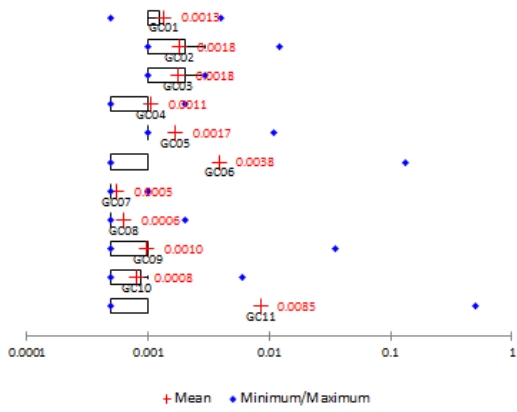
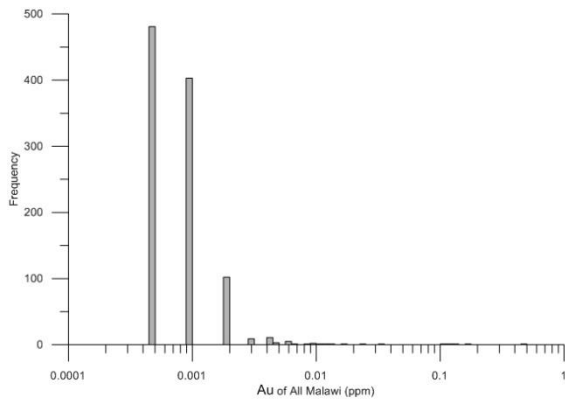
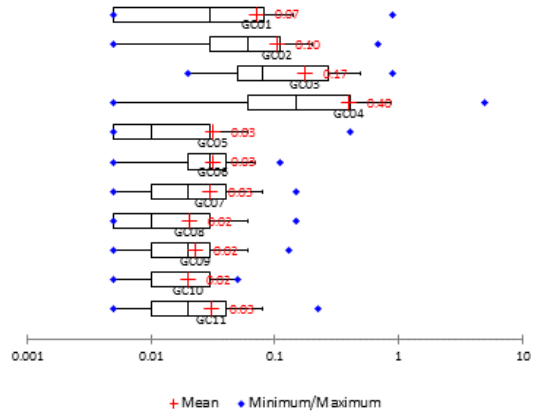


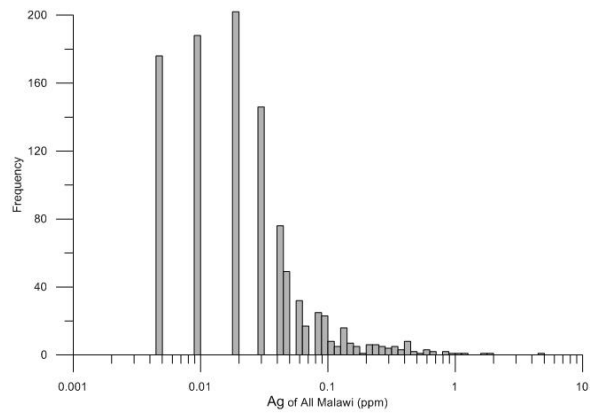
Au - Box plots



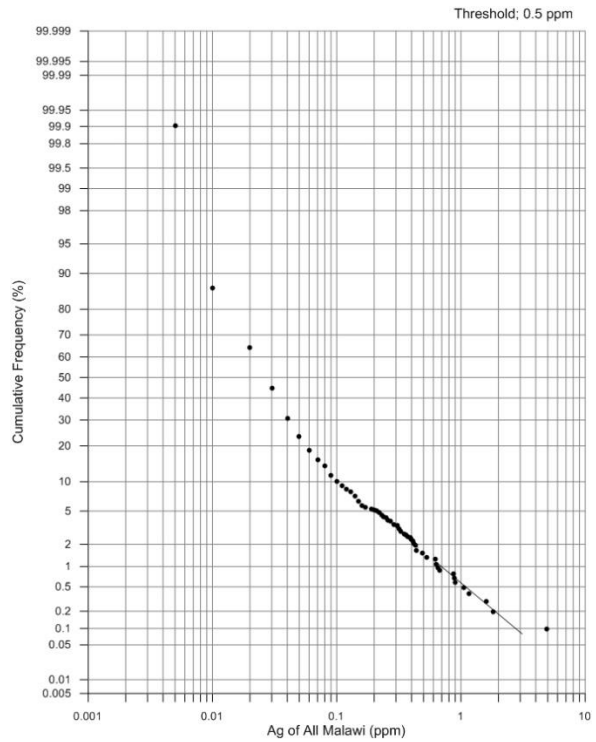
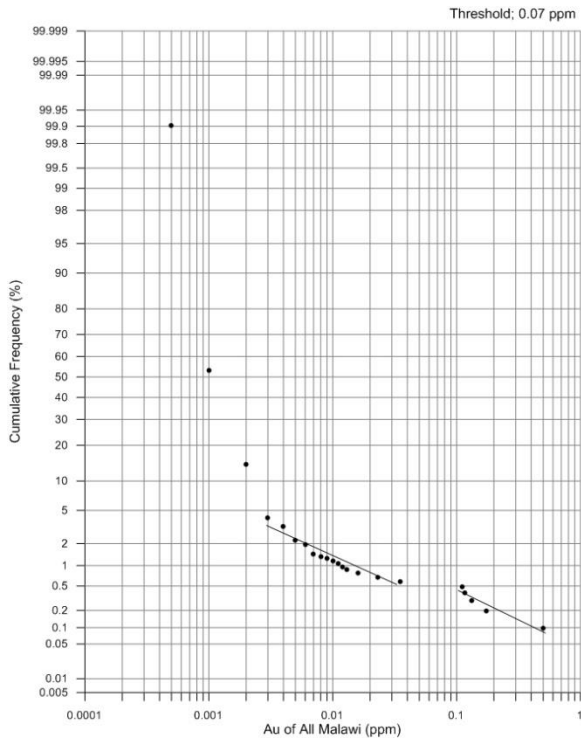
Ag - Box plots

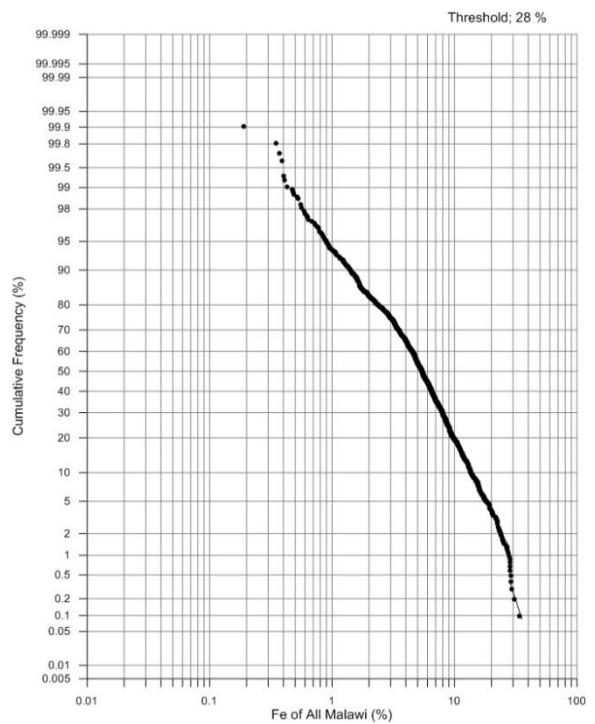
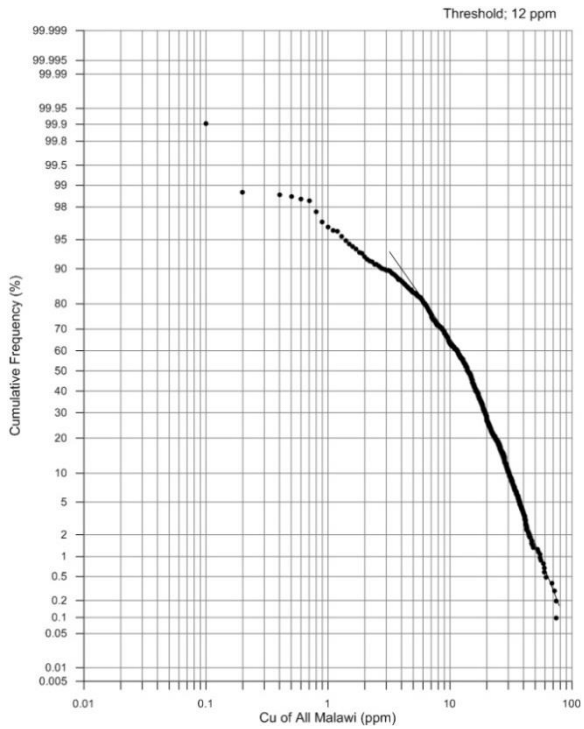
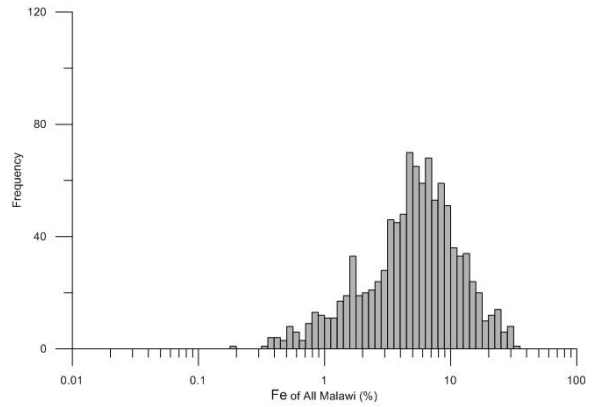
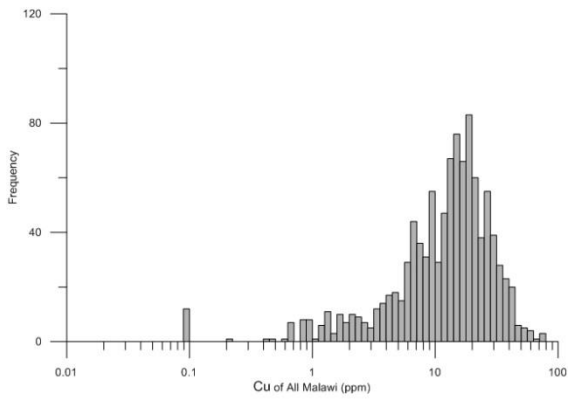
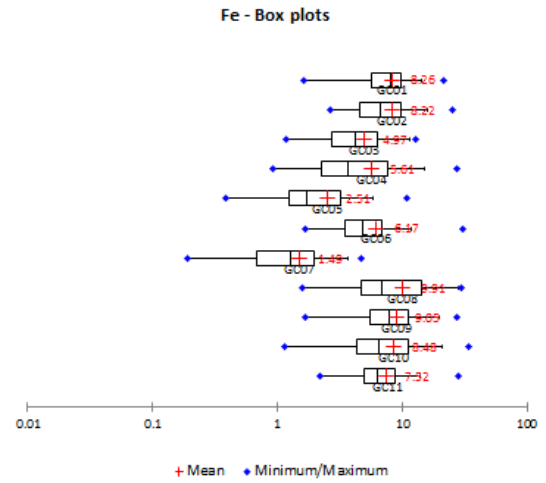
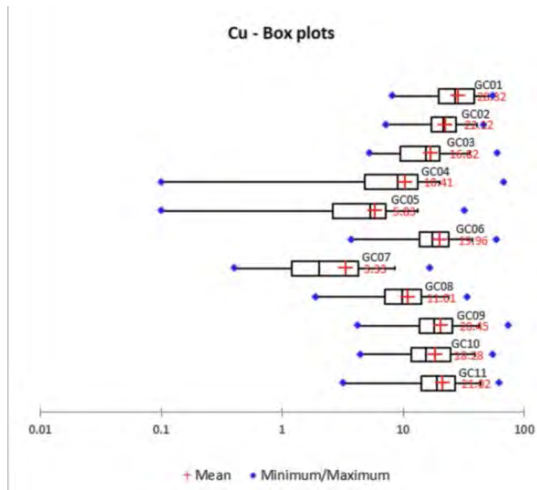


Au (GC01-11)



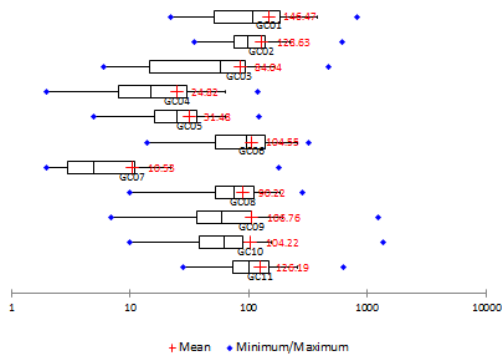
Ag (GC01-11)



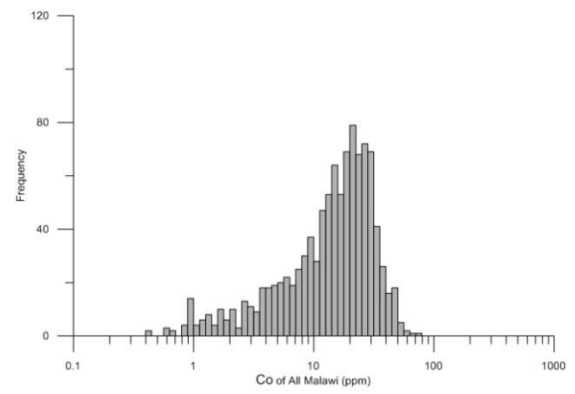
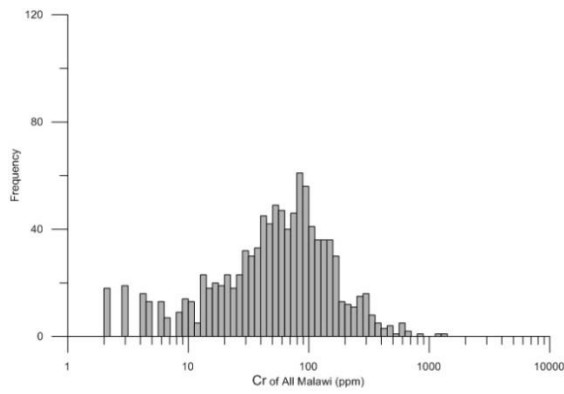
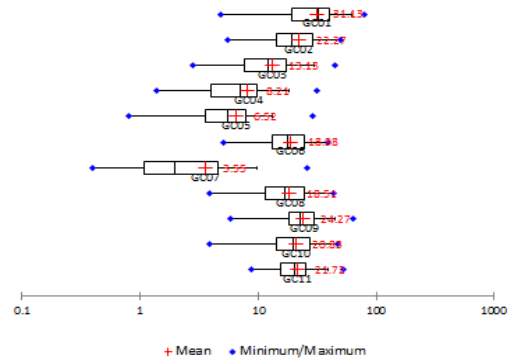


Appendix 3-3

Cr - Box plots

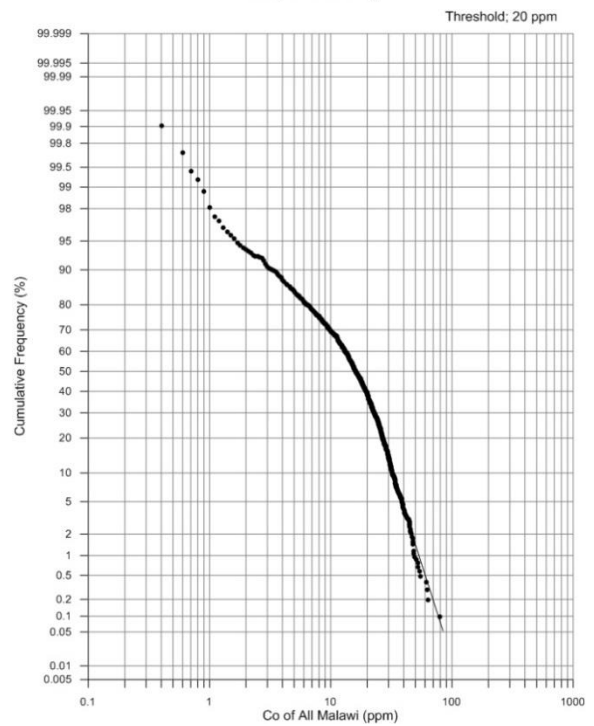
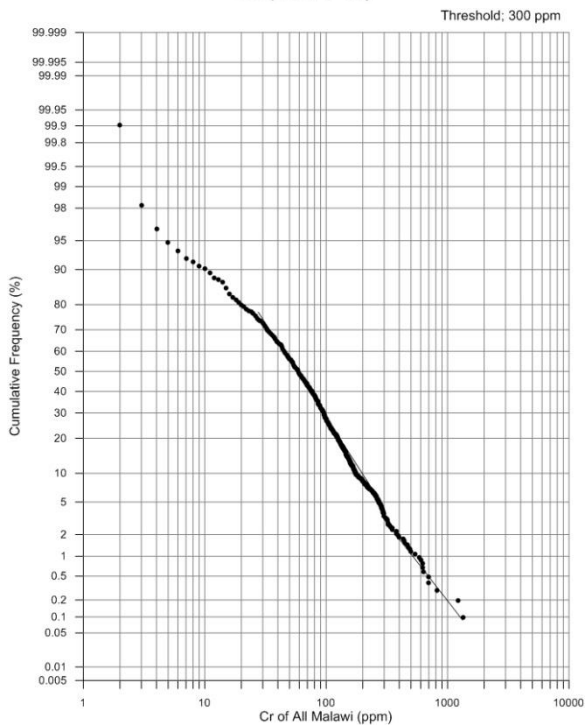


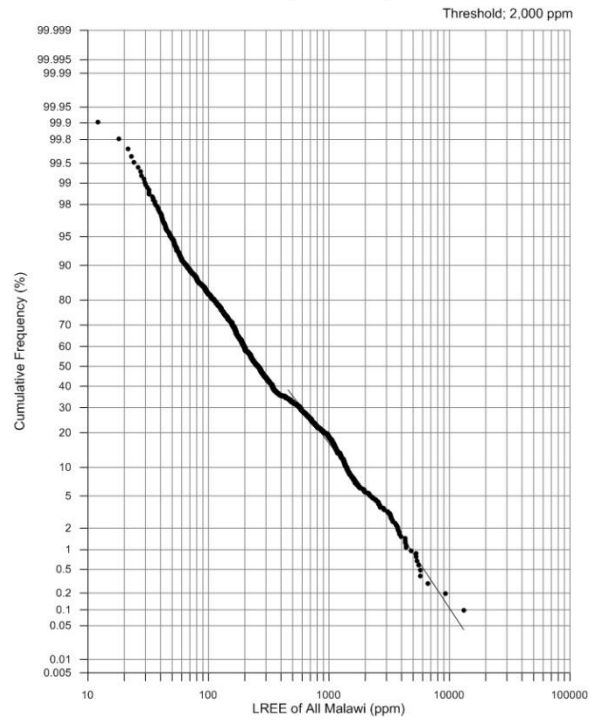
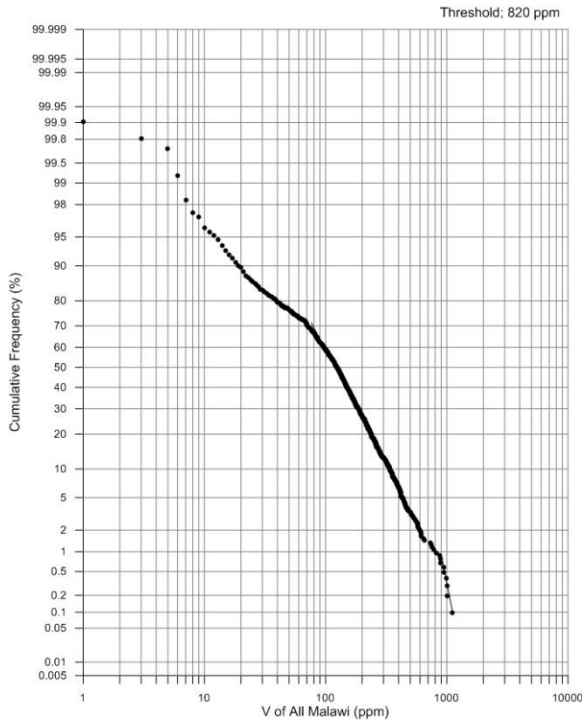
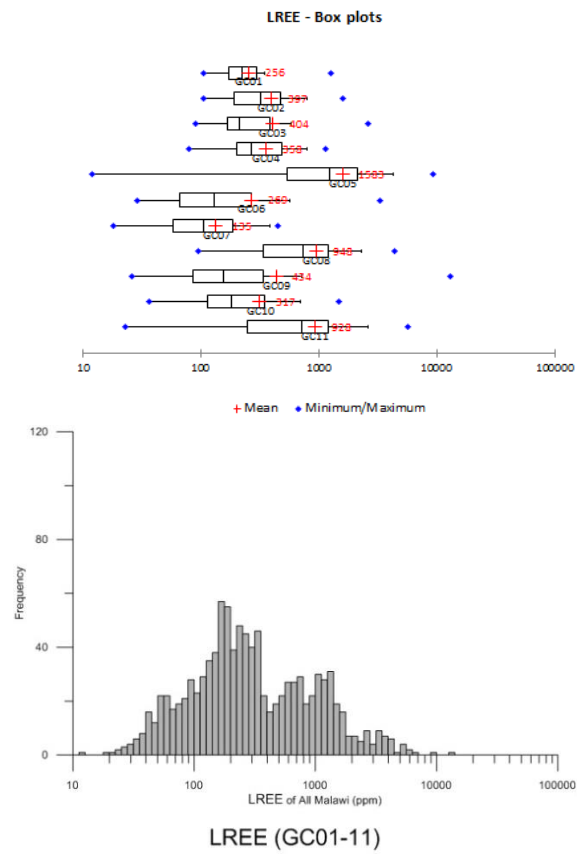
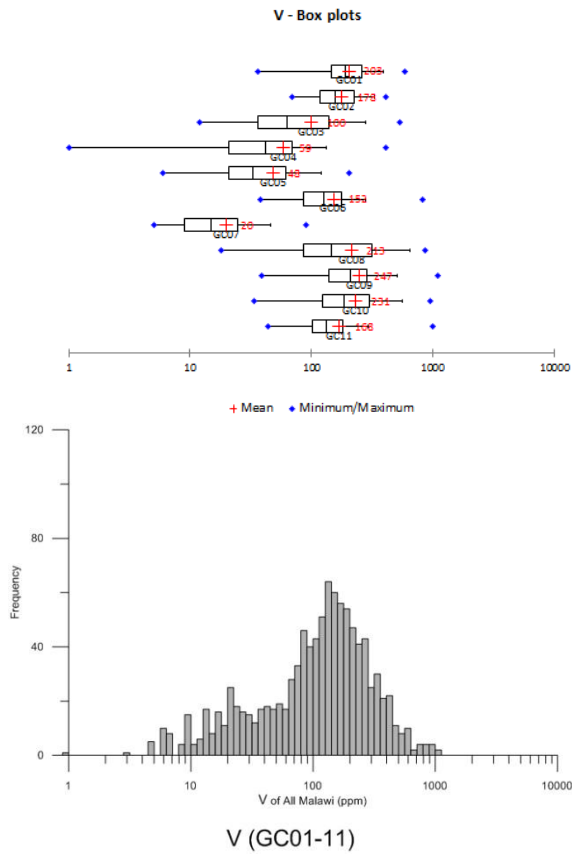
Co - Box plots



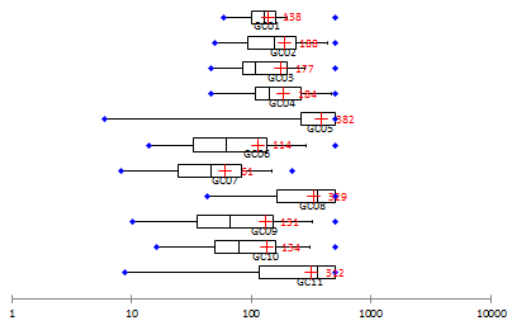
Cr (GC01-11)

Co (GC01-11)

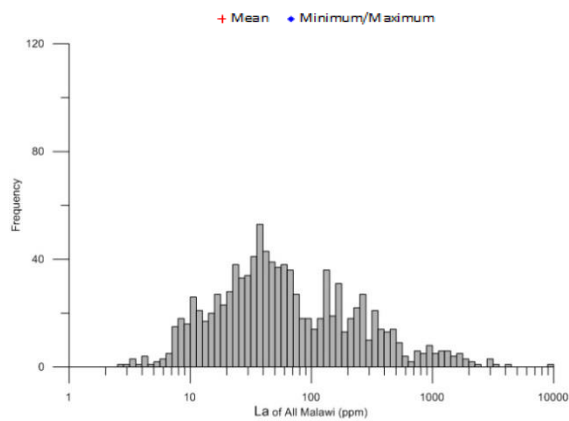
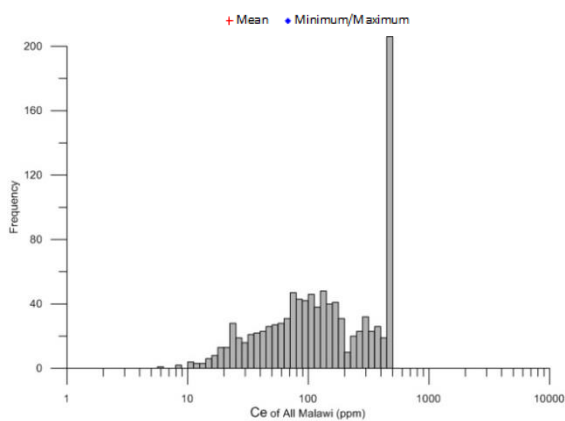
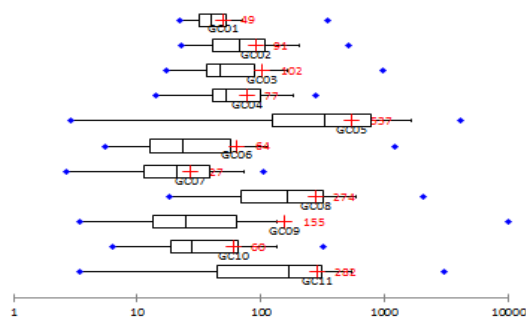




