SCHOOL OF
ELECTRICAL AND
ELECTRONIC ENGINEERING

THE UNIVERSITY
of ADELAIDE

Code Cracking: Who Murdered The Somerton Man?

Final Report

Yami Li

a1673685

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Supervisor: Prof. Derek Abbott, Dr. Matthew Berryman

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Executive Summary

The Somerton man case is a very famous unsolved case which related to an unidentified dead man on Somerton beach in Australia. The aim of this project is to find out the new clues about the Somerton man case by comparing the content of various elements in the dead man's hair with the hair of the normal man.

In this project, the main research method consists two part, one part is the spectral analysis and the other part is the comparative analysis. For spectral analysis, through burning and scanning hairs extracted from Somerton man and control samples, the hair data with respect to elements content can be recorded. In this experiment, two set of data which are glass and quartz plate test are obtained. In theory, the purity of the quartz plate is higher, so the results of spectral analysis should be more accurate. However, in view of the fact that the hair sample during the quart plate test was not complete compared with glass plate test. Thus, the test data from both experiments are utilized for comparative analysis. The hair data comparison between Somerton man and control samples are processed by Matlab programing. The reason for choosing Matlab is that it can express the distribution of each element in the hair of Somerton man and control samples clearly. These significant and small differences in content are the focus of this project.

Finally after the completion of comparative analysis, these differences can be used to speculate some useful information, such as the man's life environment before death and personal habits. Researching this case can expend the knowledge of data analysis, code cracking, engineering statistics and digital forensics.

Contents

1 Introduction

1.1 Background

This project is to study on an unsolved murder case that happened on the 1st of December 1948. At 6:30 am of that day, a man was found dead on Somerton beach. This dead man carried with no identifications and his teeth were not matched with any known person, so he is called Somerton man. After postmortem, the coroner picked some information from this dead man, such as the heart was of normal size and the death time was around 2 am of the found day. Besides, the coroner figured out that approximate three to four hours before death the man ate a pasty as meal which pathologist Dr. Dwyer suggested some poisons causing the man's death. But the pasty should not be the source of poison through further research. Finally, after a series of investigations, the coroner still could not tell any conclusion about this man's identity or cause of death and the dead man's body was buried in Adelaide's West Terrace Cemetery in 1949. It became one of the Australia's most fascinating cold cases. [2][4][10]

In order to continue the study of this case, a plaster cast of Somerton man was made in 1949. The hairs which were extracted from Somerton man plaster cast and other six different students are used for spectral analysis. [9] Hair data is recorded by Inductively Coupled Plasma Mass Spectrometer (ICP-MS) and this instrument is effective for micro-sampling of solid material for trace elements and the analysis of predominantly cation. [1] For collecting data, the hairs were burned by laser. Then, the instrument measured the levels of different isotopes and the relatively values of elements. After testing, the comparison for experimental results between Somerton man and six other different students can be processed.

1.2 Motivation

The aim of this project is to find out the new clues about the Somerton man case by comparing the content of various elements in the dead man's hair with the hair of the normal man. Even if the case has happened for decades, it is not been forgotten. The residents still would like to see the case solved. In addition, this project can expand the knowledge for data analysis, code cracking, engineering statistics and

digital forensics. In fact, this dead man was suspected to be a foreign spy due to his unknown identity. So, it is meaningful for country security as well.

1.3 Objectives and Methods

- Understanding the hair biology knowledge and some related chemical knowledge.

- Hair mass spectral experiment: hairs were burned by laser. Then, the instrument measured the levels of different isotopes and the relatively values of elements. The scan speed of mass spectrometer was 5 micrometers per second.

- Two tests: For glass test, the scan length of each control sample was 1000 micrometers. The method length was 230 seconds including 30 seconds background. The scan length of Somerton man's hair was 6054.6 micrometers and the method length was 1240.9 seconds including 30 seconds background as well. For quartz test, two sections of seven control hairs have been tested and each hair is 500 micrometers, so there are fourteen control hair data and the total length is 0.7 centimeters. Somerthon man hair scanned 500 micrometers, each subsequent transect beginning where the previous finished for a total 96 sections (4.8 centimeter total) due to the limitations of the sample stage.

- Experiment results analysis: For a healthy person, the hair growth rate is approximate 0.4 millimeters per day [7]. So based on glass test data we can get about 2.5 days information of control and 2 weeks information of Somerton man before his death. From the quartzes test data we can also know the element content differences between Somerthon man and control samples hair. All the experiment data is plotted by Matlab and the plotting figures are listed in Appendix A. Then, the comparison between Somerton man and control samples is processed. The comparisons are focus on the

different elements content in hair which can provide some useful information related to Somerton man.

- Put forward some reasonable assumptions and new clues: Based on experiment data analysis, some reasonable assumptions needs to be presented. These assumptions can be related to some activities and the living environment before his death.

- Validation of assumptions and clues: Once these assumptions are confirmed, they can be served as new clues for the case to provide more direction.

1.4 Structure of this Report

The rest of the report is about literature review and comparative analysis results which includes the list of elements and some important comparison figures. After summarizing the analysis results, the contents of project management is displayed. Finally, drawing the conclusion of this project. In addition, the Gantt chart of project timeline is attached on the end of this document.

2 Literature Review

2.1 Previous Studies

In addition to police men's investigation, there already have several academic studies. Professor Derek Abbott has worked on this case for more than 2000 hours. [9] His team took the hairs from Somerton man's plaster cast and recorded elements data by ICP-MS. Since 2009, it had become a final project for the University of Adelaide students and some students had participated this project. In 2013, the project group plot some Somerton man's hair elements' content figures and compared with control samples. [6] They have analysed the differences between Somerton man's hair and control samples. However, those hairs' data were all got from glass test. In this project, we redo the analysis based on the data that got from quartz test. In addition, we will compare those two different data figures. However, the new data should not be compared with old directly due to different drift values. The new data will multiply a constant which is got from the glass test remainder that is a bit rest of Somerton man's unburned hair. Besides, the different year of plasters needed to be considered as well.

2.2 Software

Hair data is recorded by Inductively Coupled Plasma Mass Spectrometer (ICP-MS) and presented in the form of Excel tables. Matlab is used to plot figures which are used to show the elements comparison results clearly. It has some graphing capabilities and can be applied for making engineering plots.[3] In this project, the massive hair element data are plotted by Matlab command 'scatter'. Then, use command 'hold on' to put the Somerton man's and control samples hair data on the same figure and make the comparison clear.

2.3 Hair elements

Hair analysis can demonstrate the content level of the heavy mental and essential elements in human body. [3] The different value of some essential elements in hair may be correlated with nutritional status and diseases, such as calcium (Ca), chromium (Cr), zinc (Zn), copper (Cu), and selenium (Se). The high values of some

elements such as lead (Pb), arsenic (As), mercury (Hg), and cadmium (Cd) in hair can indicate the intoxicating phenomenon. [3]

Using this analysis method can discover the useful information about the Somerton man healthy condition and has possibility to find the cause of death.

2.4 The relation between living environment and hair elements

The living environment can affect the content level of elements in human body. This effect not only caused by polluted water and food, but through the injury and radiation. Trace elements values in hair can reflect the source of behaviors including the diet hobbies, smoking and medication. Human absorbs pollution source by different ways such as oral, breath, injection and radiation. These contaminants stored in different body organs and tissues can affect human health. Hair is a good indicator of environment change. Normally, it shows the variation of trace element in human body as the hair growth.

3 Glass test data analysis

3.1 Data screening

The hair data was recorded by mass spectrometer and the data was got from glass test. There are 44 elements gained by laser ablation (shown in Table 1). Three of these elements are needed to be mentioned. The first one is sulphur (S7) which must exist in human's hair. The value of Sulfer can be refered to the drift value of the environment. The second one is lead (Pb206), the high level of Lead is harmful for human health. The third one is strontium (Sr88). This element has high percentage in Adelaide's soil compared with other areas. So, the analysis of the change tendency of Strontium's value will provide useful information about Somerton man's living environment before his death.

Table 1 Elements table for glass test

These elements gained by laser ablation of hair mass spectrometer				
Li7	Ca43	Cu65	Zr90	Hf178
B11	Sc45	Zn66	Mo95	Au197
Na23	Ti47	Ga71	Ag107	Hg202
Mg24	V51	As75	Cd111	Tl205
Al27	Cr52	Se77	Sn118	Pb206
Si29	Mn55	Se82	Sb121	Bi209
P31	Fe57	Rb85	Te125	Th232
S34	Co59	Sr88	Cs133	U238
K39	Ni60	Y89	Ba137	

3.2 Element classification

Some recorded hair data contains toxic and heavy mental elements which are harmful for human health in high values. However, most are essential elements for human body. Table 2 shows the toxic elements and essential elements in hair. The comparison of toxic elements content in hair is an important research subject.

Table 2 the Different Type Elements of Hair

Type of Element	Chemical Symbol
Essential and other elements	Li K Ca P Na B Cr Mg V Mn Fe Cu Mo Zn Co Sr Au Se Ge
Toxic elements	Pb Al Hg Ag Ba As Cd Sb Sn Bi Ni Th

In previous study, the hair data analysis is based on glass test result. However, the impurity material has influence on element values, thus, the data analysis mainly relies on quartz test rather than glass test in this project. Compared with glass plate, the quartz plate is a purity material composition. Table 3 shows the main composition of glass and quartz.

Table 3 the different Elements of Glass and Quartz

Glass	SiO_2, TiO_2, $A_{12}O_3$, FeO, MnO, MgO, CaO, Na_2O, K_2O
Quartz	SiO_2

3.3 Element content comparison

In order to speculate the cause of death and living environment, the Somerton man hair data should be compared with control samples. In this experiment, six normal people's hairs are selected as control samples. Then, the mass hair data is disposed by software for a visual comparison.

3.3.1 Excel

At first, the hair data of Somerton man was plotted by Excel (shown in Figure 1). The X axis demonstrates the scan time of mass spectrometer. The Y axis demonstrates the relative value of elements content.

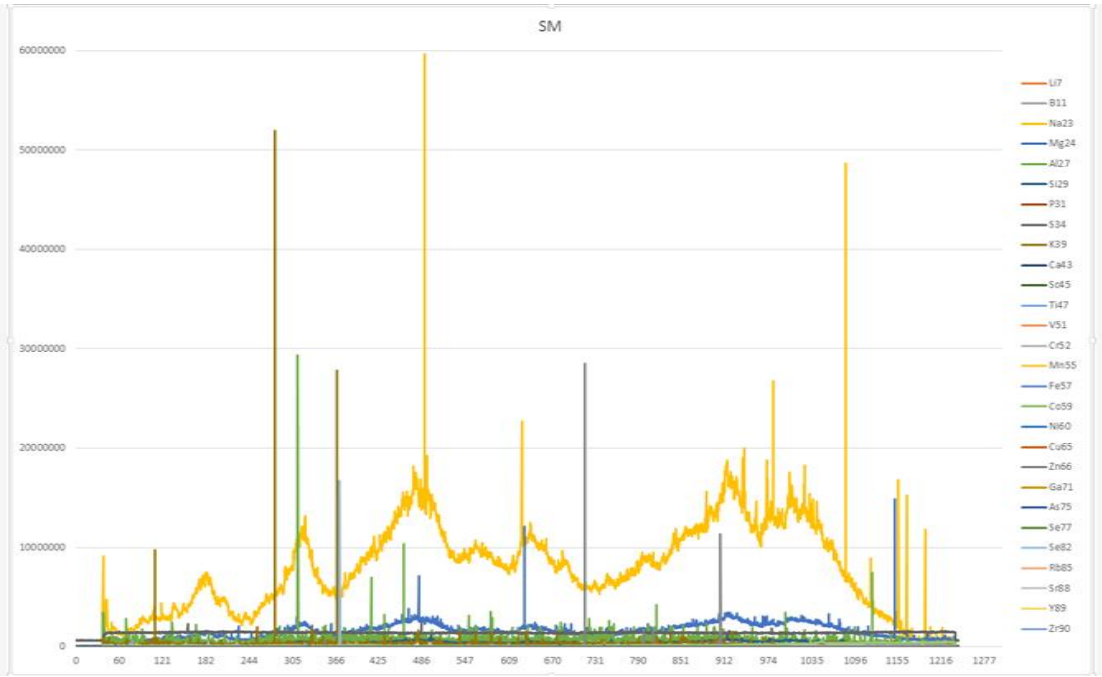


Figure 1 Somerton man's hair data

However, only 28 elements were shown on the chart. Some data was missing due to the shortage of Excel. Besides, most elements are not clear except sodium (Na23). Some traces are out of range and not obvious, such as the elements located on the bottom of this chart. So, these troubles result in the difficulties of contrast.

The control samples hair data plotted by Excel (shown on appendix A) as well. Unfortunately, they all have the shortages as the Somerton man's data chart.

3.3.2 Matlab

In order to solve these problems, Matlab can be used to plot each element's content distribution. 44 elements comparison figures have been plotted and shown on appendix A. Some comparison figures of element value display the results clearly. However, some figures have difficulties to find the tendency. The elements figures' classification is shown on table 4.

Table 4 Classify elements by comparison results

Comparison Result		Elements
Good Result	Same Values	B11,P31,S34
	Different Values	Sr88,Hg202,Pb206
	Same Tendency	Na23,Mg24,Si29,Ca43
Bad Result	No Tendency	Li7,Al27,K39,Sc45,Ti47,V51,Cr52,Fe57,Co59,Ni60,Cu65, Zn22,Ga71,As75,Se77,Se82,Rb85,Y89,Zr90,Mo95,Ag107, Cd111,Sn118,Sb121,Te125,Cs133,Ba137,Hf178,Au197, Tl205,Bi209,Th232,U238

The quality of the results is considered below, four elements (Na23, Mg24, Si29 and Ca43) have the similar tendency. Meanwhile these four elements are all contained in glass material in previous study. This phenomenon can assume that the recorded elements values are affected by glass slice. However, the elements which do not exist in the glass will not be affected.

In table 4, the same value means that the content of elements in the Somerton man and control samples can be regarded as the same value. Different value represents a significant difference in element content, and the change trend is not similar. No tendency means that the comparison figures can't show the law of change and the results can't be compared. Figure 2 shows the lead (Pb206) relative value comparison between Somerton man and control samples.

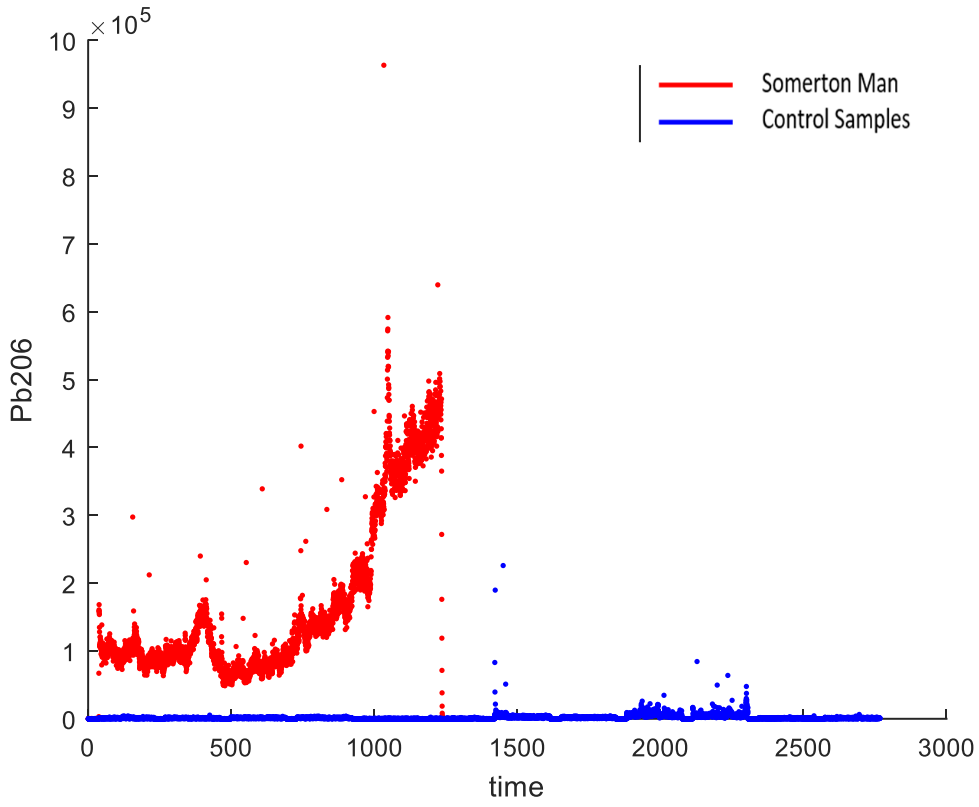


Figure 2 Lead (Pb206) Value Comparison

The X axis demonstrates the scan time of mass spectrometer. The Y axis demonstrates the relative value of Lead content. The mass spectrometer scans from the root of hair. Therefore, the smaller number of X axis represents the closer to death time. In Figure 2, the content of lead in control samples is very low and there is slight upward trend only in a short period of time. However, there have found a very high level of Lead in Somerton man's hair compared with control samples especially the end of his hair. This situation of high lead content is worthy of attention. Through further studying the distribution graph of lead content, it clearly shows a tendency that the lead value has a visual reduction before his death. So, it can be affirmed that high level of lead was not the main cause of his death. In fact, the high level of lead content can be related to the living environment and the rapid decline in lead content may represents the recent replacement of the living environment. Thus, some of the geographic information in 1948 needed to research, such as solid analysis, petroleum quality, water quality and nuclear power plant location.

Figure 3 shows the mercury (Hg202) relative value comparing between Somerton man and control samples.

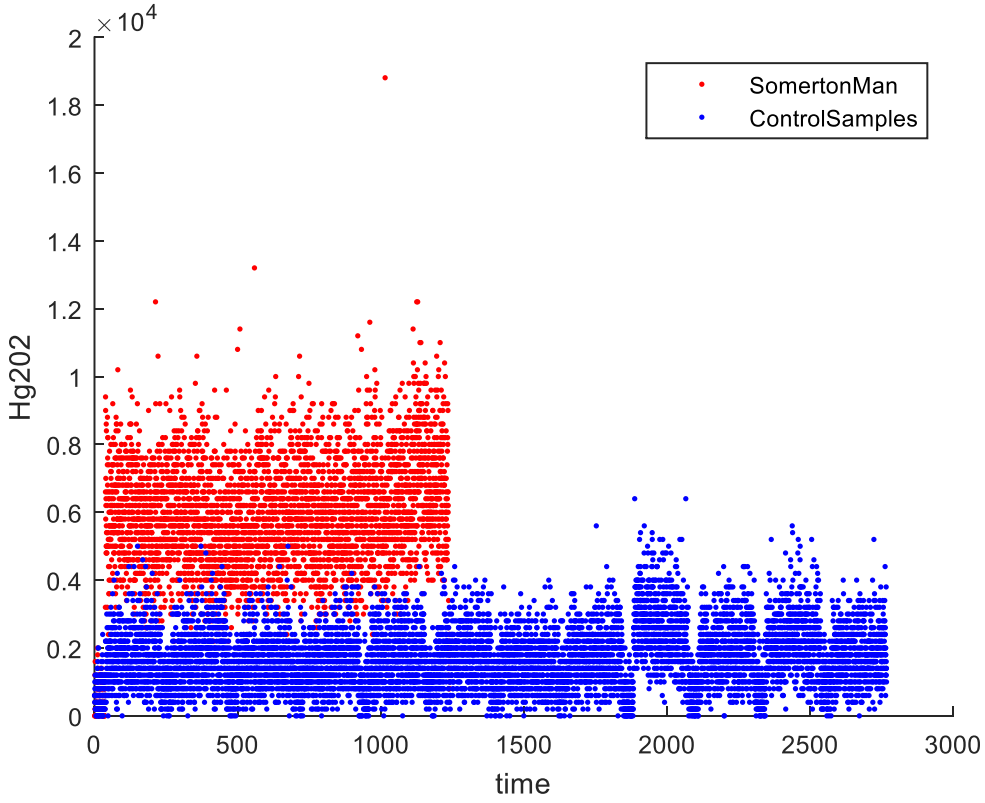


Figure 3 Mercury (Hg202) Value Comparison

The X axis demonstrates the scan time of mass spectrometer. The Y axis demonstrates the relative value of mercury content. There have found a higher level of mercury in Somerton man's hair compared with control samples. This value from root to the end of hair is basically the same. Through research, mercury is a highly toxic heavy metal pollutants of biologic toxicity. It is difficult to be discharged back into the organism. So it is a serious threat to human health. However, mercury is ubiquitous in nature. There are trace amounts of mercury existing in plants animals and food. Normally, human can eliminate toxins through excretion and metabolism to keep the amount that should not influence health. This is the reason for finding mercury in human's hair. The main pollution of mercury is from chlor-alkali, plastics, batteries, electronics and other industrial emissions. The Somerton man's higher level of mercury may be due to his living area. Thus, this should not be regarded as the cause of his death.

The strontium value between the Somerton man and control samples' hair are obviously different. Figure 4 shows the strontium (Sr88) relative value comparing between Somerton man and control samples.

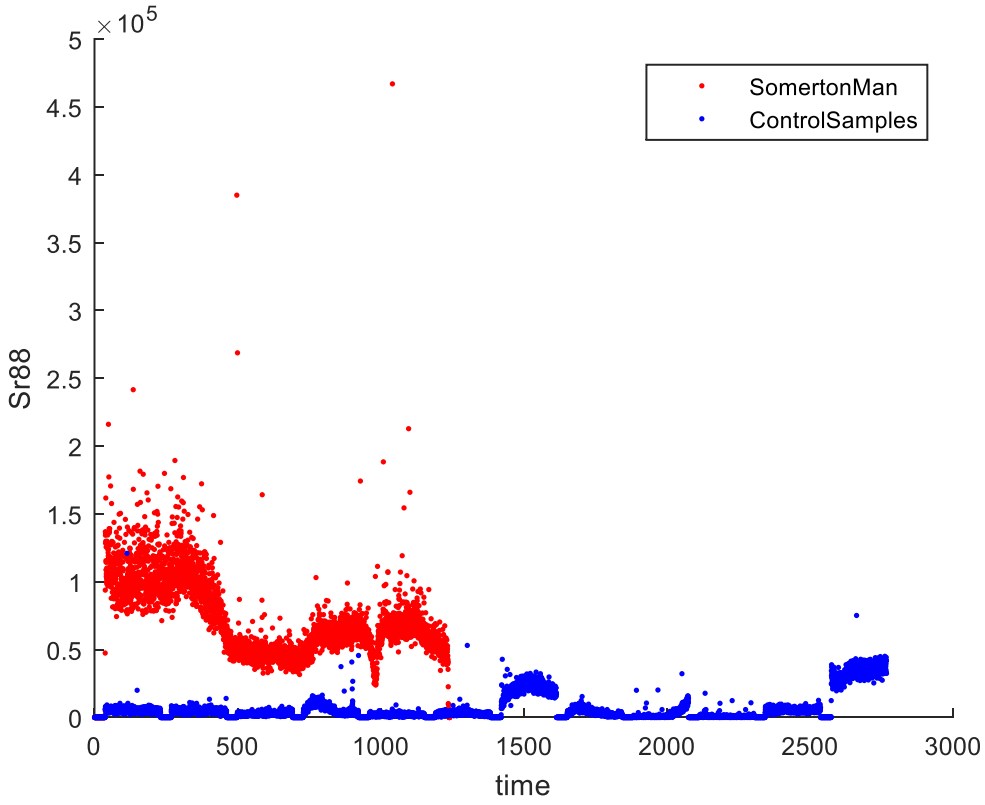


Figure 4 Strontium (Sr88) Value Comparison

The X axis demonstrates the scan time of mass spectrometer. The Y axis demonstrates the relative value of strontium content. Strontium exists in mineral water. It is an essential element for human. This element can prevent hardening of the arteries. At the root of Somerton man hair, the content of strontium is significant high. This means the living area for Somerton man contains high level of strontium content before his death. In addition, the strontium value shows an increasing tendency in his last two weeks. However, strontium is not a toxic element and the increasing tendency is not the cause for the death of Somerton man. Reasonable inference is that the Somerton man changes living environment two weeks before the death and this is the same with the speculation for lead content change.

3.3.3 Moving-average Filter in Matlab

Some comparison figures cannot be shown clearly by Matlab plotting. Thus, the Moving-average Filter should be applied. Firstly, selecting a window size for Filter. Then, calculating the arithmetic average of outliers within the window and make the average of the demand as outlier's window centre point. After that, moving the window as window size and the average method is repeated until this process is complete. This method has a good inhibitory effect on periodic disturbance and makes the figure smoother. It is suitable for high frequency oscillation system.

All of the elements content figures have been plotted by using moving-average filter and shown on appendix B. After using moving-average filter, the comparison figures have some new founds, such that more similar tendency elements are found and some clear comparison figures have been shown. The details are shown on table 5.

