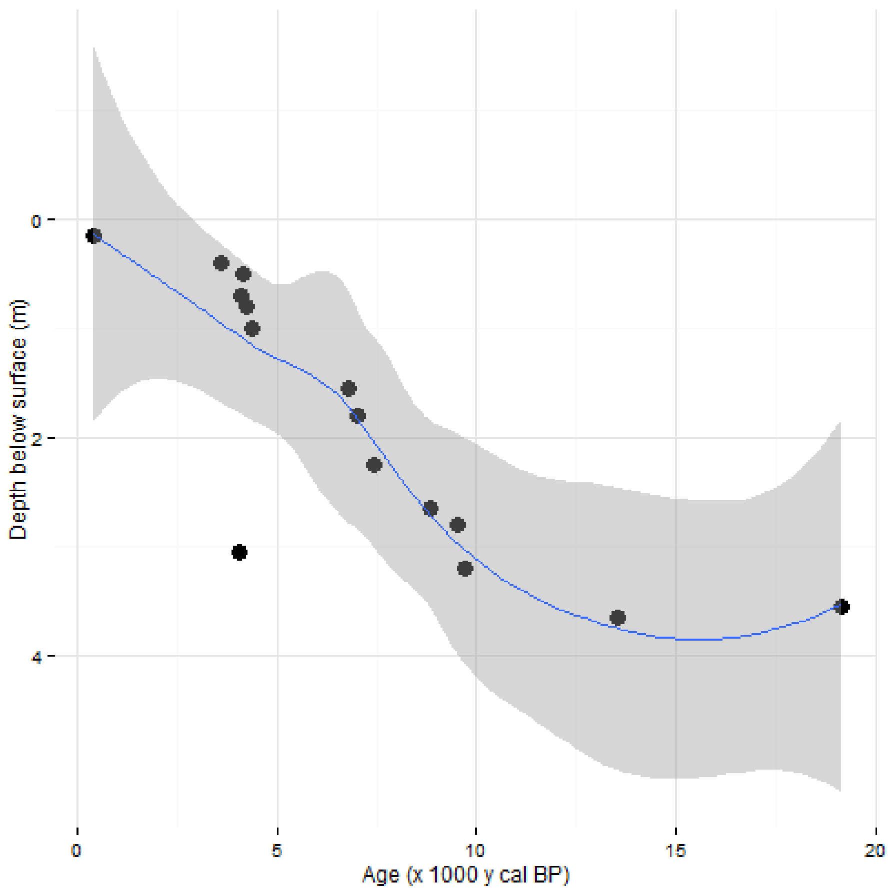

Figure 1: this is one plot

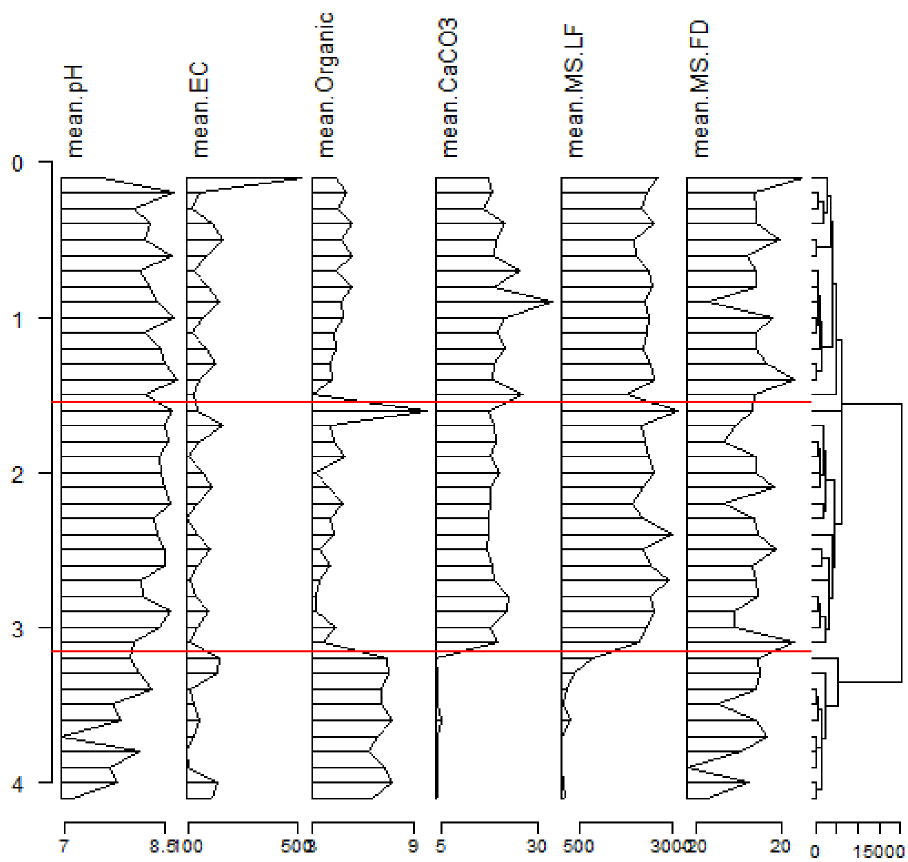