Ce - Box plots

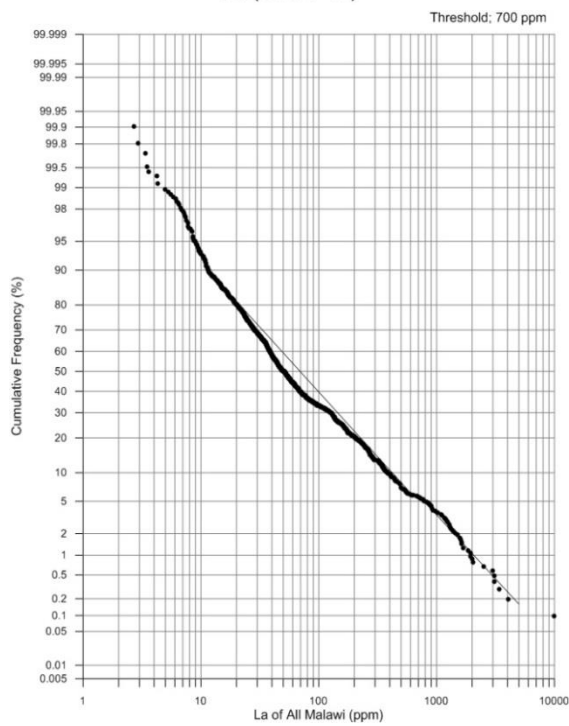
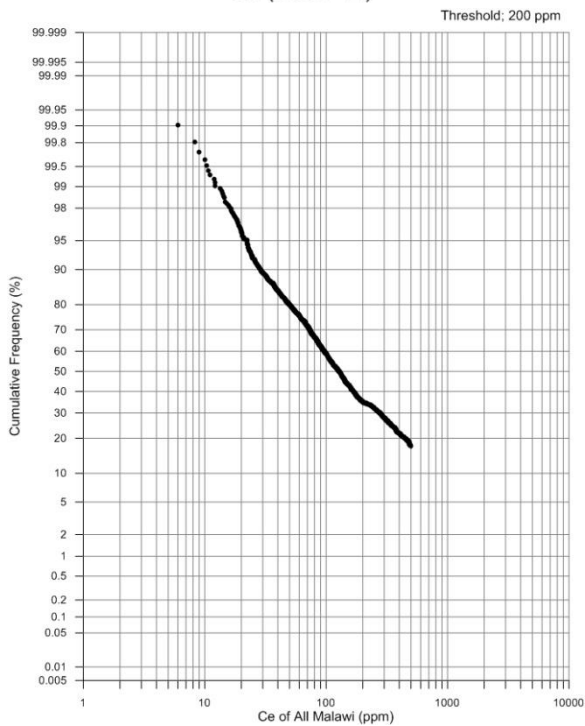


La - Box plots

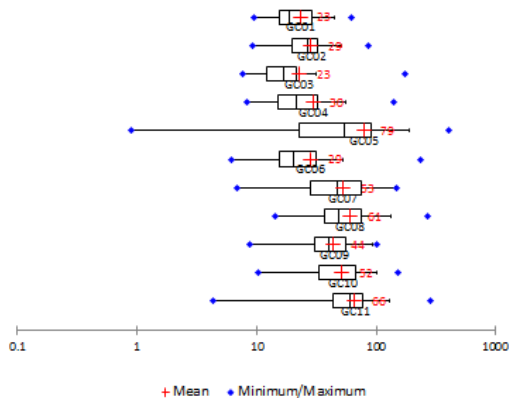


Ce (GC01-11)

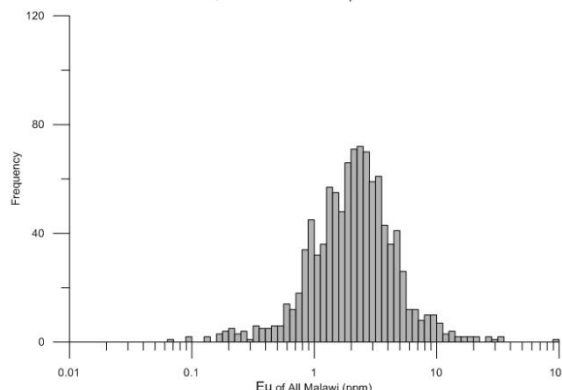
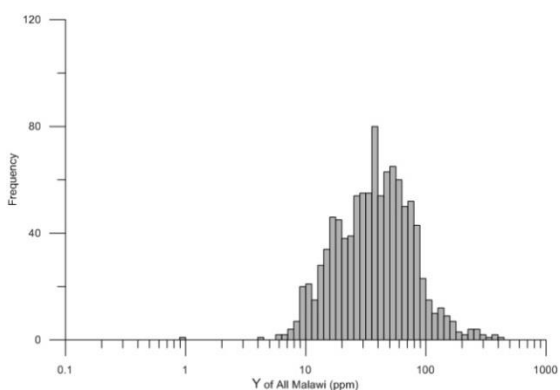
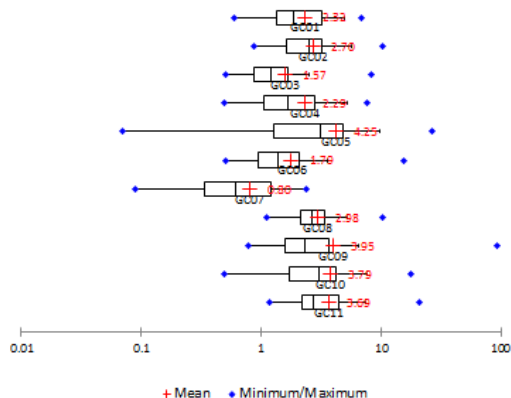
La (GC01-11)



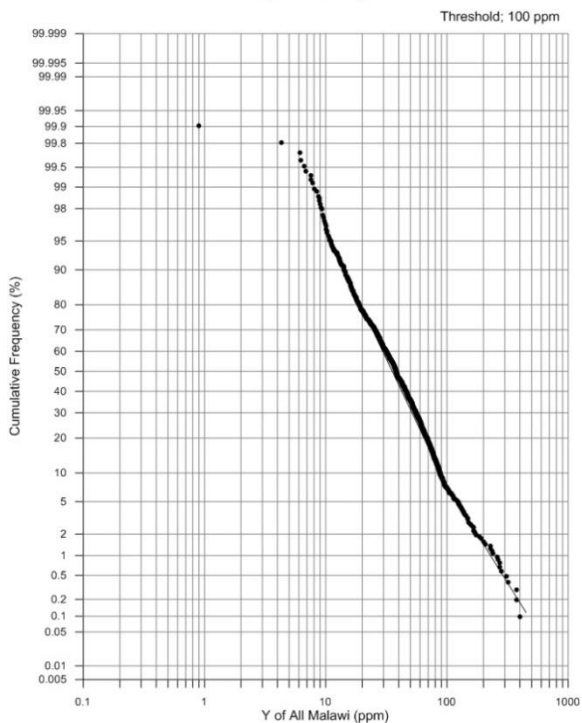
Y - Box plots



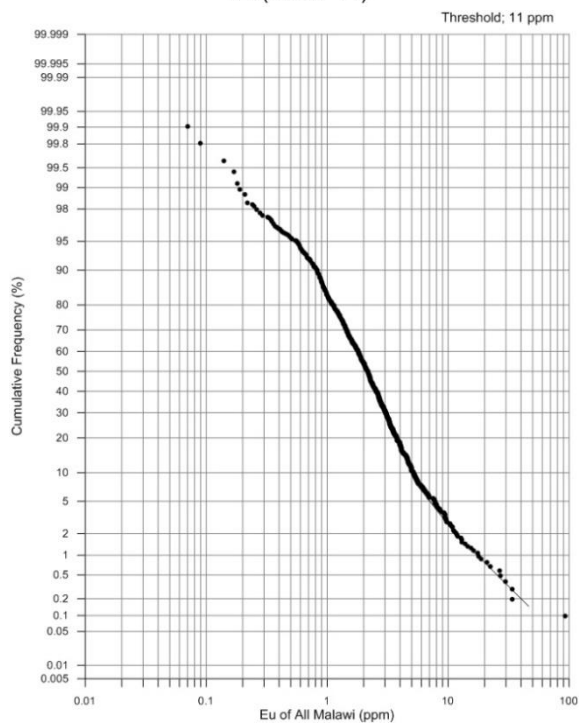
Eu - Box plots



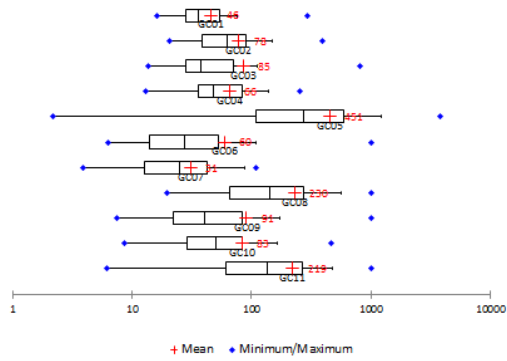
Y (GC01-11)



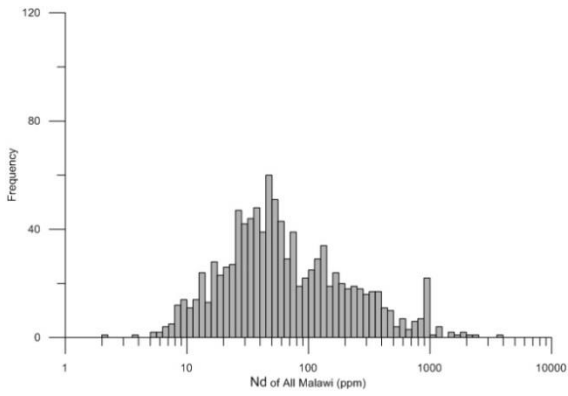
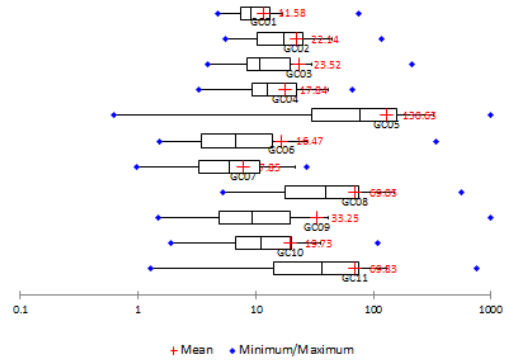
Eu (GC01-11)



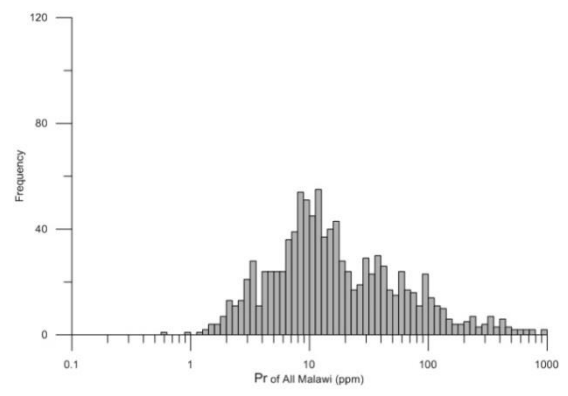
Nd - Box plots



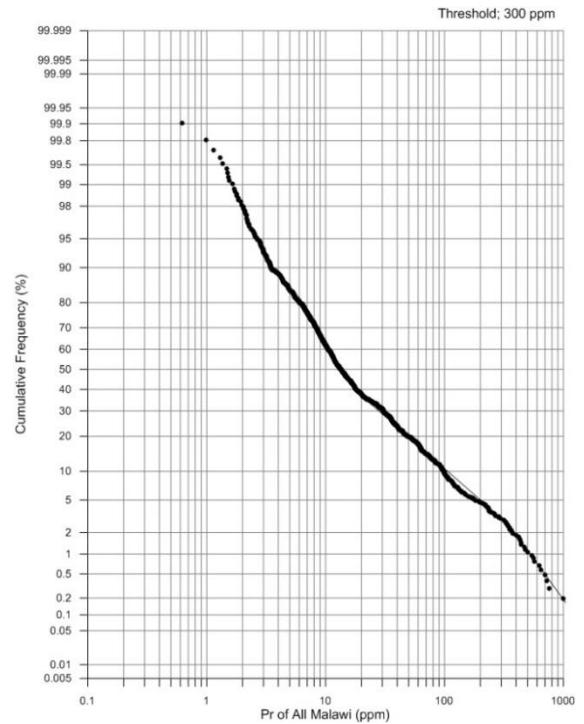
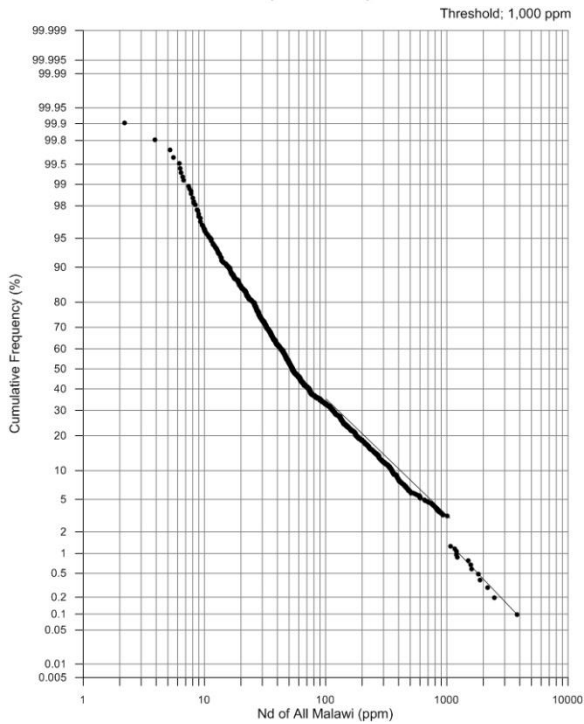
Pr - Box plots



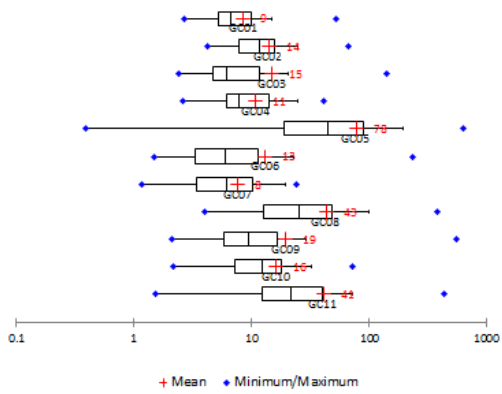
Nd (GC01-11)



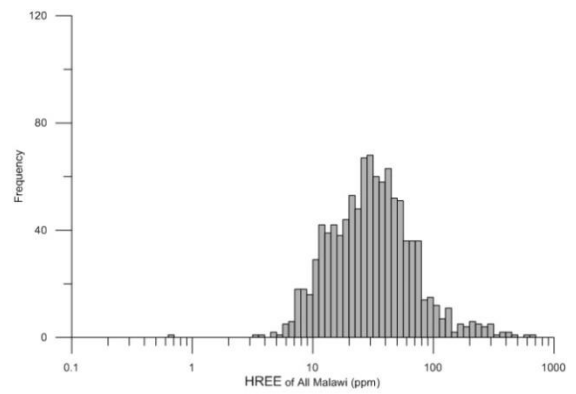
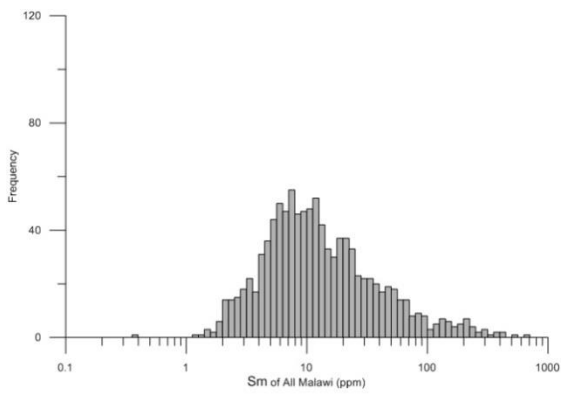
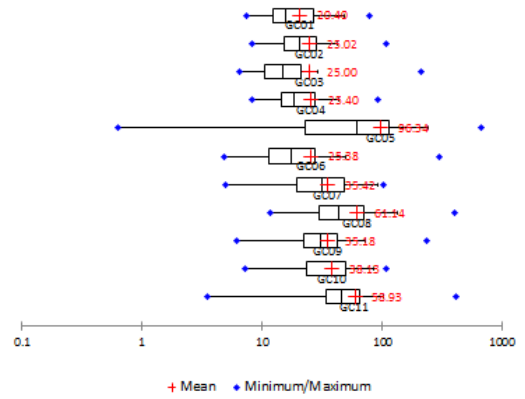
Pr (GC01-11)



Sm - Box plots

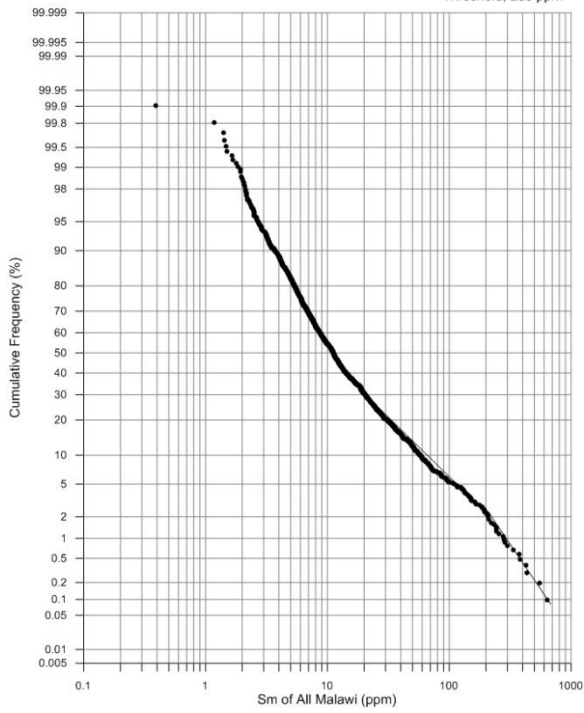


HREE - Box plots



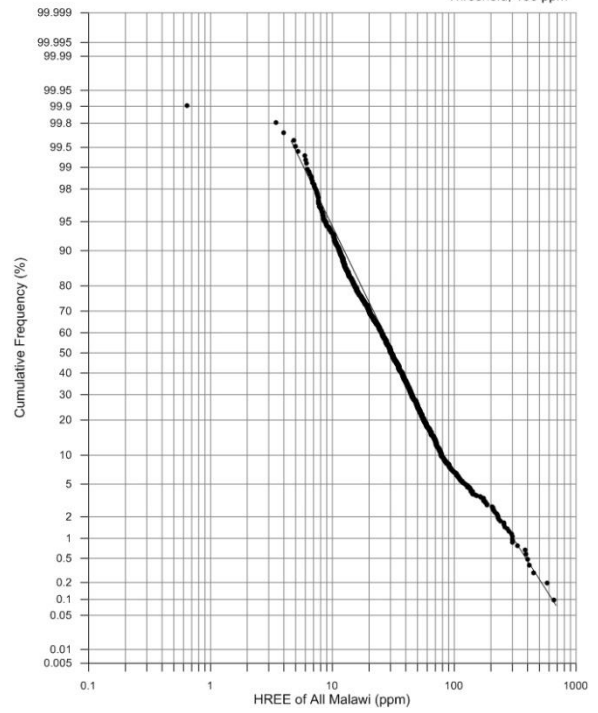
Sm (GC01-11)

Threshold: 200 ppm

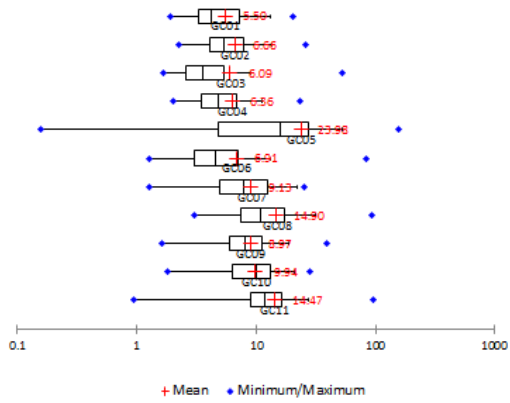


HREE (GC01-11)

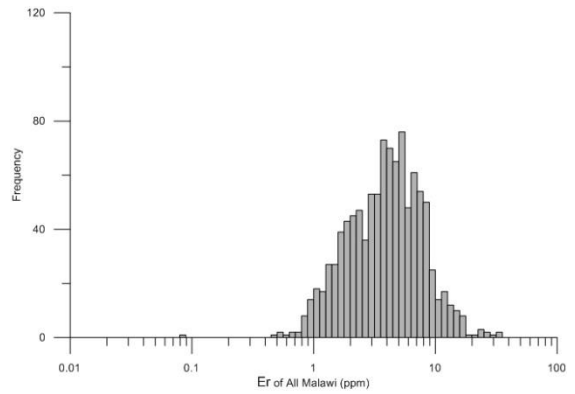
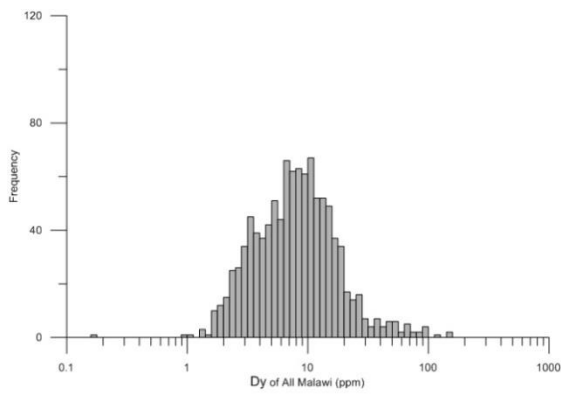
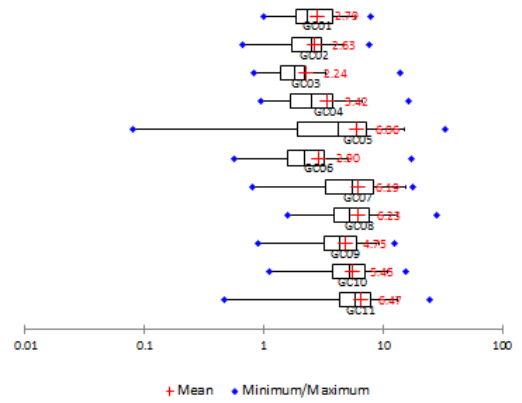
Threshold: 150 ppm



Dy - Box plots

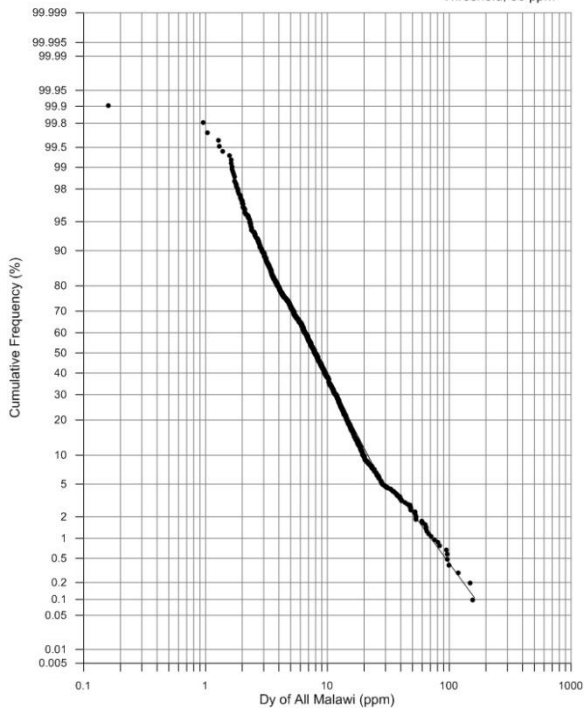


Er - Box plots



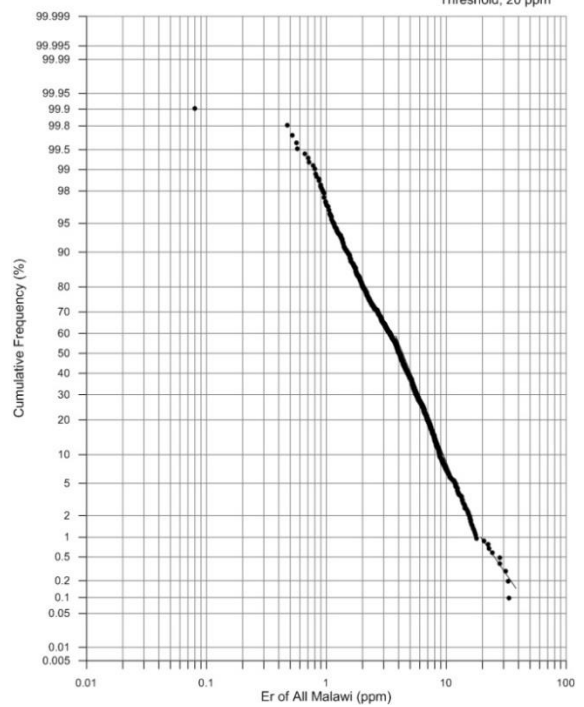
Dy (GC01-11)

Threshold: 36 ppm

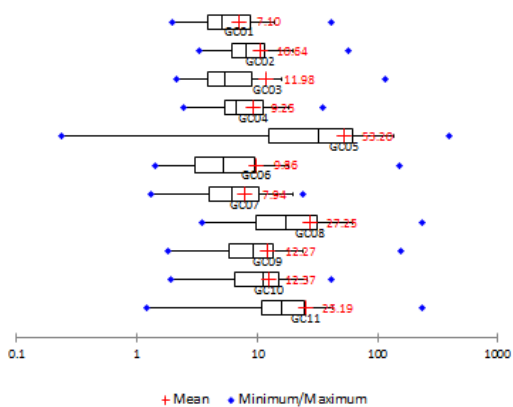


Er (GC01-11)

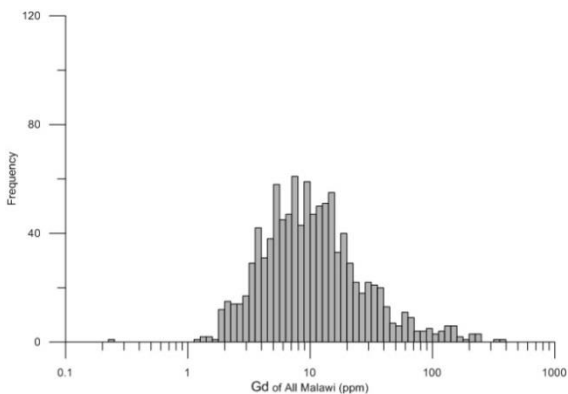
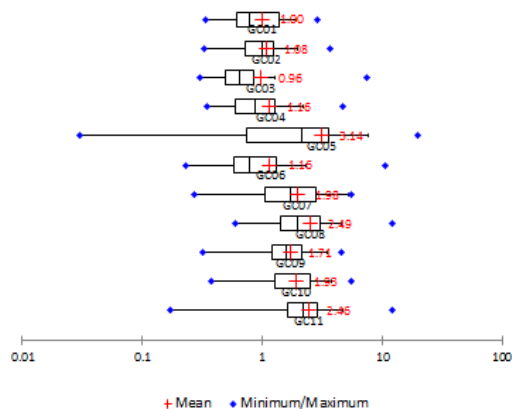
Threshold: 20 ppm