Table 5 Classify elements by comparison results

Comparison Result		Elements
Good Result	Same Values	B11,P31,S34,K39,Cr52,Co59,Ni60,Cu65, Zn22,Se82,Rb85,Sn118,Te125,Bi209,U238
	Different Values	Sr88,Hg202,Pb206,Ag107, ,As75,Au197,Mo95,Cs133
	Same Tendency	Na23,Mg24,Si29,Ca43, Ti47, Fe57
Bad Result	No Tendency	Li7,Al27,Sc45, ,V51,Ga71,Se77,Y89,Zr90,Sb121,Ba137, Hf178,Tl205,Th232

Through filtering, As75, Ag107, Cd111 are the new found toxic elements which have high level in the Somerton man's hair. The content distribution is shown as follow:

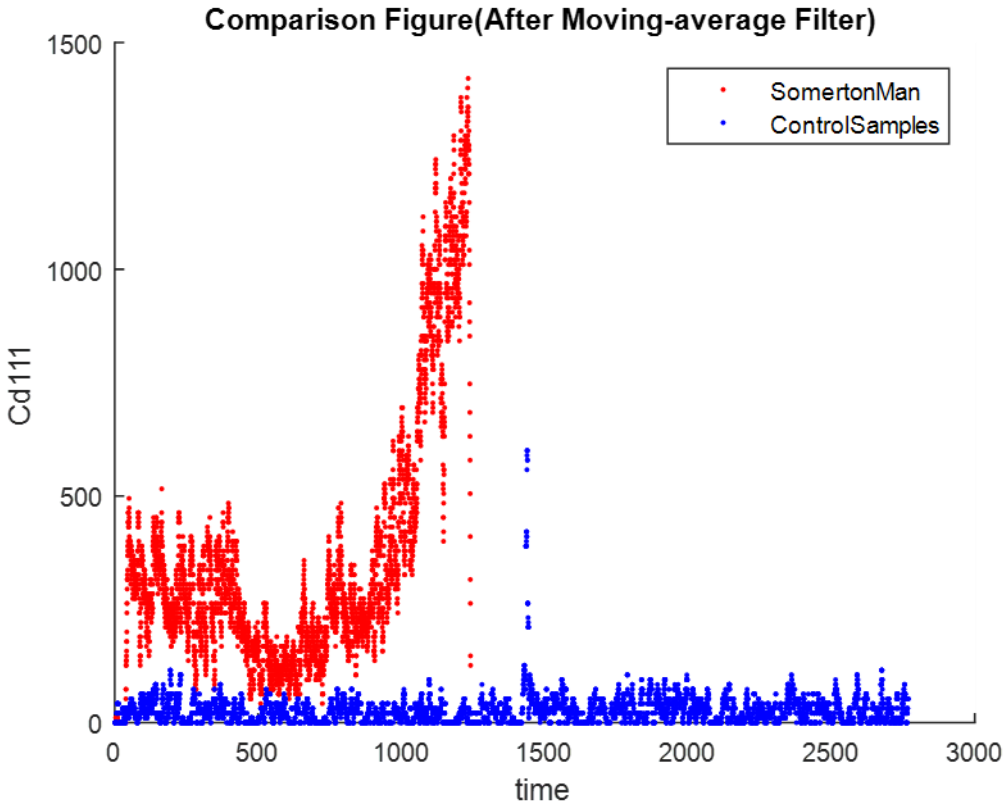


Figure 5 Cadmium (Cd111) Value Comparison

Cadmium is an element present in the nickel-cadmium battery and it is a toxic element which can create poison gas when boiled. The average content value of cadmium in Somerton man is much higher than control samples especially when the scan time is 1400 seconds. However, the change trend of this element are similar with lead and content value of cadmium shows a decreasing tend for his last time. Unlike lead, cadmium is more toxic and it can be regarded as the clue for the death of Somerton man. However, this kind of battery did not appear before 60 years. That can be indicate this battery is not the source of cadmium. It can also be observed from the figure that the hair for control samples contain cadmium as well. Thus, it can assume that this kind of element may come from drinking water or food, or other frequently used items.

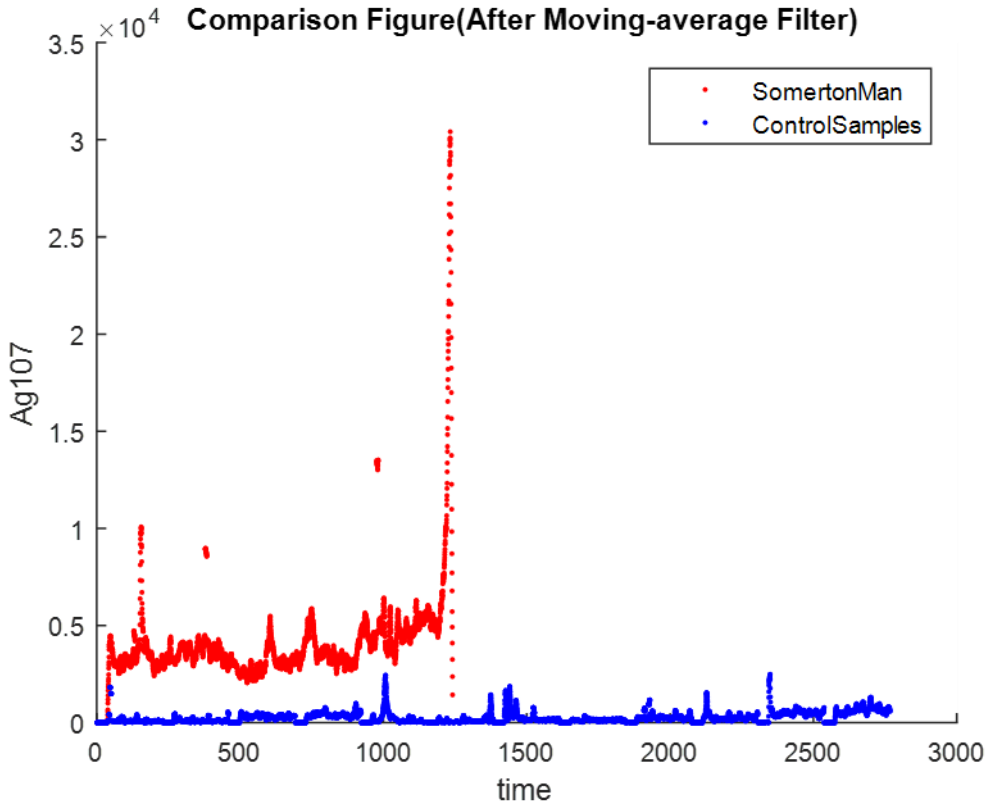


Figure 6 Silver (Ag107) Value Comparison

Through the observation of Figure 6， the silver content of Somerton man is higher than control samples. Besides, the value change for silver in hair of Somerton man is not obvious and the whole tends to be stable. Thus, this element should not be used for the speculation of Somerton man living condition. Besides, the element of silver is not harmful for human healthy. It can only make some colour change for skin. Thus, this element will not be researched in this project.

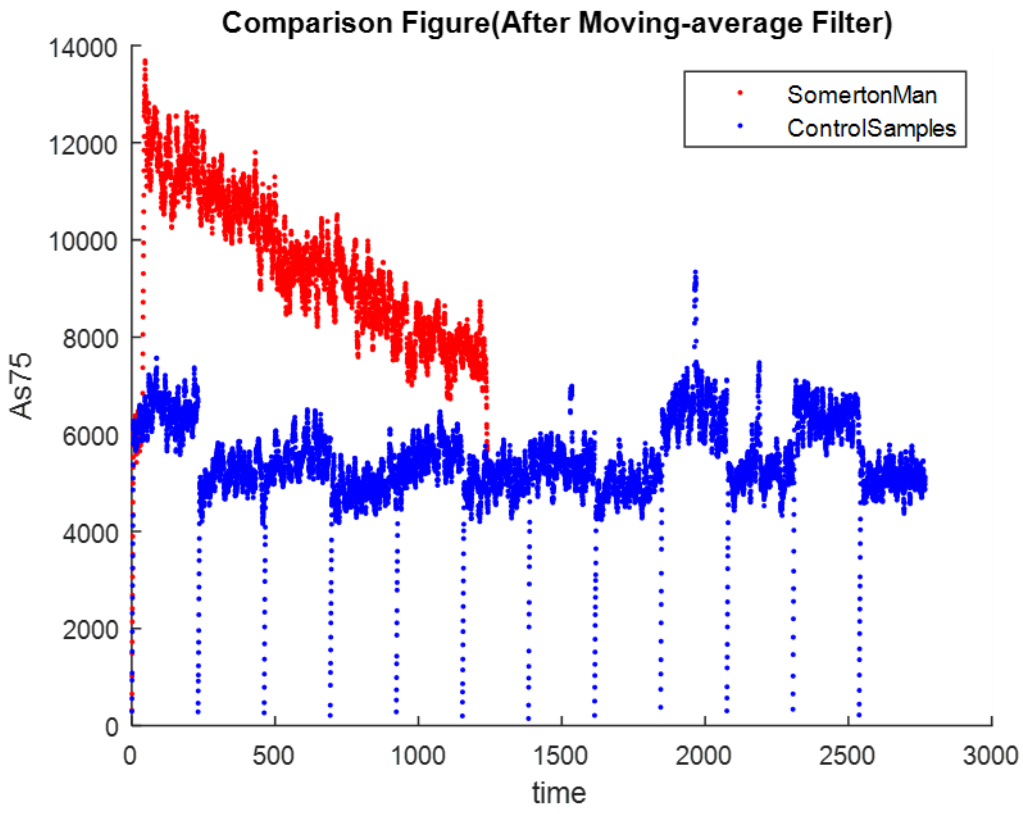


Figure7 Arsenic (As75) Value Comparison

Arsenic content level in Somerton man is increasing during the last two week. At the tip of Somerton hair, the arsenic content is similar with control samples. That means this content level is not harmful for human. Besides, the living area of Somerton can be assumed as same as control samples. However, the arsenic level is significant high at his last few days and the arsenic can be used for making toxicant. So, changing living area or being poisoned should be considered. This comparison figure can be regarded as one valuable clue.

3.4 Knowledge Gaps

This project can generate several new clues for the case of Somerton man. Meanwhile, these new clues were confirmed by comparative analysis of elemental contents. New clues can provide more directions for the future research

4 Quartz test data analysis

4.1 Data screening

Compared with glass plate, quartz plate is more pure. So, some elements recorded in the glass experiment were not present in the quartz test and some elements have different relative atomic weight. The recorded 35 elements in quartz test are shown in Table 6.

Table 6 Recorded Elements on Quartz Test

Elements gained by laser ablation on quartz test					
Li7	C13	Na23	Mg24	Al27	Si28
S34	K39	Ca43	Ti47	V51	Cr52
Mn55	Fe57	Co59	Ni60	Cu63	Zn66
As75	Se77	Se82	Sr86	Sr87	Sr88
Ag107	Cd111	Sn118	Au197	Hg202	Tl205
Pb206	Pb208	Bi209	Th232	U238	

4.2 Data comparison figures

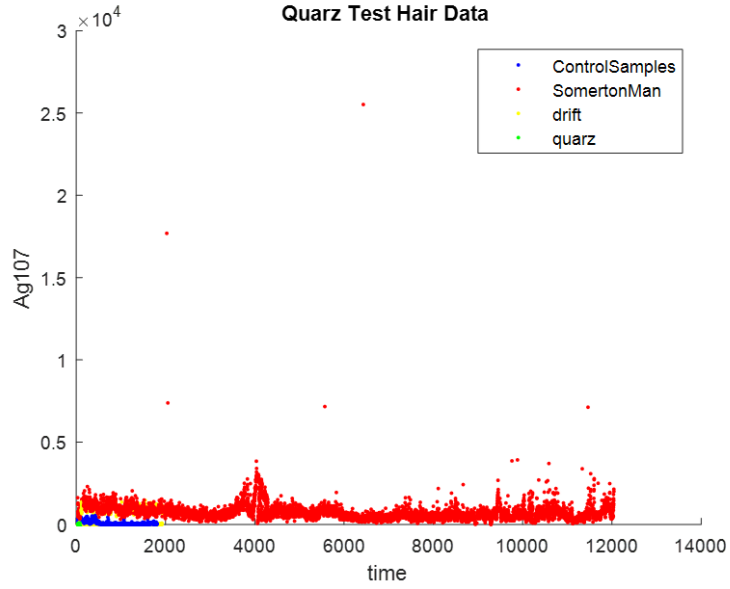
All of the quartz data is recorded. In order to comparison, the data of element has been classified as four sets of data:

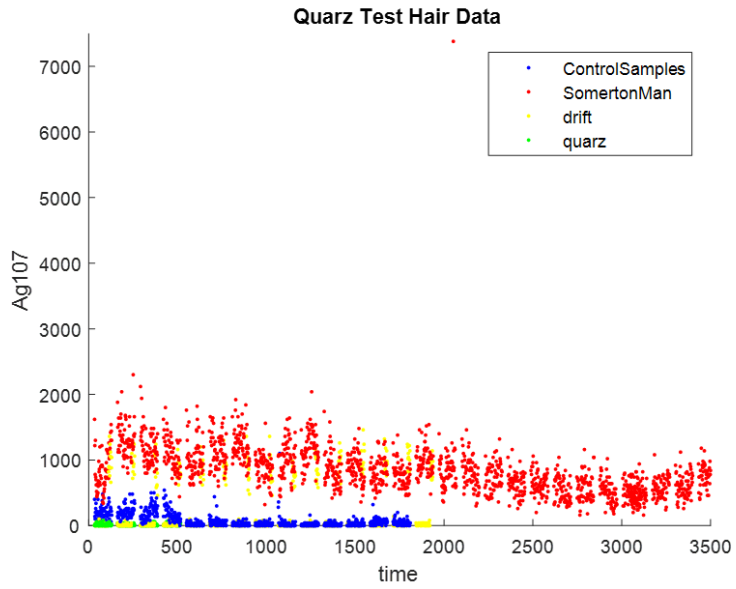
- Control sample hairs: Files name are Hair02-Hair08. For control hairs, it analyzed 2 sections of each hair, each 500um in length, so there are 0.7 centimeters control sample in total. The number of samples is seven, and each person takes two hairs as the two samples.
- Somerton Man: It analyzed 500um sections, each subsequent transect beginning where the previous finished for a total of 96 sections (4.8cm total).
- Standards: The files named NIST612-1 to NIST612-20 (20 transects) are standards and were run to ensure that the instrument wasn't grifting too much during the analysis, they can be used to compensate for the drift if need be as they were run at intervals during the sample acquisition.
- Background: Transits of 100um lengths across the quartz, files are Glue -1 to Glue–4.

For the quartz test data, each element needs to plot three comparison figures. The first comparison is the comparison of four sets of data which are control samples, Somerthon man, quartz and standards. The second one is enlarged graph for the first

comparison figure. The third figure shown fourteen control samples' hair data comparison.

Using the different colour dots to represent the four sets of data. Blue dots represent control samples, red dots represent Somerton man, yellow dots represent standards and green dots represent quartz background. The Figures (8-14) show the comparison of four sets of data. The X axis for all of the figures describes the scan times of the laser. The Y axis represents the relative value of elements in four sets of data.





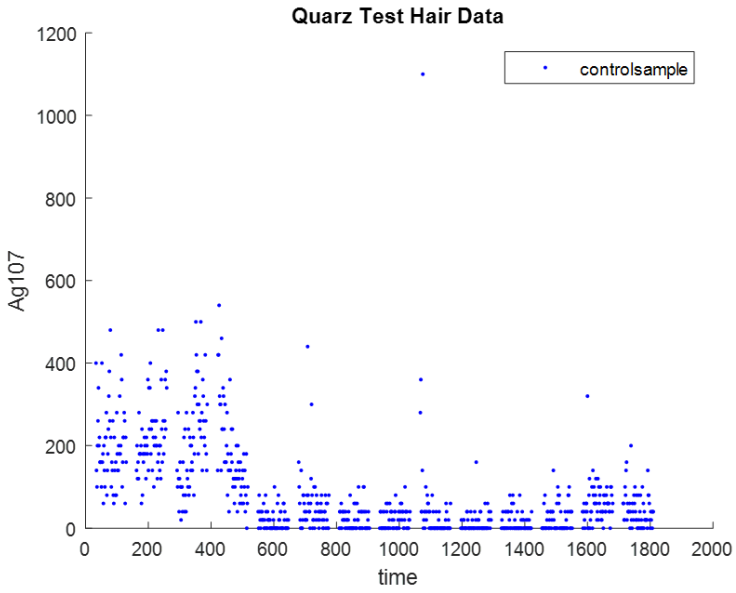
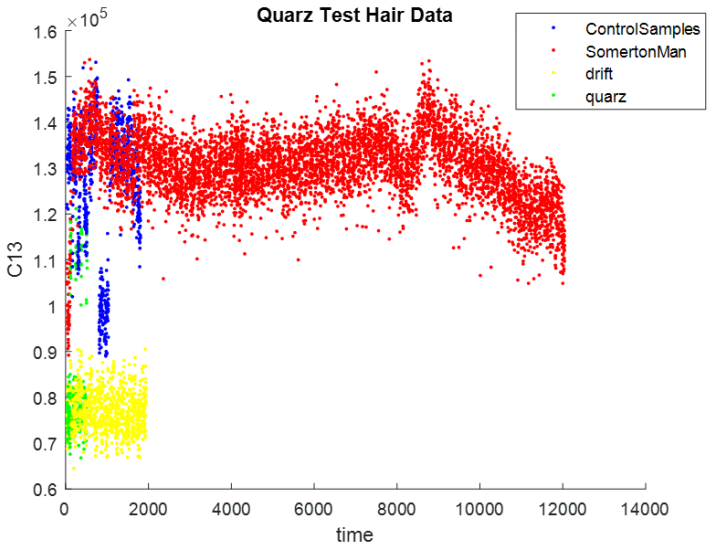
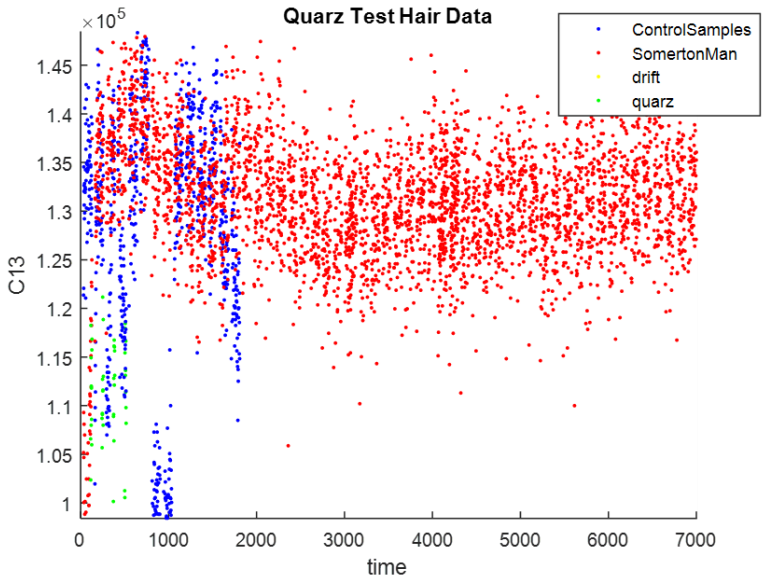


Figure 8 Silver (Ag107)

The comparison result of silver (Ag107) value between four sets of data is shown in Figure 8. Yellow dots represent the drift values which are basically stable and indicate that the drift change is not significant. Thus, the recorded data is reliable. Green dots represent the silver content in quartz. As can be seen from the figure, the content of silver in the quartz is very small. Therefore, this set of data has little effect on the test data. In general, the silver element content in Somerton man's hair is higher than the control hairs. In quartz experiment, the relative content value of silver in the hair is a table value and it is similar with the glass experiment result.





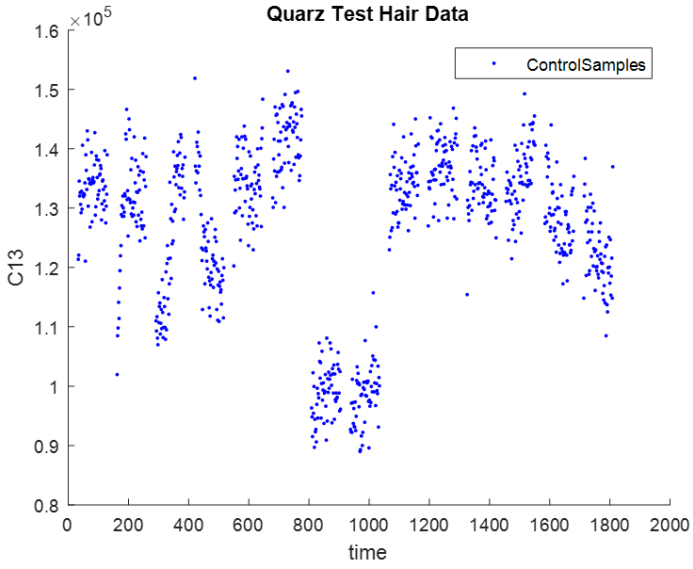
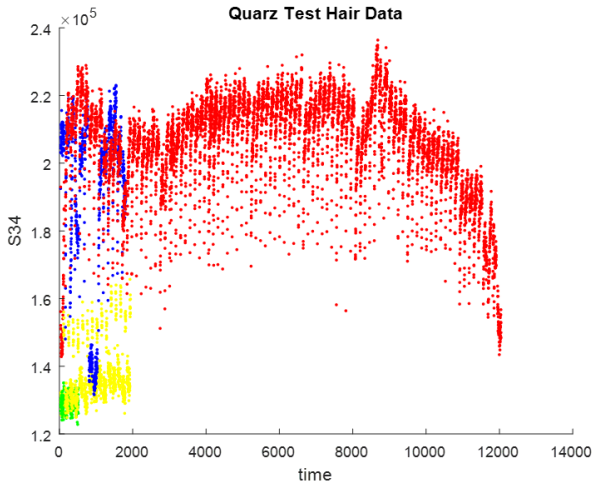


Figure 9 Carbon (C13)



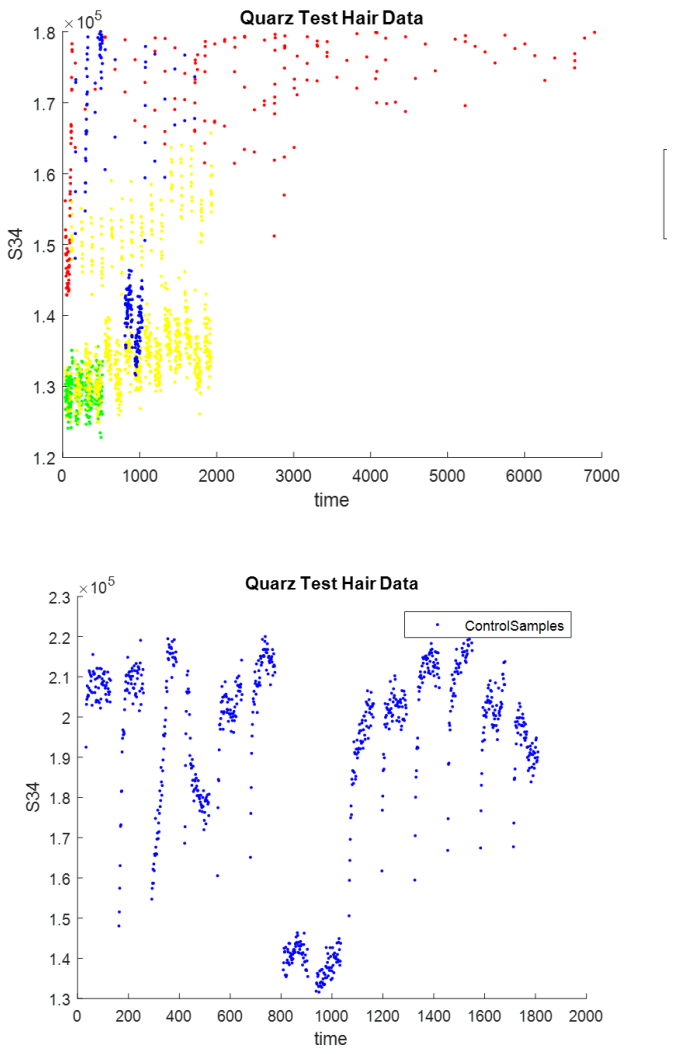


Figure 10 Sulphur (S34)

Same as silver, the standard values for sulphur and carbon are constant which means the instrument wasn't drifting too much. By comparison, the carbon and sulphur relative values are similar among Somerton man and 12 control hairs. Only two samples have significant differences and these samples come from one special person. Carbon and sulphur are essential elements in human hair. The change in the content of these two elements can be a direct indicator of a person's living environment. Based on the comparison results of the Figure 9 and 10, the living environment conditions for Somerton man and six control samples are similar but different from the special one. Thus, the living environment of Somerton man can be confirmed.