Figure 2: here are the data!

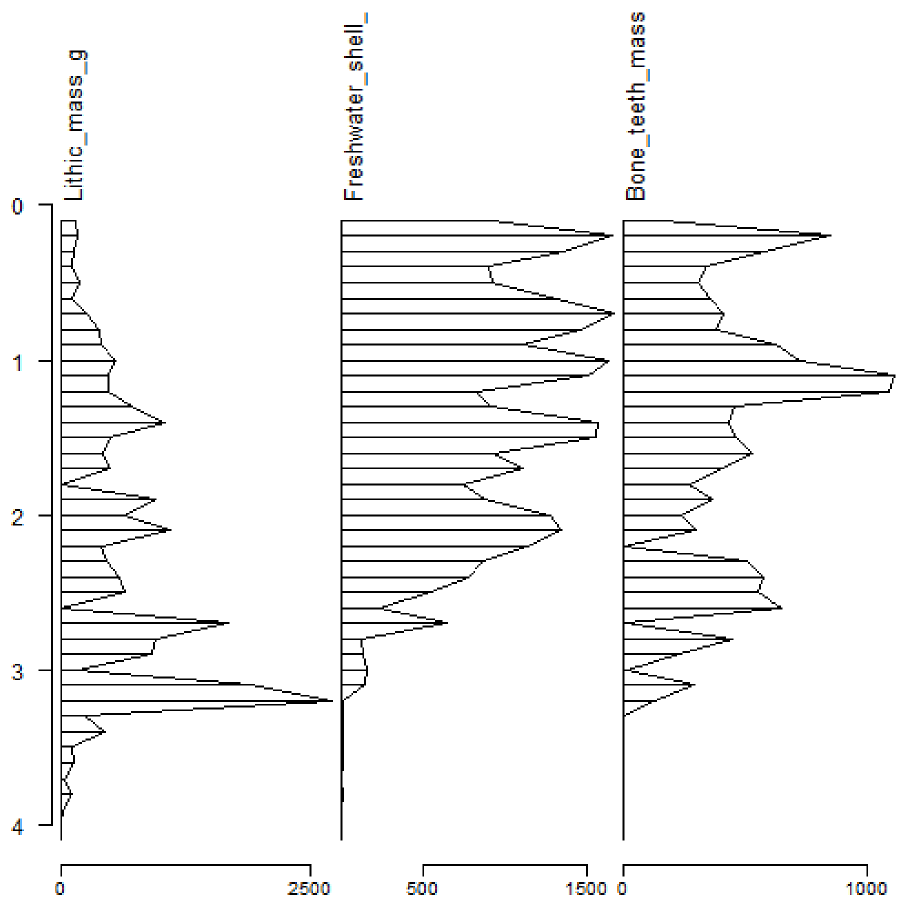

Figure 3: here are the data!