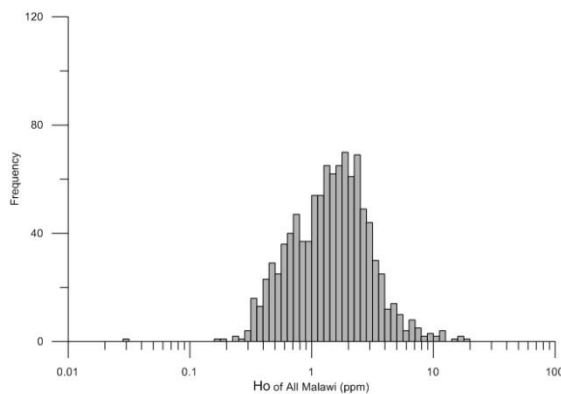
Gd - Box plots



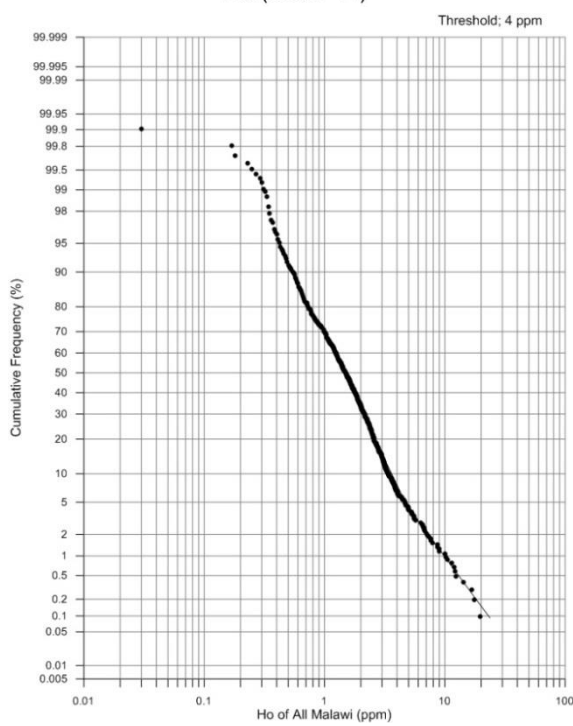
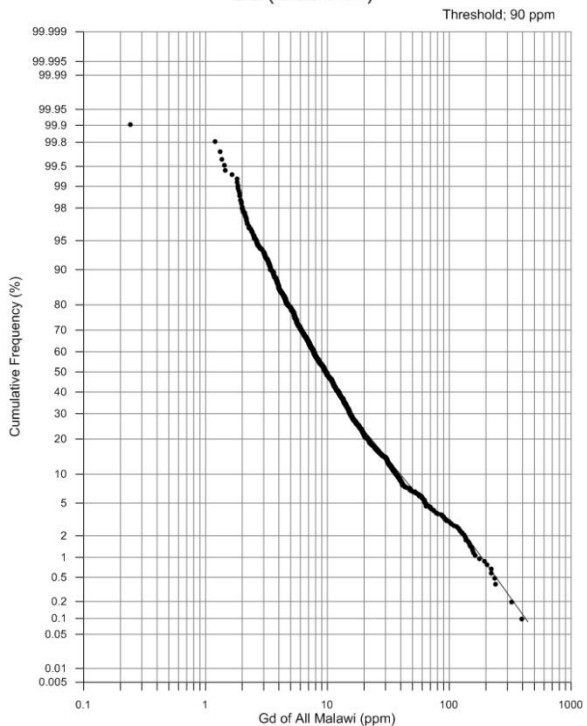
Ho - Box plots



Gd (GC01-11)

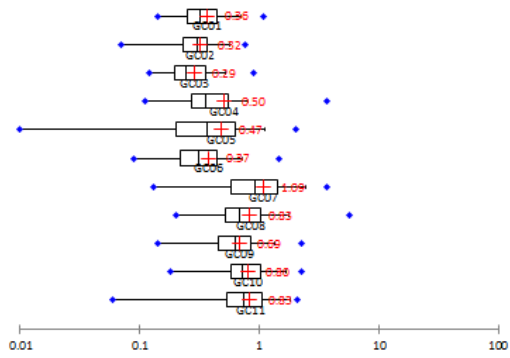


Ho (GC01-11)

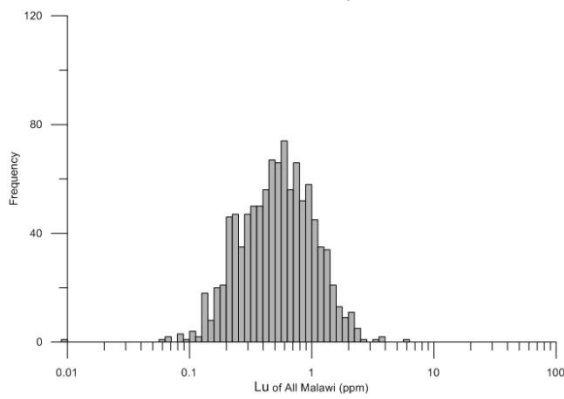


Appendix 3-3

Lu - Box plots

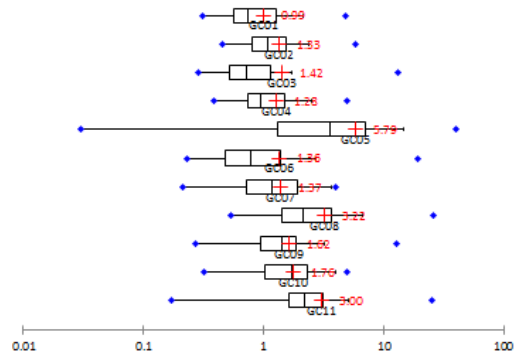


+ Mean • Minimum/Maximum

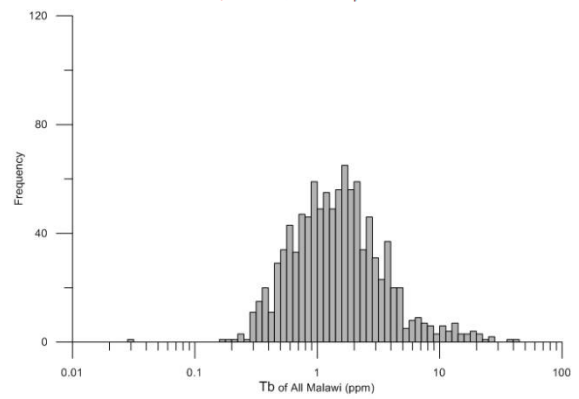


Lu (GC01-11)

Tb - Box plots

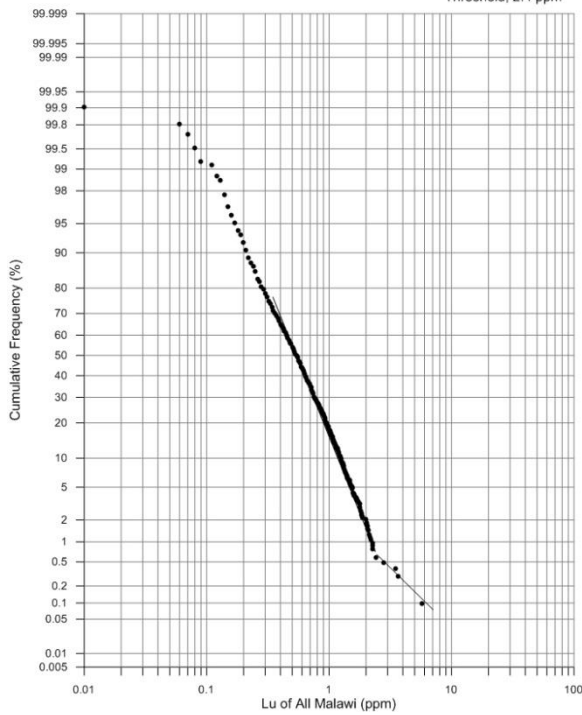


+ Mean • Minimum/Maximum

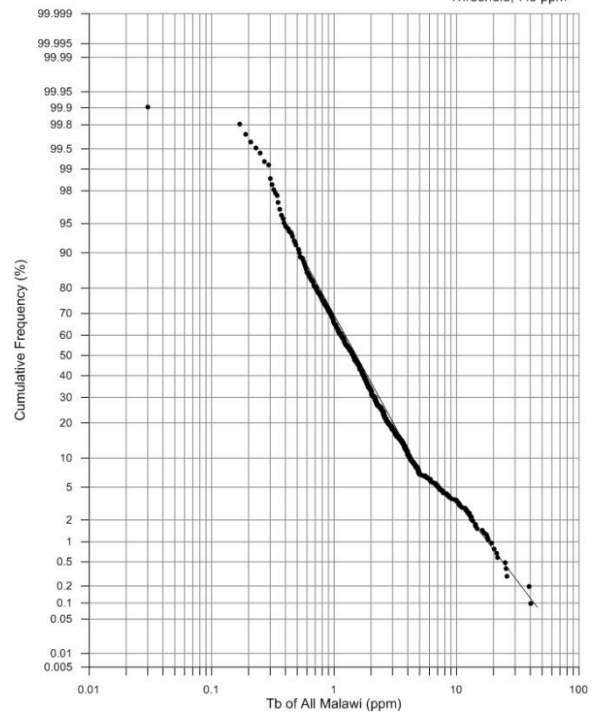


Tb (GC01-11)

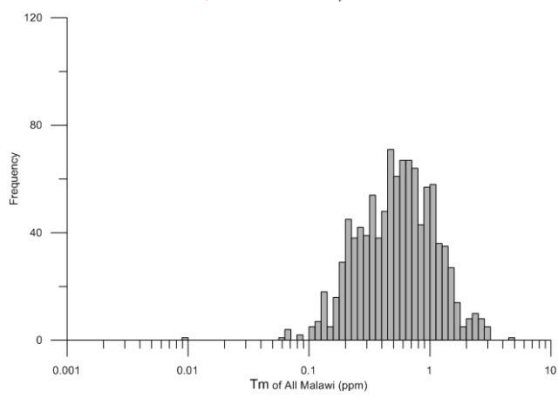
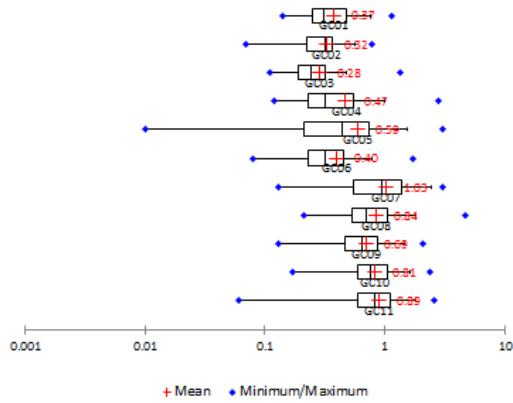
Threshold; 2.4 ppm



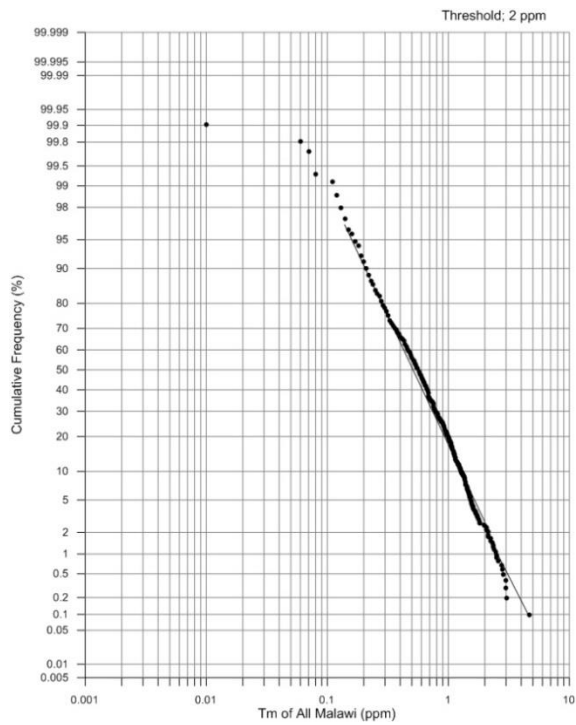
Threshold; 7.5 ppm



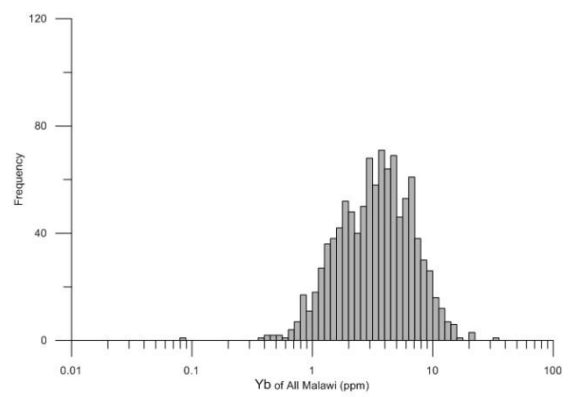
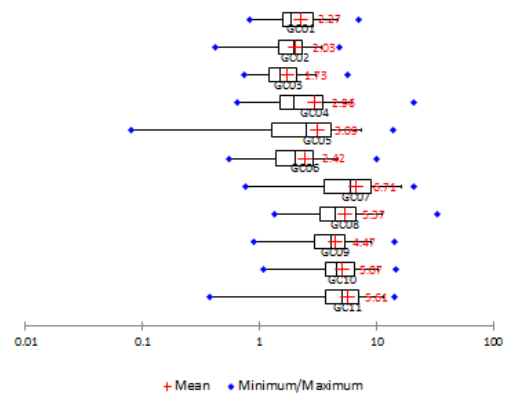
Tm - Box plots



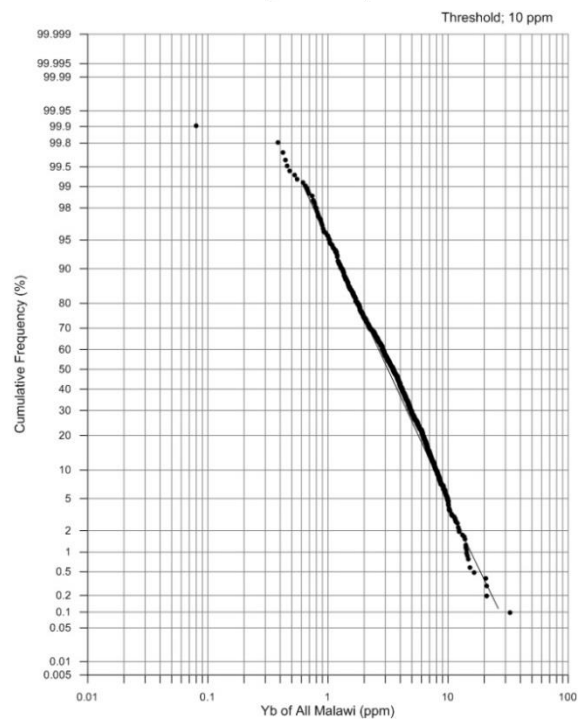
Tm (GC01-11)



Yb - Box plots

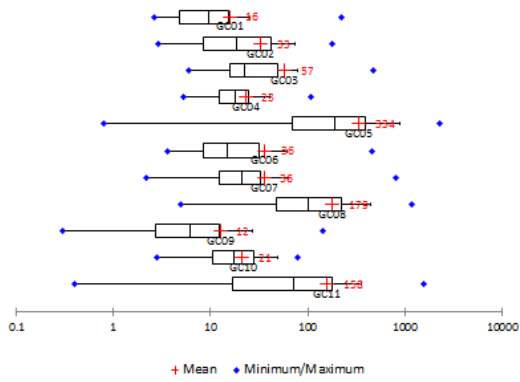


Yb (GC01-11)

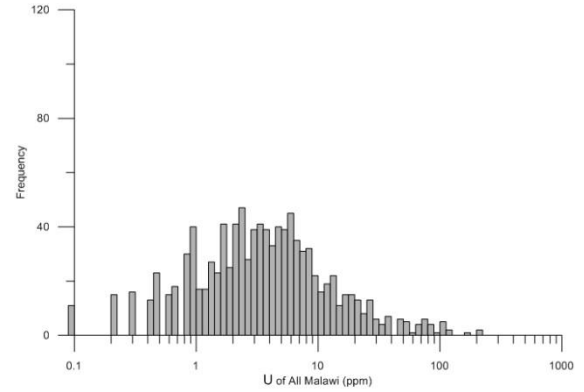
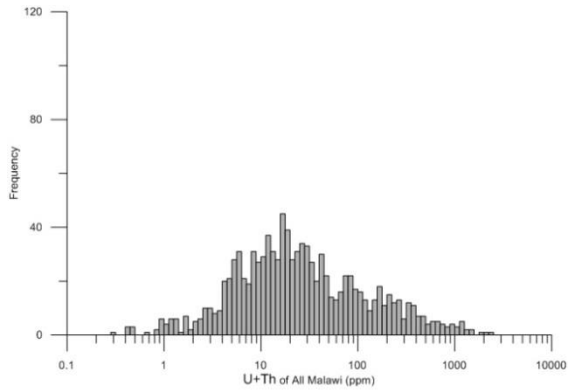
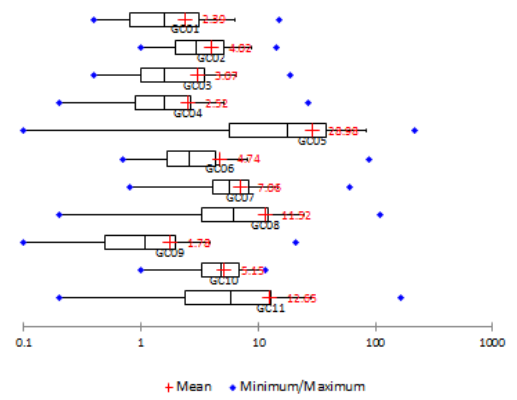


Appendix 3-3

U+Th - Box plots

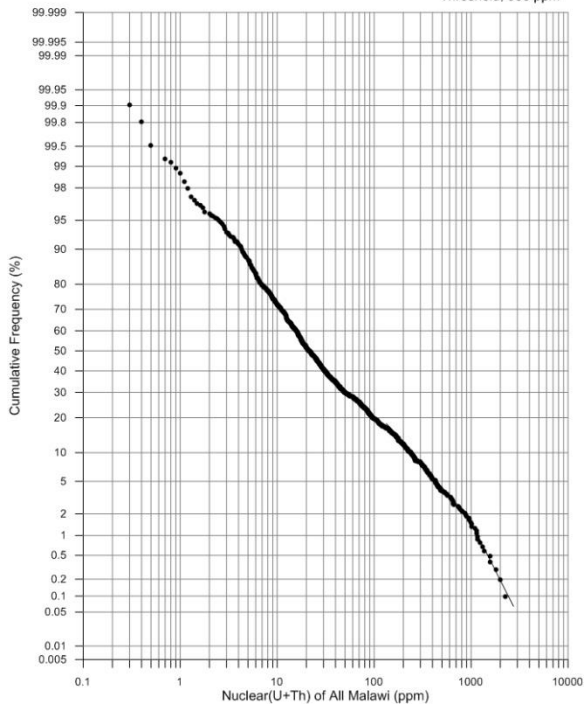


U - Box plots



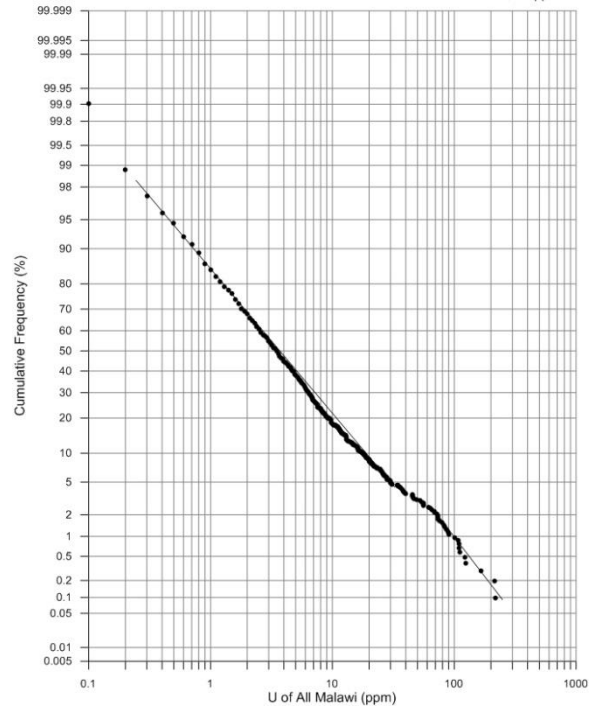
U+Th (GC01-11)

Threshold: 950 ppm



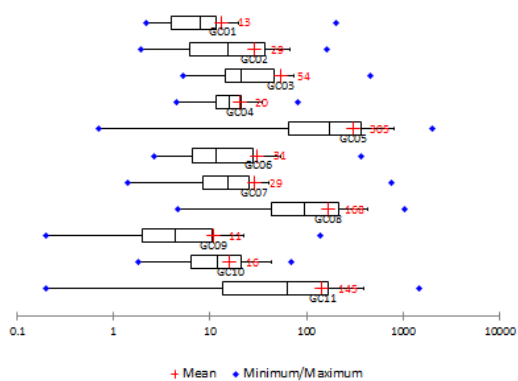
U (GC01-11)

Threshold: 56 ppm

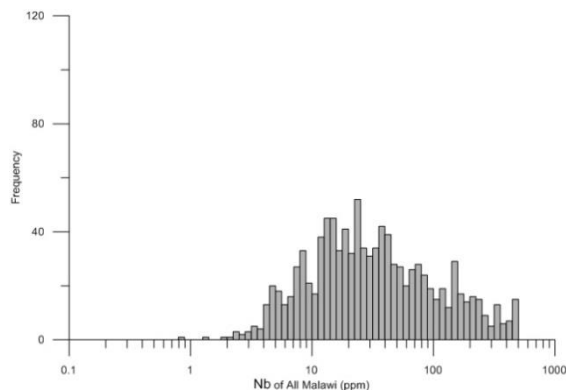
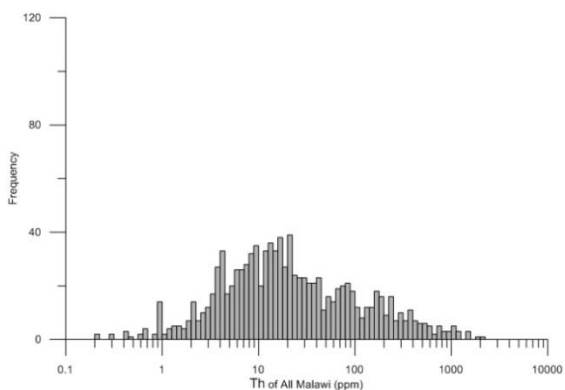
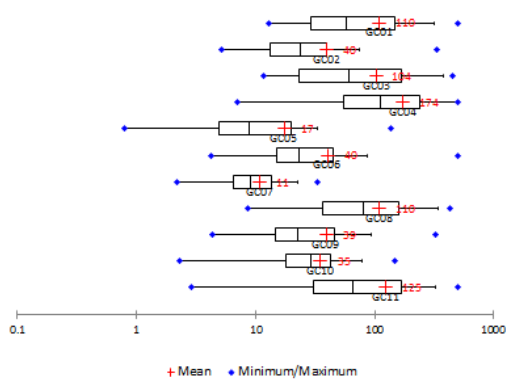


Appendix 3-3

Th - Box plots

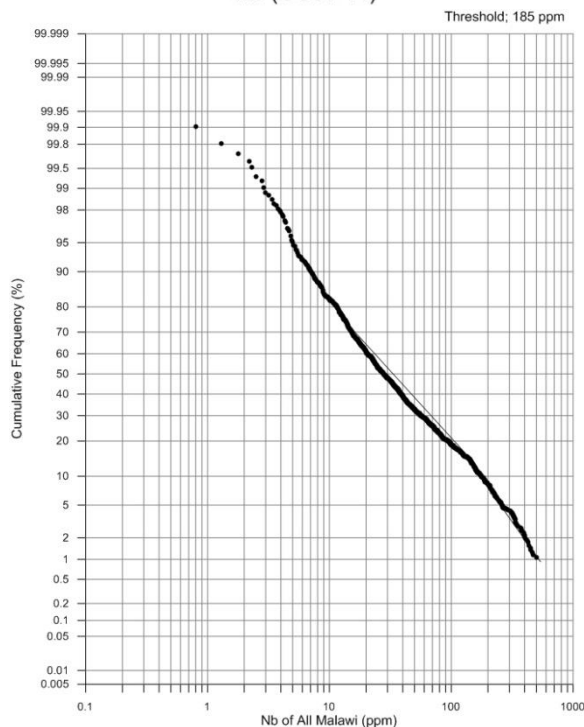
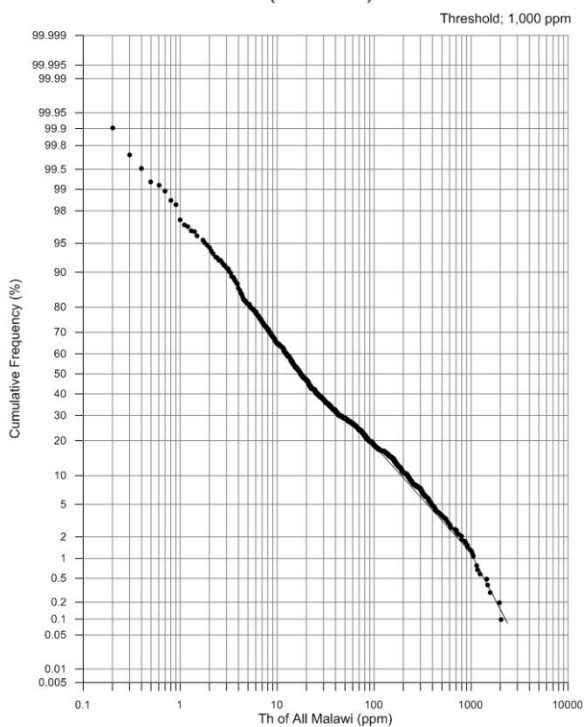