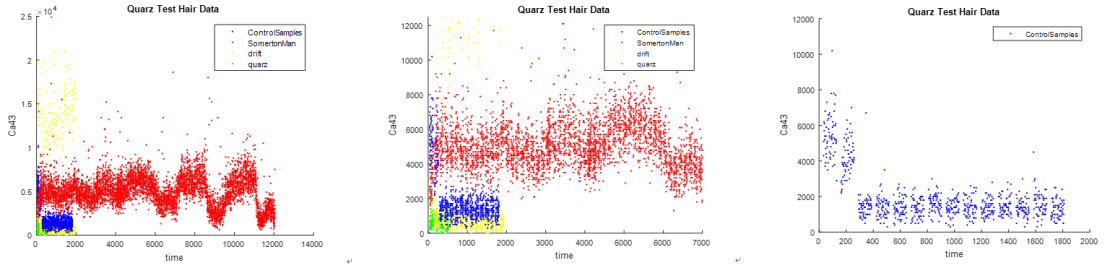


Figure 11 Calcium (Ca43)

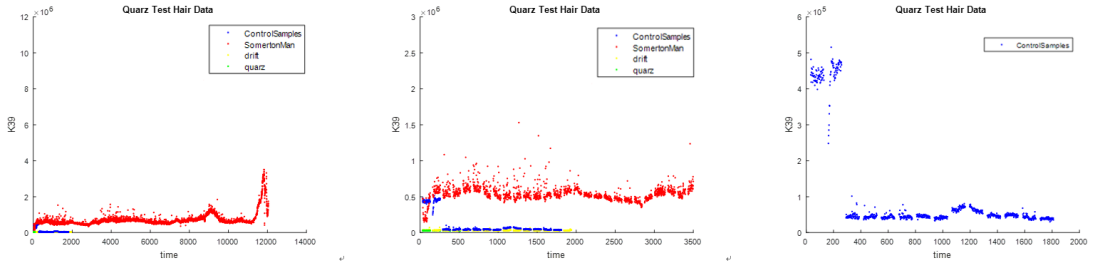


Figure 12 Potassium (K39)

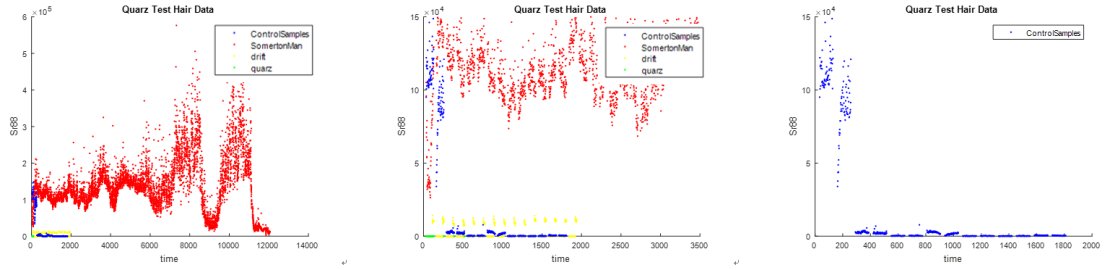
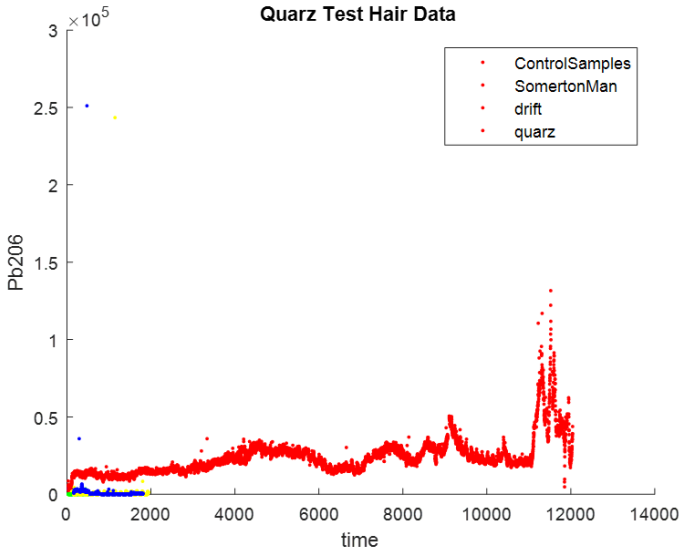


Figure 13 Strontium (Sr88)

Compared with the elements relative values between Somerton man and control samples, Figure 11, 12, and 13 have some similarities. The relative values of calcium, potassium and strontium in Somerton man' hair are higher than most control hairs. However, the content of these three elements in two samples is close to the content of Somerton man' hair. Moreover, these two hair samples both are from the one person. Based this result, it can be speculated that the content values of these three elements in the living environment for Somerton man and this special sample are similar.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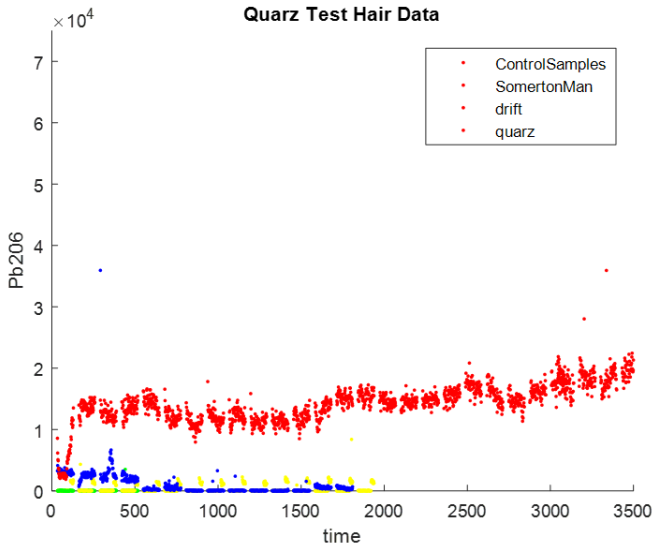
2.5
2
1.5
1
0.5
0
Pb206
0
2000
4000
6000
8000
10000
12000
14000
time
ControlSamples
SomertonMan
drift
quarz


Quarz Test Hair Data
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6
5
4
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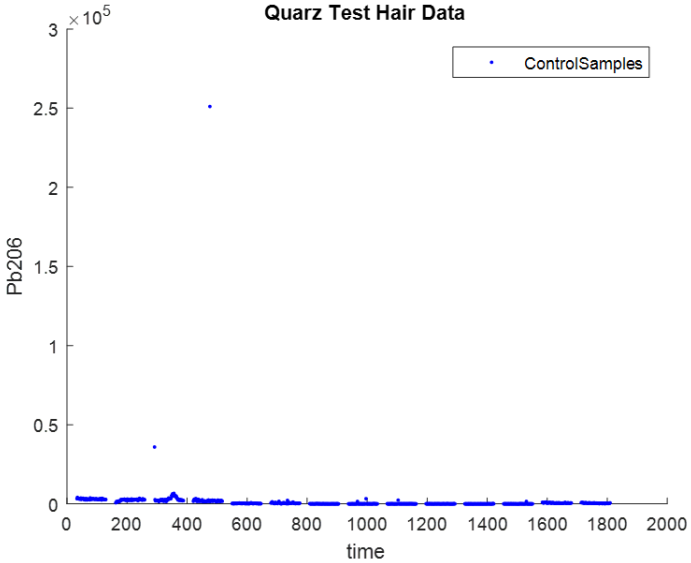
time
ControlSamples
SomertonMan
drift
quarz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400
600
800
1000
1200
1400
1600
1800
2000
time
ControlSamples

Figure 14 Lead (Pb206)

It has mentioned in the previous chapter that lead is a toxic element, and the data obtained from the glass plate experiment show that the lead content in Somerton man's hair is significantly higher than that in control hairs. This phenomenon still exists in the quartz plate test. Since the incomplete hair for quartz plate test, the trend of lead content value in the hair before Somerton man dying cannot be expressed. However, the content of lead in Somerton man's hair is indeed higher than the control hairs.

The difference in lead levels does not indicate that the death of Somerton man is caused by the high level of lead in the body. The difference may be due to the fact that the lead content in human living environment is different from 60 years ago.

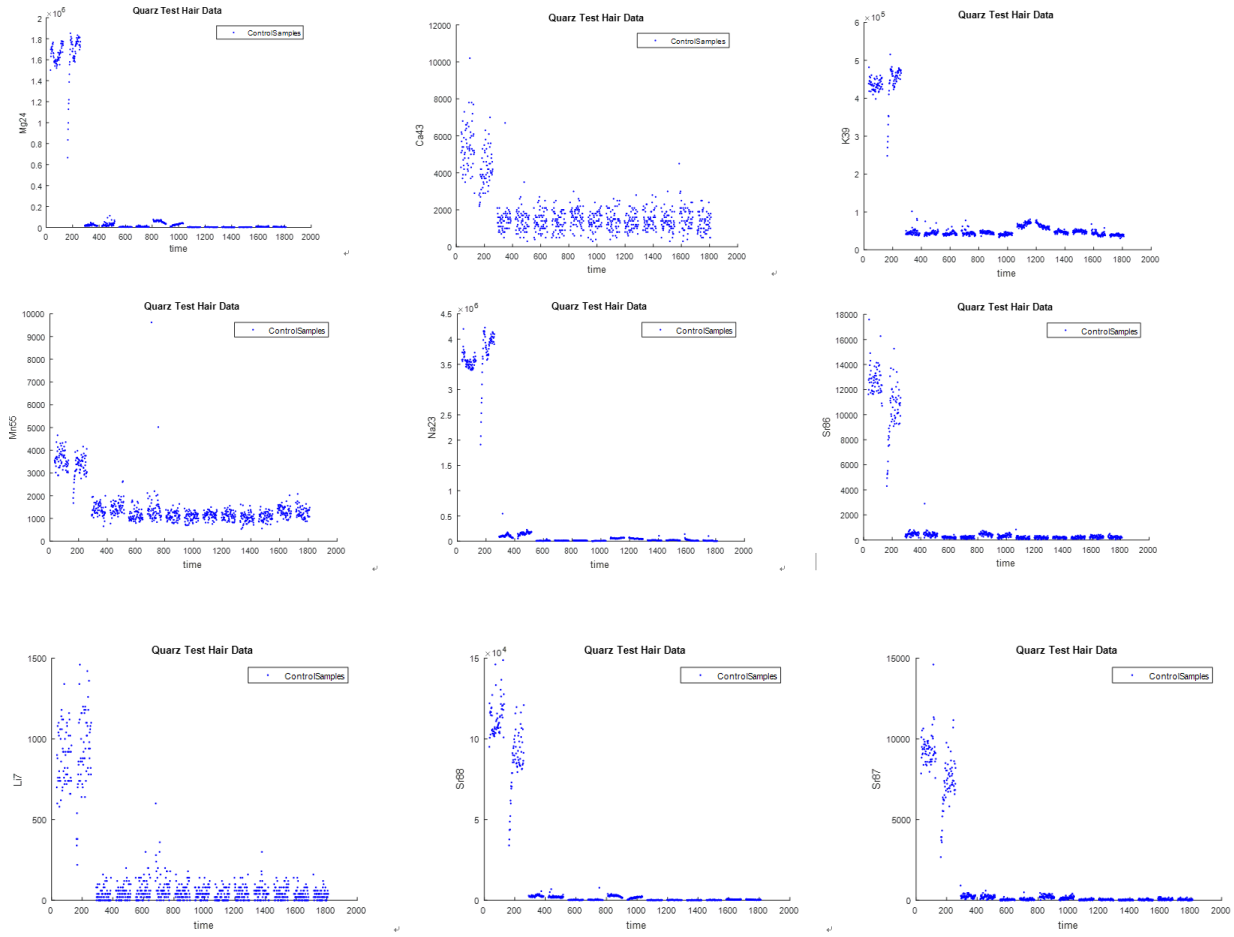


Figure 15 Comparison of the relative values of some elements in control hairs

For control hairs, two sections of each hair have been analysed. There are fourteen control hairs which are from seven persons. By comparing these 14 samples, it was found that there was a difference in the elemental content between the samples, especially the first control person's hair. Figure 15 shows the relative value of the first sample is significantly higher than the other samples. These elements are Mg, Ca, K, Mn, Na, Li, Sr. In addition, by the analysis and comparison results of several previous graphs, the values of the elemental contents of this sample are similar to those of Somerton man. From this result it can be inferred that this control sample and Somerton man have similarities in the living environment or lifestyles.

5 Comparison of glass and quartz test results

5.1 The same elements were recorded in both tests.

In the glass plate test and the quartz plate test, 31 same elements were recorded and shown in table 7.

Table 7 the Same Elements in Two Data Sets

The same elements in two data					
Li7	C13	Na23	Mg24	Al27	Si28
S34	K39	Ca43	Ti47	V51	Cr52
Mn55	Fe57	Co59	Ni60	Zn66	As75
Se77	Se82	Sr88	Ag107	Cd111	Sn118
Au197	Hg202	Tl205	Pb206	Bi209	Th232
U238					

5.2 Comparison of two test results

In section 3 and section 4, the differences of elements' relative content between Somerton man and the control samples have been shown. Then, these two experimental results of Somerton man's hair data should be compared. According to previous studies, the two set of data should have similar trend in the period of time and the relative content values derived from both experiments are different. In addition, the difference in relative content values can be offset through a set of data multiplying a constant number which is derived from the comparison of two test data. The following figures are the comparison of several representative elements and all the elements' comparison figures are shown on Appendix D.

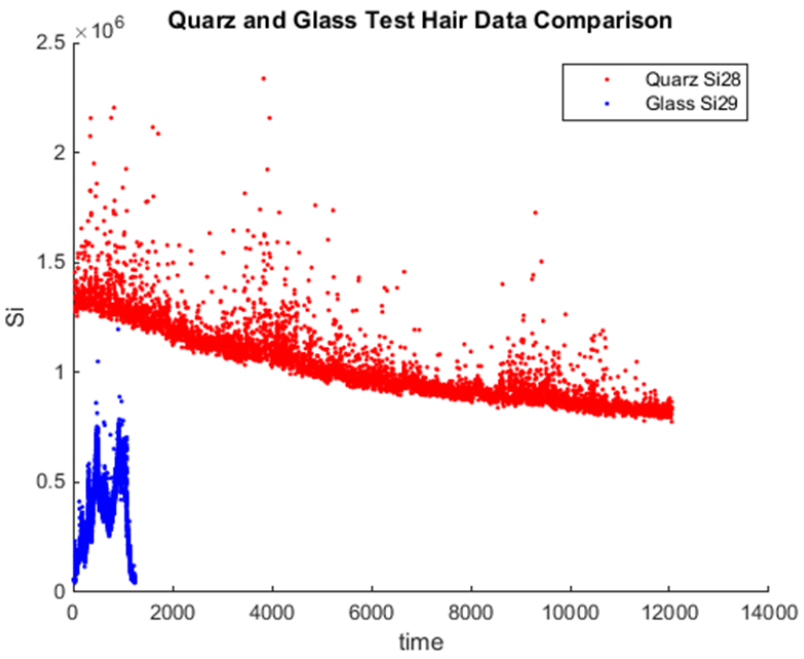


Figure 16 Comparison of the relative values of Silicon (Si) in two tests

As can be seen from Figure 16, silicon relative content in quartz test is higher than in the value in glass test and the trend is significantly different. In glass test, silicon value curve has no obvious change rule. In the quartz experiment, even if the change trend is obvious, but considering the experimental sample is incomplete, this trend cannot be directly used for comparison. Thus, it cannot find the constant number from Figure 16.

The following figures that from Figure 17 to 20 are the different elements comparison results of two test hairs. It is hard to find the same trend from this comparison. Therefore, it is necessary to find another suitable way to compare the two sets of data.

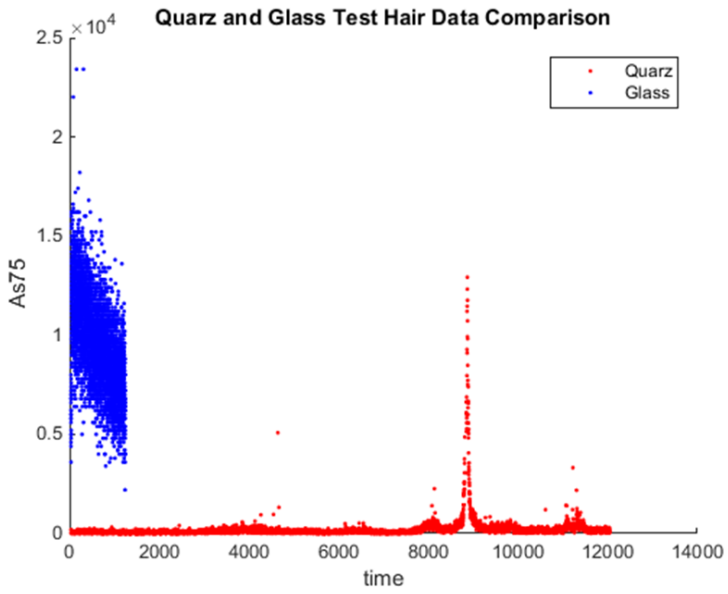


Figure 17 Comparison of the relative values of Arsenic (As75) in Somerton man hair

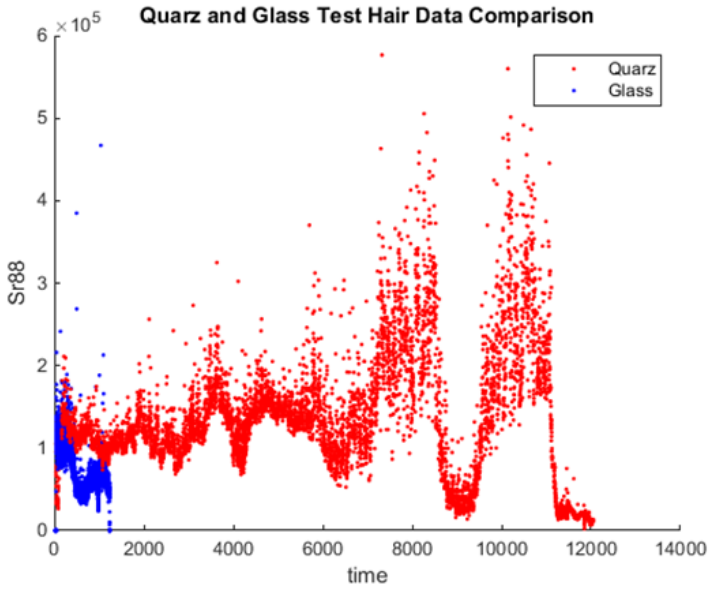


Figure 18 Comparison of the relative values of Strontium (Sr88) in Somerton man hair

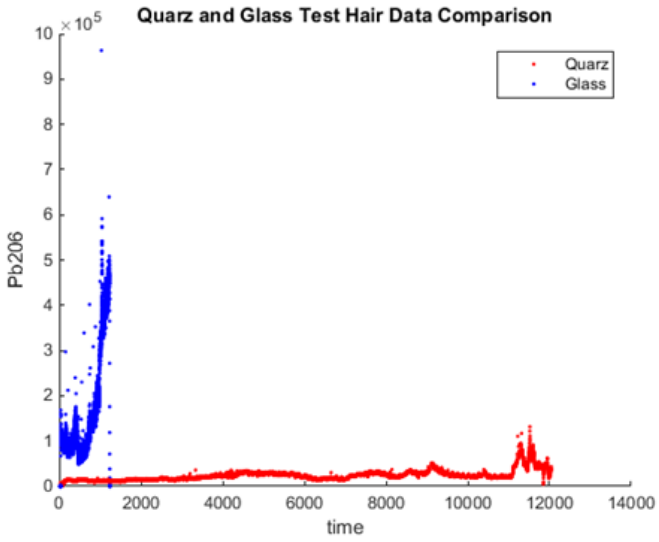


Figure 19 Comparison of the relative values of Lead (Pb206) in Somerton man hair

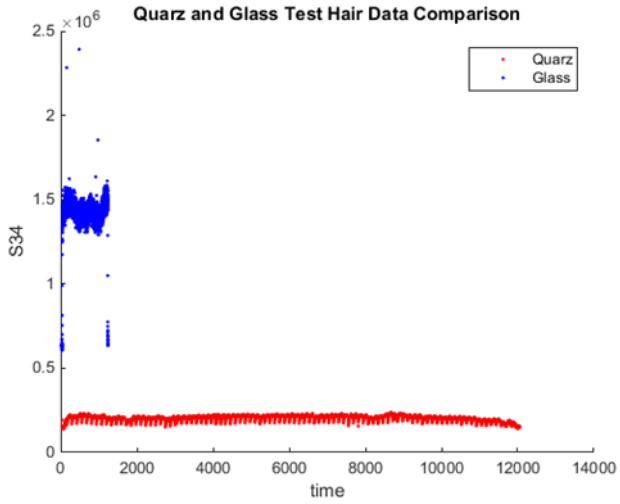


Figure 20 Comparison of the relative values of Sulphur (S34) in Somerton man hair

6 Future Works

For this project, Somerton man's hair elements data which got from glass test and quartz test have been plotted. The future works are as following:

- Re-analysing the uncommon elements value of Somerton man's hair
- Find more clues related to Somerton man's living environment
- Find the same trend of element change in two Somerton man's hair tests.
- Gain the constant number to offset the difference between two test data.

7 Project Management

7.1 Timeline

The timeline Gantt chart has been attached in appendix B. It has listed the key milestones of the project (shown in Table 8).

Table 8 Key Milestones of the Project

Time	Milestones
Semester A	
Week 1	Research Methods
Week 2-3	Research Information
Week 4-5	Prepare Proposal Seminar
Week 6	Proposal Presentation
Middle Break	1st Thesis Draft
Week 7-8	Plot Comparison Figure
Week 9-11	Analysis Glass Test Data Verification Viewpoints
Week 12	Semester A Performance
Semester B	
Week 1	Review
Week 2-4	Plot Comparison Figures
Week 5-5	Analysis Quartz Test Data
Week 6-8	Compare Glass Test and Quartz Test
Week 9-11	Final Report
Week 11	Project Exhibition Poster
Week 12	Create YouTube Video
Week 12	Final Seminar

7.2 Work breakdown

The key task for the project is plotting and comparing data figures. Then, finding clues from the comparison. Due to two group members have different study directions, the project work is individual.

7.3 Task allocation

The project has two directions. In general, two group members work on different specific tasks. This report devote to analyzing the mass spectrometer data of the Somerton man hairs. The other group member works on cracking code and writing software.

7.4 Management Strategy

To ensure finishing project on time, we have set the following strategies:

- Meeting with supervisors frequently
- Receiving effective feedbacks from supervisors
- Finish tasks without delay
- Communicate with group member frequently.

7.5 Risk Management and Budget

The project has 500 dollars budget but the software tools are open source in the University of Adelaide. So we do not need cost money on this project.

The risks of project are listed in Table 9. The first risk should be considered is misunderstanding project tasks. So, the well communication with supervisors is essential. For this report, the crucial task is plotting figures by Matlab. Matlab unavailable will have influence on project processing. However, the Matlab is available on the computers of university. So, this risk can be negligible.

Table 9 Project Risks

Risk	Likelihood	Rating	Risk Estimation
1. Group member absent	Rare	Low	Medium
2. Group members' communications failure	Unlikely	Moderate	Medium
3. Data Loss	Slight	Negligible	Medium
4. Task completion time delay	Rare	low	Low
5. Bugs in code	Likely	Moderate	Medium
6. Matlab Unavailable	Rare	Moderate	Negligible
7. Group member leaves	Unlikely	Negligible	Negligible
8. Lack of resources	Rare	low	Low
9. Misunderstanding project tasks	Slight	Negligible	Low

8 Conclusions

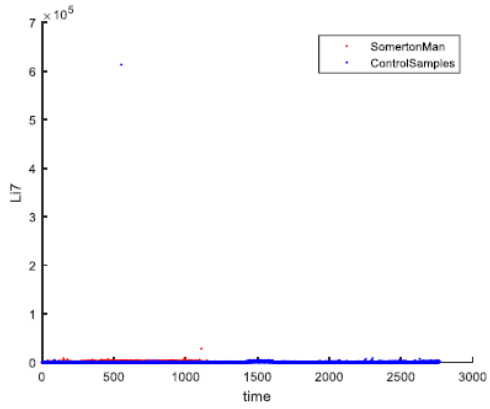
In this project, three important comparisons of experimental data were made. These three comparisons are related to glass test, quartz test and the comparison of glass and quartz test results.

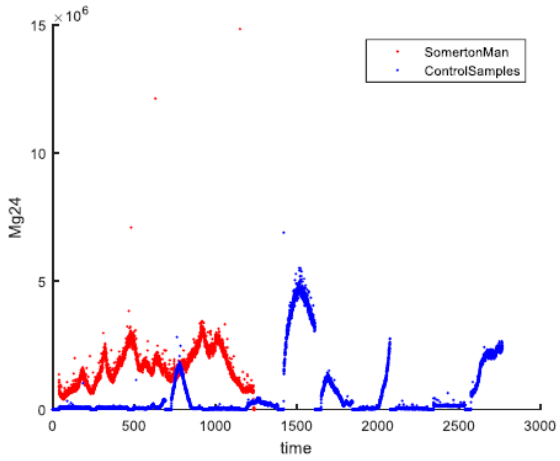
In the comparison of the experimental data of glass plate test, the relative values of element content for lead, mercury, arsenic and cadmium in Somerton man's hair are significantly higher than control samples in certain period of time. However, these elements' content have been reduced to a safe range before his death. Thus the high content of these elements cannot be regarded as the main cause of Somerton man's death, only as a reference to the change of living environment.