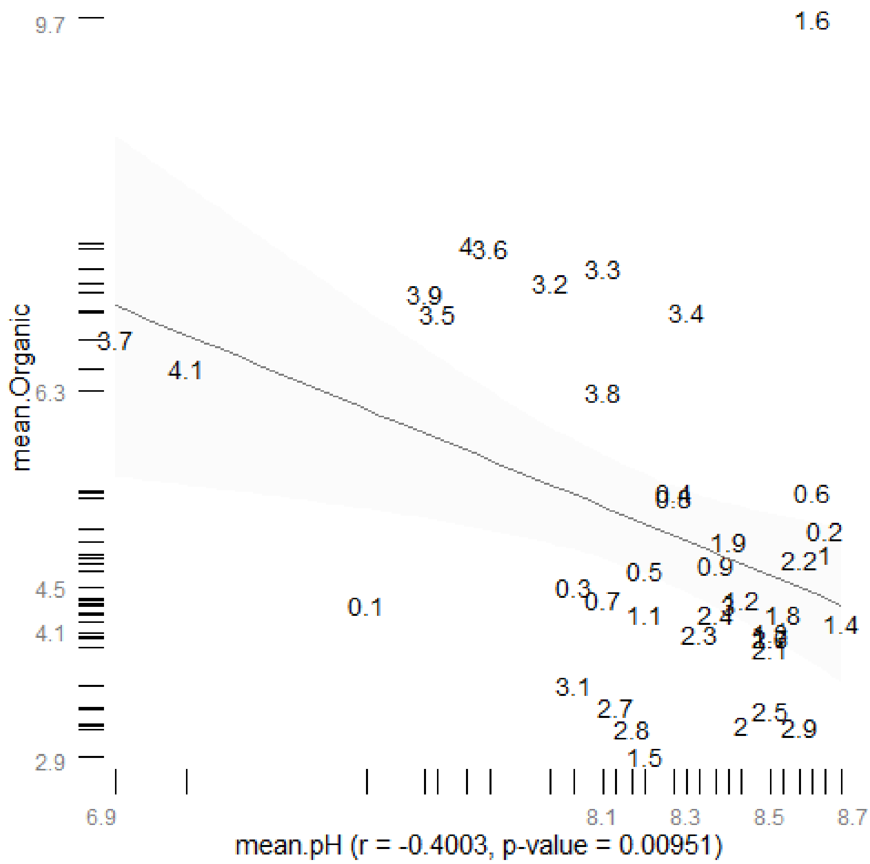

Figure 4: this is one plot

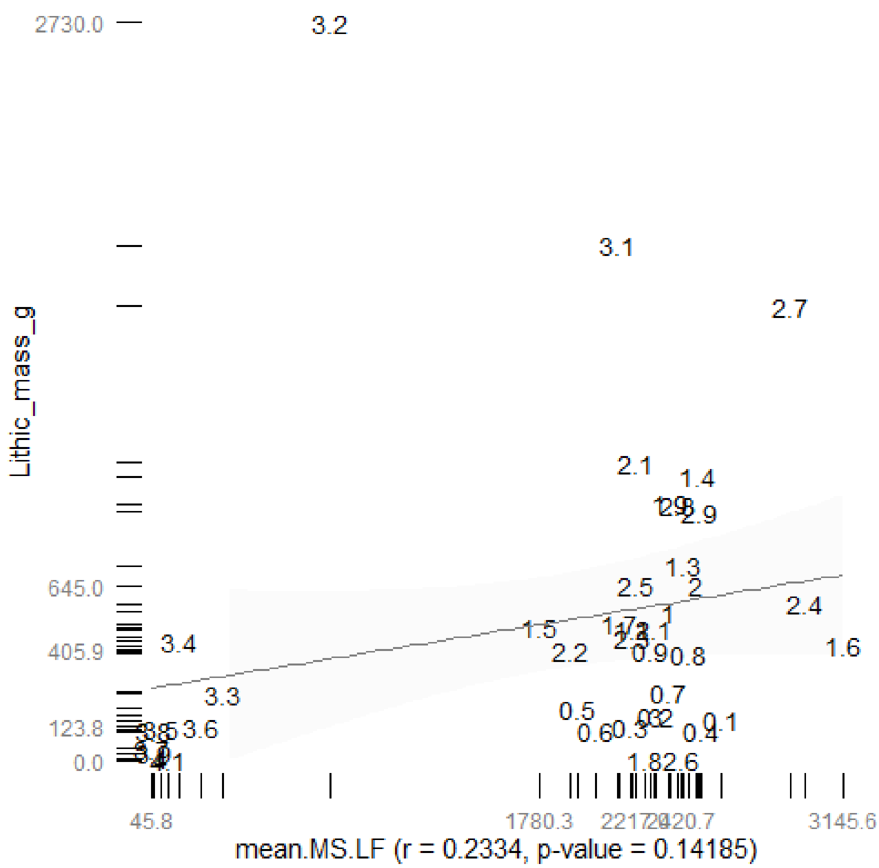