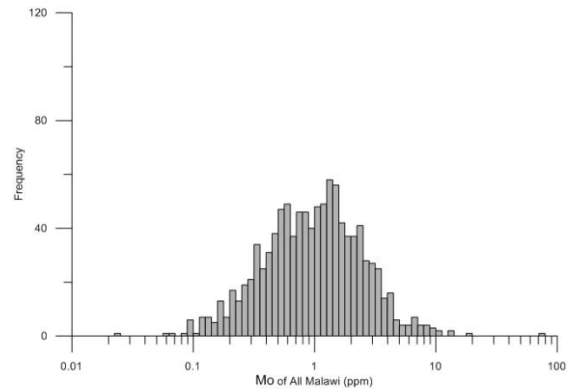
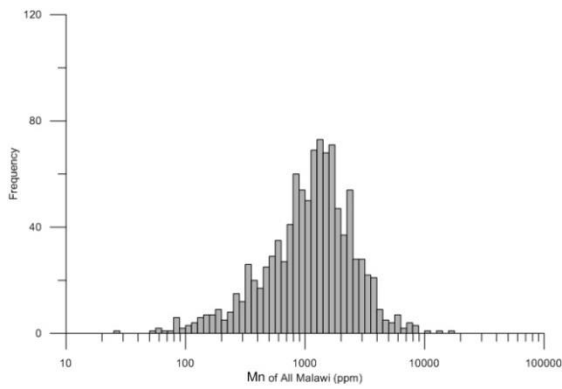
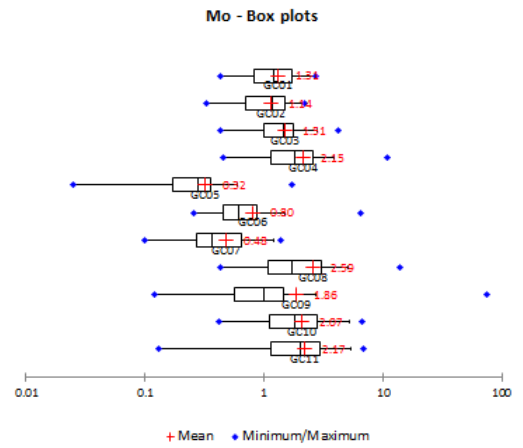
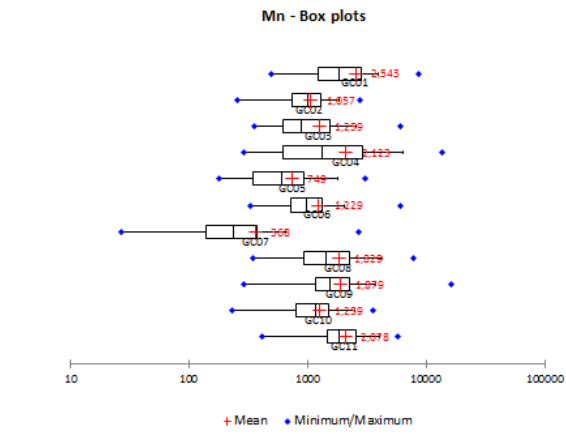
Nb - Box plots



Th (GC01-11)

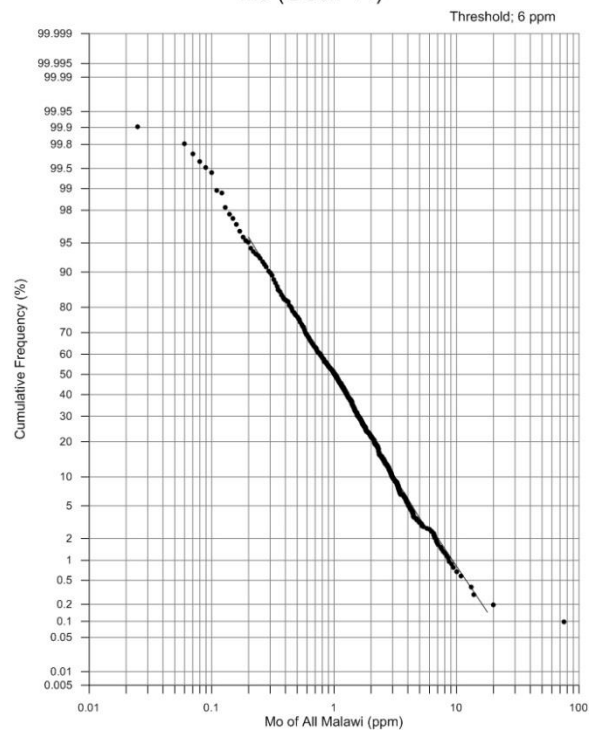
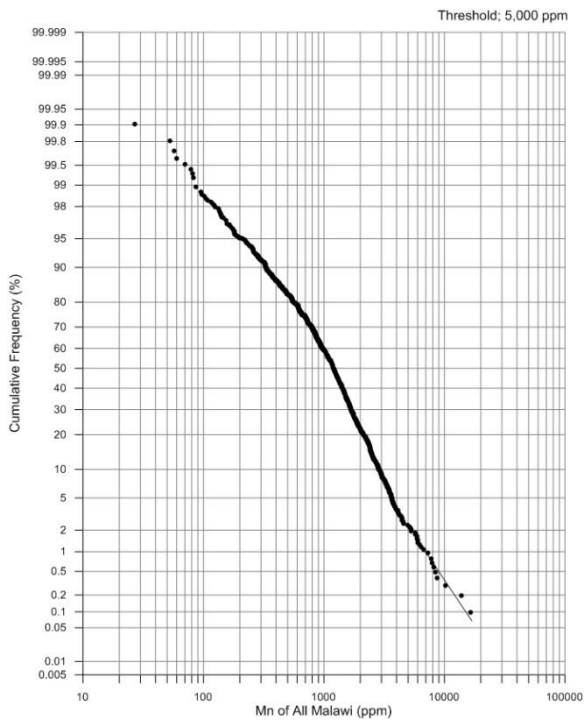
Nb (GC01-11)



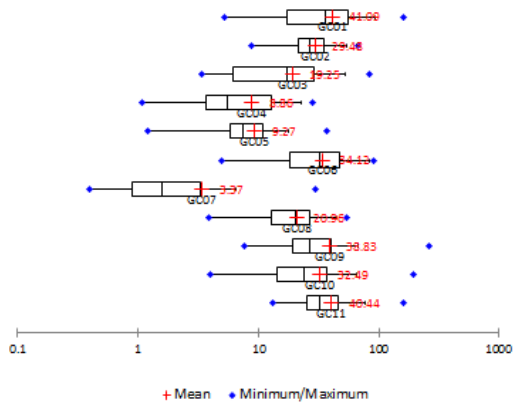


Mn (GC01-11)

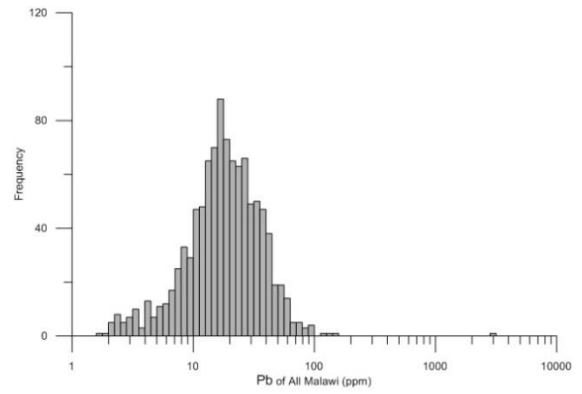
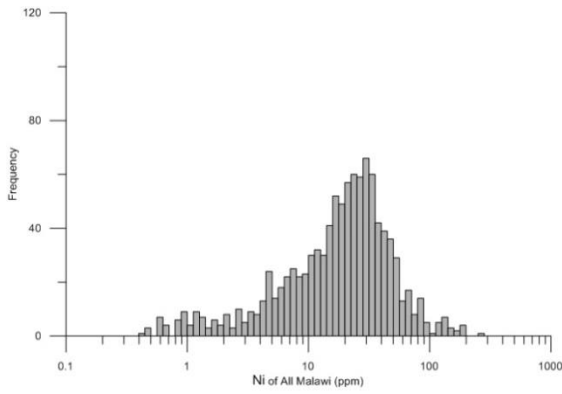
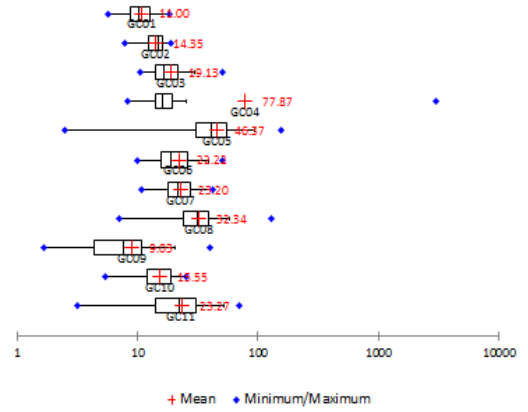
Mo (GC01-11)



Ni - Box plots

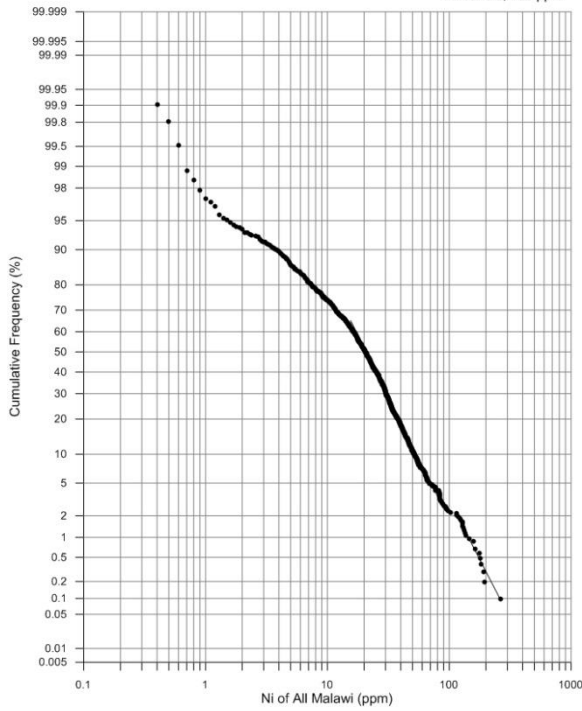


Pb - Box plots



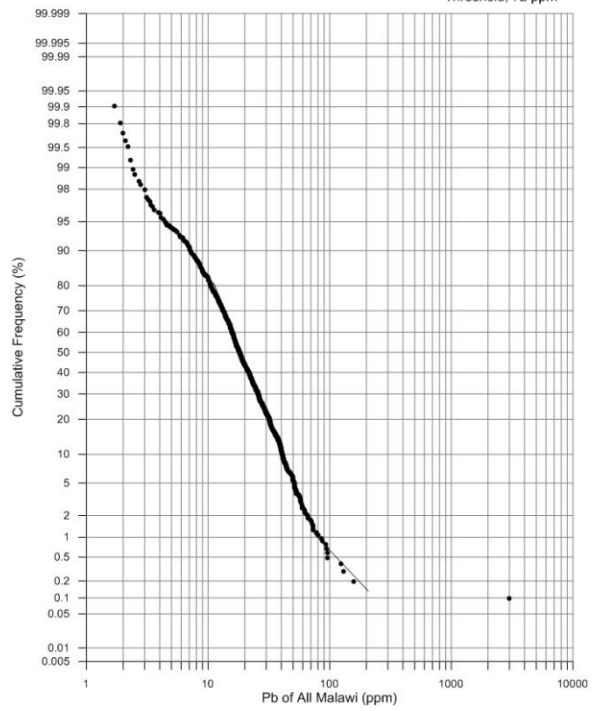
Ni (GC01-11)

Threshold: 100 ppm



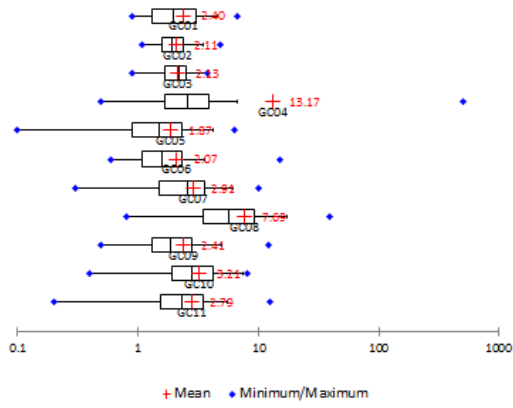
Pb (GC01-11)

Threshold: 72 ppm

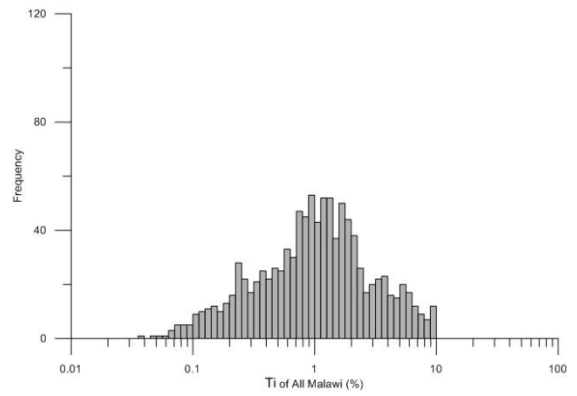
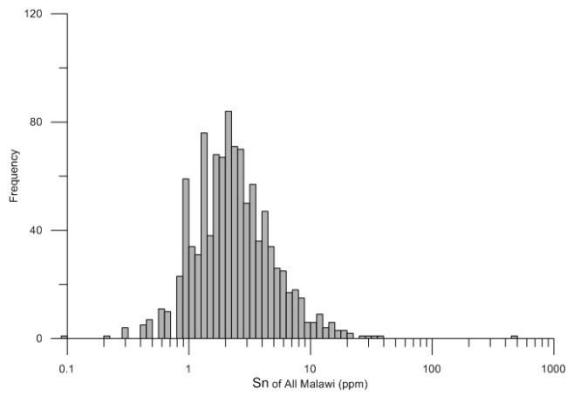
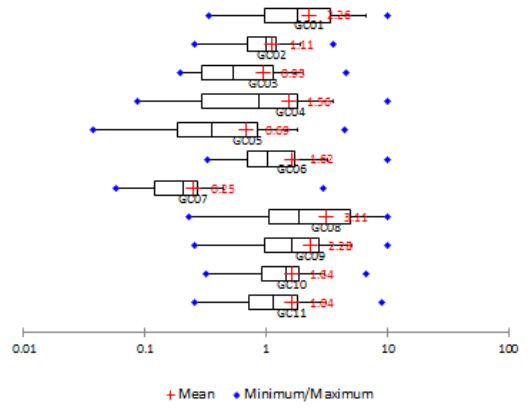


Appendix 3-3

Sn - Box plots

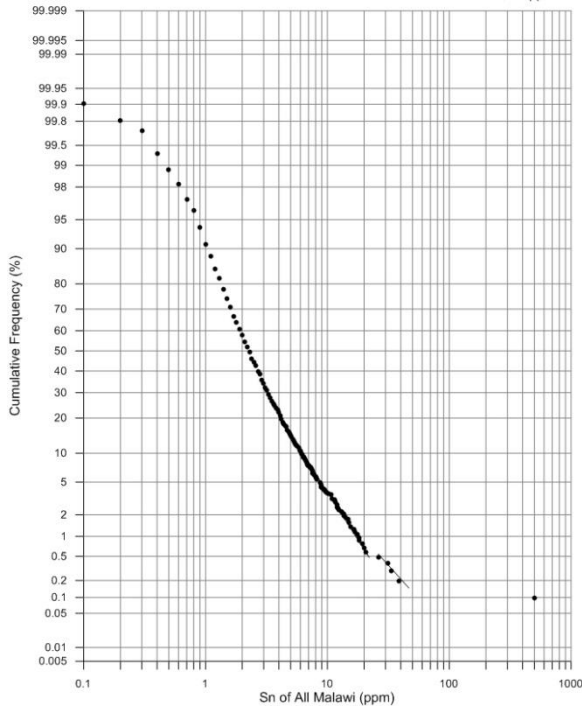


Ti - Box plots



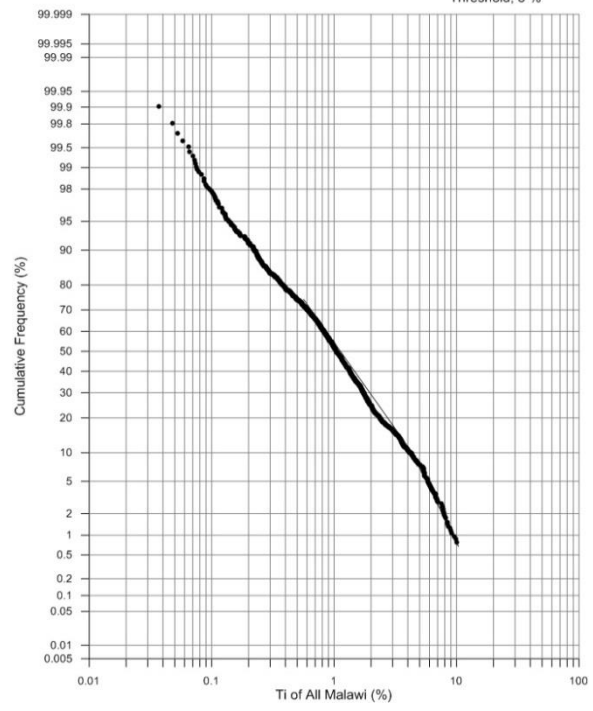
Sn (GC01-11)

Threshold: 23 ppm

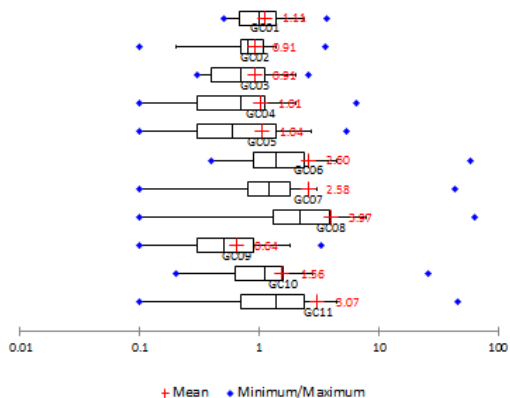


Ti (GC01-11)

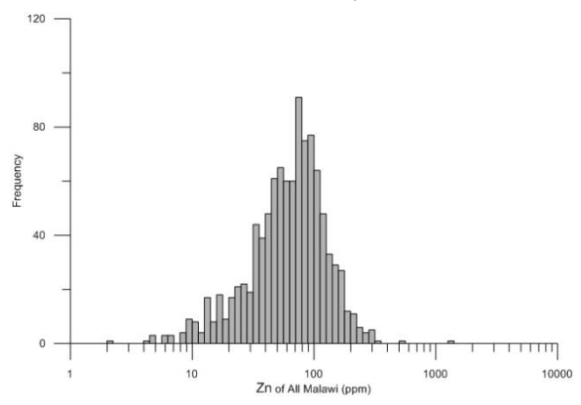
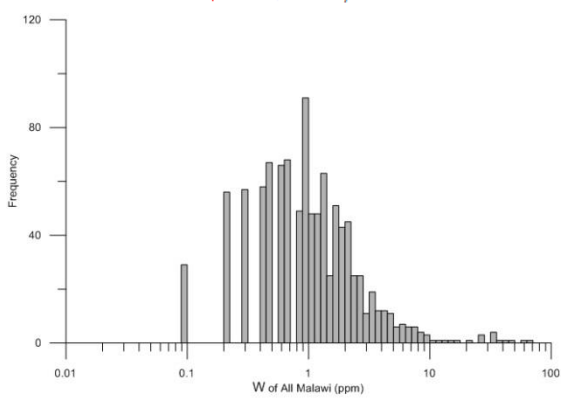
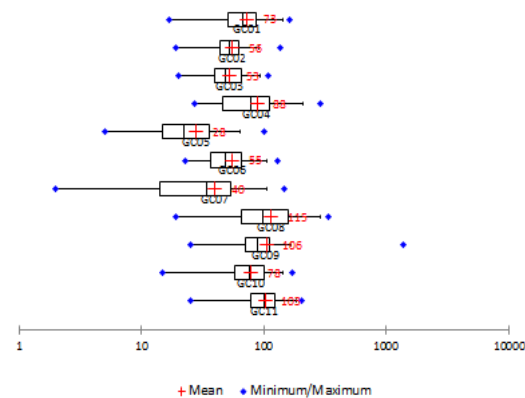
Threshold: 5 %



W - Box plots

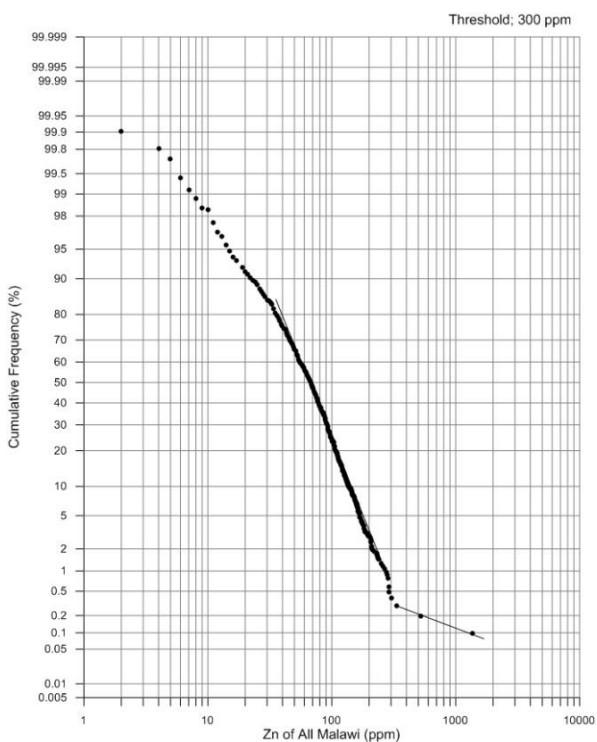
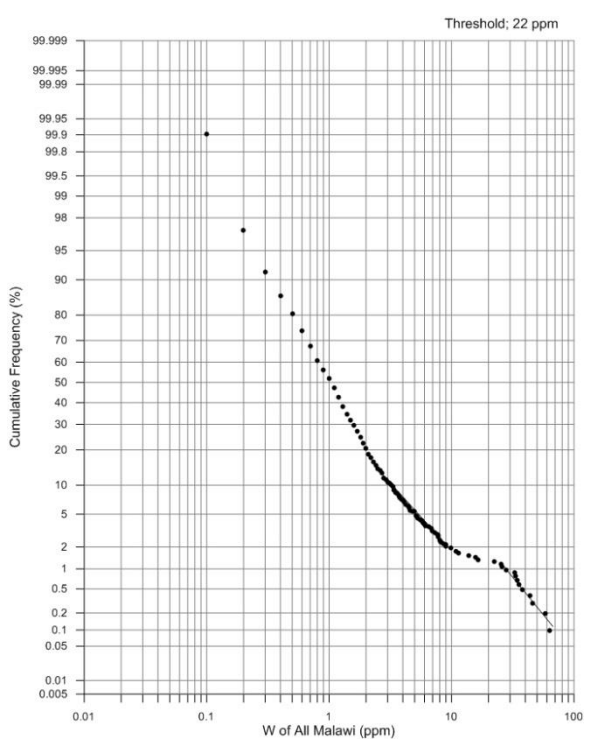


Zn - Box plots

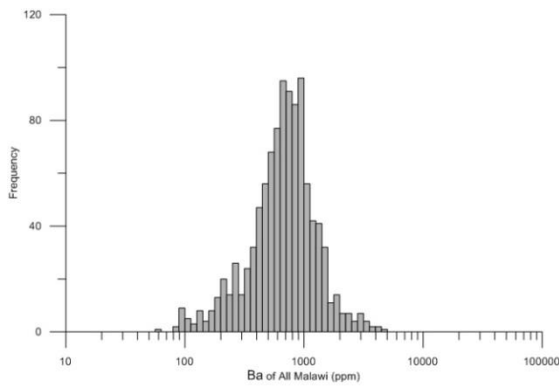
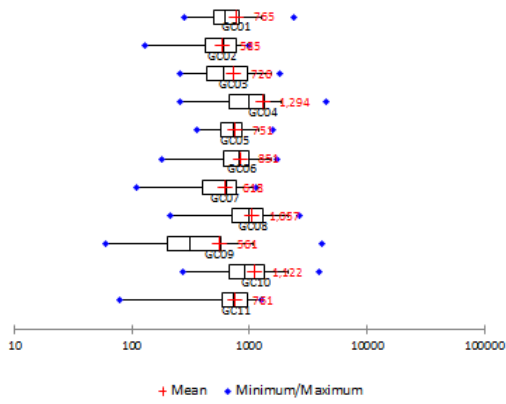


W (GC01-11)

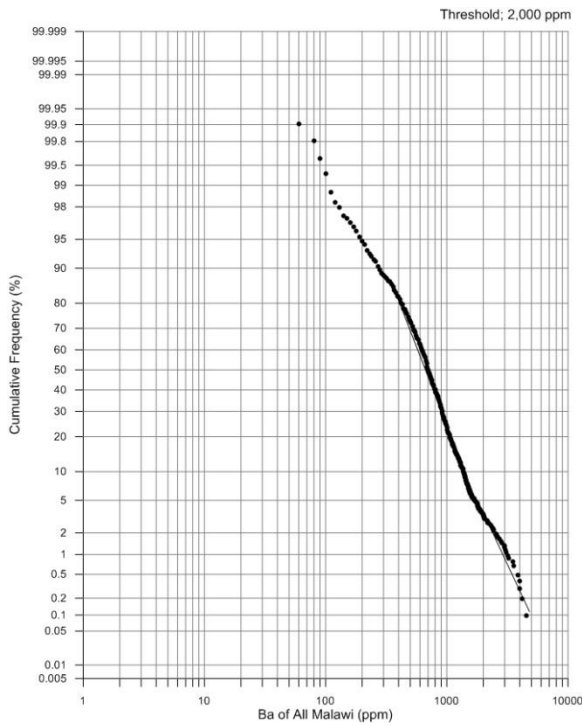
Zn (GC01-11)



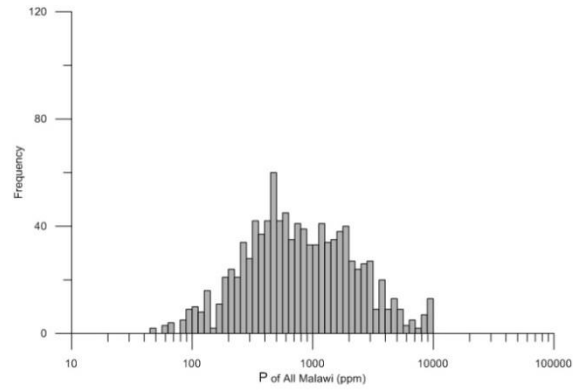
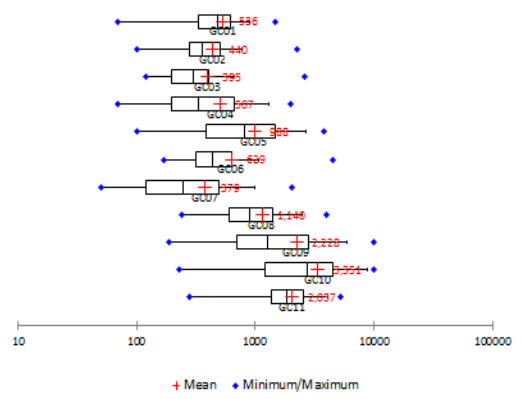
Ba - Box plots