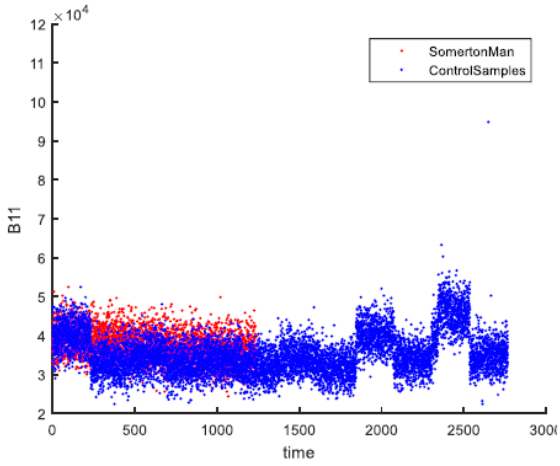
In the comparison for the data of quartz test, the total amount of recorded elements were reduced from 44 in glass test to 35 which is due to the high purity of quartz plate. Thus, some elements in glass test are excluded. Through comparison, the content of carbon and sulphur in Somerton man's hair has a large difference with the fourth sample. In addition, the content of potassium, strontium and calcium are similar with the first sample. Therefore, it can assume that Somerton man's living area is different with the fourth sample, but similar with the first sample.

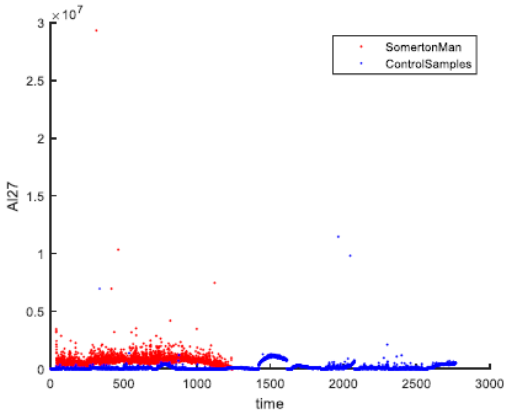
The data comparison between glass and quartz test does not achieve the desired results. So, the experimental method may need to change in the future work.

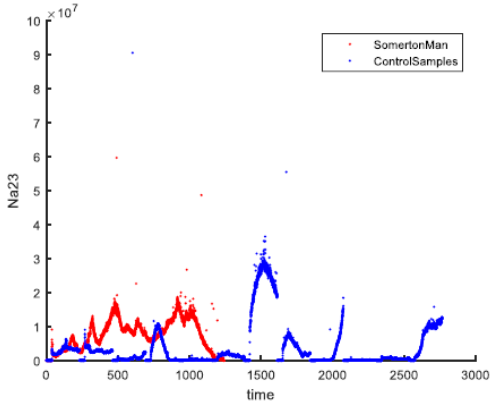
Appendix A: Glass test figures

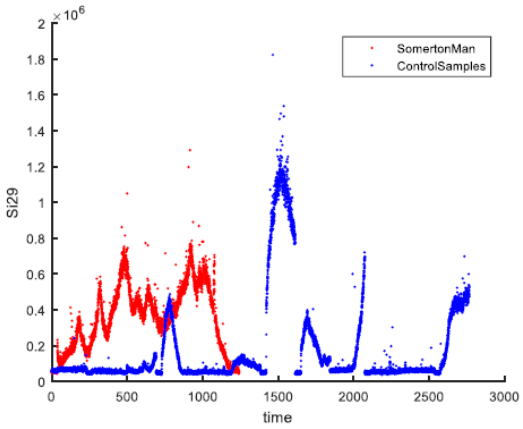


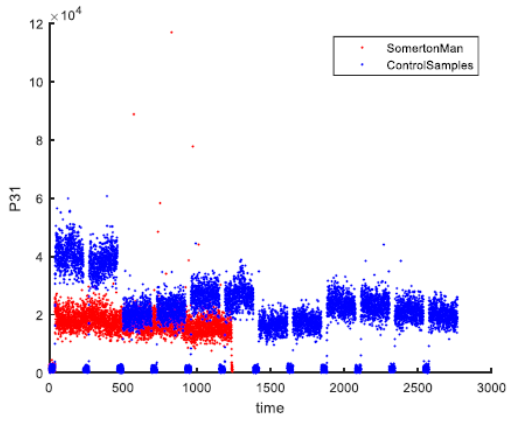








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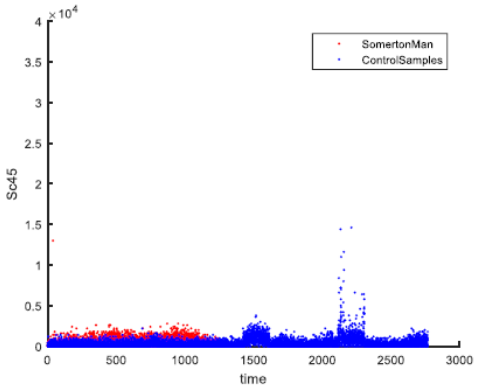
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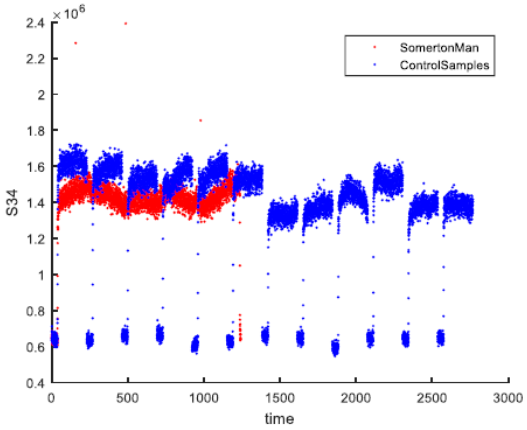
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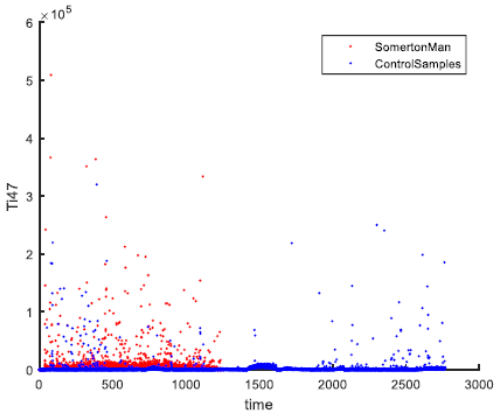
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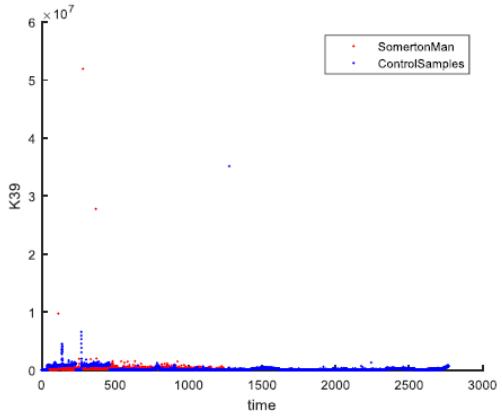
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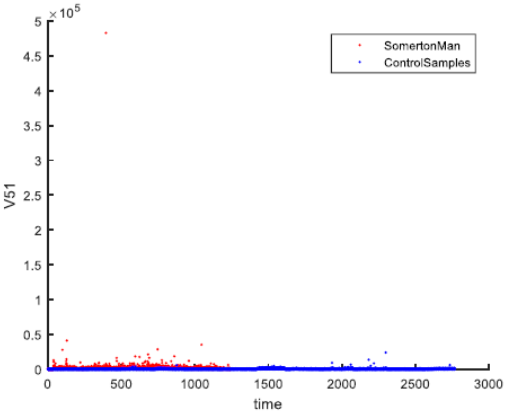
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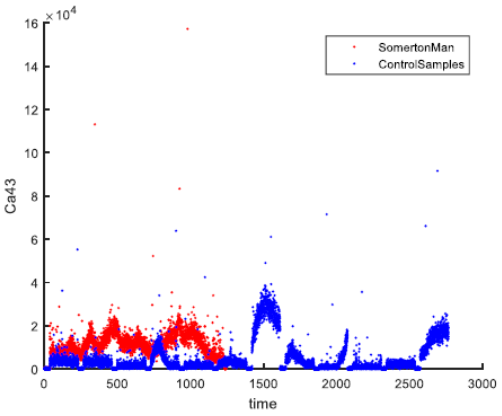
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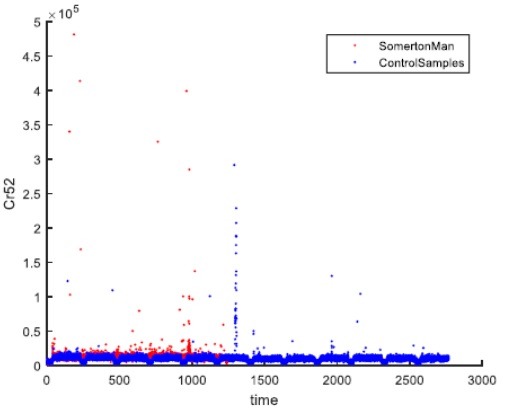
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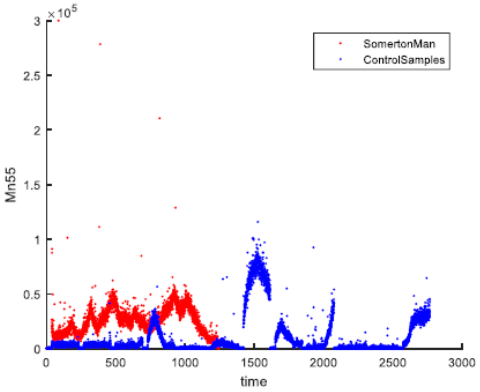
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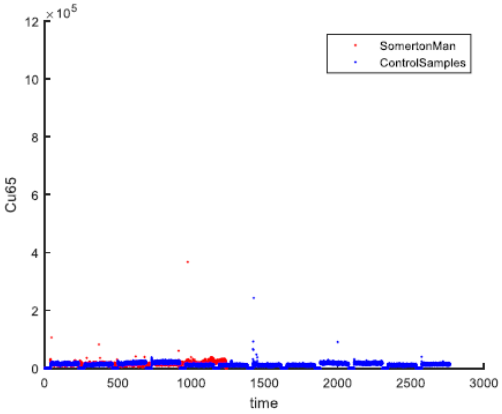
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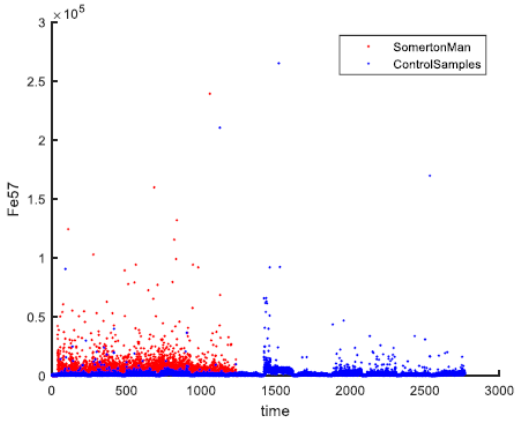
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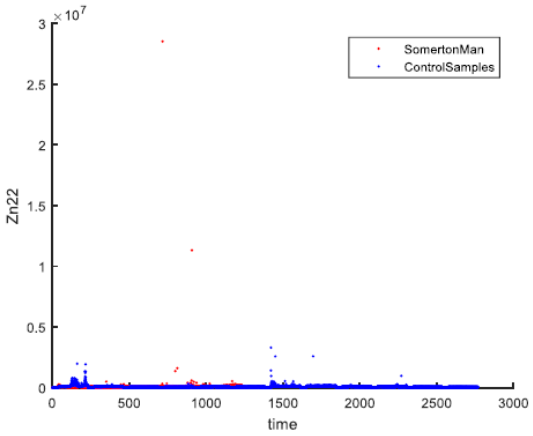
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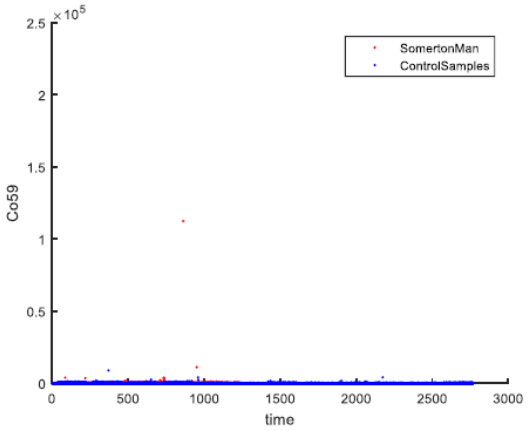
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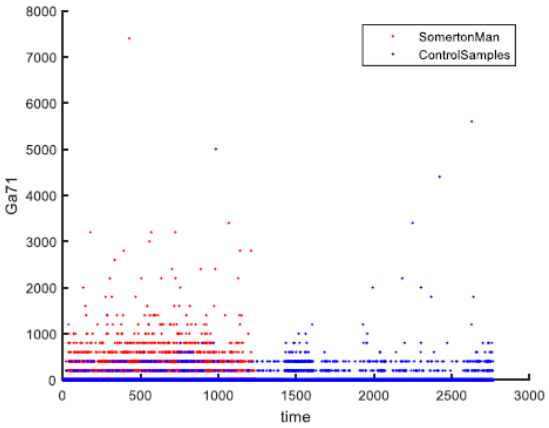
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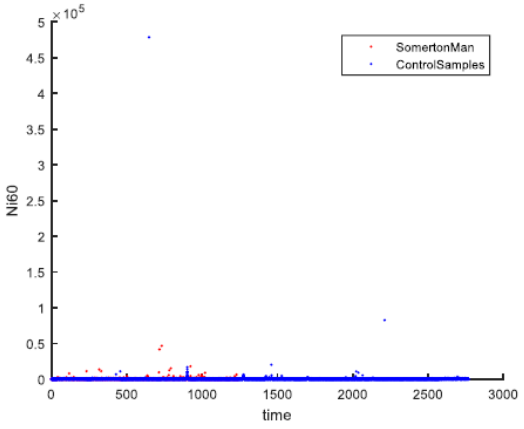
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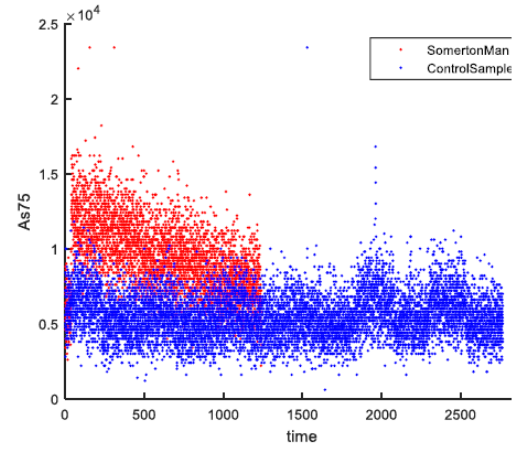
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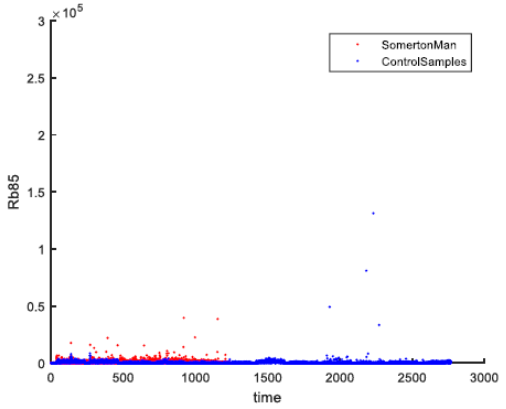
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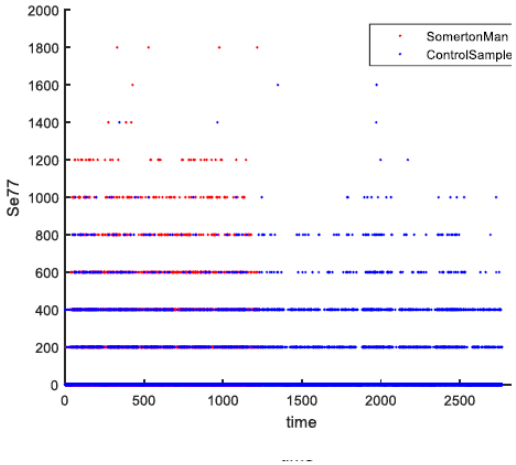
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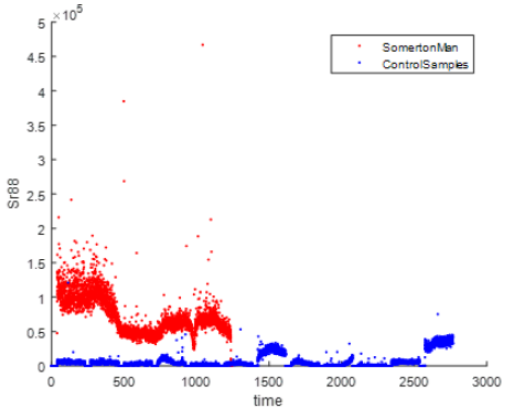
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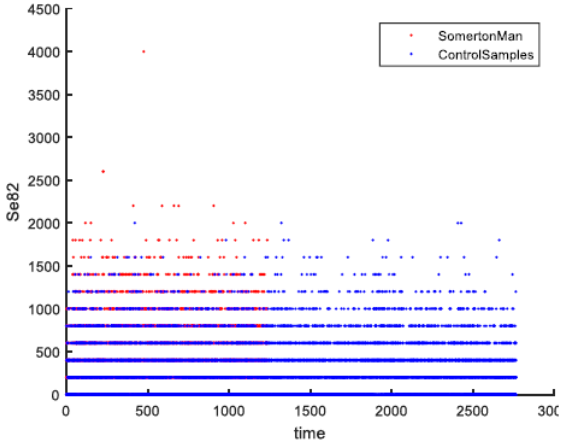
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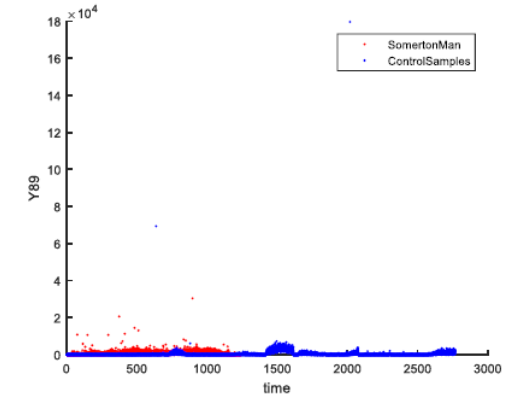
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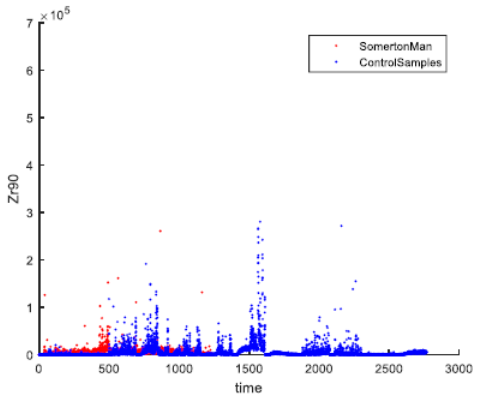
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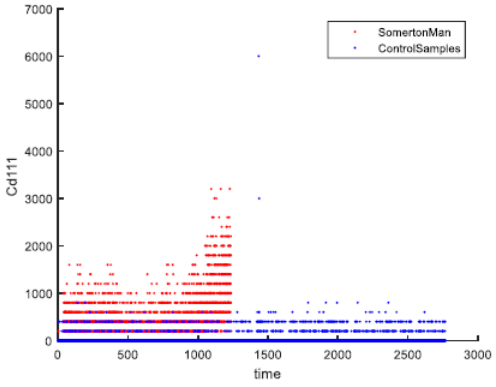
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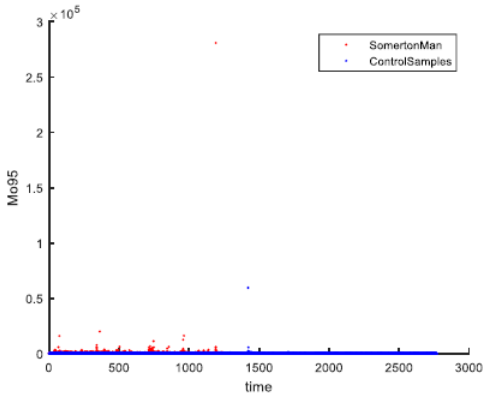
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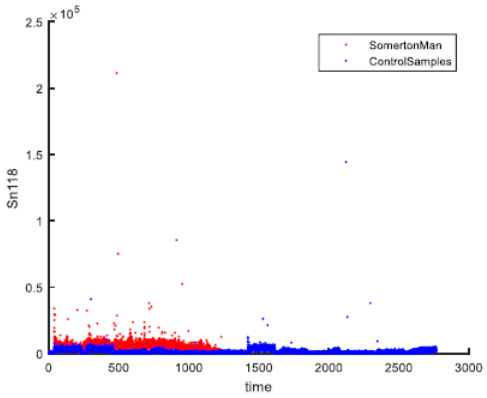
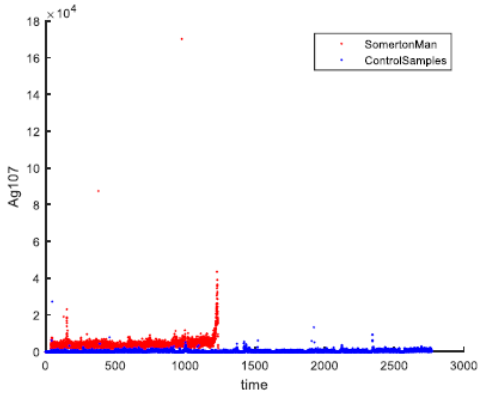
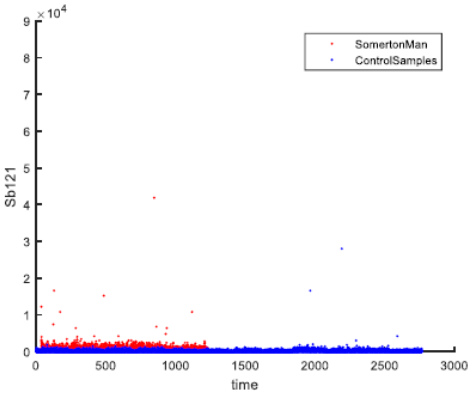
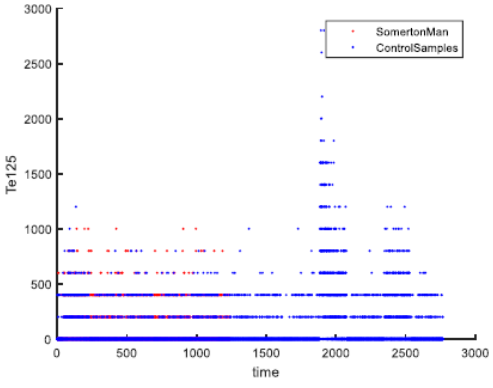
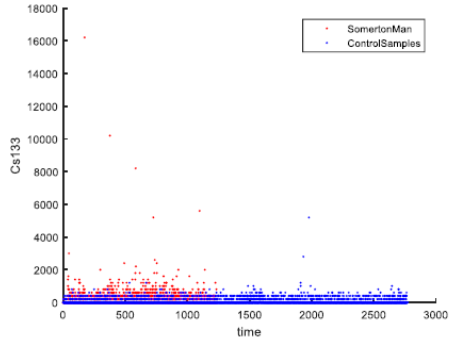
Mo95
time