Figure 5: this is one plot

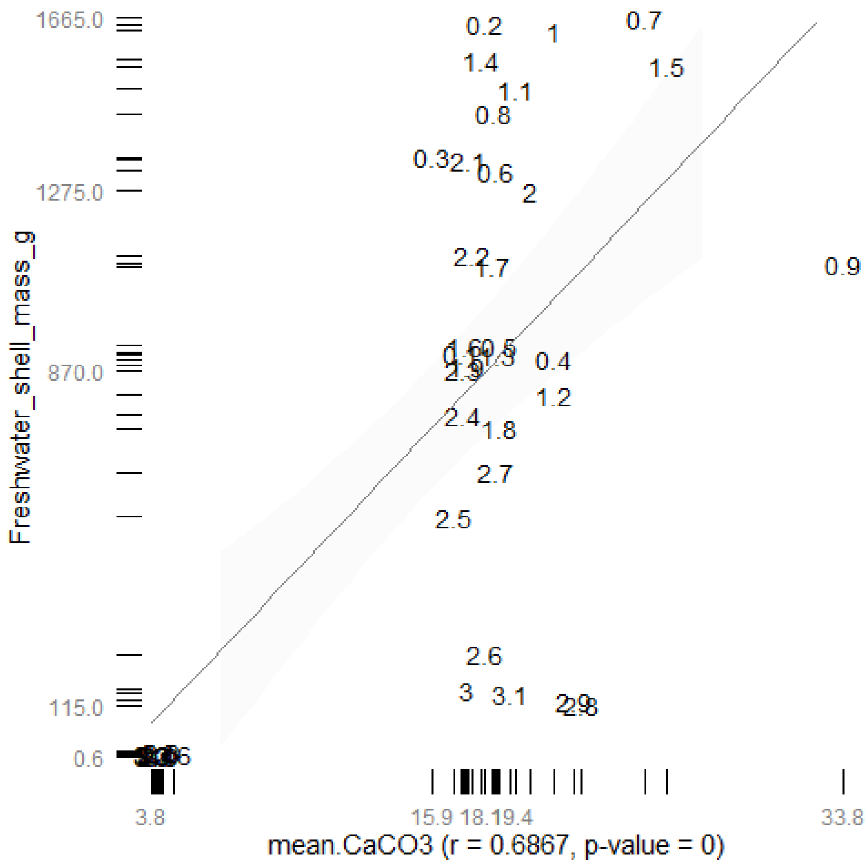

Figure 6: this is one plot

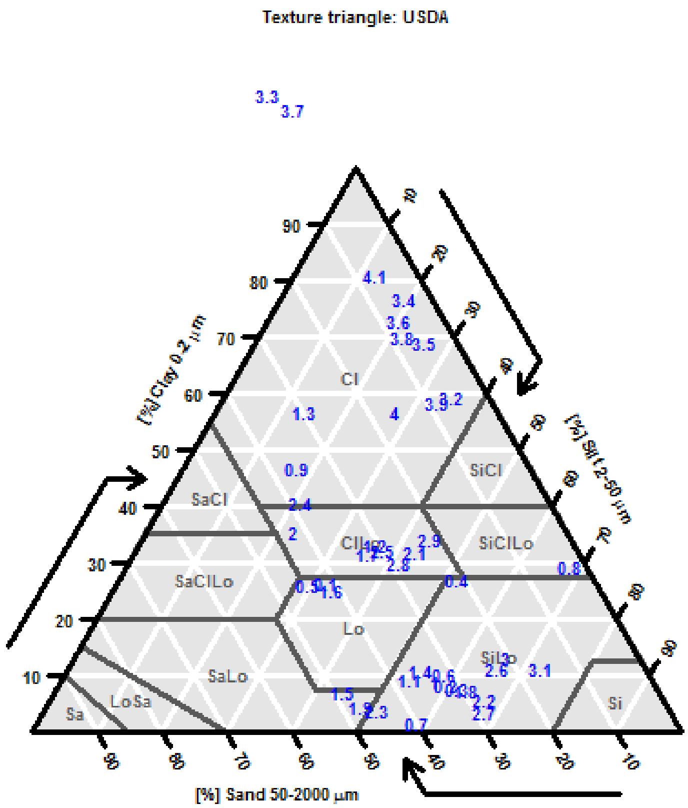