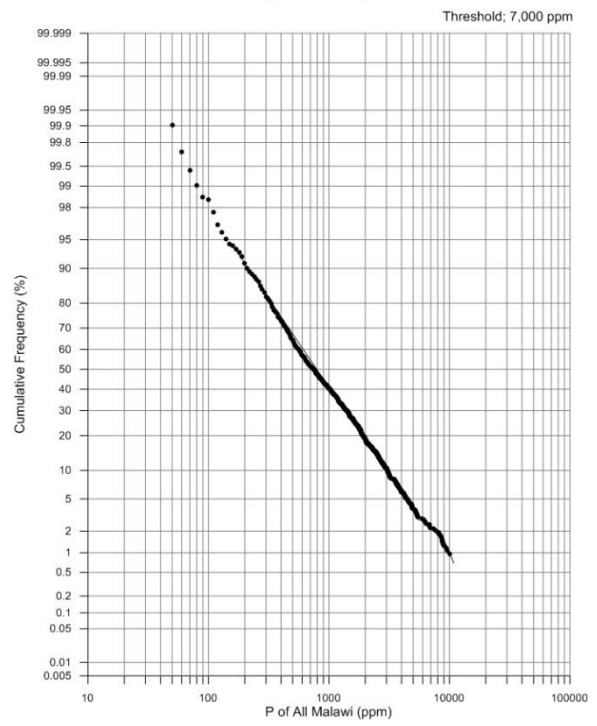
Ba (GC01-11)



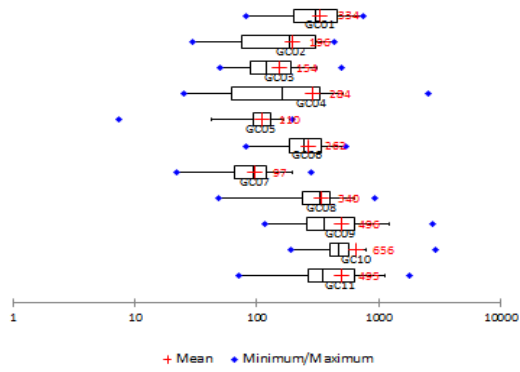
P - Box plots



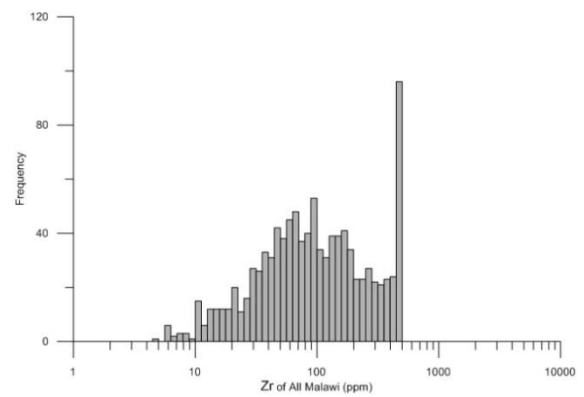
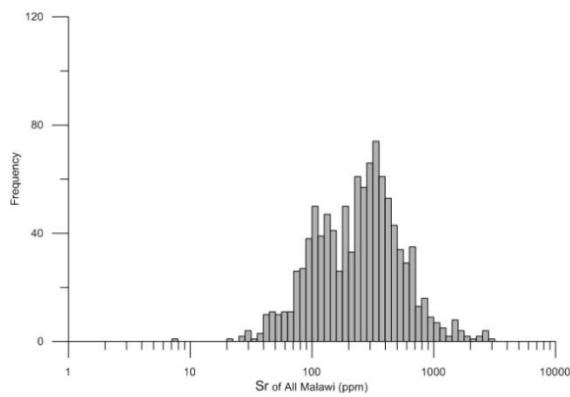
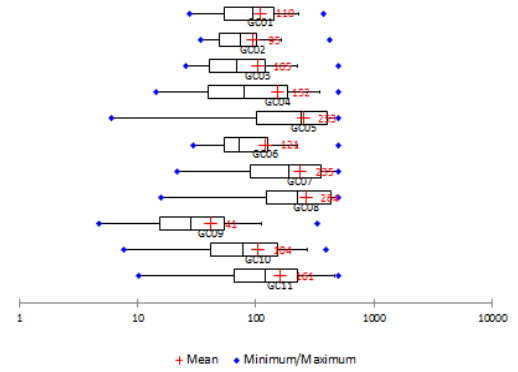
P (GC01-11)



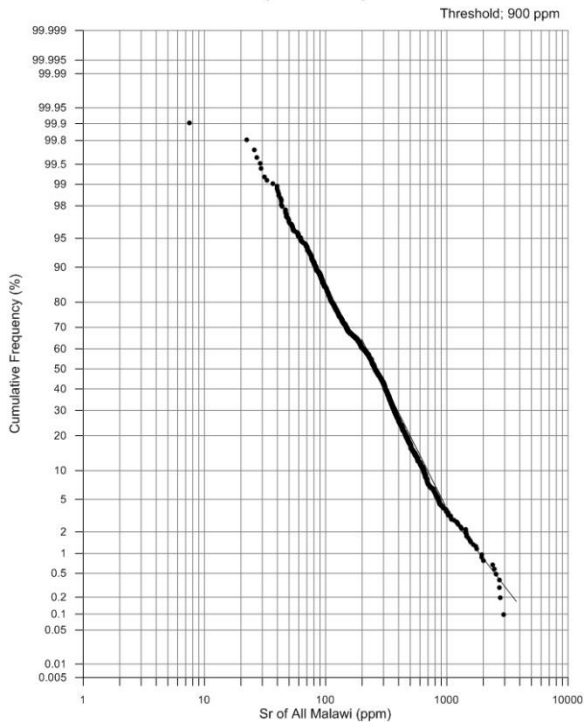
Sr - Box plots



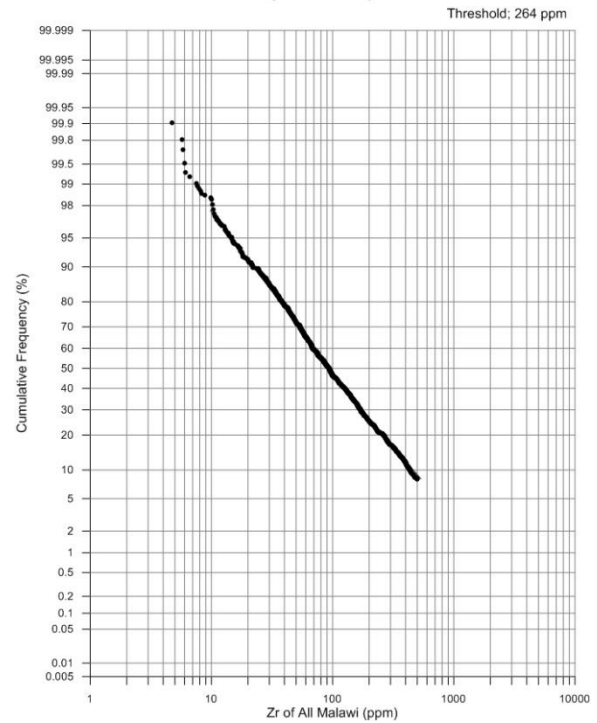
Zr - Box plots



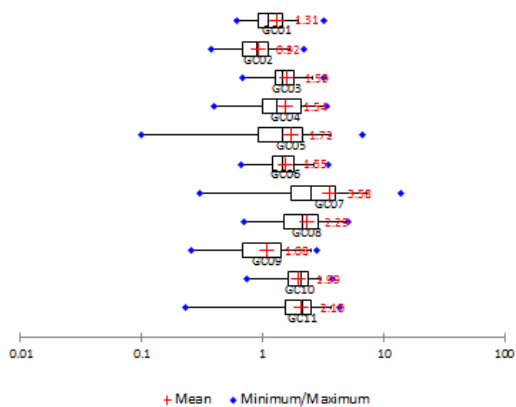
Sr (GC01-11)



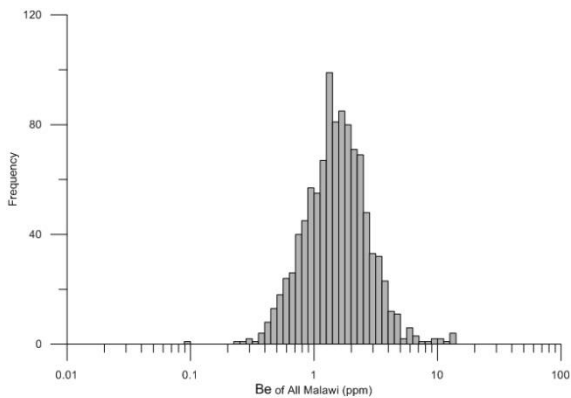
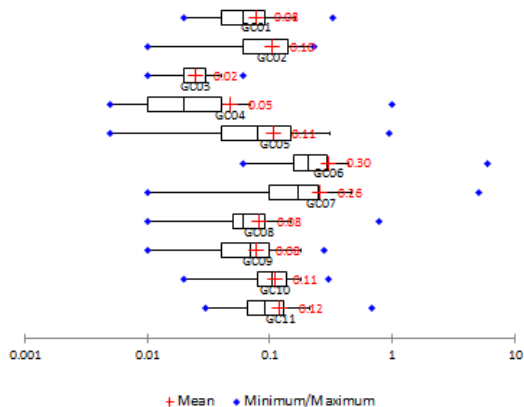
Zr (GC01-11)



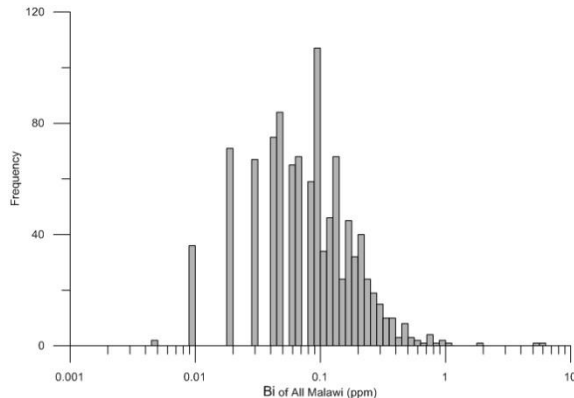
Be - Box plots



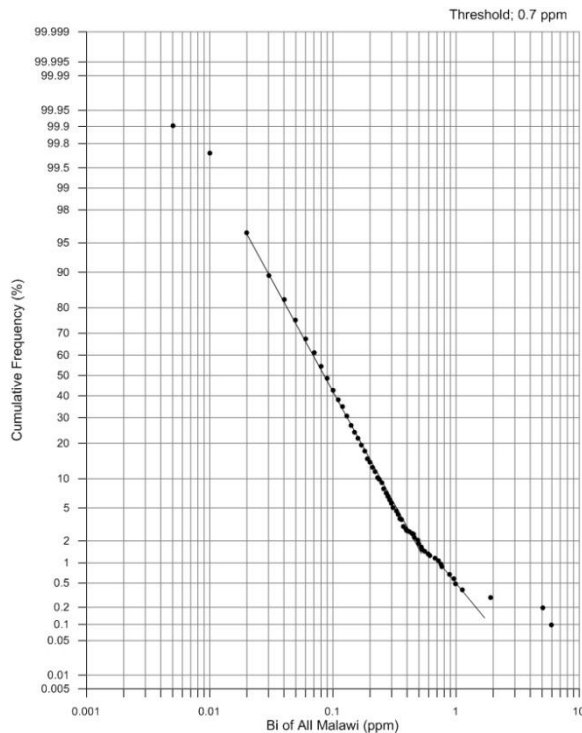
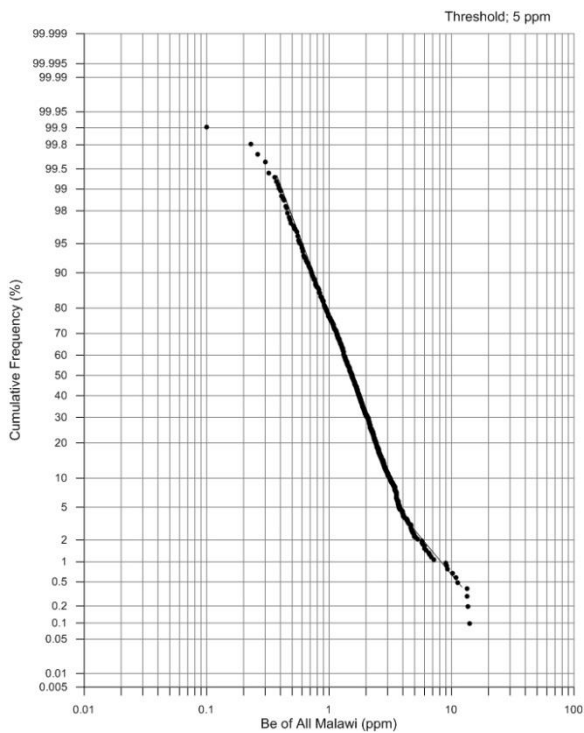
Bi - Box plots



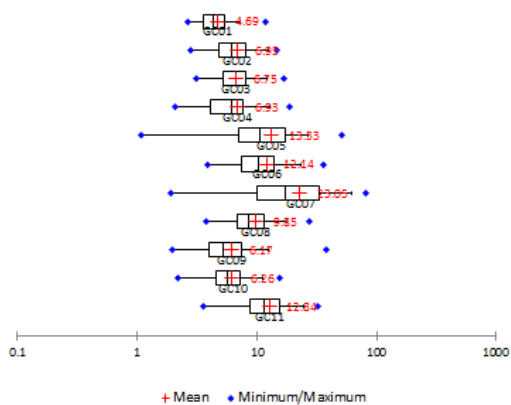
Be (GC01-11)



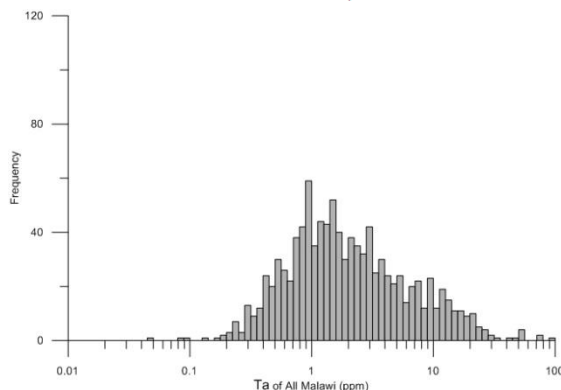
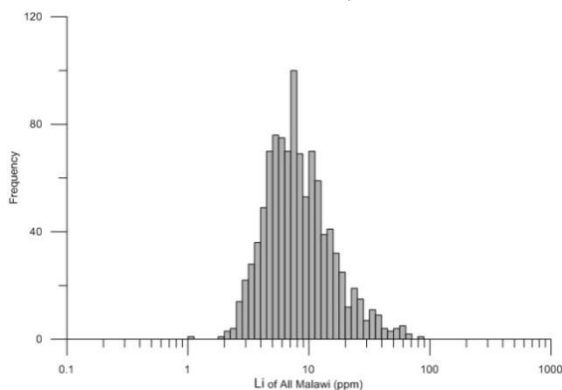
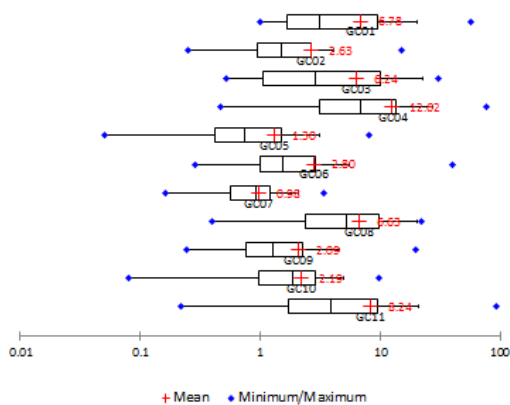
Bi (GC01-11)



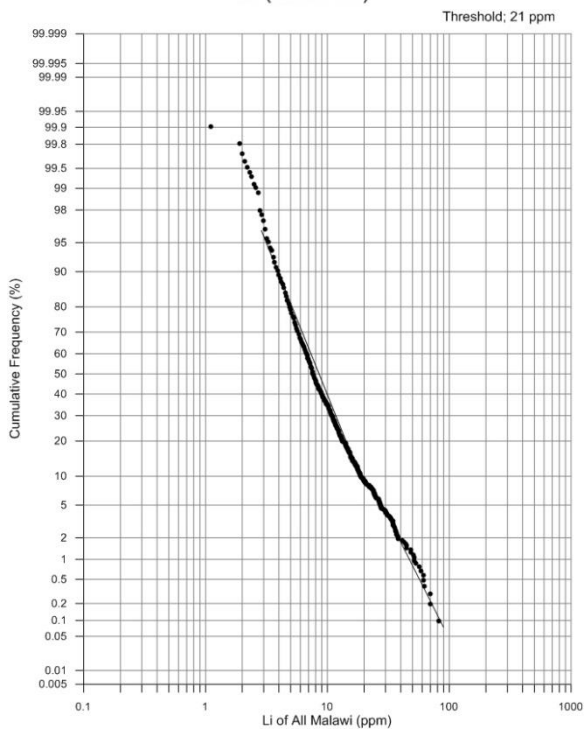
Li - Box plots



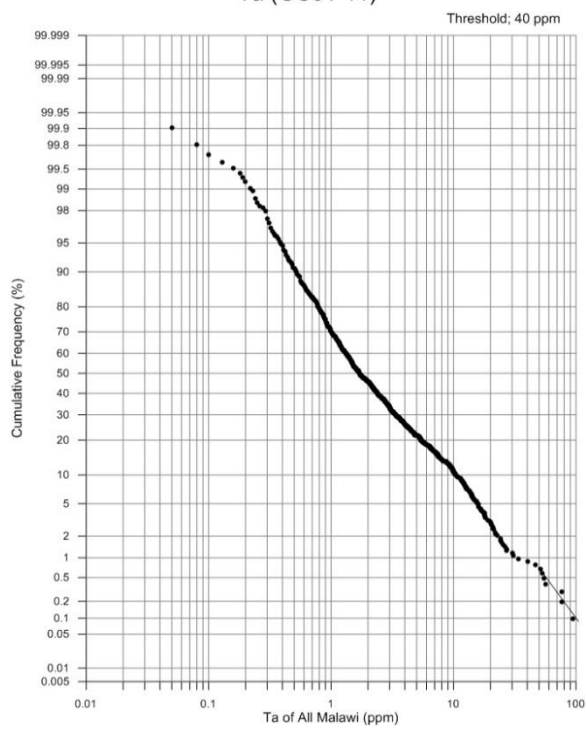
Ta - Box plots



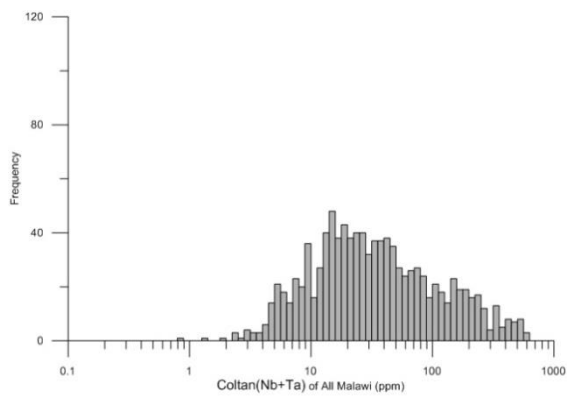
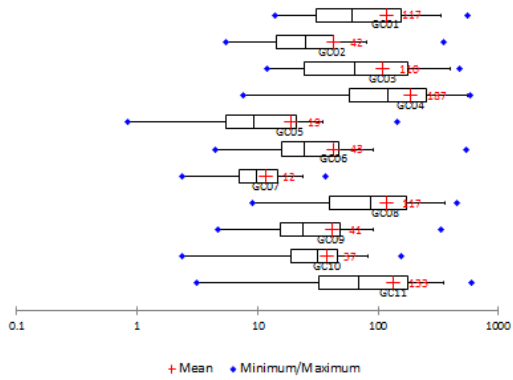
Li (GC01-11)



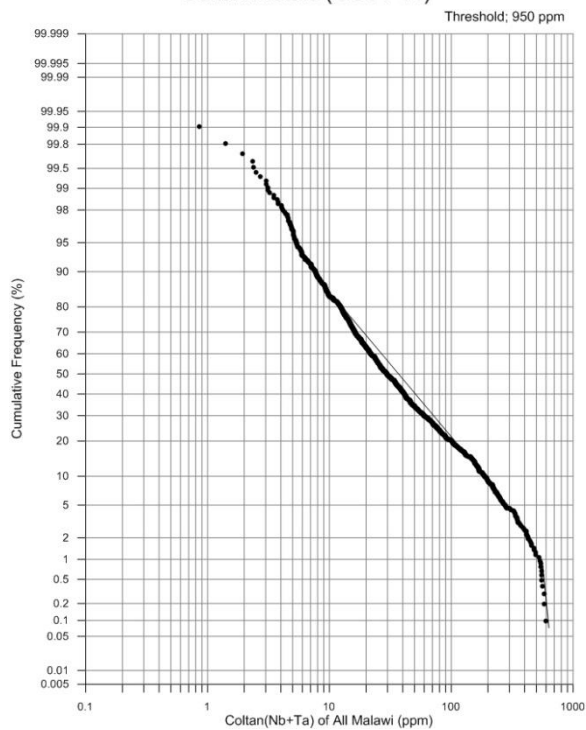
Ta (GC01-11)



Coltan(Nb+Ta) - Box plots

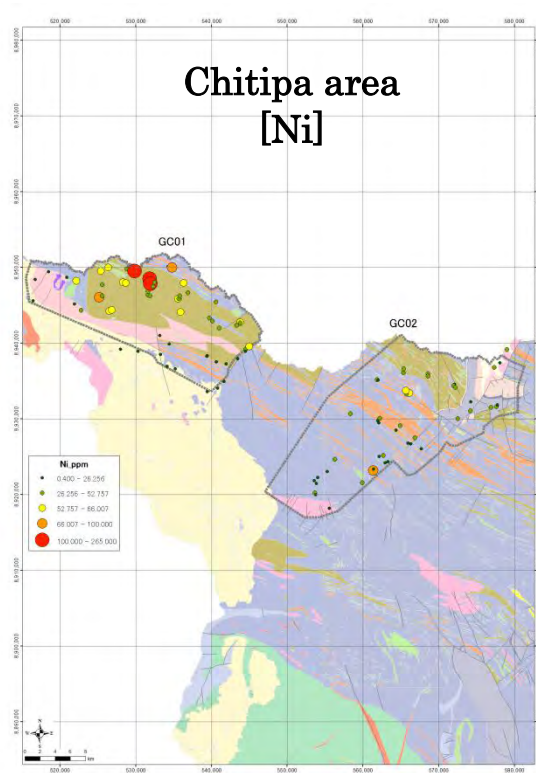
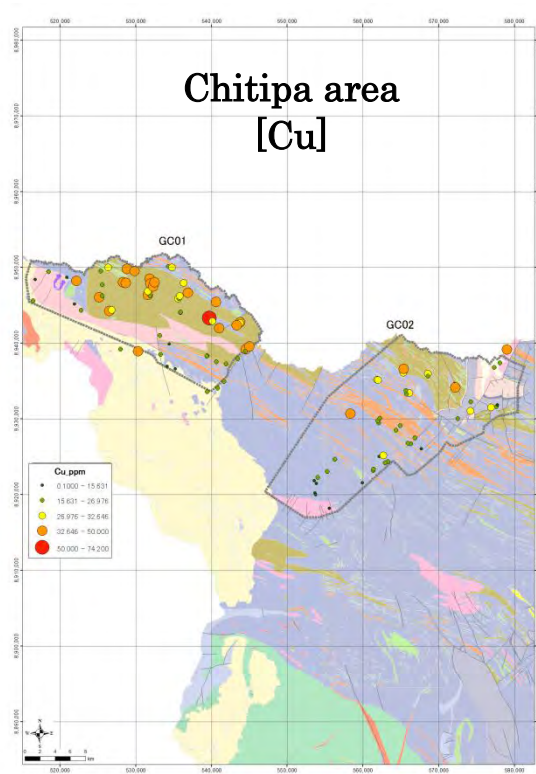


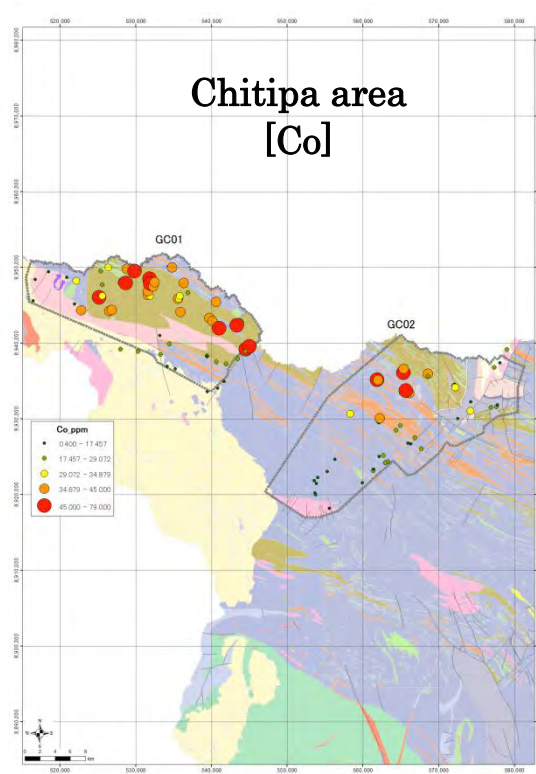
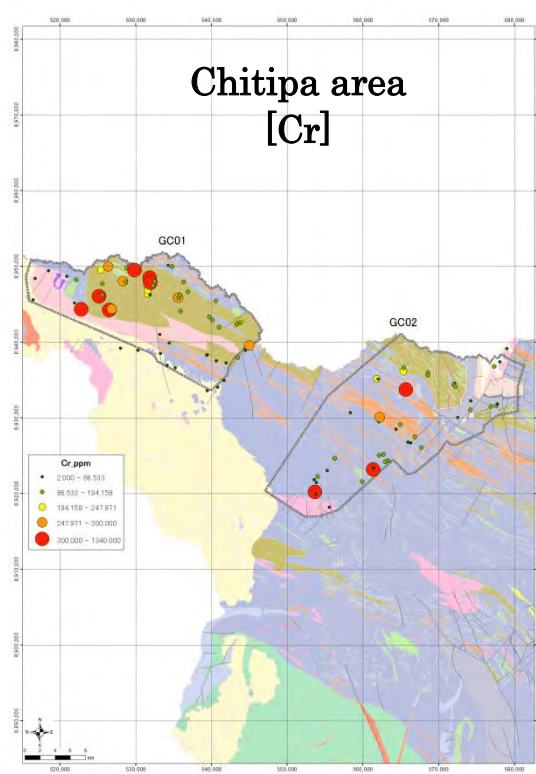
Coltan metals (GC01-11)