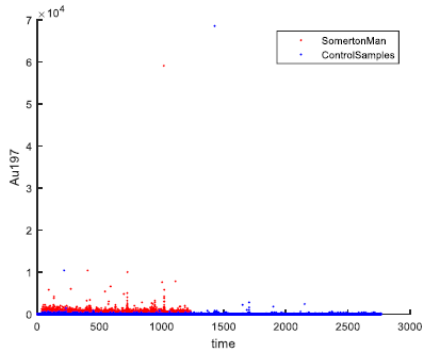

SomertonMan
ControlSamples
Sn118
time

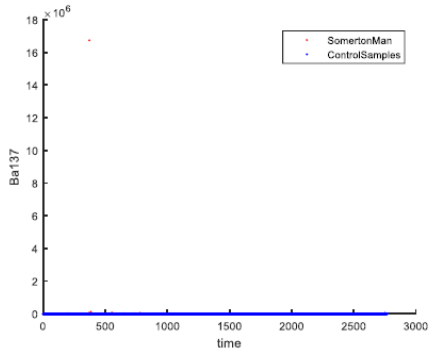

SomertonMan
ControlSamples
Ag107
time

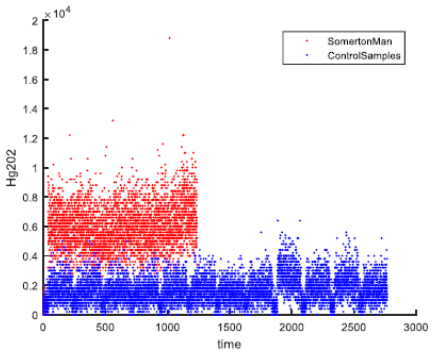

SomertonMan
ControlSamples
Sb121
time

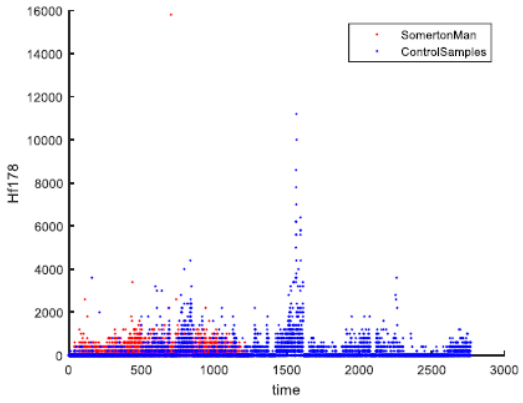

SomertonMan
ControlSamples
Te125
time

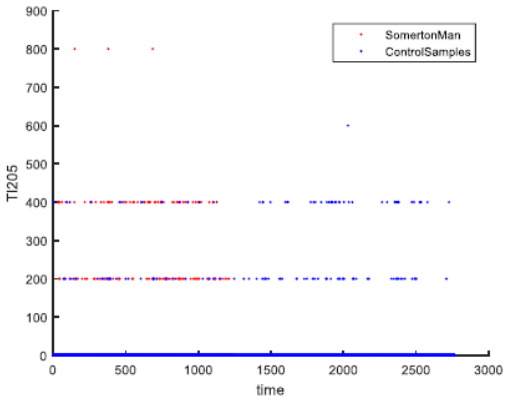

SomertonMan
ControlSamples
Cs133
time

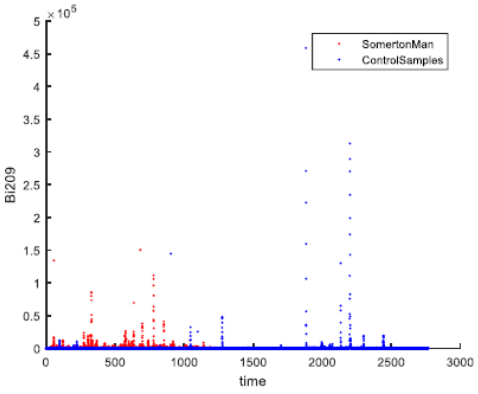

SomertonMan
ControlSamples
Au197
time

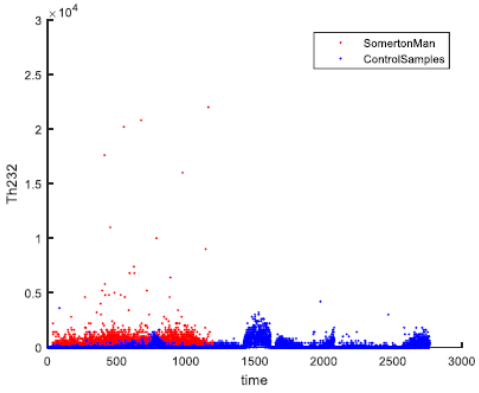

SomertonMan
ControlSamples
Ba137
time

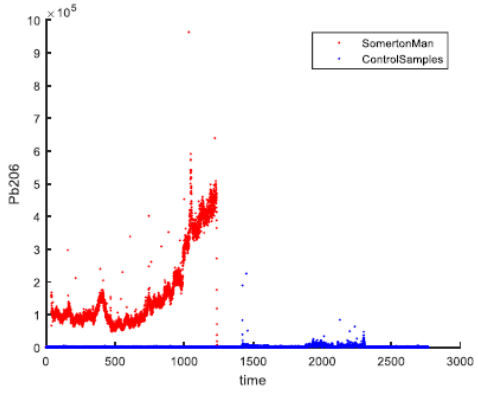

SomertonMan
ControlSamples
Hg202
time

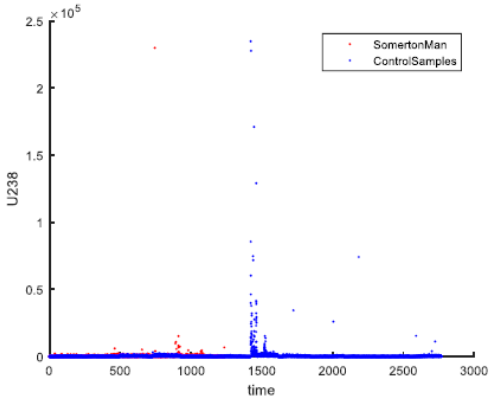

SomertonMan
ControlSamples
Hf178
time


SomertonMan
ControlSamples
Tl205
time

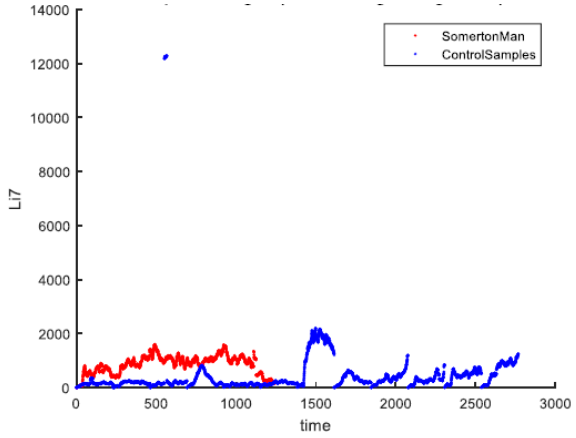

SomertonMan
ControlSamples
Bi209
time

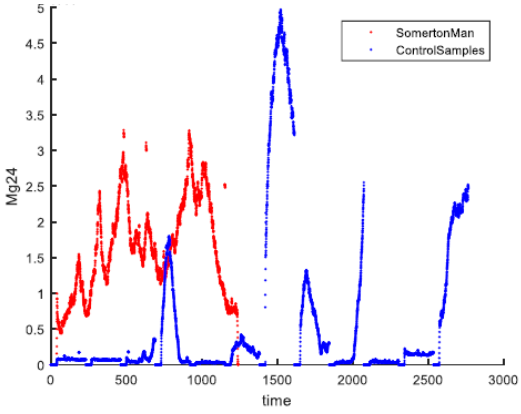

SomertonMan
ControlSamples
Th232
time

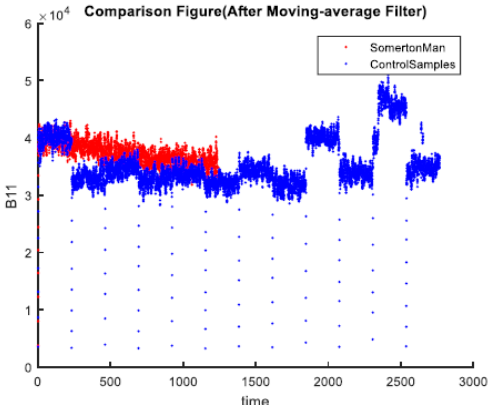

SomertonMan
ControlSamples
Pb206
time

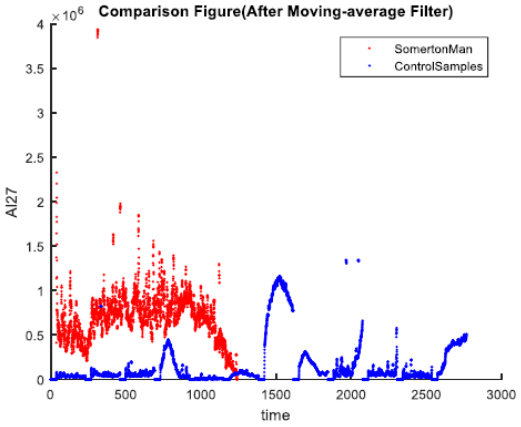

SomertonMan
ControlSamples
U238
time

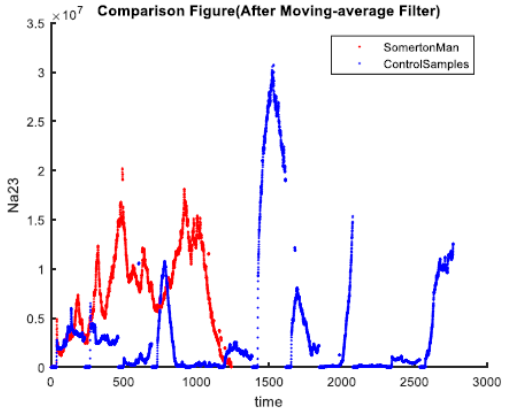
Appendix B: After Moving-average Filters