Figure 7: this is one plot

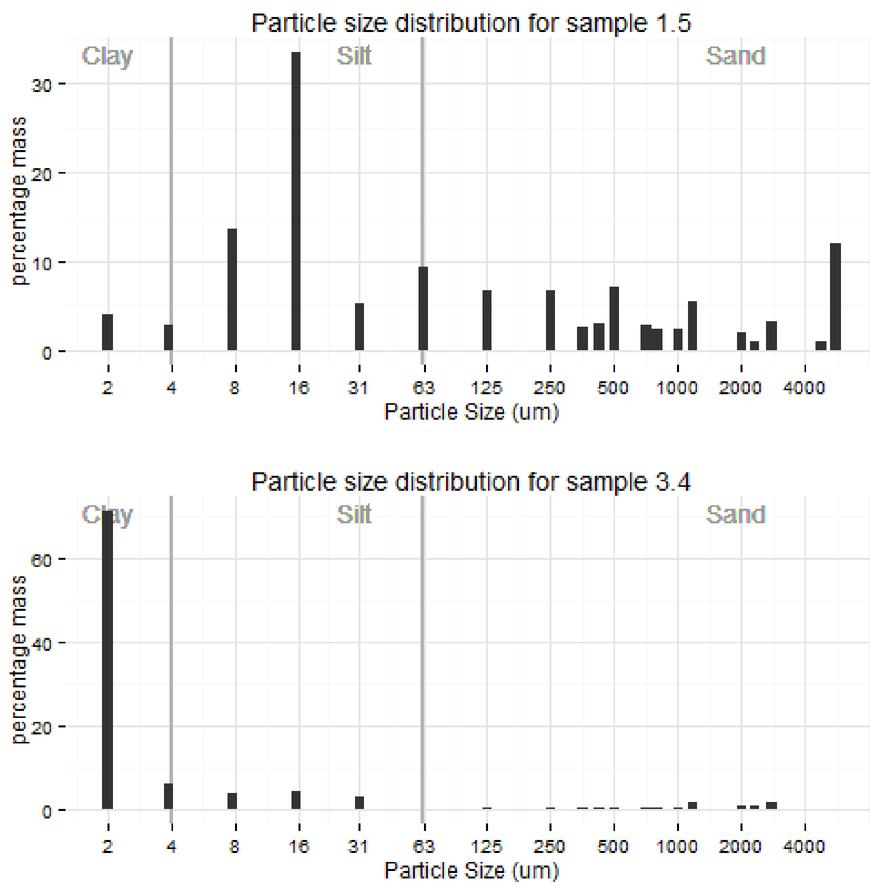

Figure 8: this is one plot