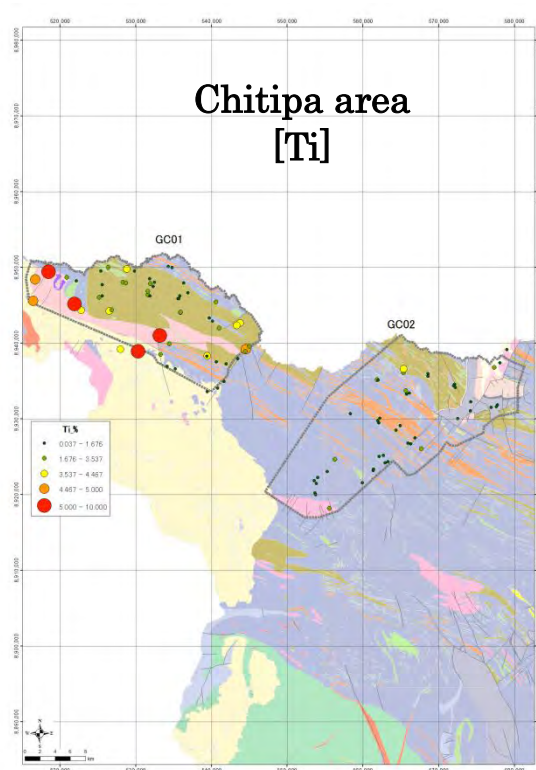
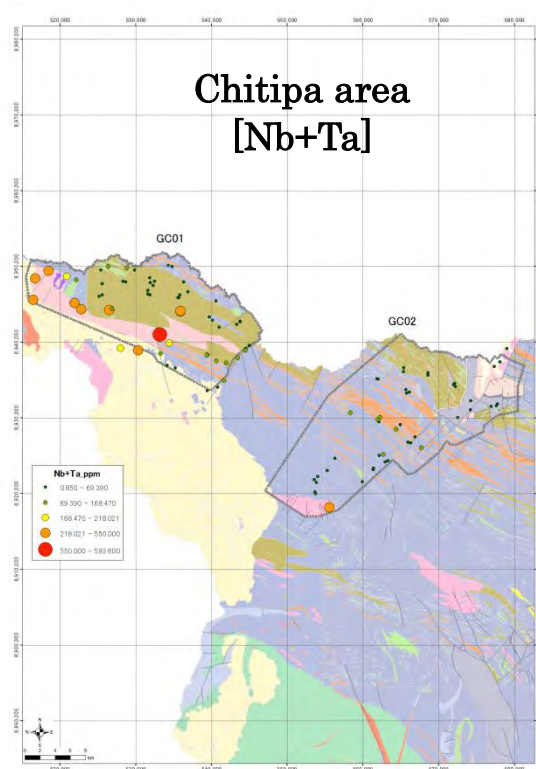


Appendix 3-4 Geochemical maps

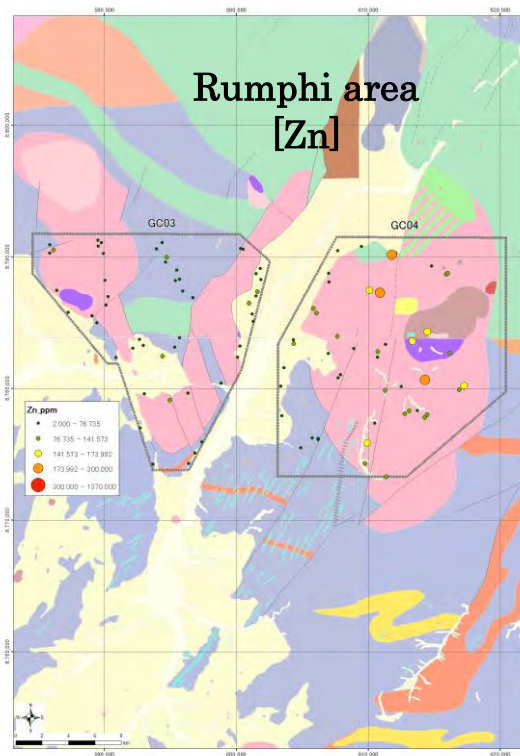
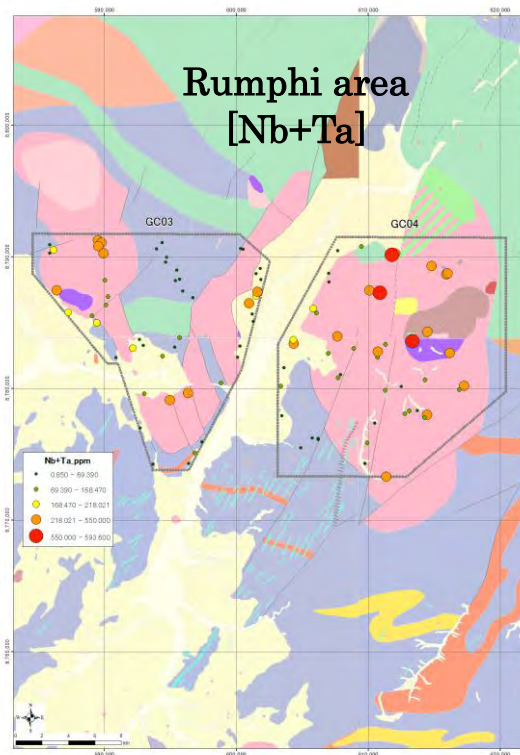
(1) GC01-02

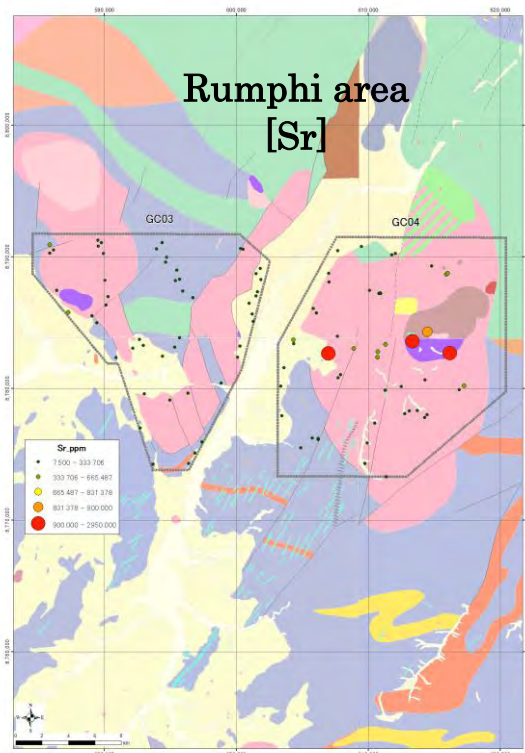
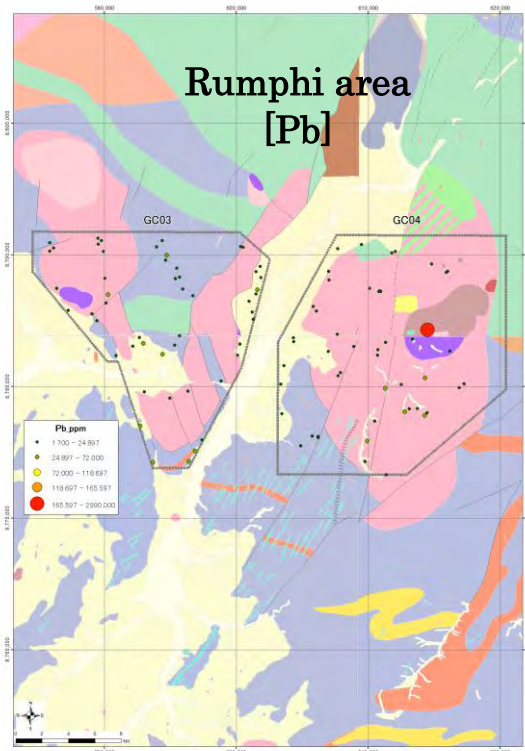


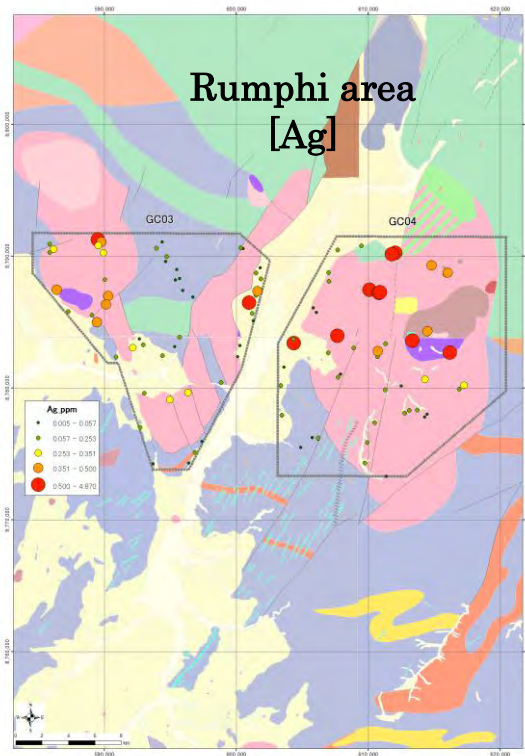
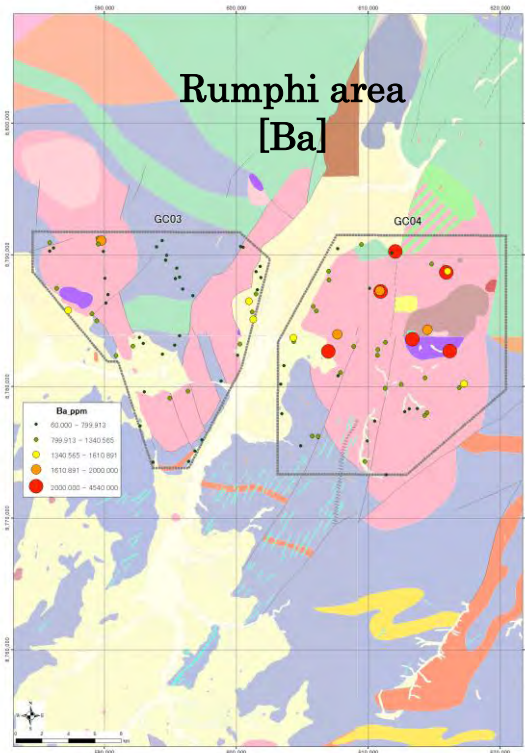




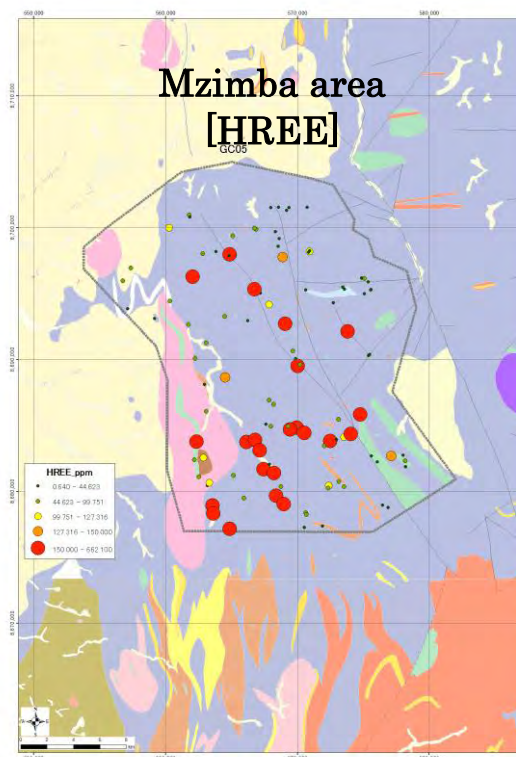
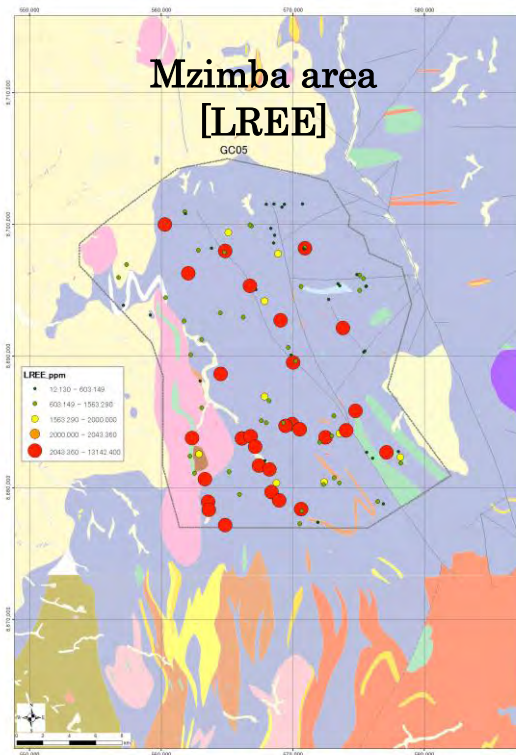
(2) GC03-04

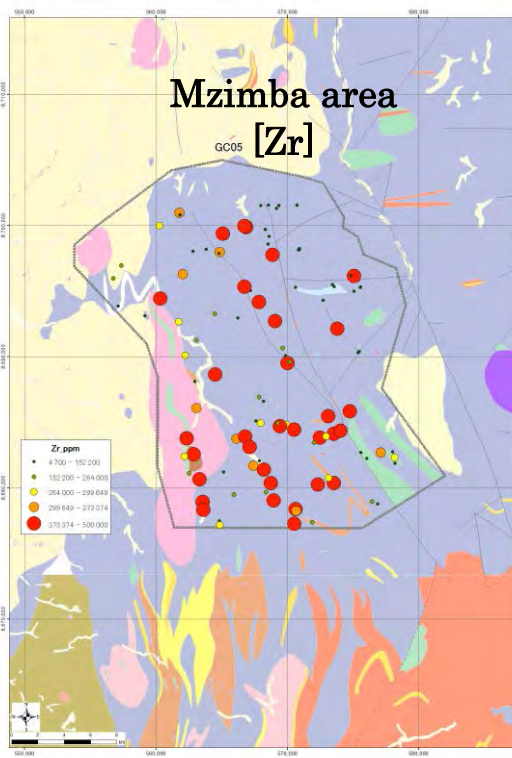
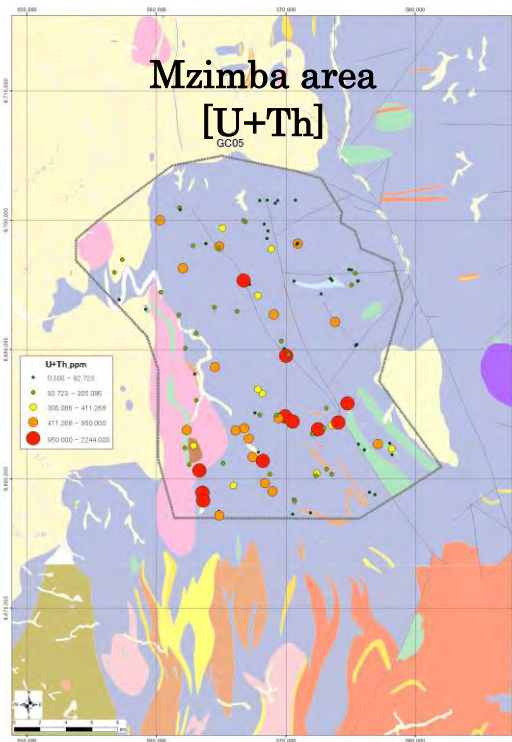




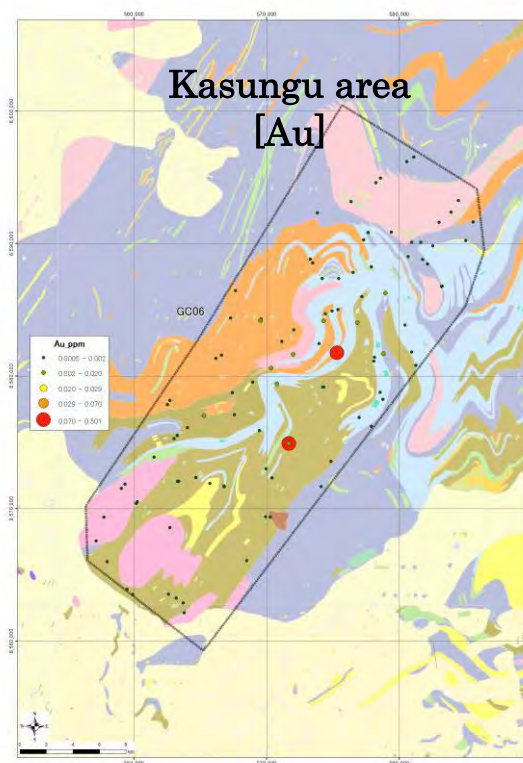
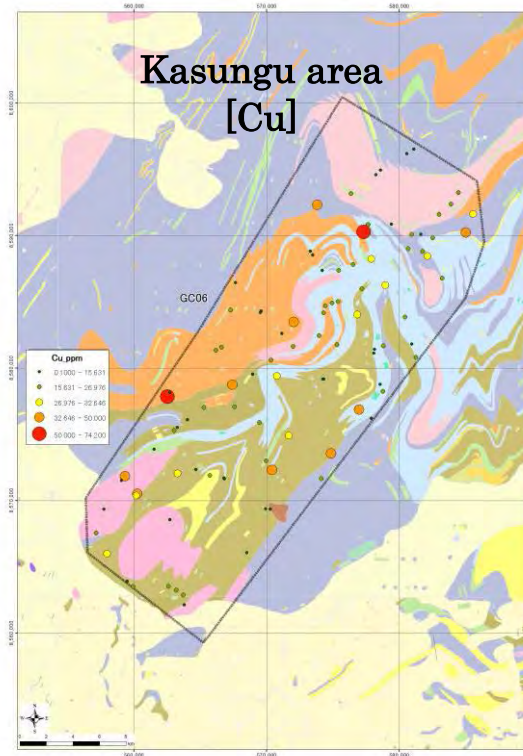


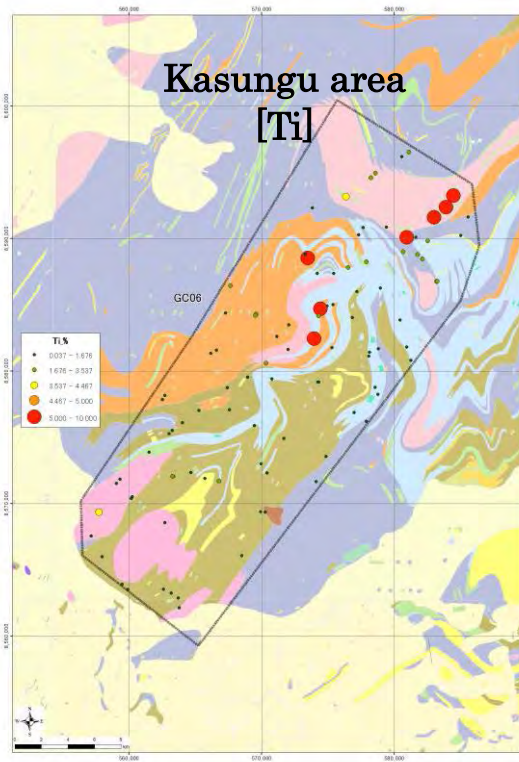
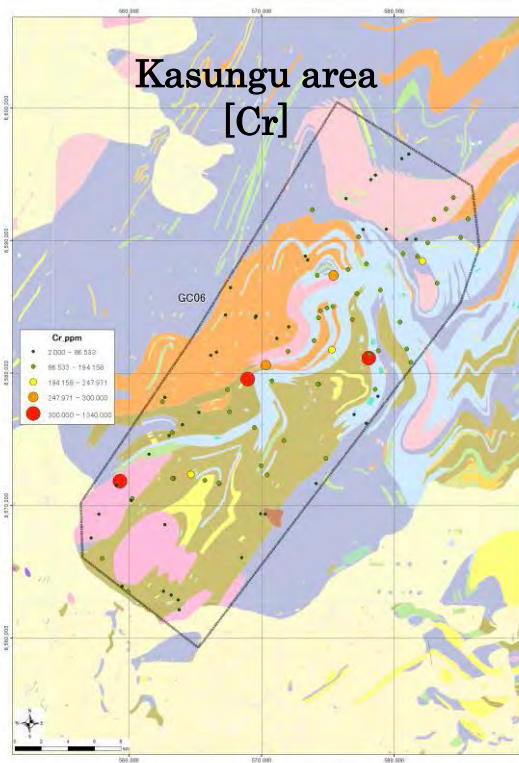
(3) GC05

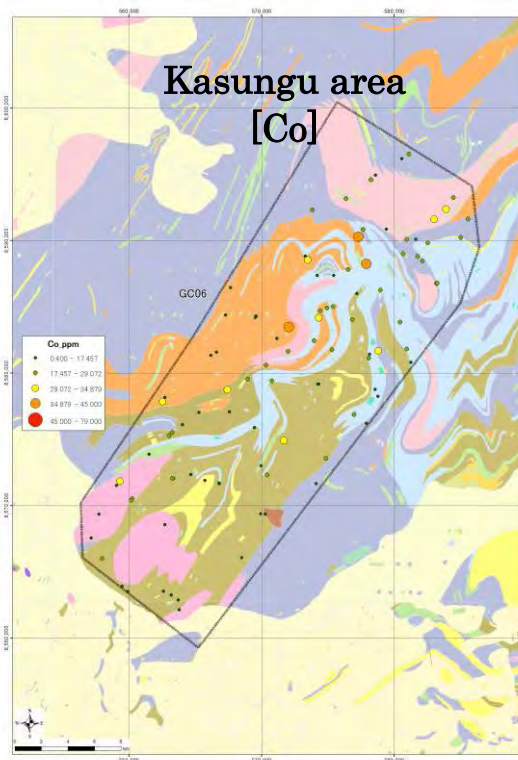
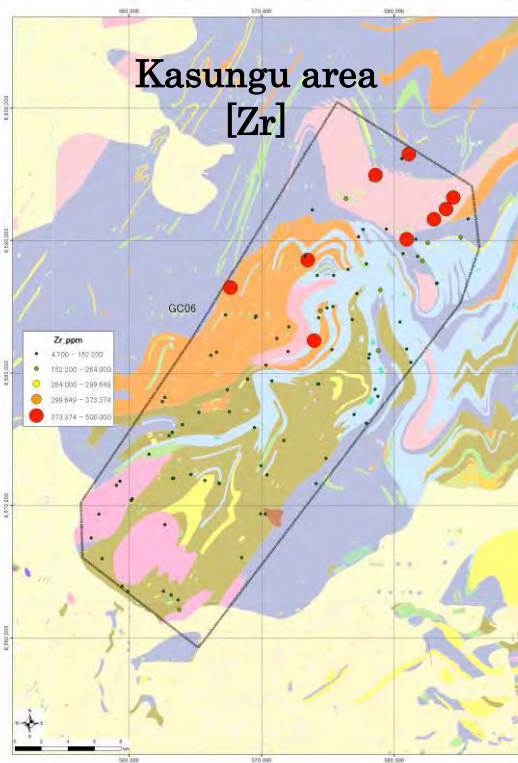




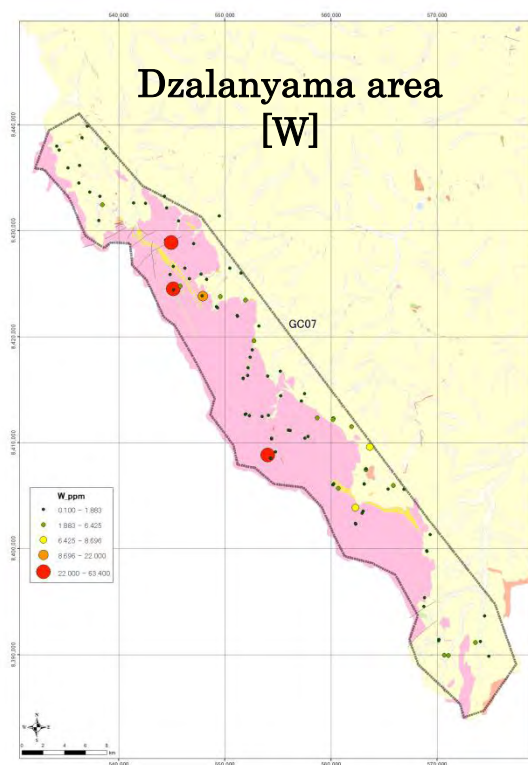
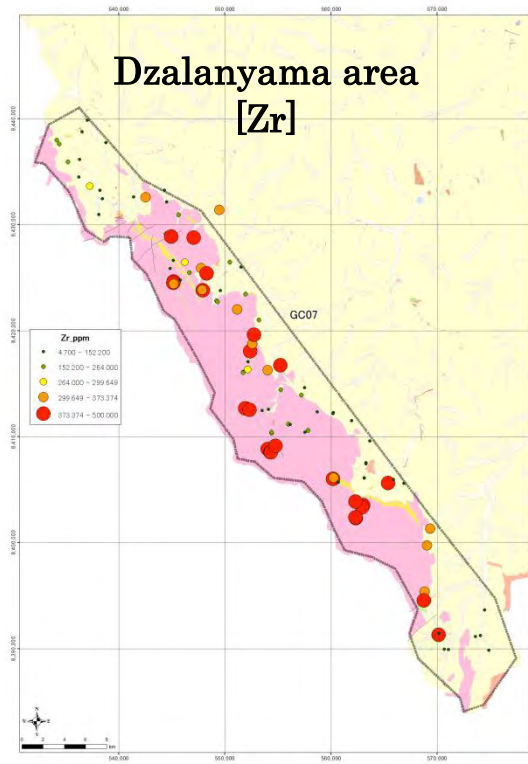
(4) GC06