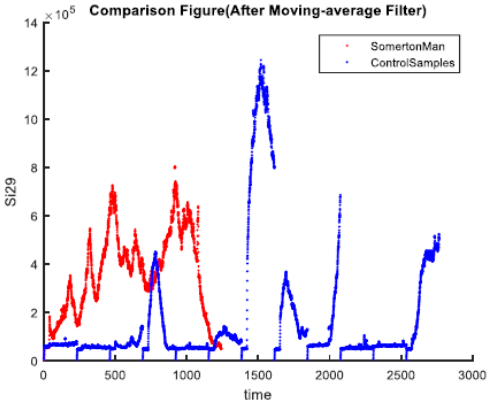


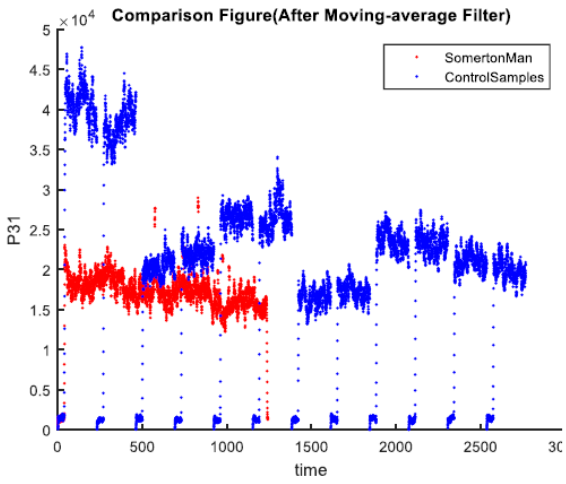


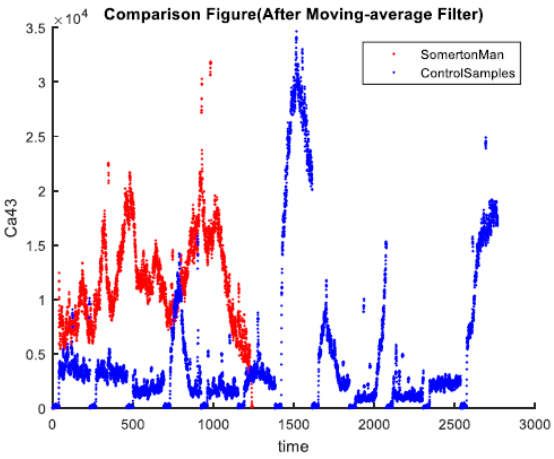


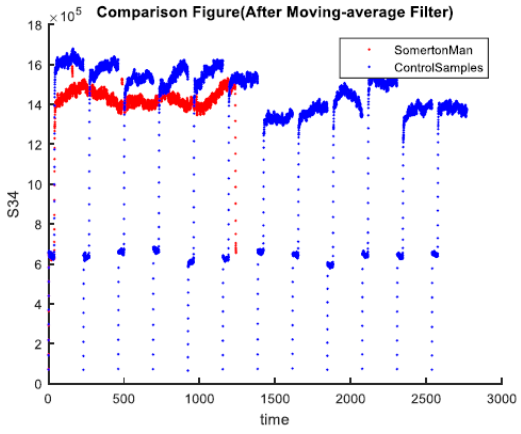


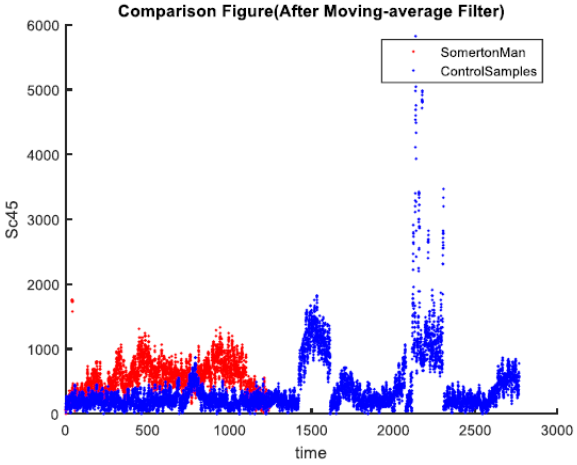


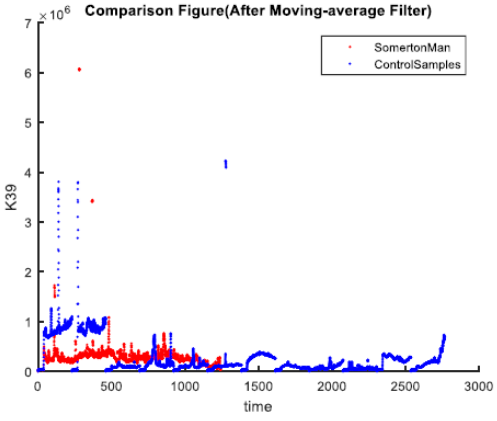


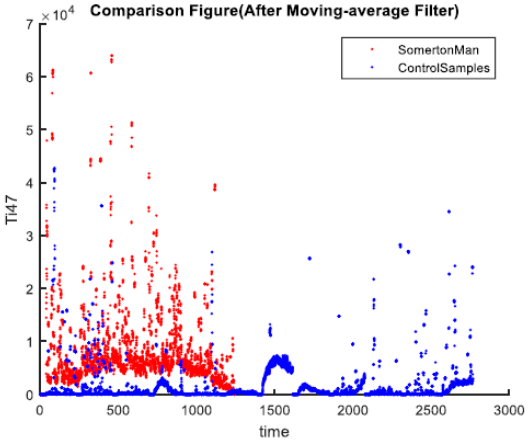

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
P31
time

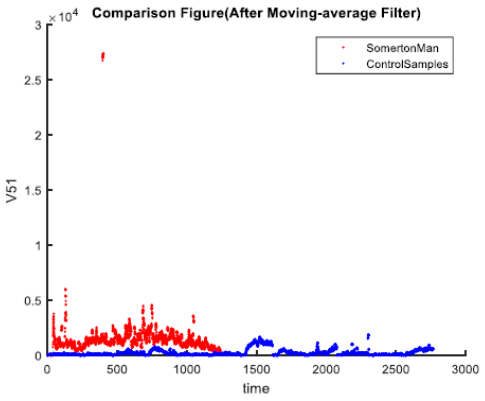

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Ca43
time

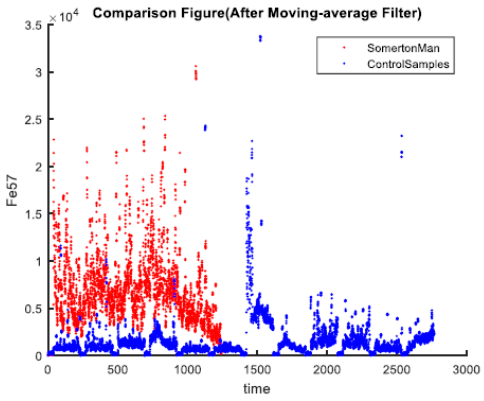

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
S34
time

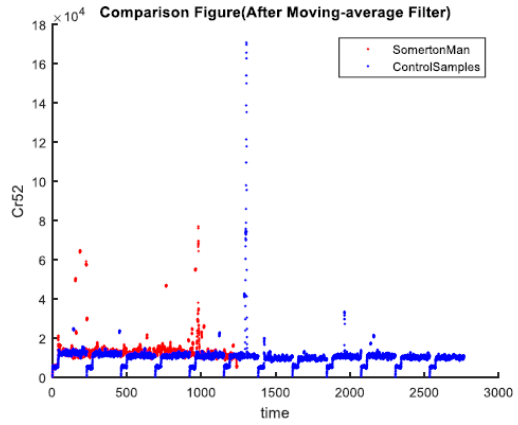

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Sc45
time

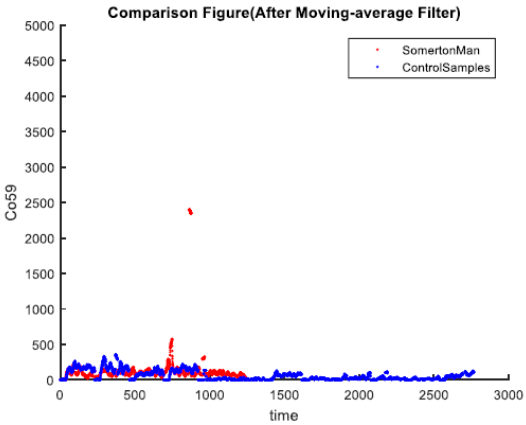

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
K39
time

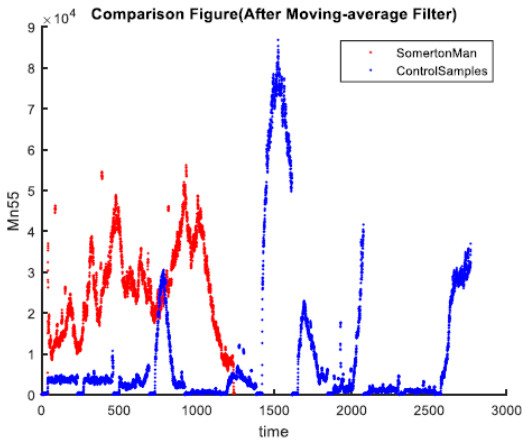

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Ti47
time

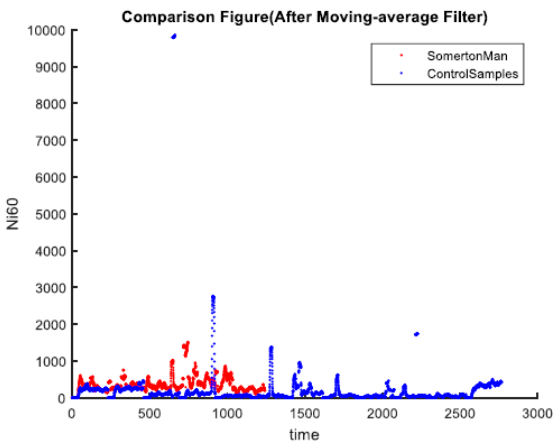

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
V51
time

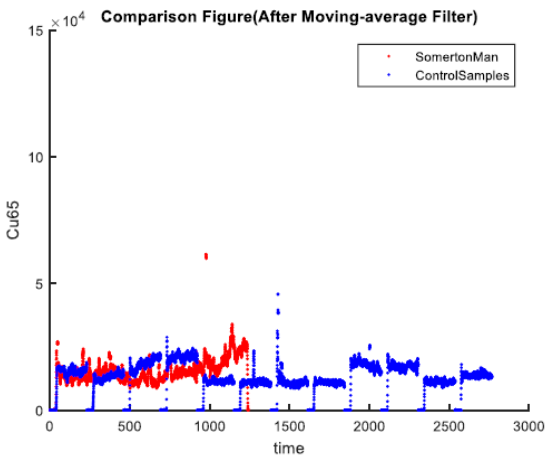

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Fe57
time

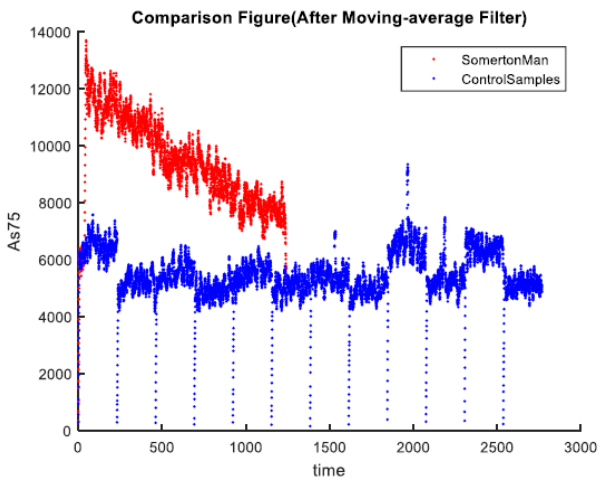

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Cr52
time

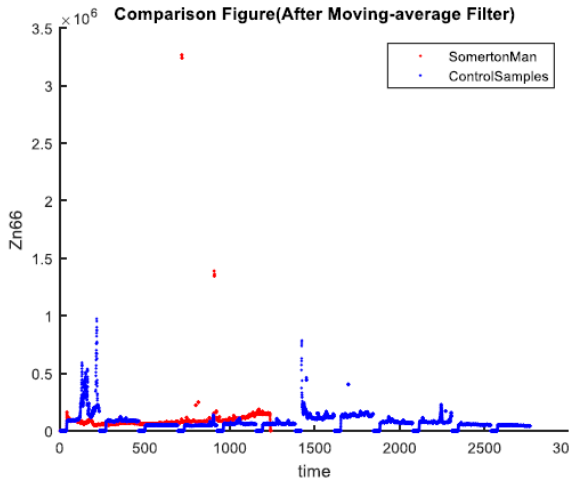

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Co59
time

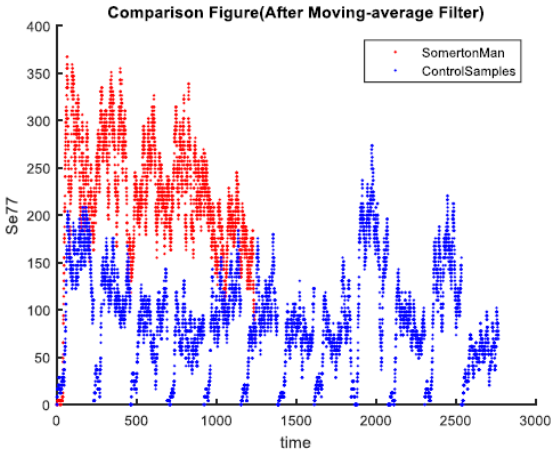

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Mn55
time

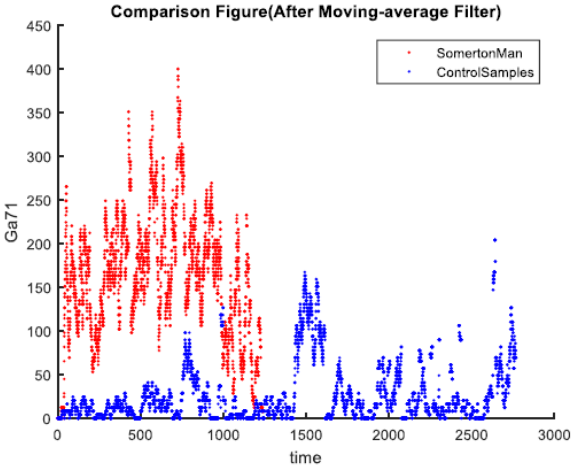

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Ni60
time

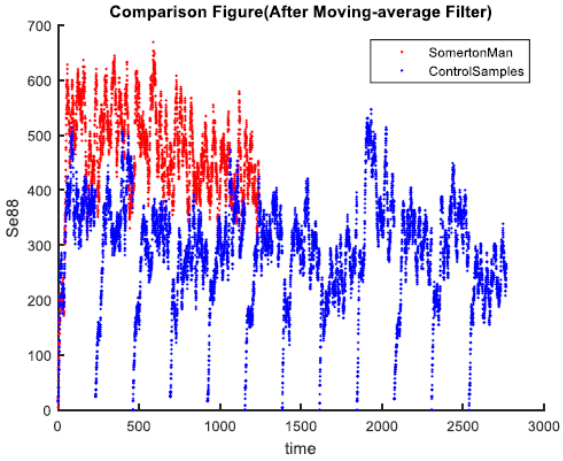

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Cu65
time

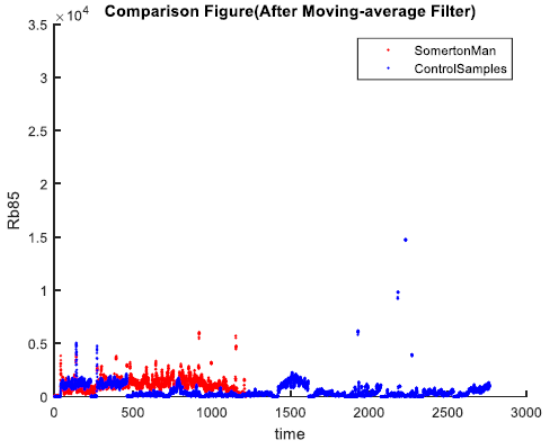

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
As75
time

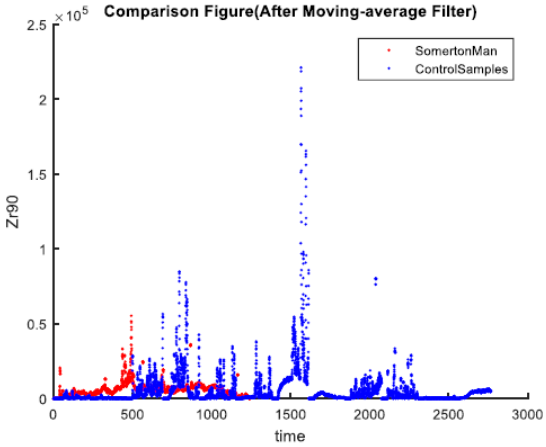

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Zn66
time

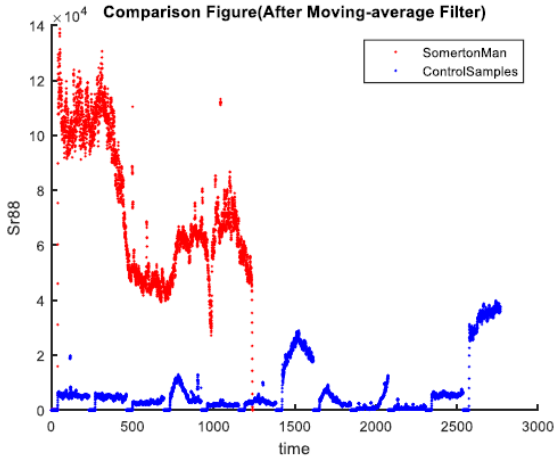

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Se77
time

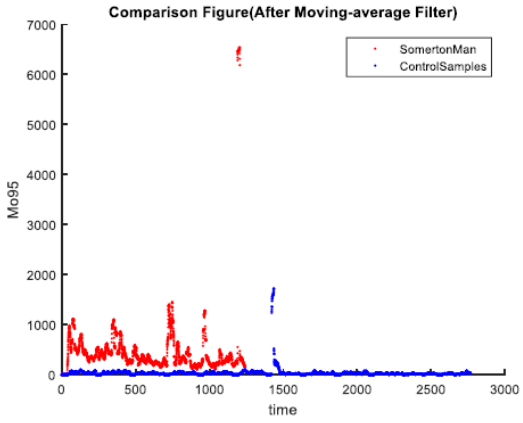

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Ga71
time

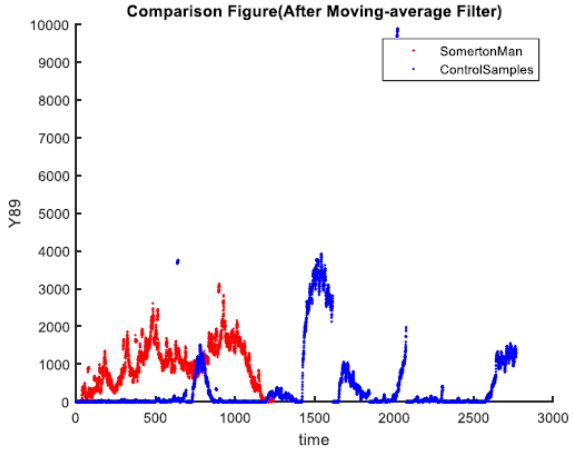

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Se88
time

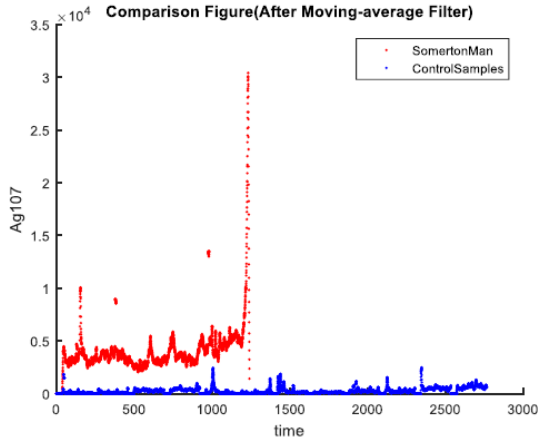

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Rb85
time

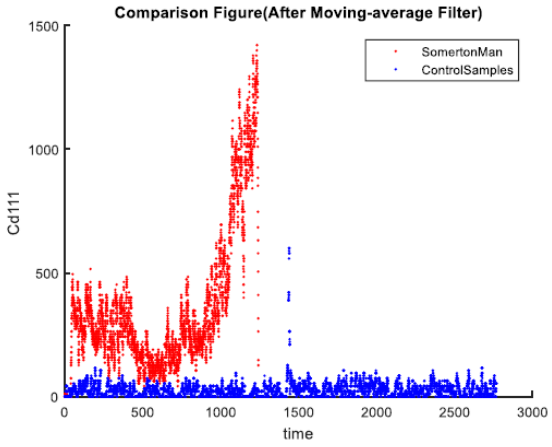

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Zr90
time

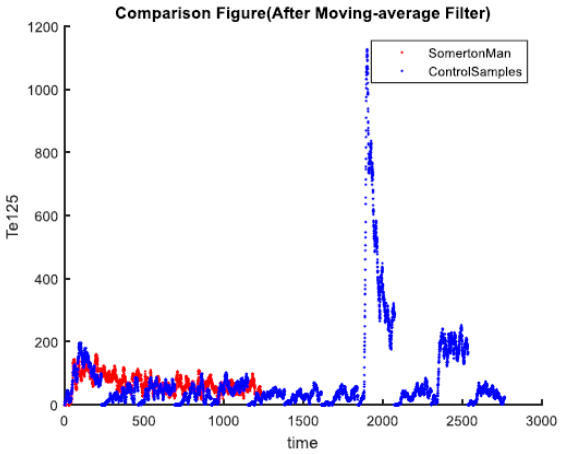

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Sr88
time

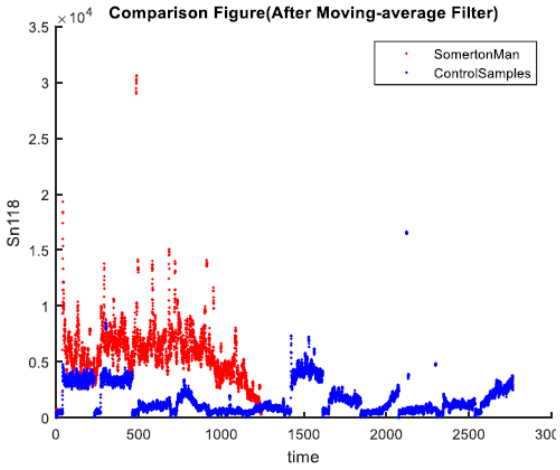

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Mo95
time

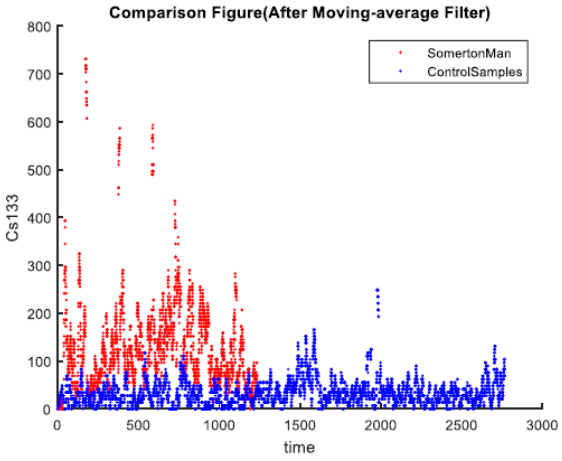

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Y89
time

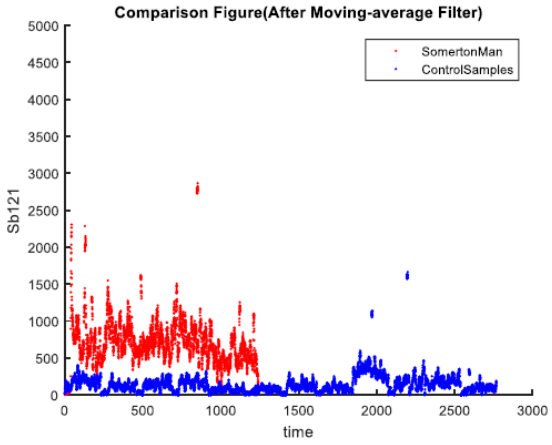

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Ag107
time

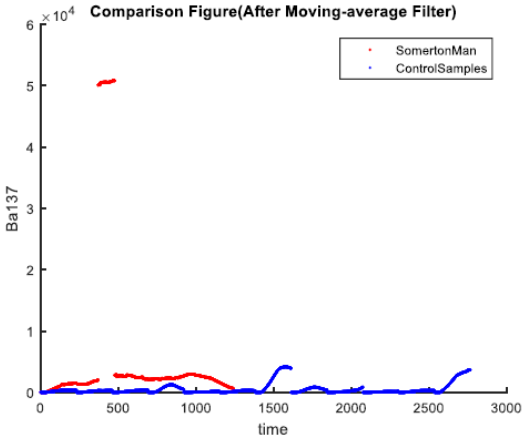

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Cd111
time

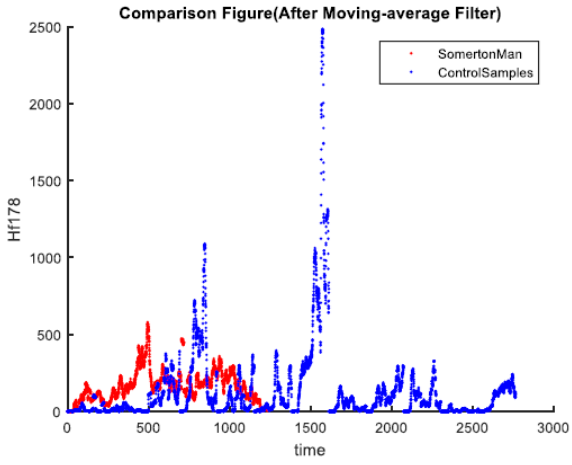

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Te125
time

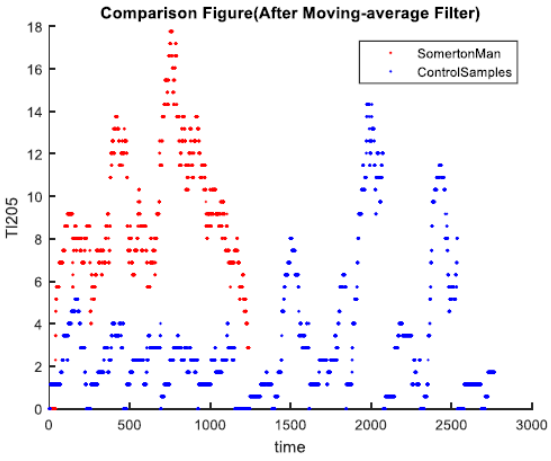

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Sn118
time

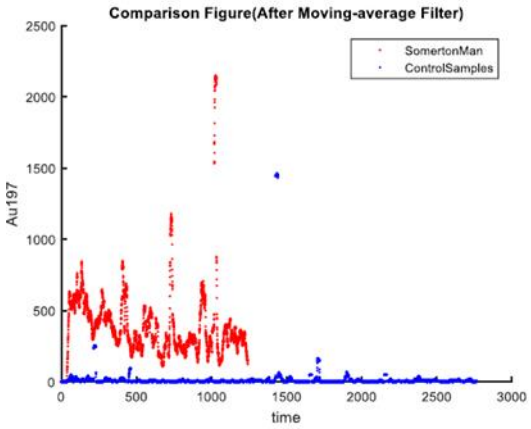

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Cs133
time

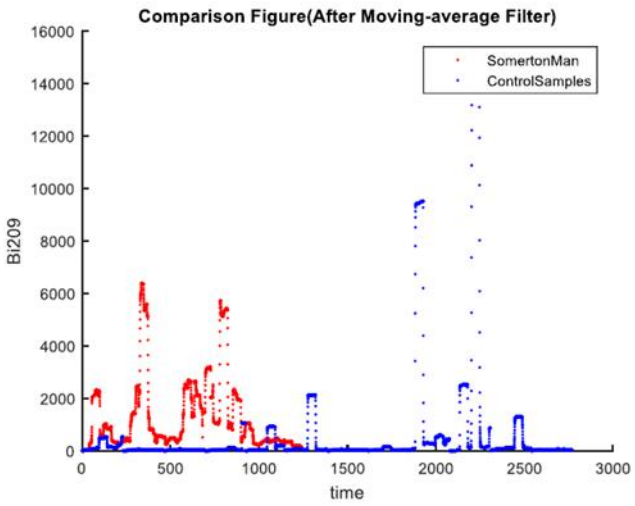

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Sb121
time

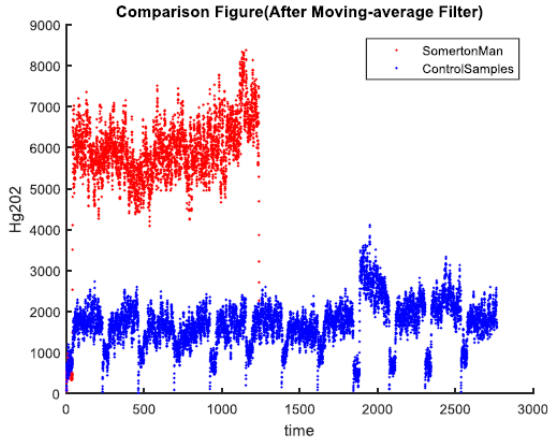

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Ba137
time

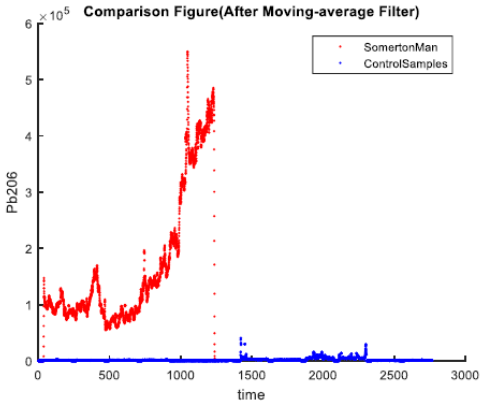

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Hf178
time

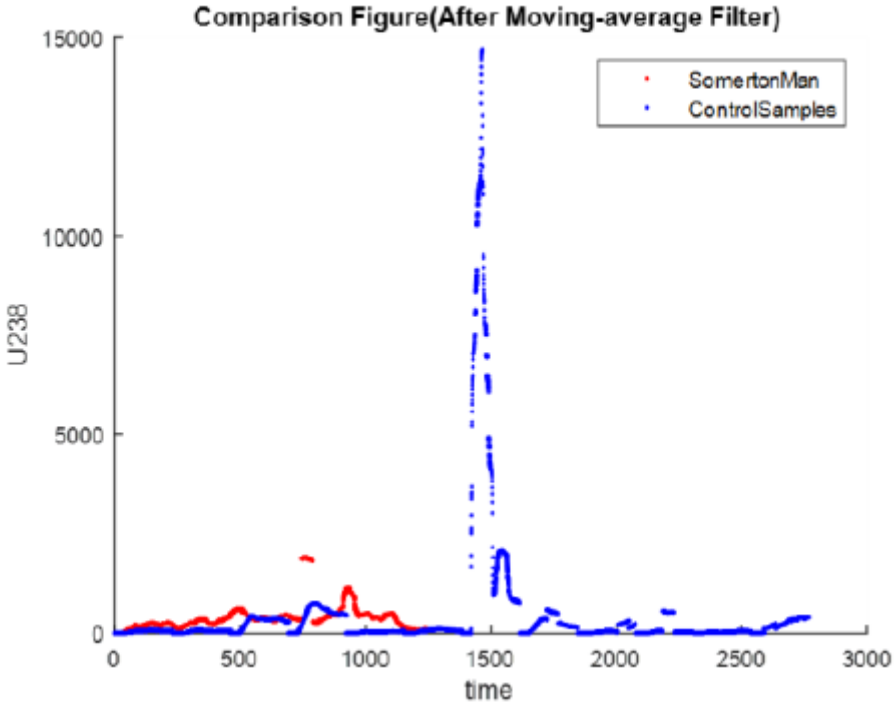

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Tl205
time


Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Au197
time


Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Bi209
time


Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Hg202
time


Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Pb206
time


Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
U238
time
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15000
0
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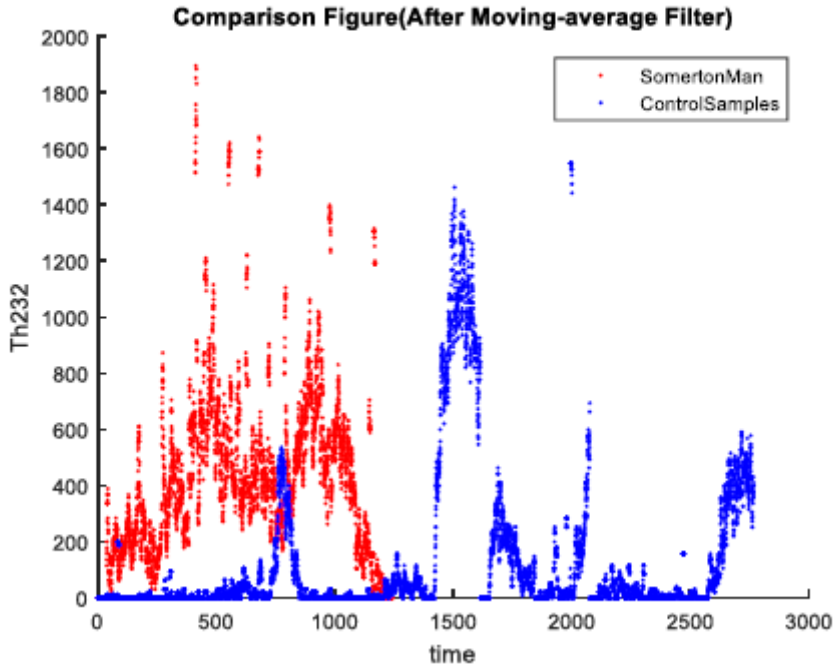
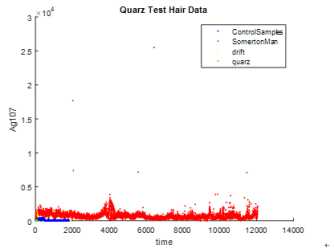
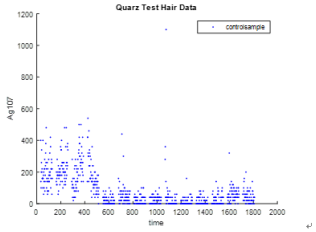
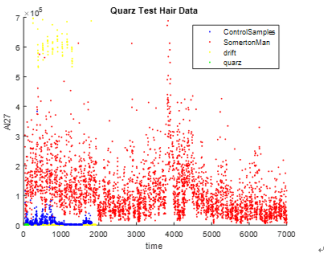
1000
1500
2000
2500
3000

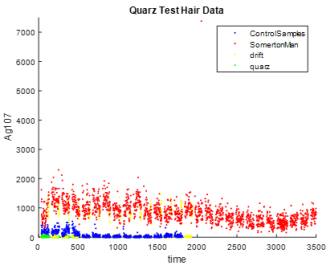

Comparison Figure(After Moving-average Filter)
SomertonMan
ControlSamples
Th232
time
0
200
400
600
800
1000
1200
1400
1600
1800
2000
0
500
1000
1500
2000
2500
3000

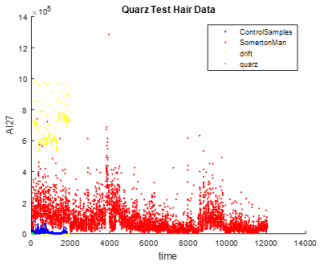
Appendix C: Quartz data figures

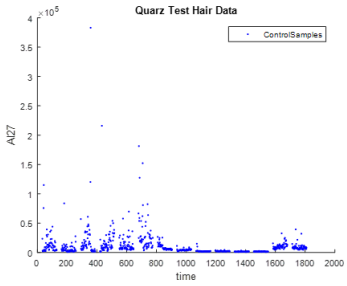


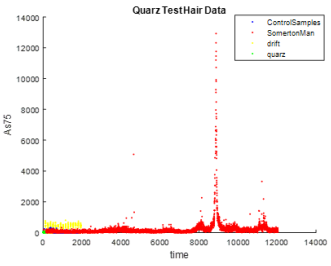


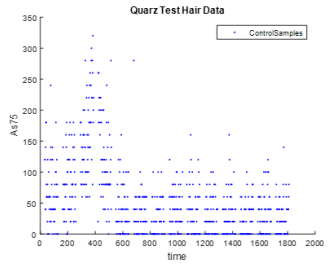


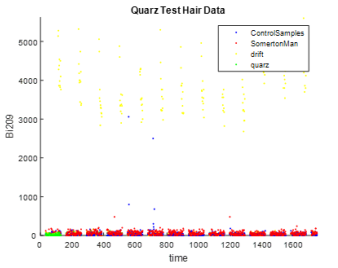


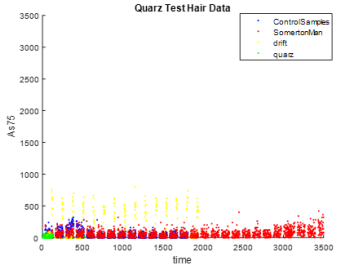


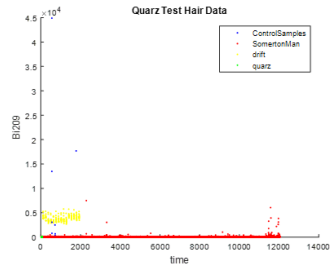


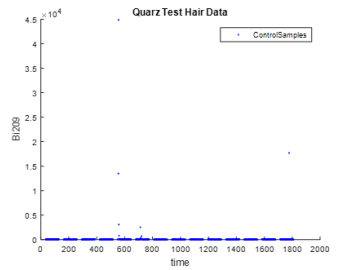


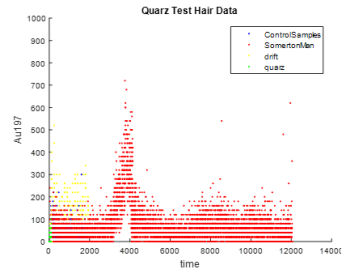


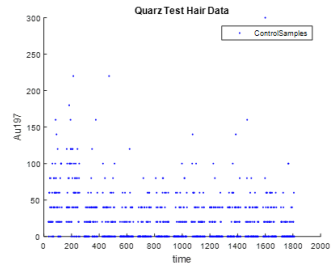


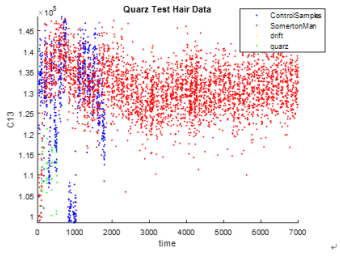


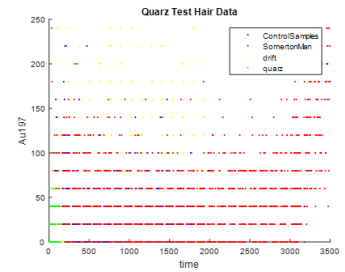


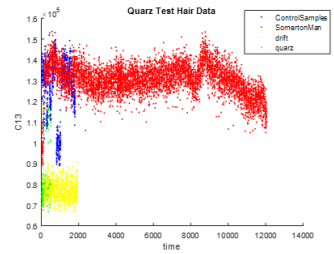


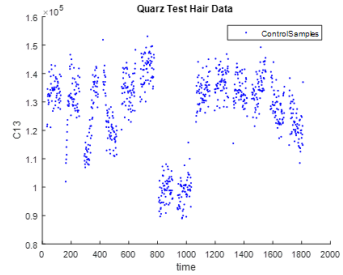


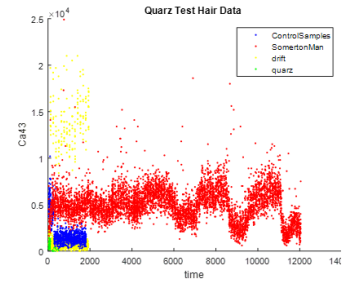


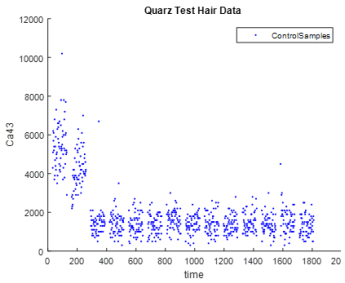









Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Ca43
time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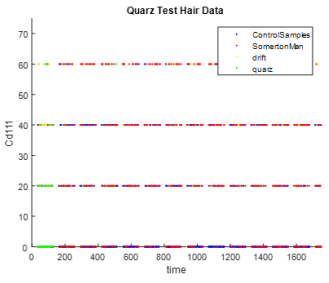
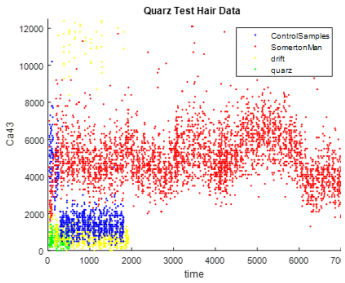
ControlSamples
Ca43
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Cd111
time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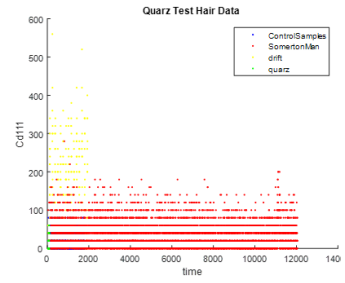
ControlSamples
SomertonMan
drift
quarz
Ca43
time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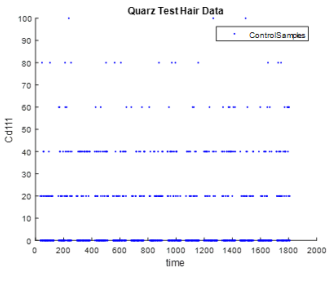
ControlSamples
SomertonMan
drift
quarz
Cd111
time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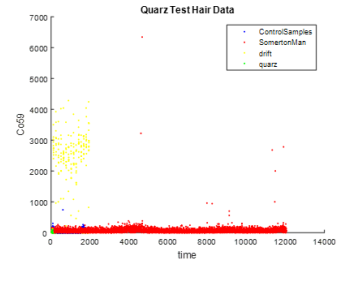
ControlSamples
Cd111
time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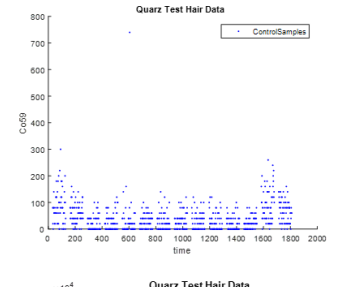
ControlSamples
SomertonMan
drift
quarz
Co69
time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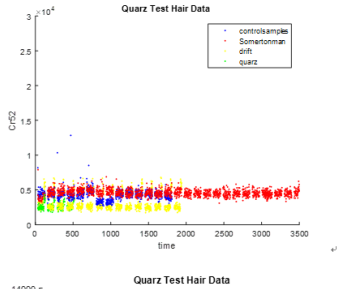
ControlSamples
Co69
time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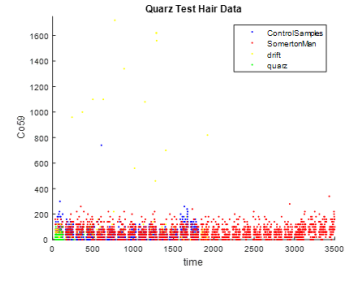
controlsamples
Somertonman
drift
quarz
Cr52
time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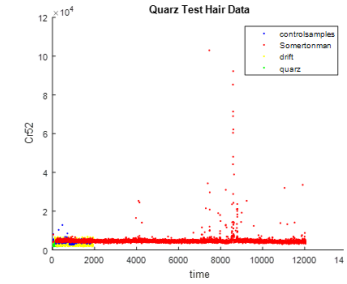
ControlSamples
SomertonMan
drift
quarz
Co69
time