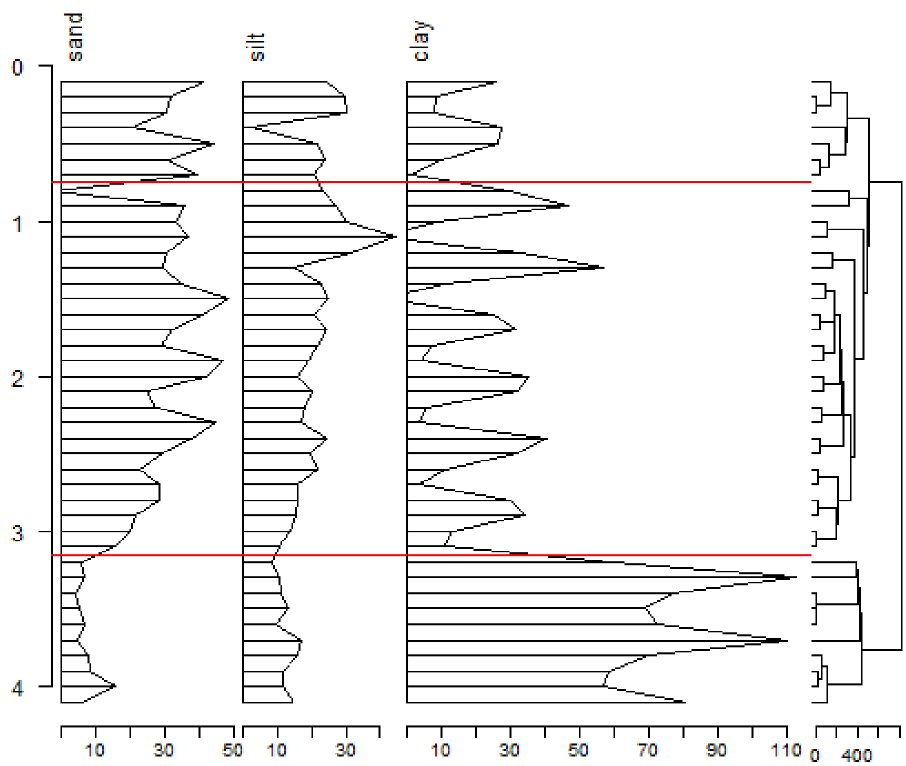

Figure 9: this is one plot

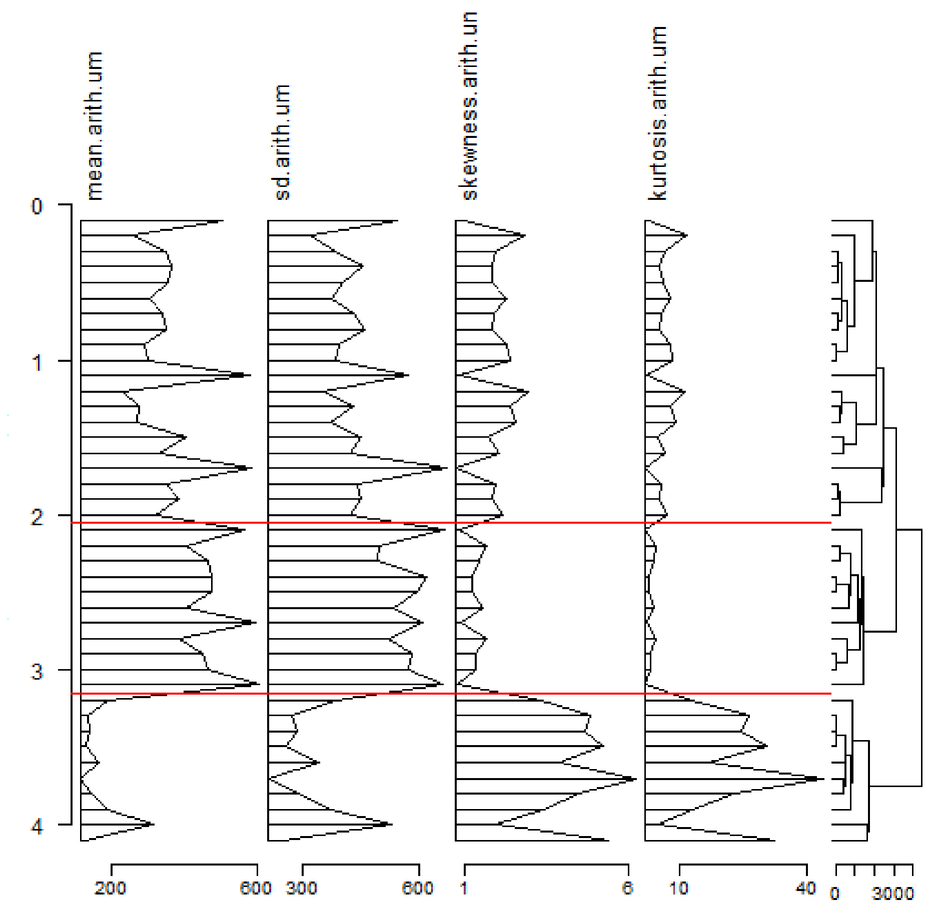

Figure 10: this is one plot