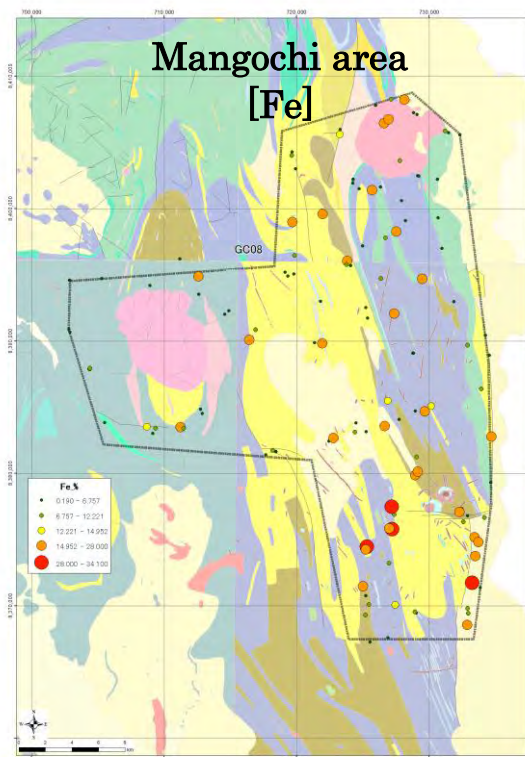
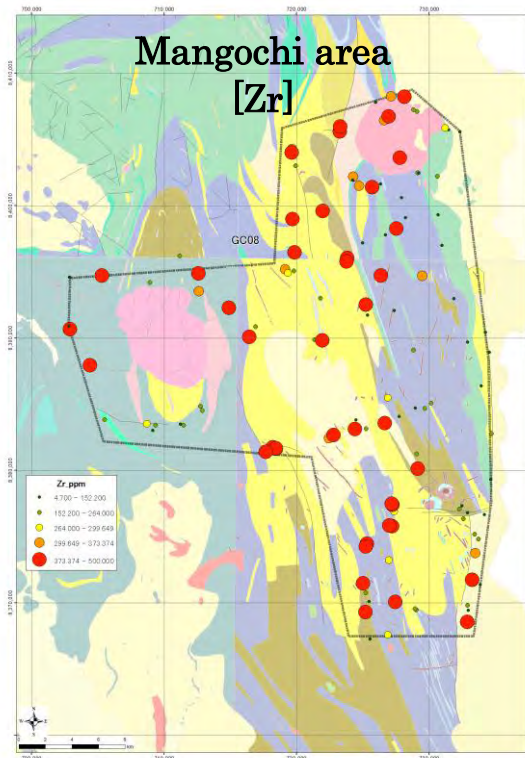


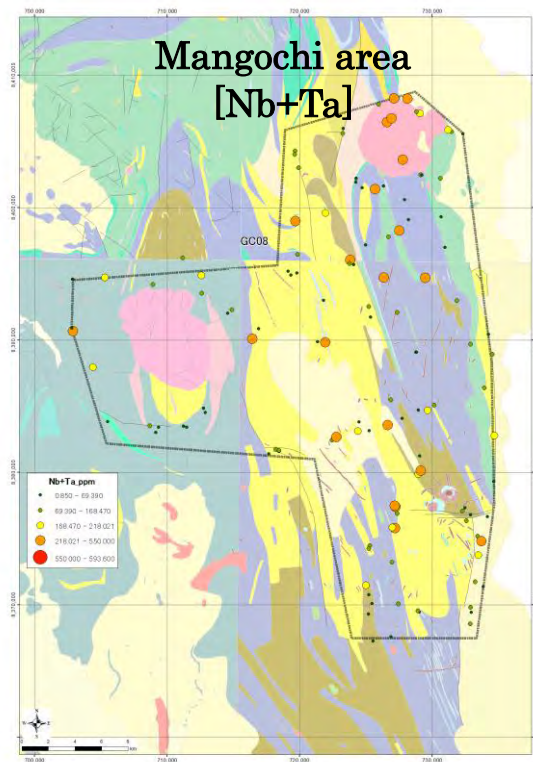
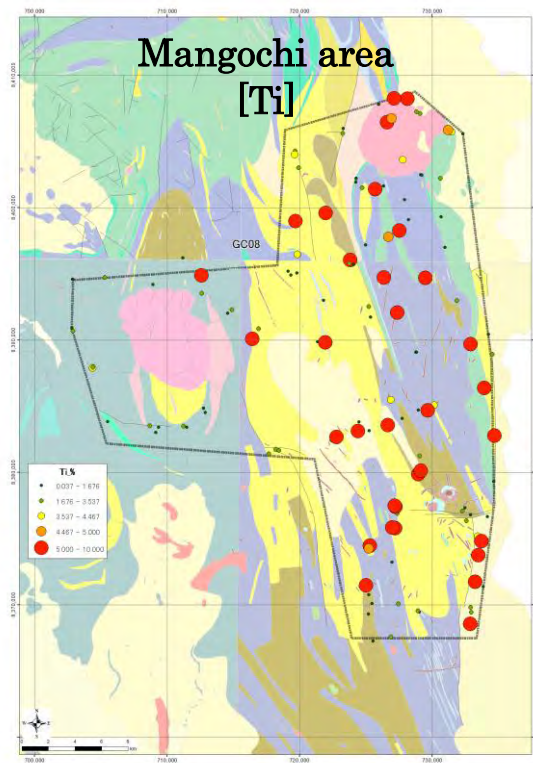


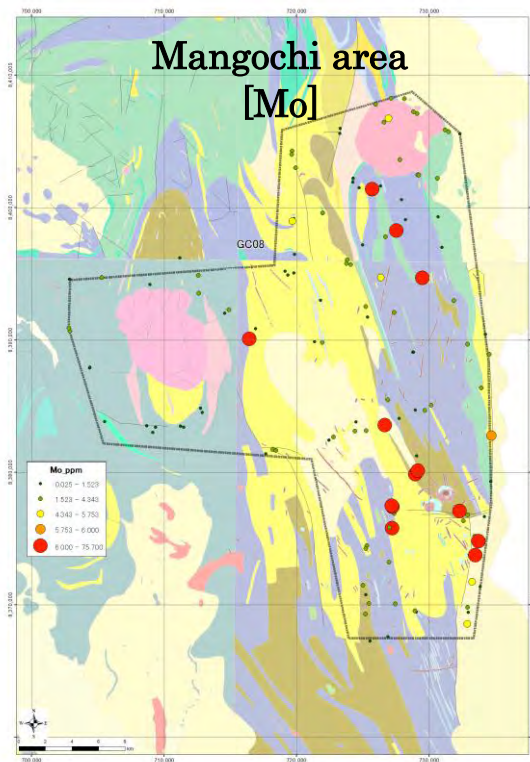
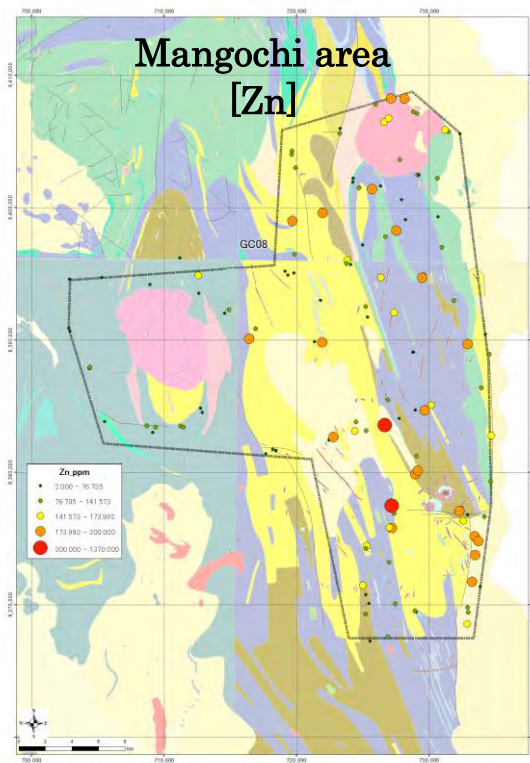
(5) GC07

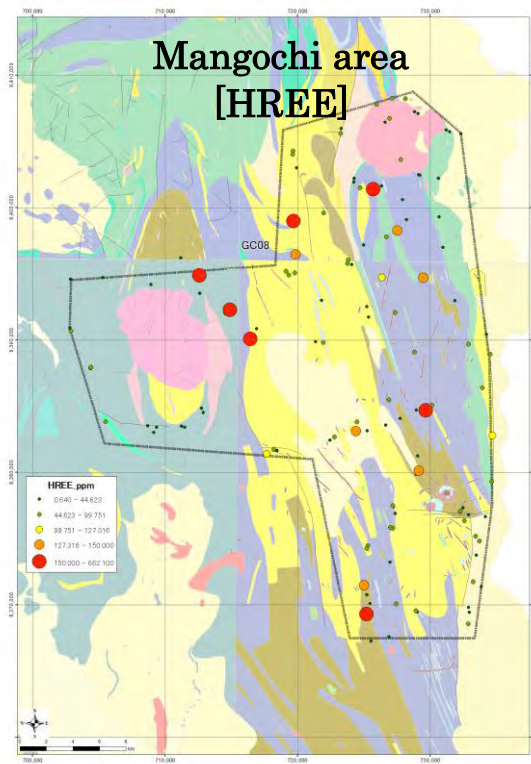
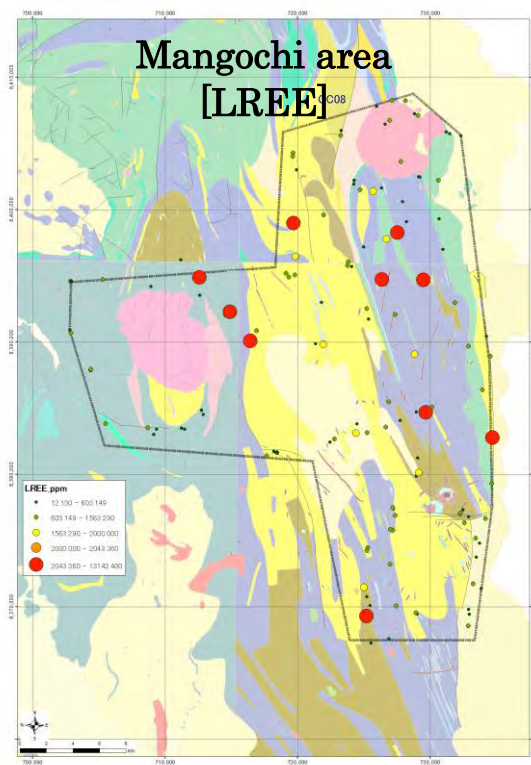


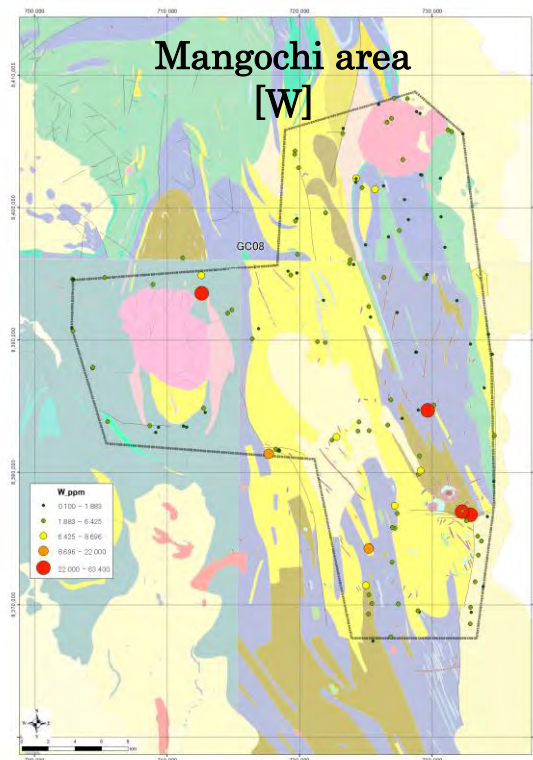
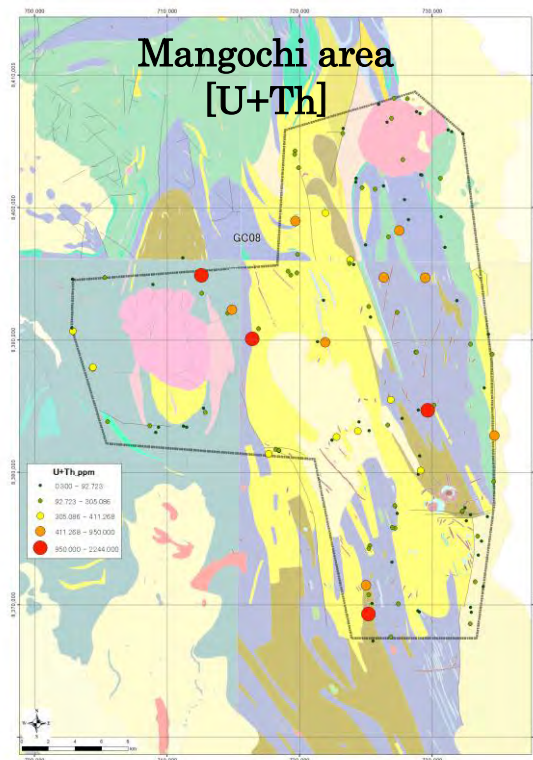
(6) GC08



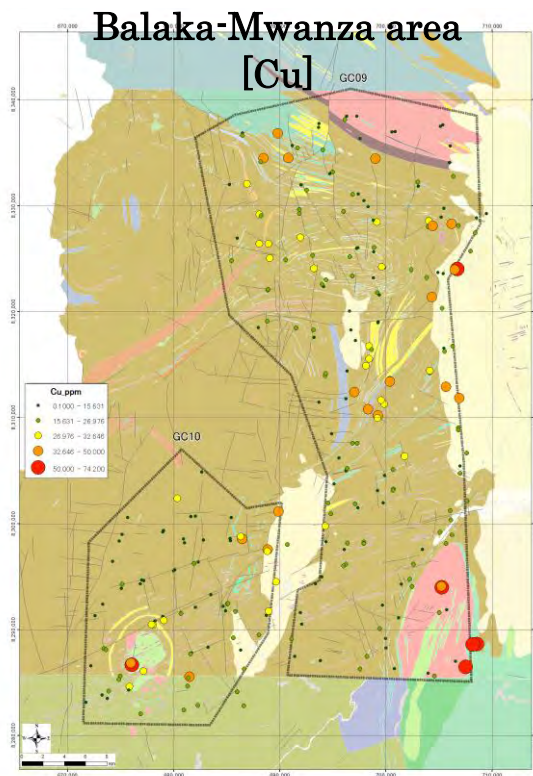
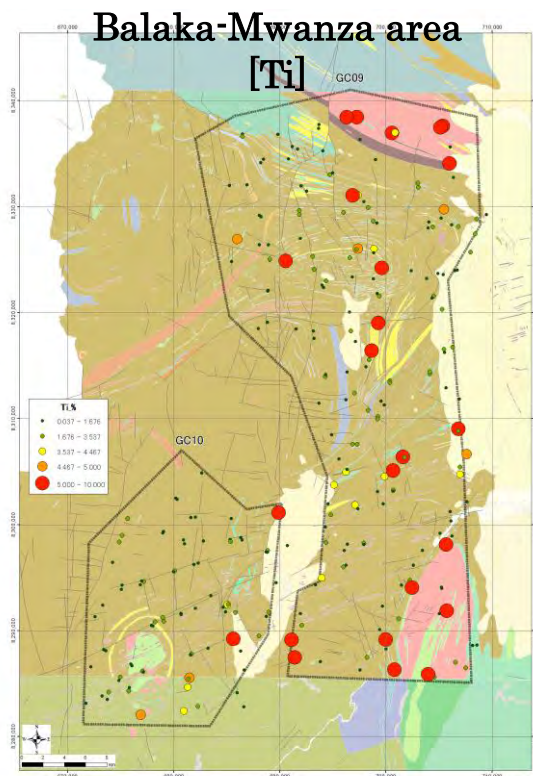


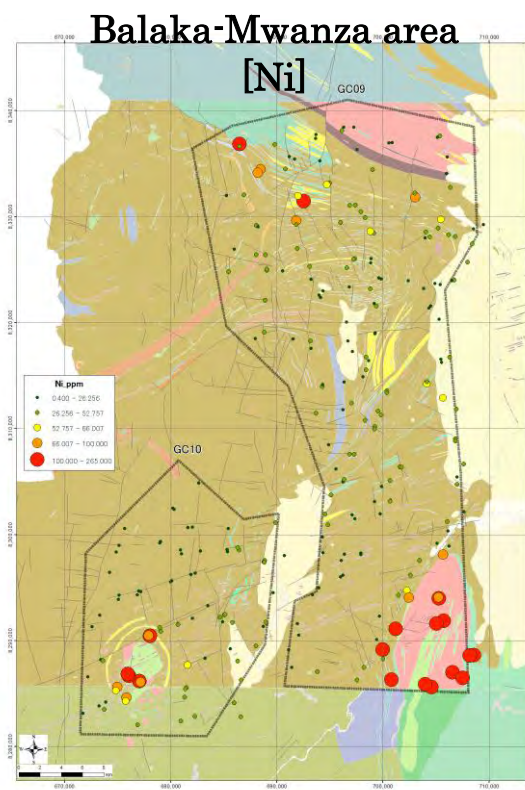
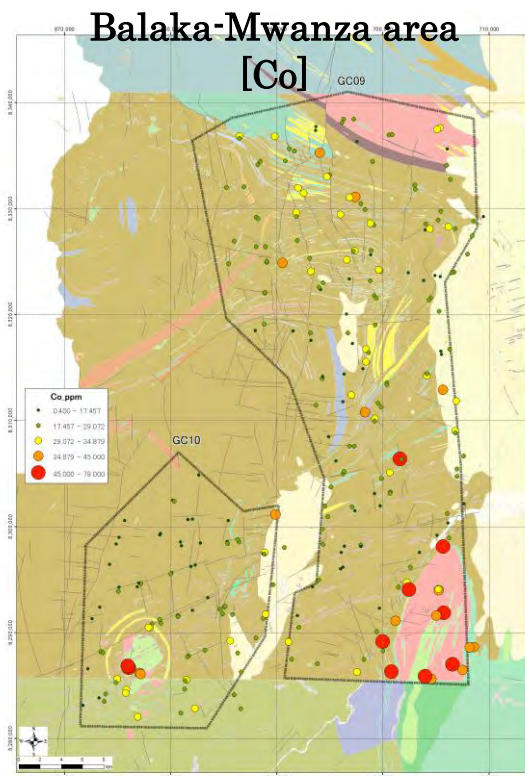


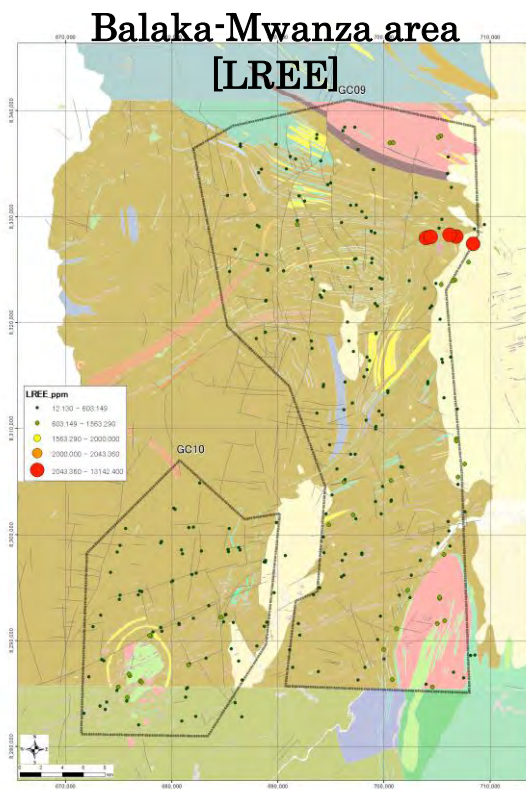
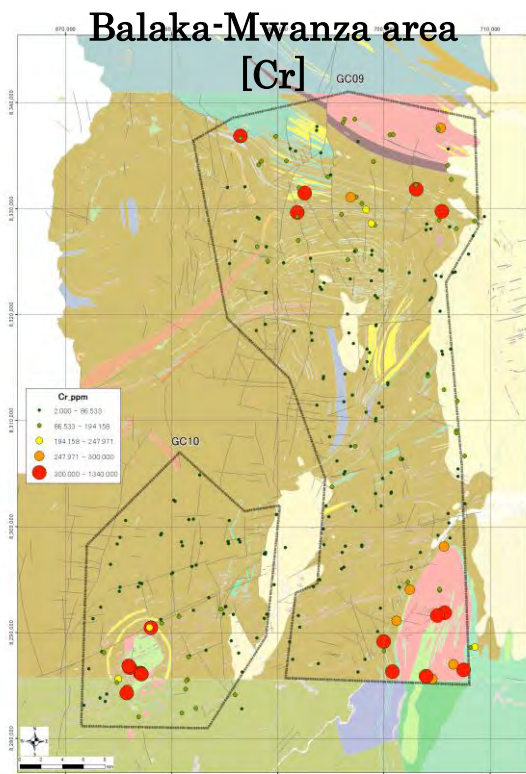


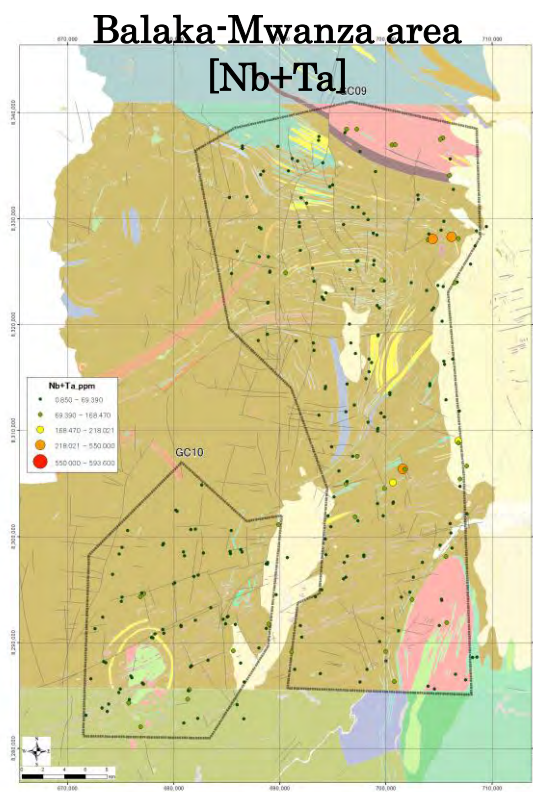
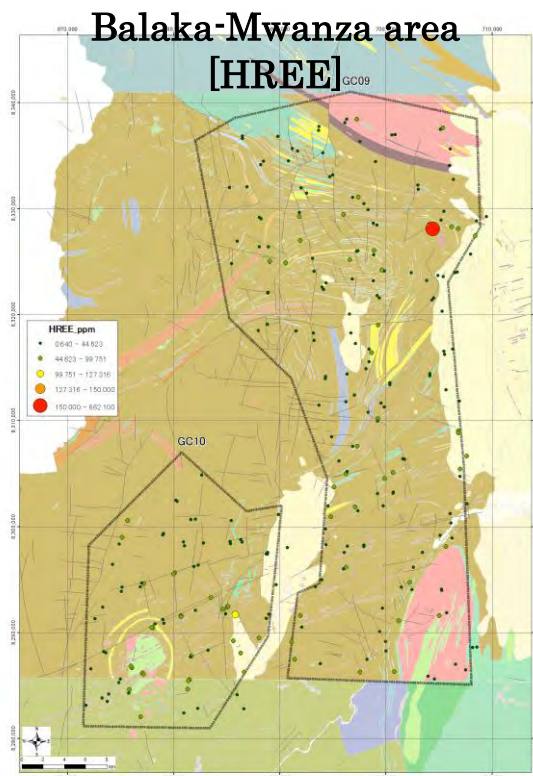


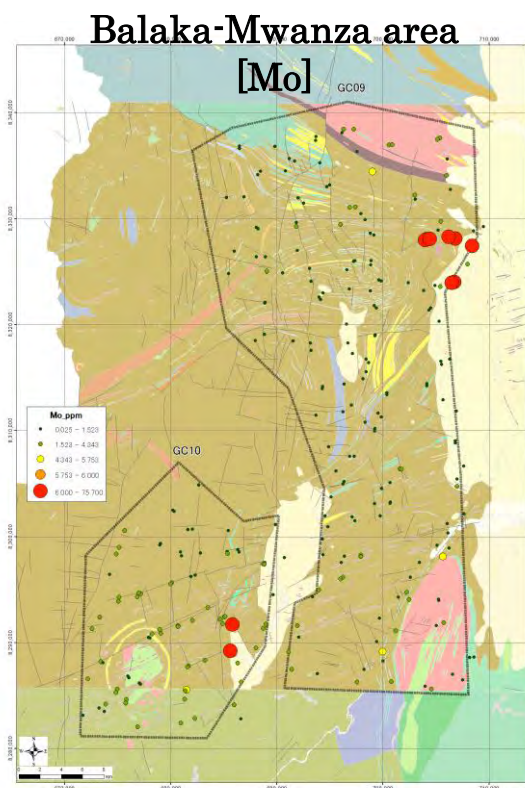
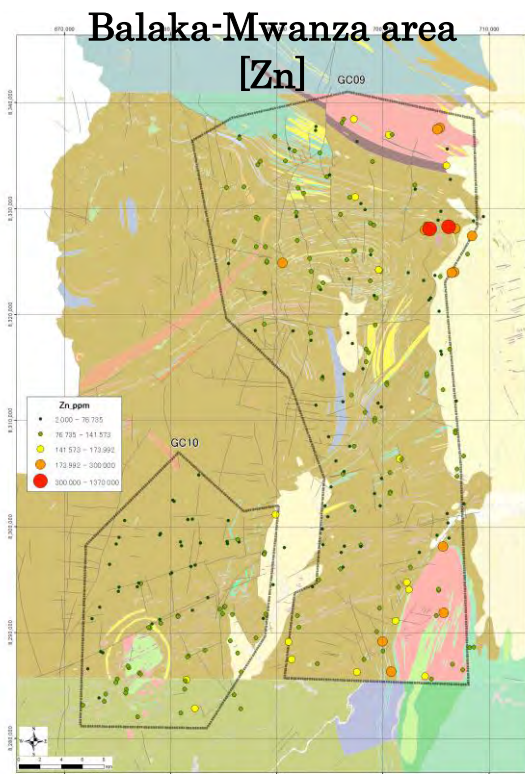
(7) GC09-10