Quarz Test Hair Data
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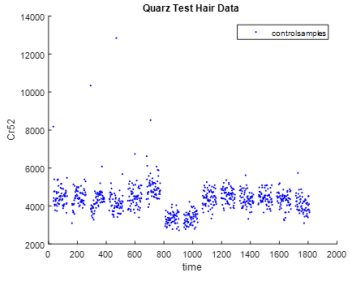
Somertonman
drift
quarz
Cr52
time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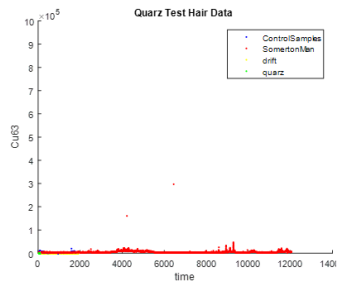
Cr52
time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ControlSamples
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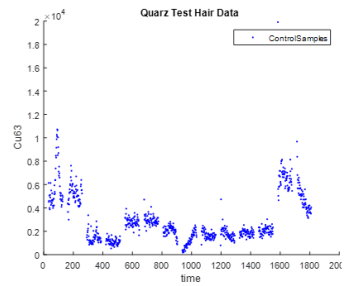
drift
quarz
Cu63
time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Cu63
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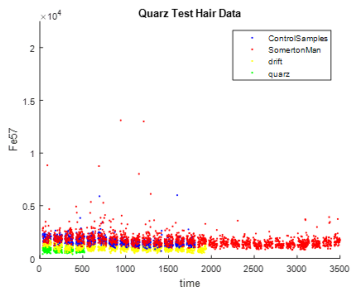
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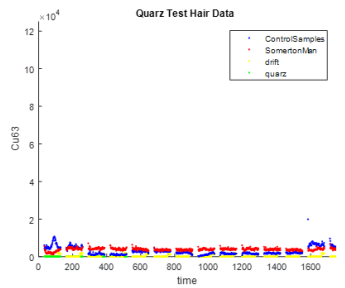
ControlSamples
SomertonMan
drift
quarz
Fe57
time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ControlSamples
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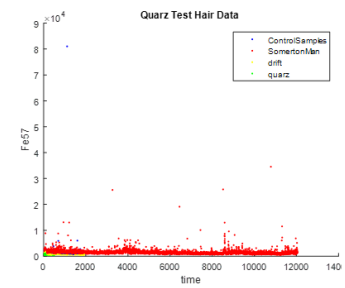
drift
quarz
Cu63
time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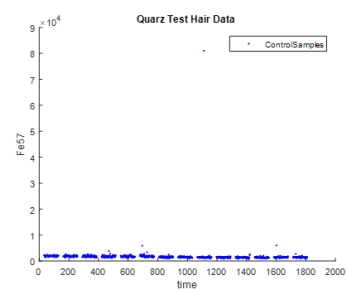
ControlSamples
SomertonMan
drift
quarz
Fe57
time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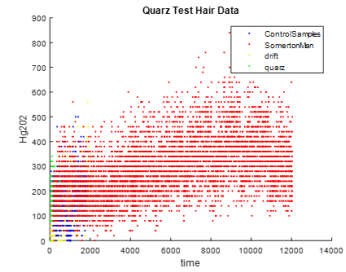
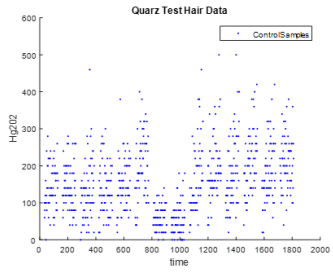
ControlSamples
Fe57
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Hg202
time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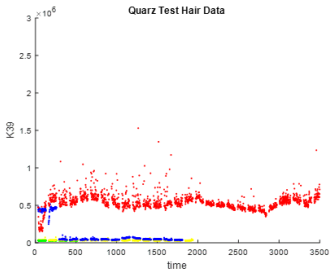
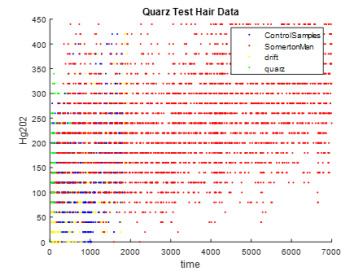
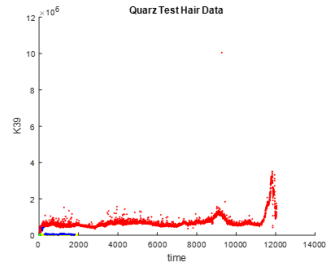
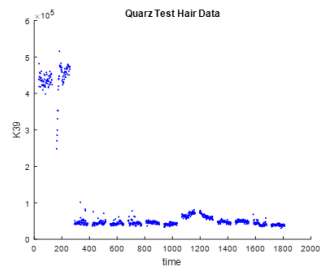
ControlSamples
Hg202
time


Quarz Test Hair Data
K39
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Hg202
time


Quarz Test Hair Data
K39
time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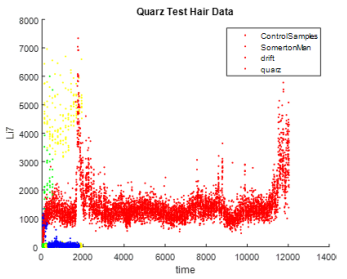
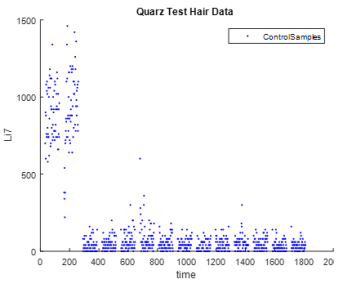
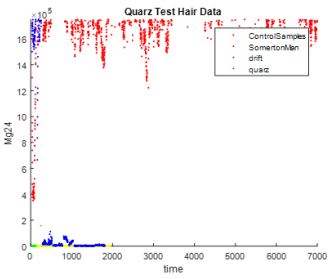
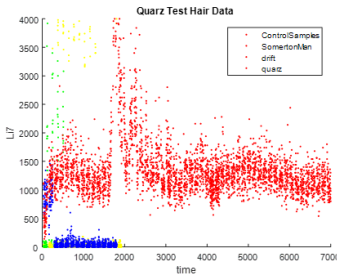
K39
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Li7
time


Quarz Test Hair Data
ControlSamples
Li7
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Mg24
time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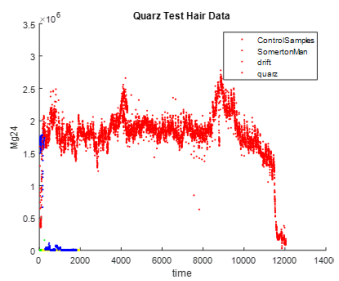
ControlSamples
SomertonMan
drift
quarz
Li7
time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ControlSamples
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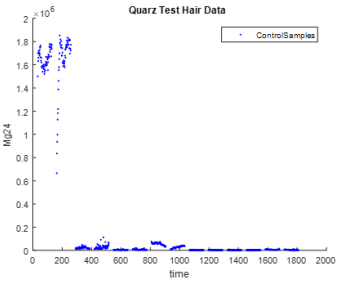
drift
quarz
Mg24
time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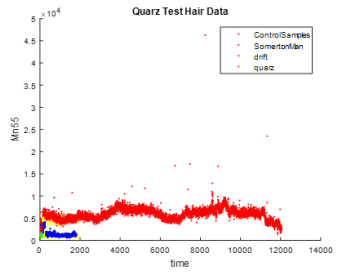
ControlSamples
Mg24
time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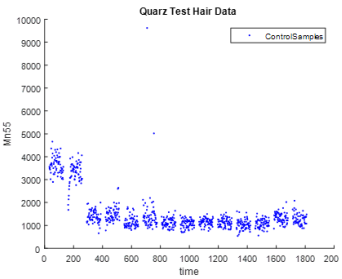
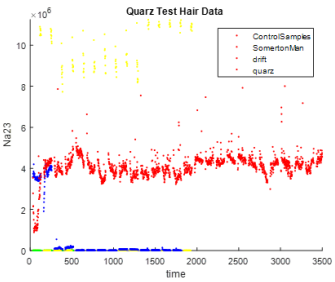
ControlSamples
SomertonMan
drift
quarz
Mn55
time


Quarz Test Hair Data
ControlSamples
Mn55
time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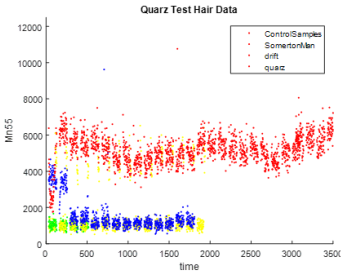
ControlSamples
SomertonMan
drift
quarz
Na23
time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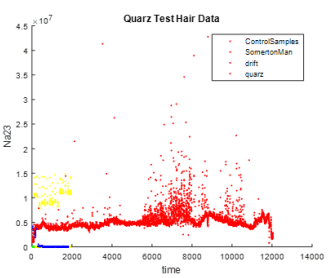
ControlSamples
SomertonMan
drift
quarz
Mn55
time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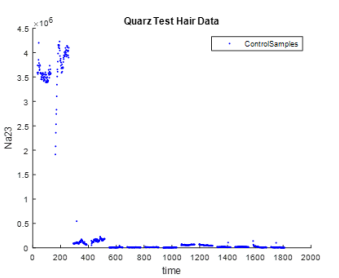
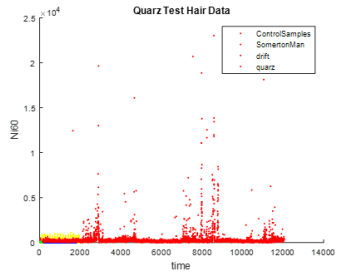
ControlSamples
SomertonMan
drift
quarz
Na23
time


Quarz Test Hair Data
ControlSamples
Na23
time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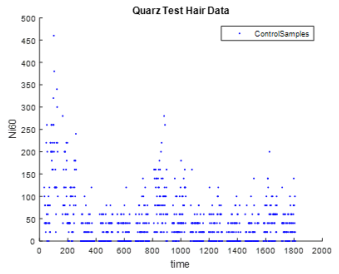
ControlSamples
SomertonMan
drift
quarz
Ni60
time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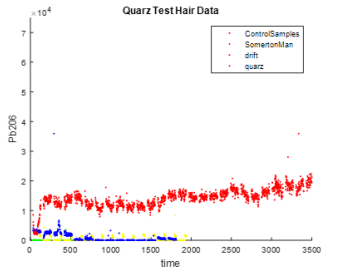
ControlSamples
Ni60
time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ControlSamples
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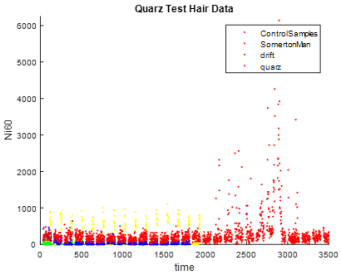
drift
quarz
Pb206
time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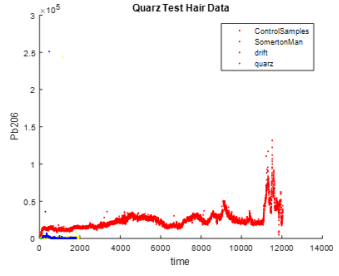
ControlSamples
SomertonMan
drift
quarz
Ni60
time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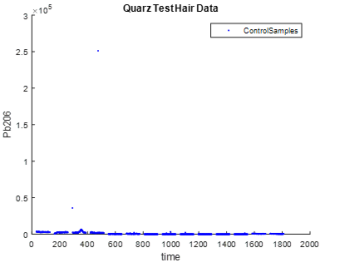
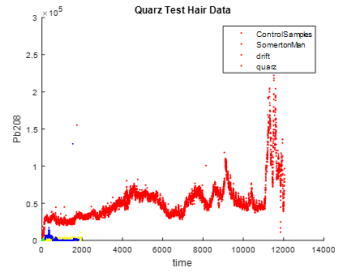
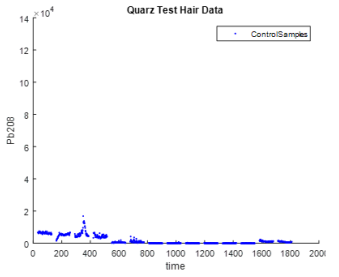
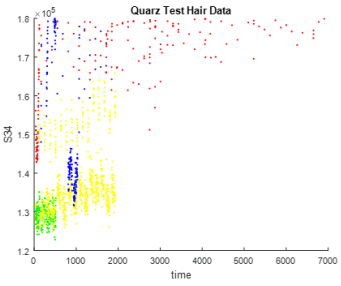
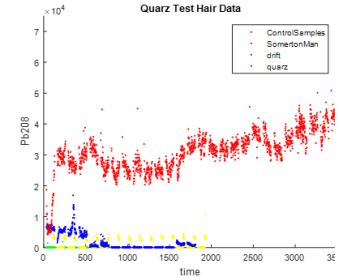
ControlSamples
SomertonMan
drift
quarz
Pb206
time


Quarz Test Hair Data
ControlSamples
Pb206
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Pb208
time


Quarz Test Hair Data
ControlSamples
Pb208
time


Quarz Test Hair Data
S34
time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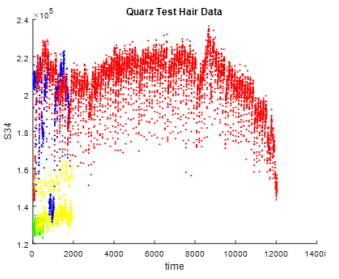
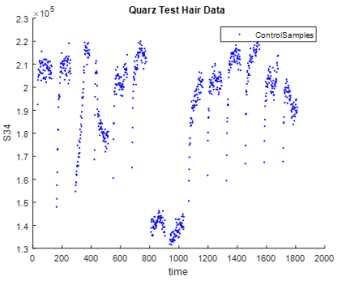
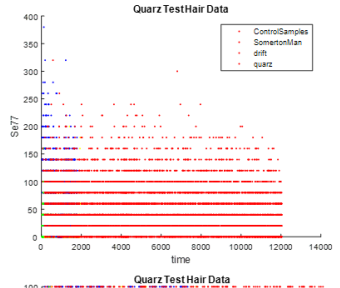
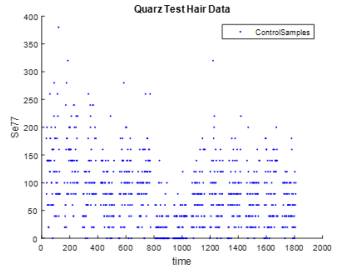
ControlSamples
SomertonMan
drift
quarz
Pb208
time

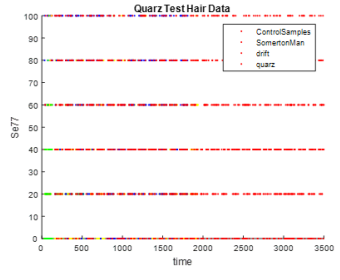

Quarz Test Hair Data
S34
time

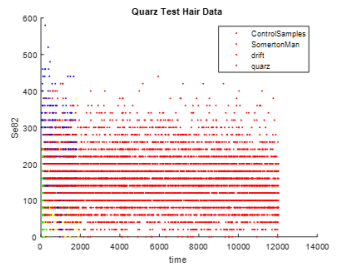

Quarz Test Hair Data
ControlSamples
S34
time

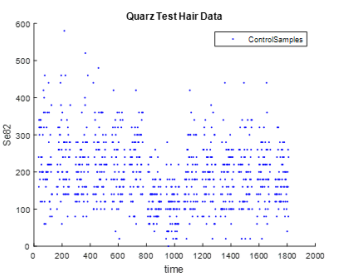

Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Se77
time

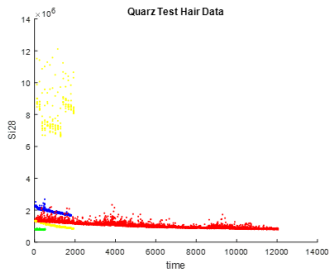

Quarz Test Hair Data
ControlSamples
Se77
time

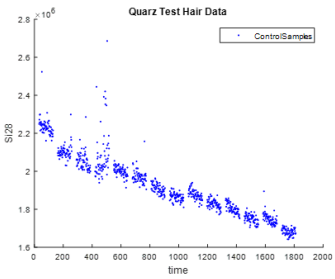

Quarz Test Hair Data
Se82
time

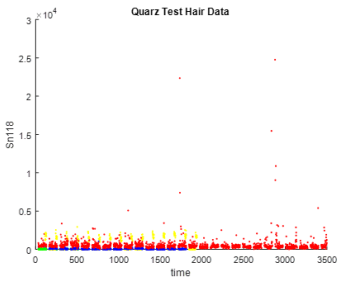

Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Se77
time

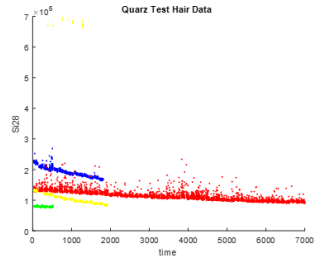

Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Se62
time

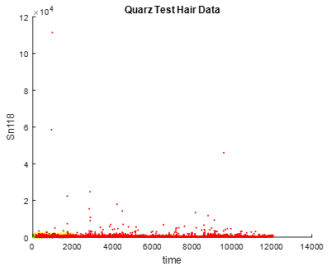

Quarz Test Hair Data
ControlSamples
Se62
time


Quarz Test Hair Data
Si28
time


Quarz Test Hair Data
ControlSamples
Si28
time


Quarz Test Hair Data
Sn118
time


Quarz Test Hair Data
Si28
time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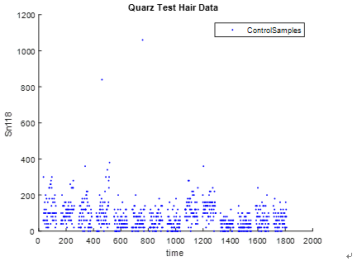
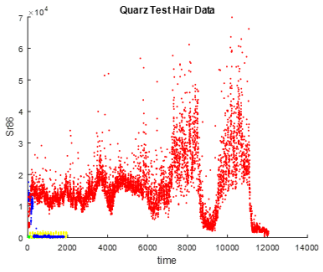
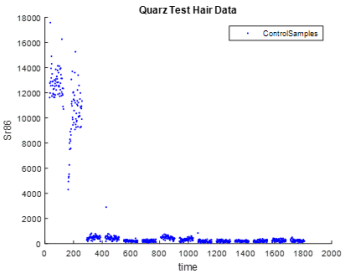
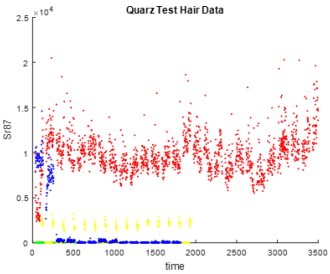
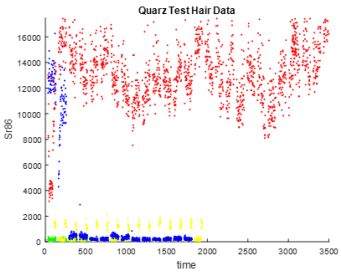
Sn118
time

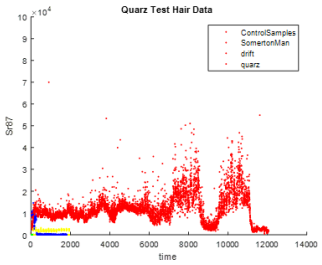

Quarz Test Hair Data
ControlSamples
Sn118
time

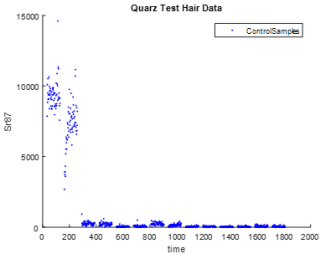

Quarz Test Hair Data
Sr66
time

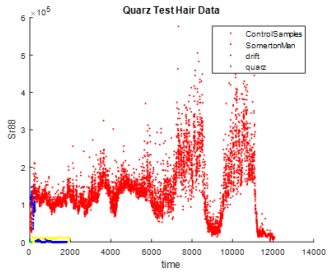

Quarz Test Hair Data
ControlSamples
Sr66
time

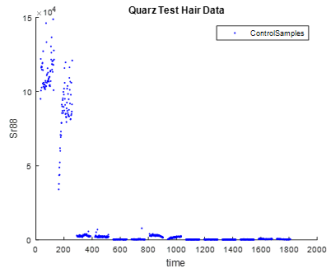

Quarz Test Hair Data
Sr67
time


Quarz Test Hair Data
Sr66
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Sr67
time


Quarz Test Hair Data
ControlSamples
Sr67
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Si88
time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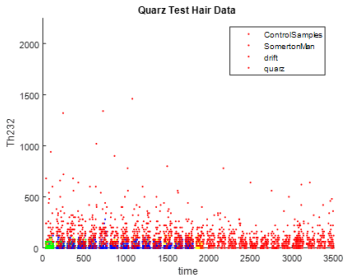
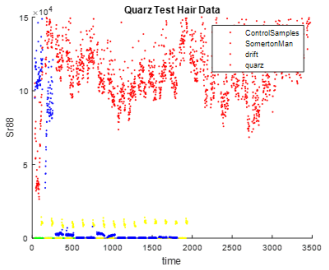
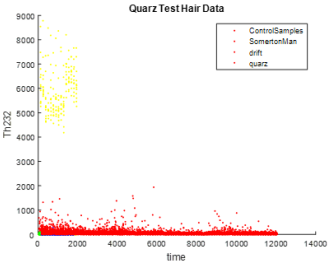
ControlSamples
Si88
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Th232
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Si88
time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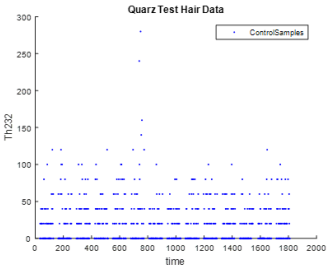
drift
quarz
Th232
time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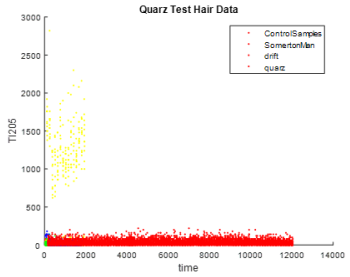
Th232
time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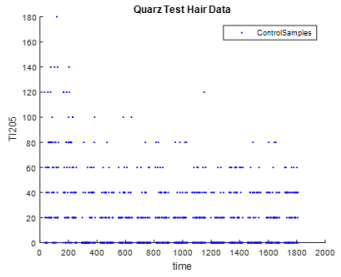
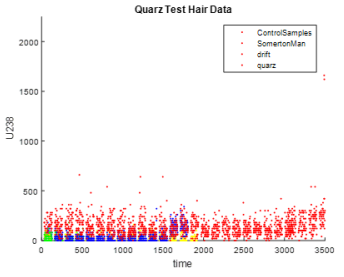
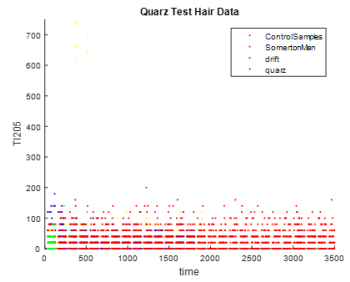
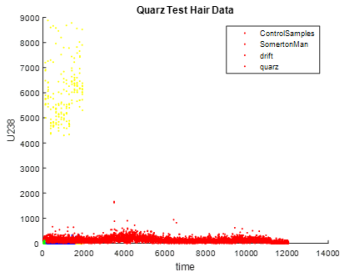
ControlSamples
SomertonMan
drift
quarz
Ti205
time


Quarz Test Hair Data
ControlSamples
Ti205
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
U238
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
Ti205
time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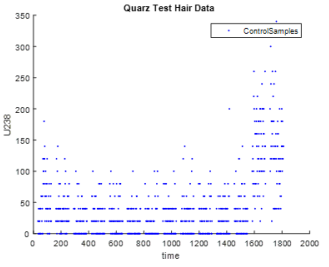
ControlSamples
SomertonMan
drift
quarz
U238
time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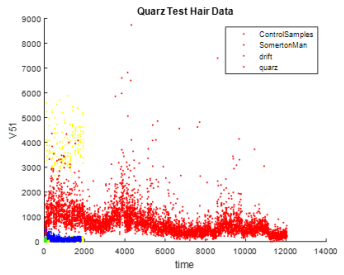
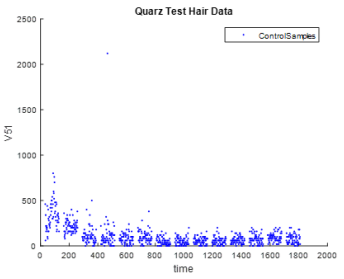
ControlSamples
U238
time


Quarz Test Hair Data
ControlSamples
SomertonMan
drift
quarz
V51
time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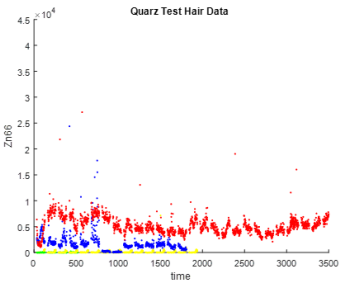
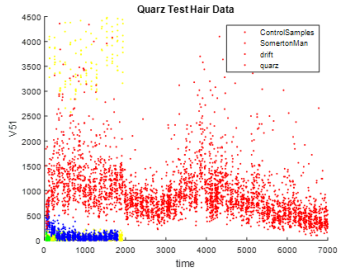
ControlSamples
V51
time


Quarz Test Hair Data
Zn66
time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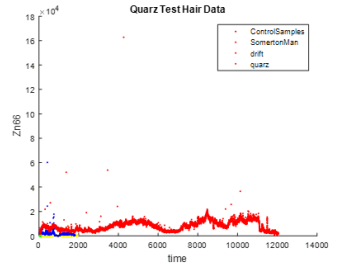
ControlSamples
SomertonMan
drift
quarz
V51
time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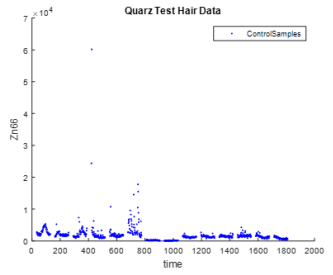
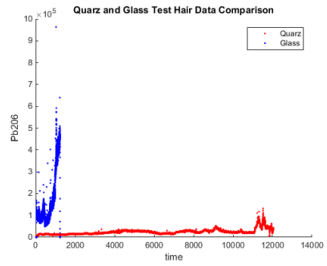
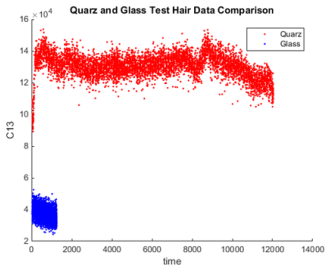
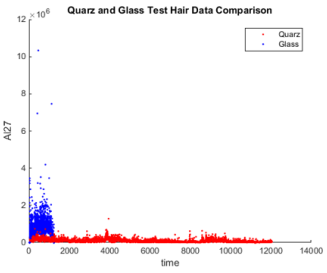
ControlSamples
SomertonMan
drift
quarz
Zn66
time

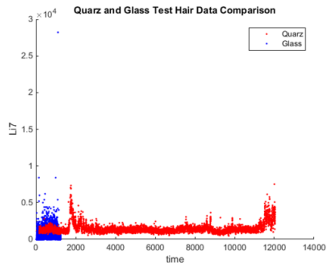

Quarz Test Hair Data
ControlSamples
Zn66
time

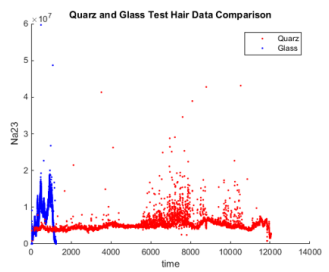
Appendix D: Two test comparison figures

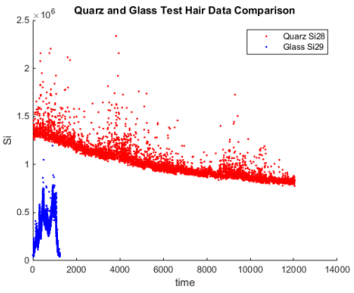


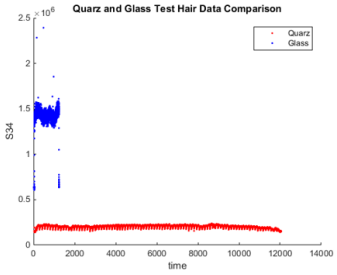


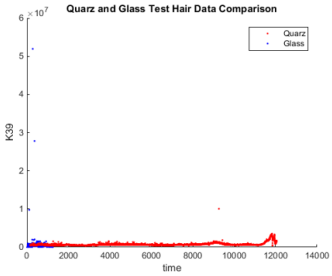


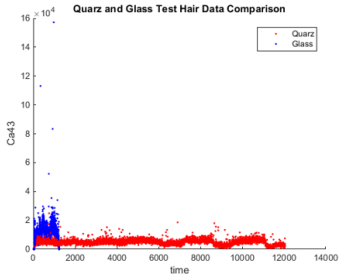


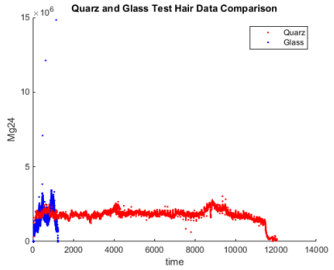


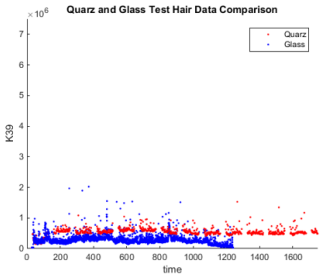


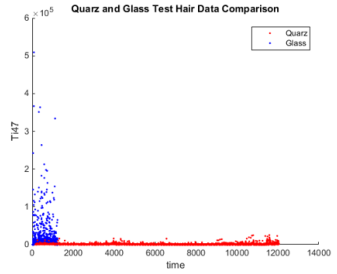


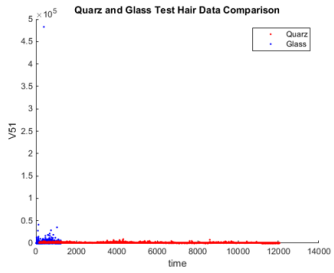


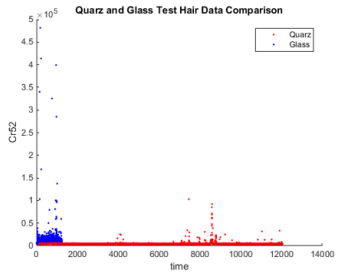


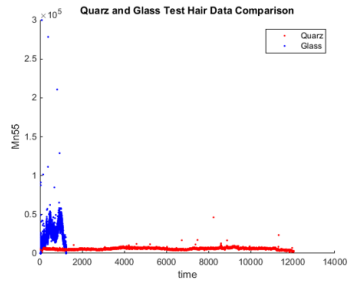


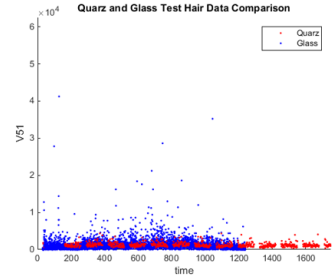


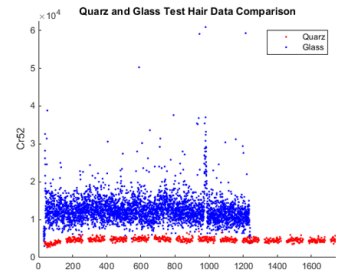


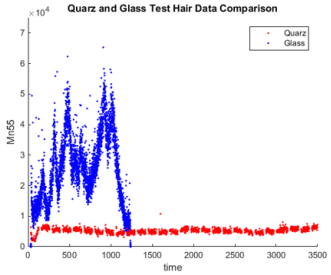


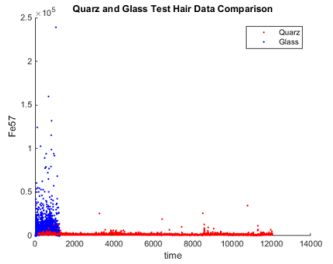


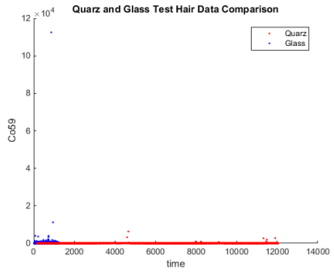


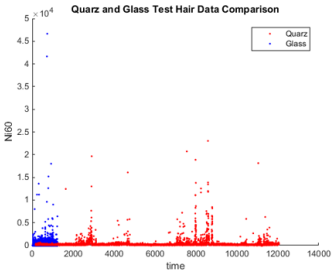


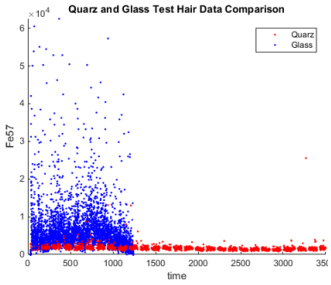


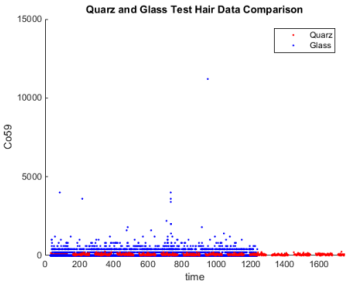


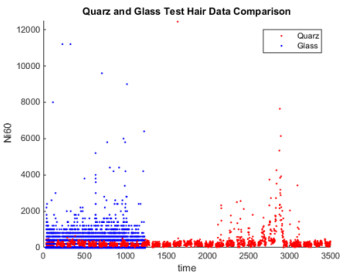

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Fe57
time

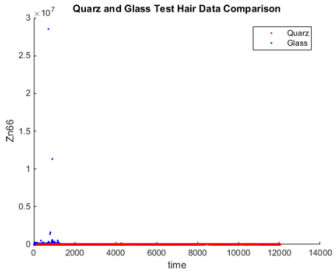

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Co59
time

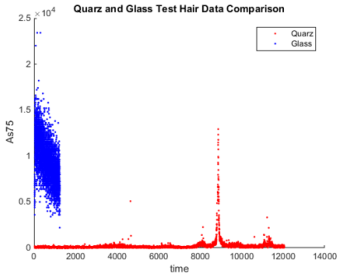

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Ni60
time

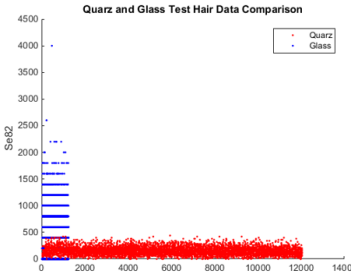

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Fe57
time

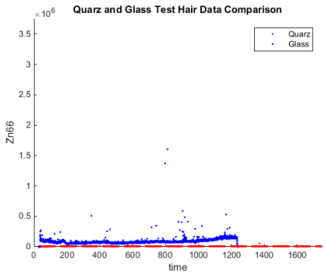

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Co59
time

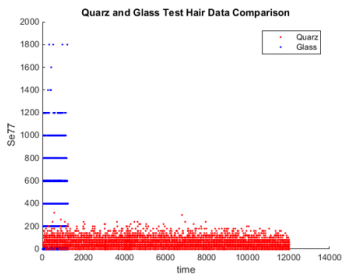

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Ni60
time


Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Zn66
time


Quarz and Glass Test Hair Data Comparison
Quarz
Glass
As75
time


Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Se82
time


Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Zn66
time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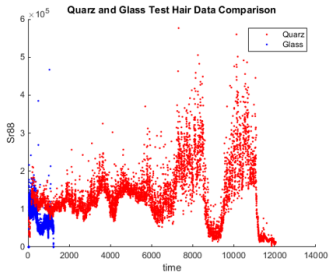
Quarz
Glass
Se77
time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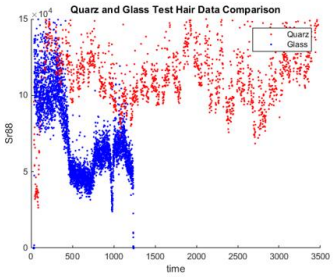
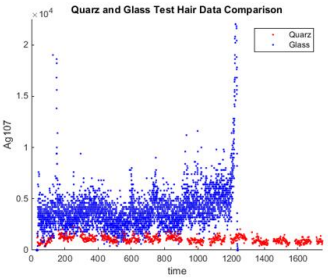
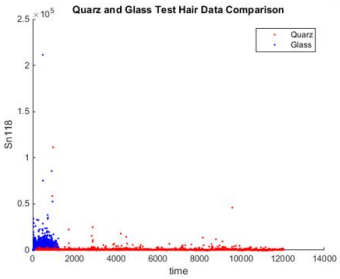
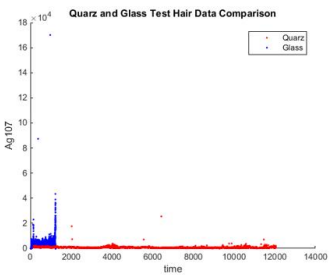
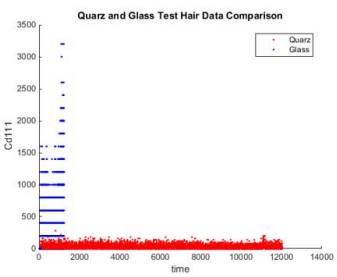
Quarz
Glass
Sr88
time

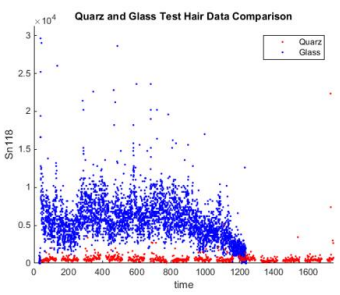

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Sr88
time

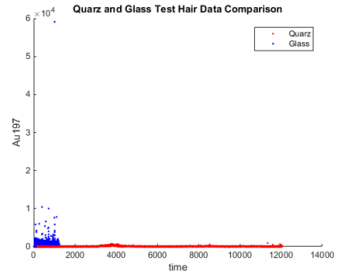

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Ag107
time

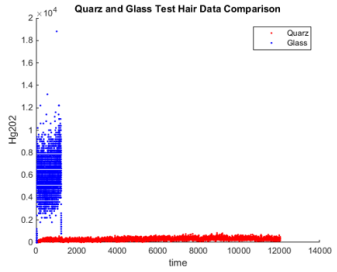

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Sn118
time

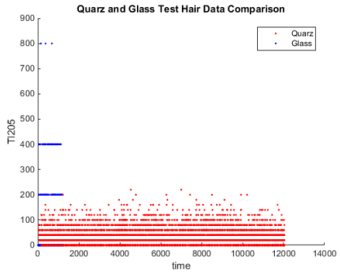

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Ag107
time

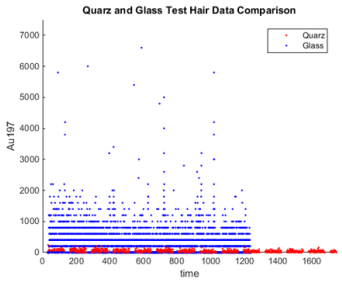

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Cd111
time

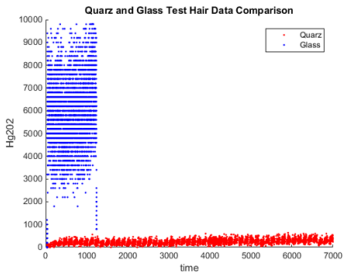

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Sn118
time

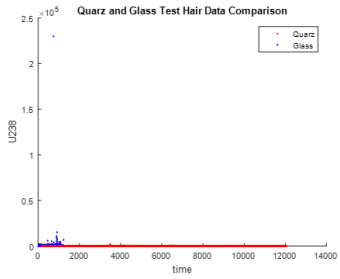

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Au197
time

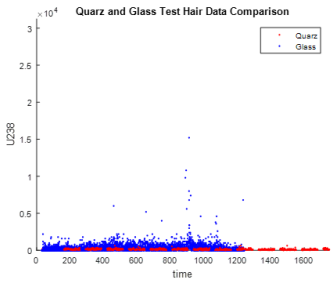

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Hg202
time

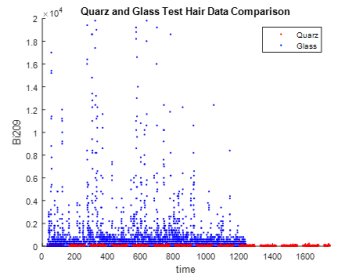

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Tl205
time

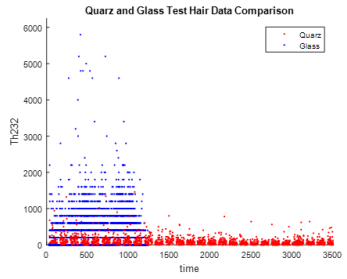

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Au197
time

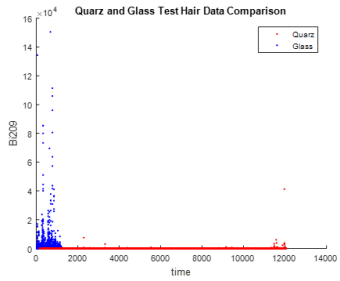

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Hg202
time

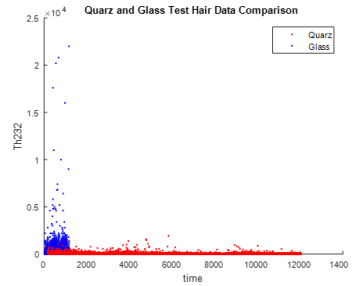

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
U238
time


Quarz and Glass Test Hair Data Comparison
Quarz
Glass
U238
time


Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Bi209
time

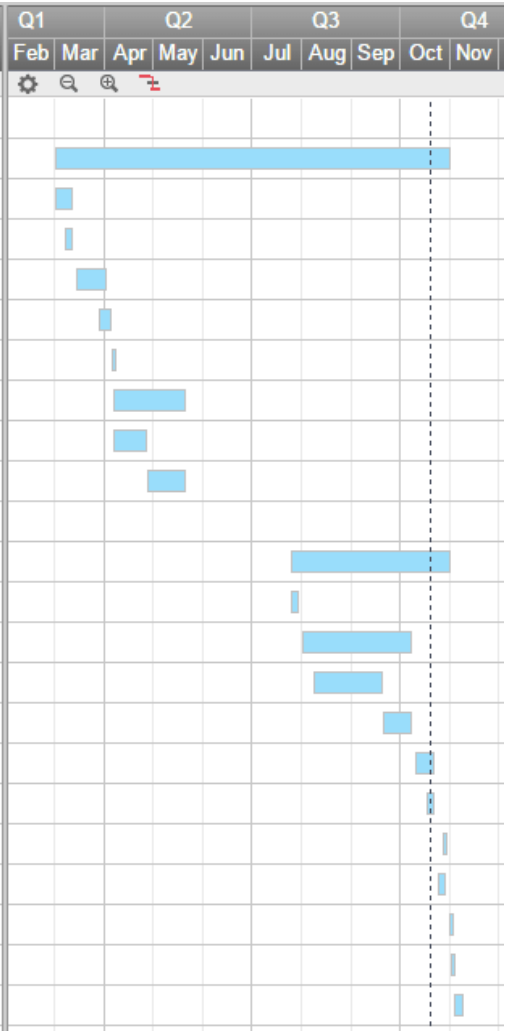

Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Th232
time


Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Bi209
time


Quarz and Glass Test Hair Data Comparison
Quarz
Glass
Th232
time

Appendix E: The Timeline Gantt Chart

Task Name	Duration	Start	Finish
Master Project			
Semester A	175d	03/01/16	10/31/16
project Research	9d	03/01/16	03/11/16
Research background	5d	03/07/16	03/11/16
Project Proposal	15d	03/14/16	04/01/16
Literature Review	6d	03/28/16	04/04/16
Proposal Seminar	2d	04/05/16	04/06/16
Glass Test Data analysis	33d	04/06/16	05/20/16
1st Thesis Draft	15d	04/06/16	04/26/16
2nd Thesis Draft	18d	04/27/16	05/20/16
Semester B	71d	07/25/16	10/31/16
Review	5d	07/25/16	07/29/16
Quartz Data analysis	50d	08/01/16	10/07/16
Plotting Figures	31d	08/08/16	09/19/16
Plotting Comparison Figures	14d	09/20/16	10/07/16
Final Report	10d	10/10/16	10/21/16
Poster	5d	10/17/16	10/21/16
Poster Exhibition	2d	10/27/16	10/28/16
Final Seminar Prepare	5d	10/24/16	10/28/16
Final Seminar	1d	10/31/16	10/31/16
Wiki Page	3d	11/01/16	11/03/16
Youtube Video	4d	11/03/16	11/08/16



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[9] 'Somerton man' viewed on 23 March 2016

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<http://www.gizmodo.com.au>

Glossary and Symbols

ICP-MS: Inductively Coupled Plasma Mass Spectrometer

Chemical elements symbol and name table

Symbol	Name		Symbol	Name		Symbol	Name
Li	Lithium		Fe	Iron		Sn	Tin
B	Boron		Co	Cobalt		Sb	Antimony
Na	Sodium		Ni	Nickel		Te	Tellurium
Mg	Magnesium		Cu	Copper		Cs	Cesium
Al	Aluminium		Zn	Zinc		Ba	Barium
Si	Silicon		Ga	Gallium		Hf	Hafnium
P	Phosphonrus		As	Arsenic		Au	Gold
S	Sulphur		Se	Selenium		Hg	Mercury
K	Potassium		Rb	Rubidium		Tl	Thallium
Ca	Calcium		Sr	Strontium		Pb	Lead
Sc	Scandium		Y	Yttrium		Bi	Bismuth
Ti	Titanium		Zr	Zirconium		Th	Thorium
V	Vanadium		Mo	Molybdenum		U	Uranium
Cr	Shromium		Ag	Silver			
Mn	Manganese		Cd	Cadmium			