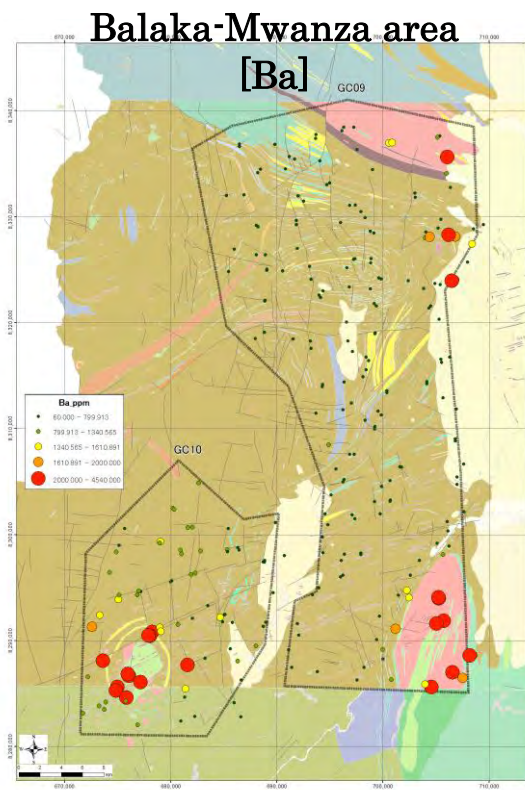
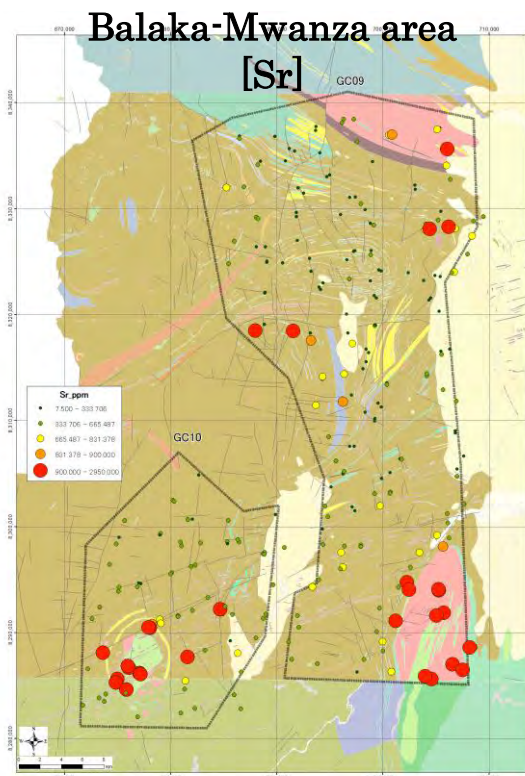


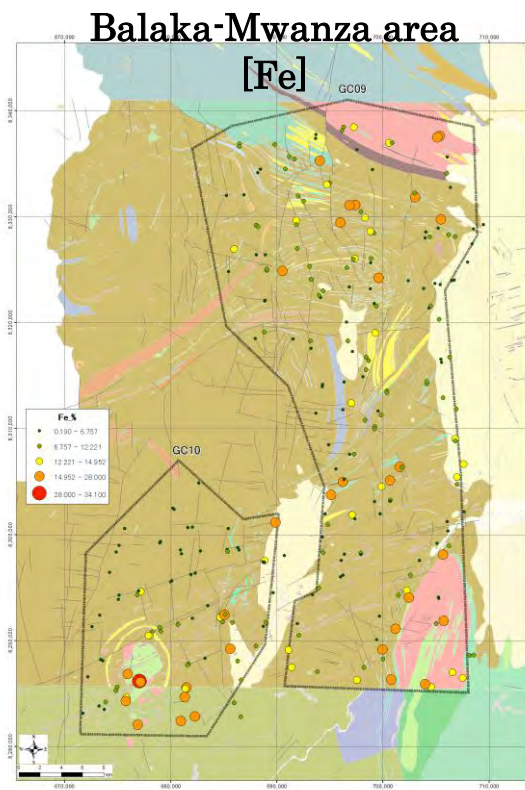
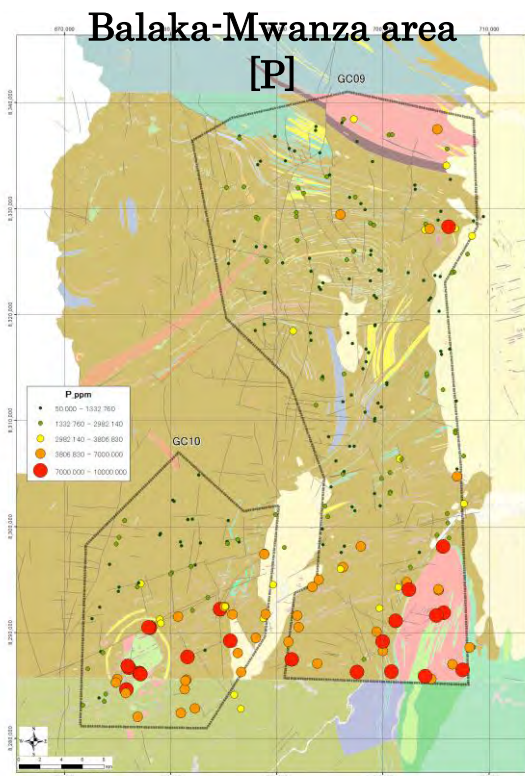




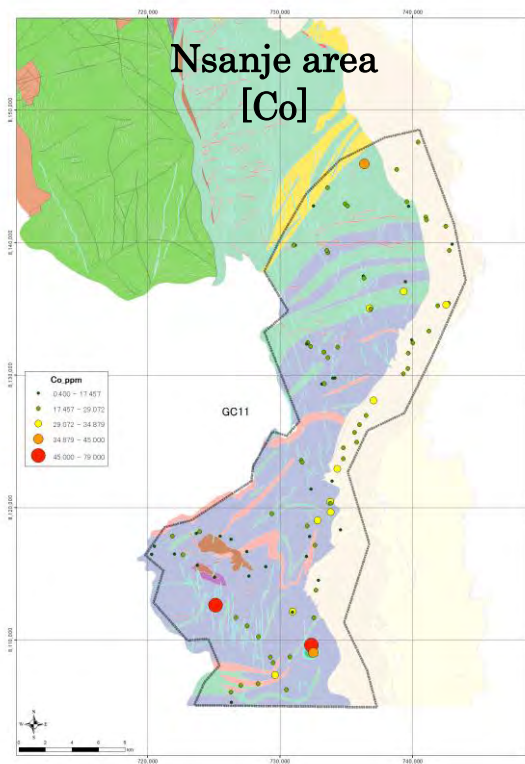
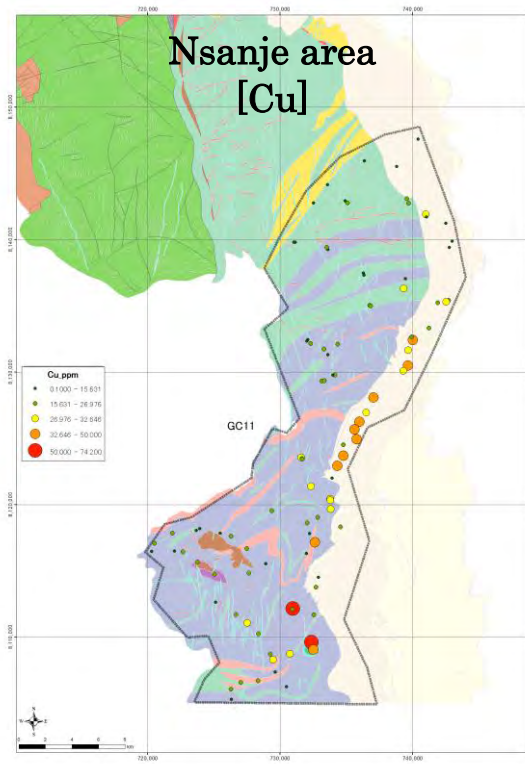


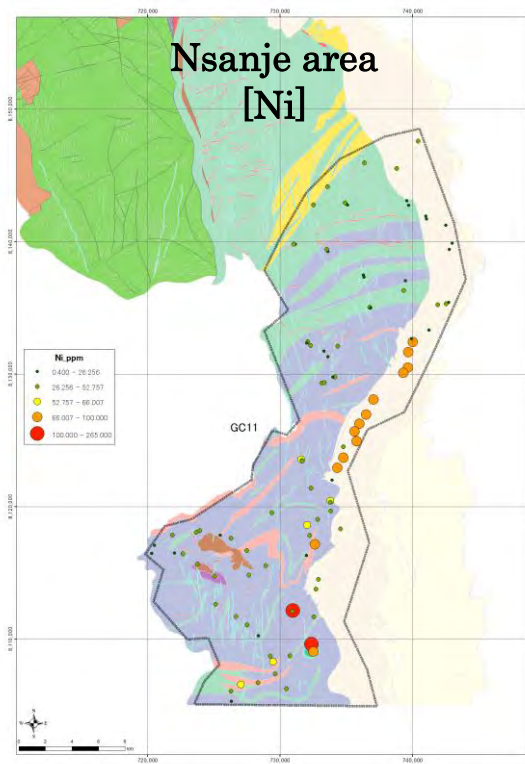
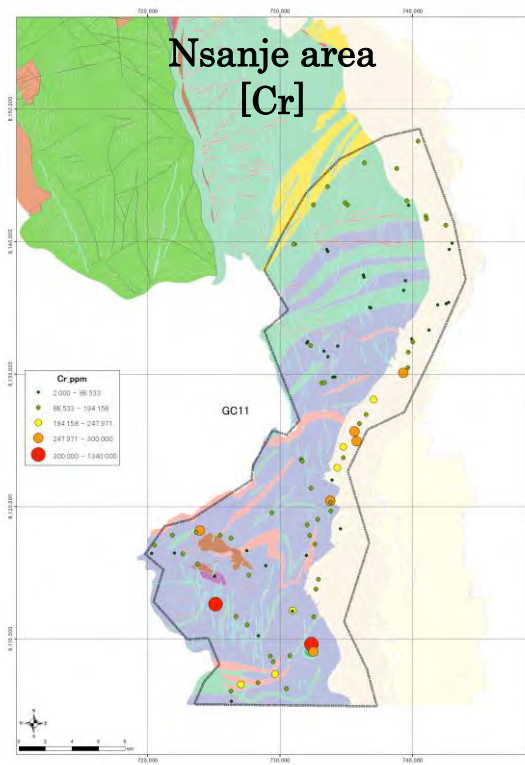


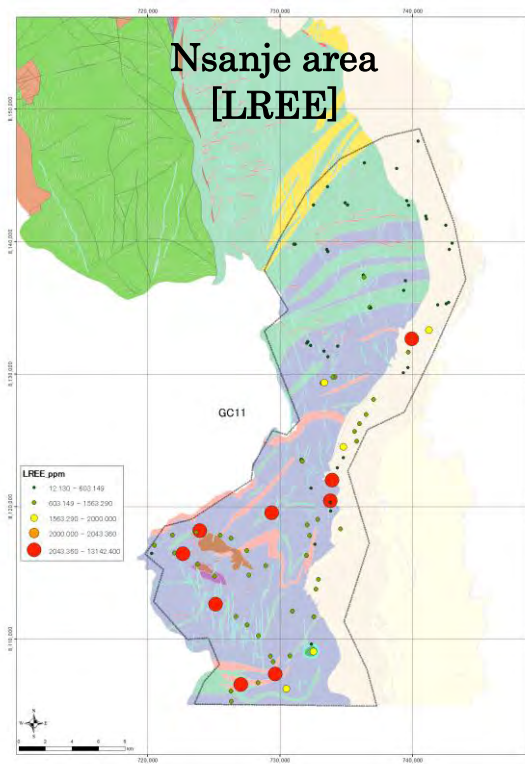
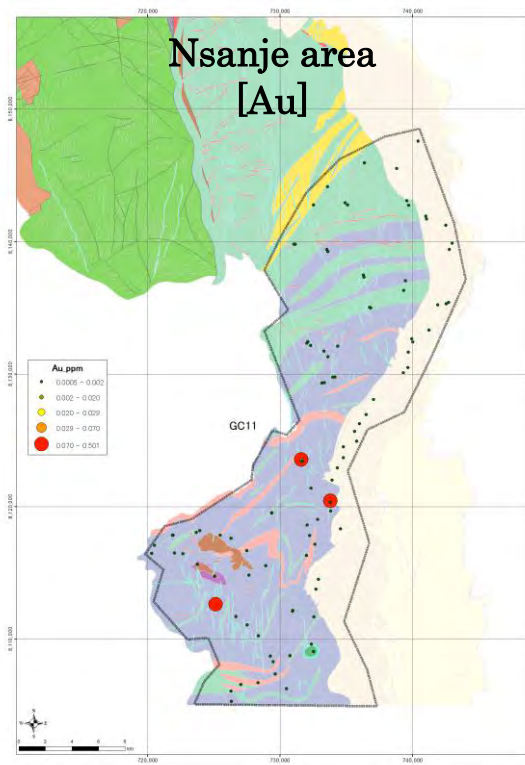


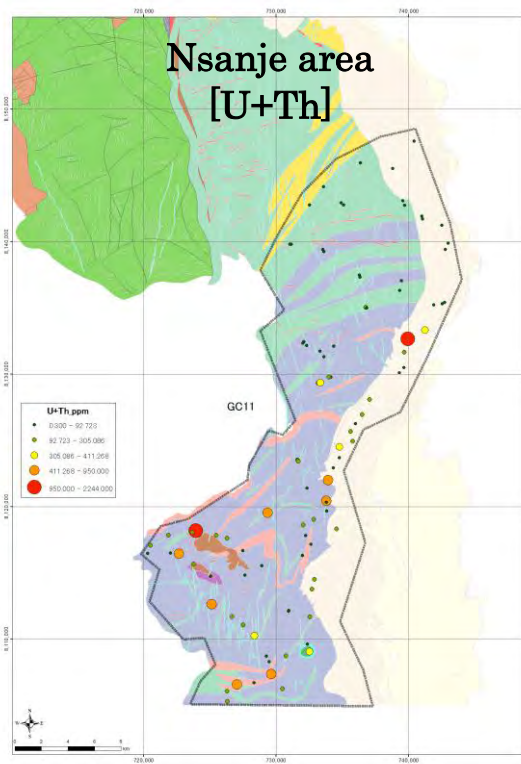
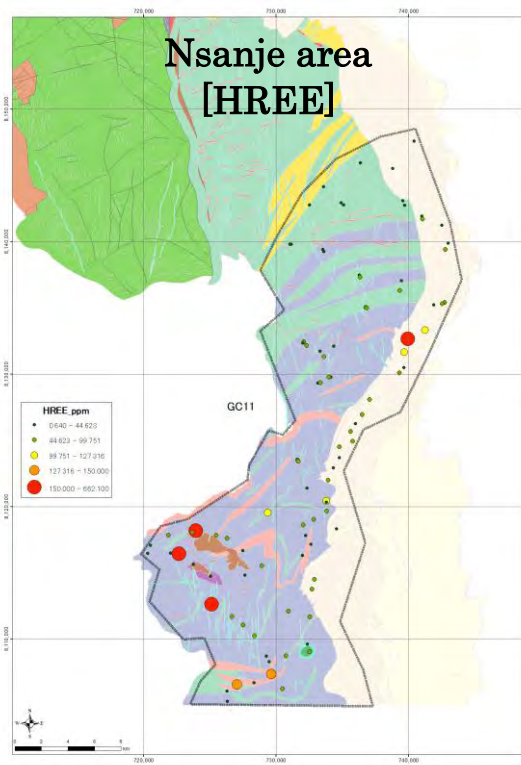


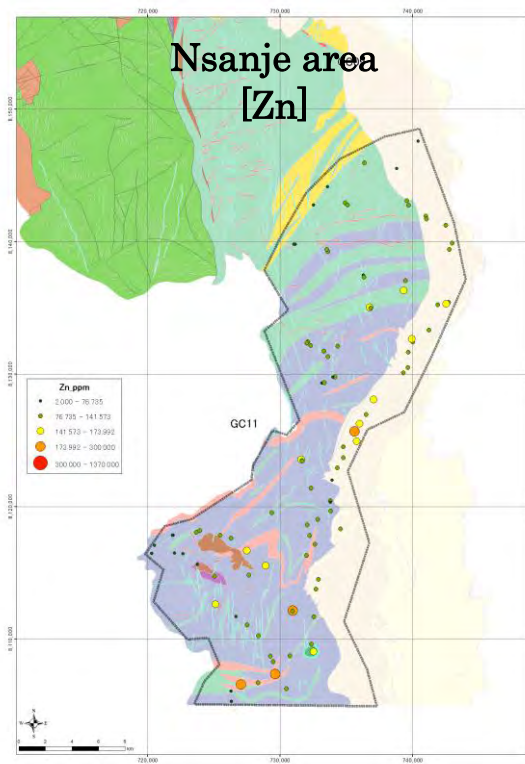
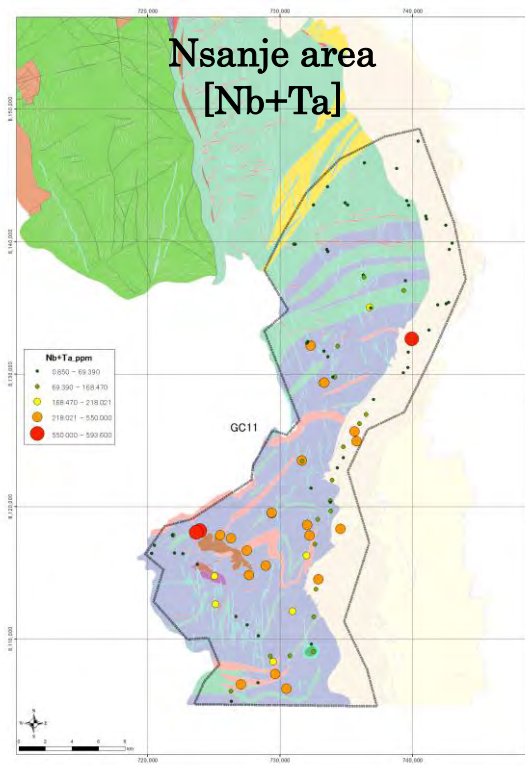
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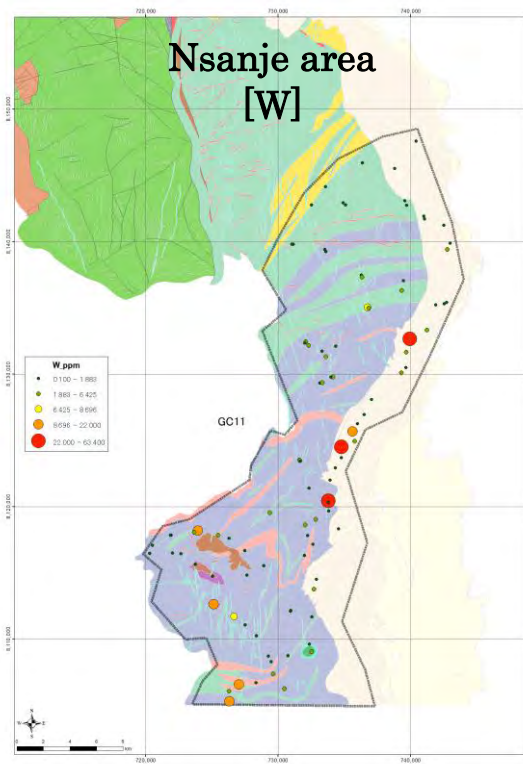
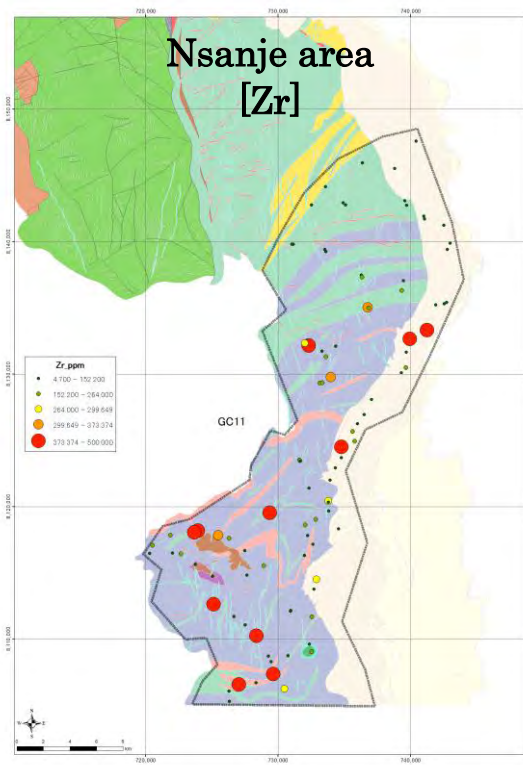


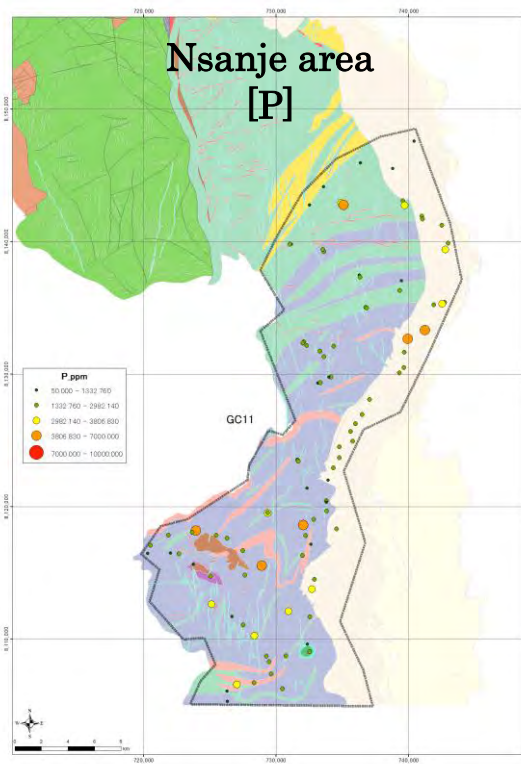
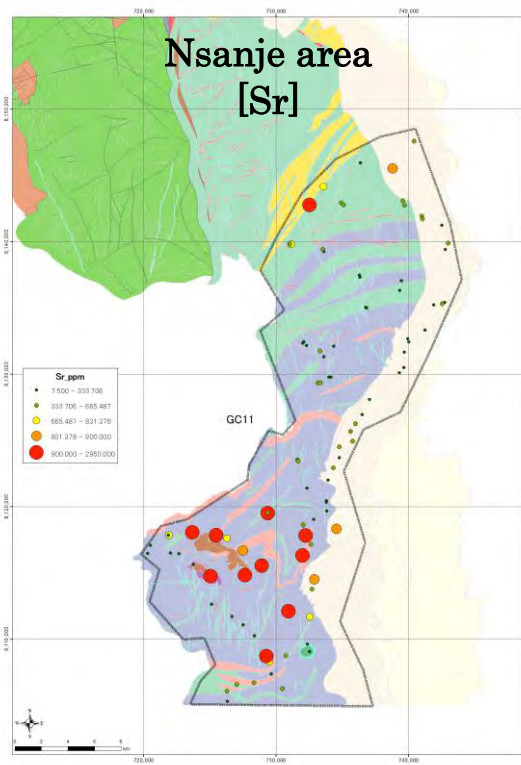












Thermo Scientific Niton Portable XRF Training



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Menu

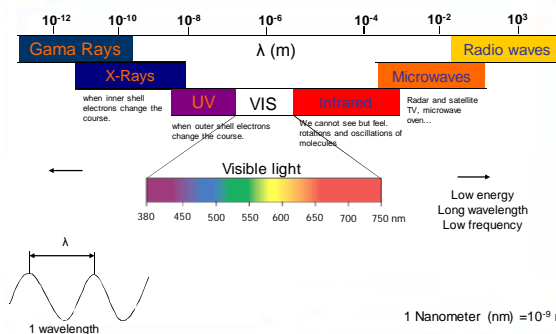
1. Basic XRF Theory
2. Radiation Safety
3. Sample Preparation
4. Basic Operation
5. Software installation and operation

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Basic XRF Theory

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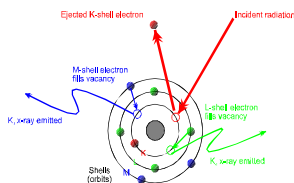
The Electromagnetic Spectrum



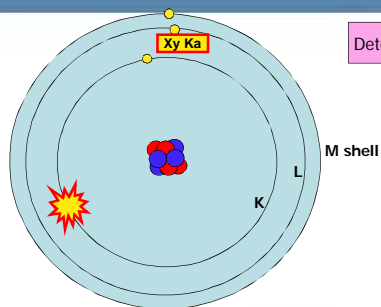
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XRF Analysis

Characteristic x-ray production:
primary x-rays cause atoms (elements) in a sample to fluoresce and emit characteristic x-rays

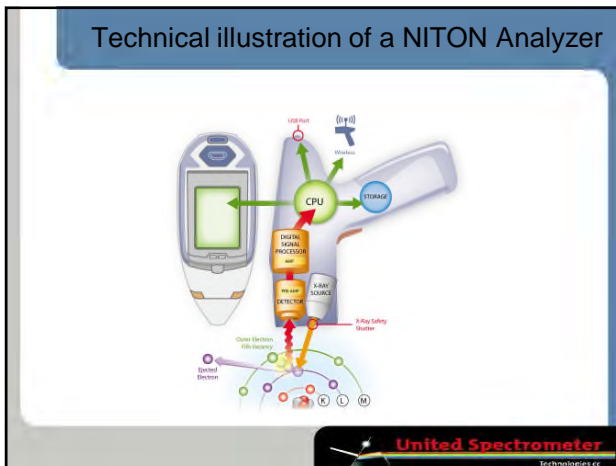
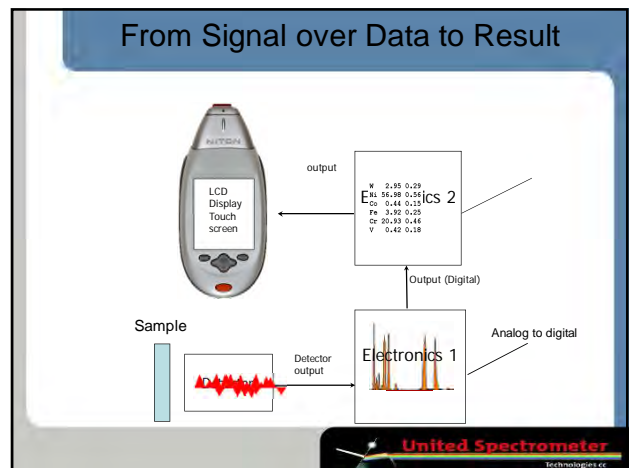
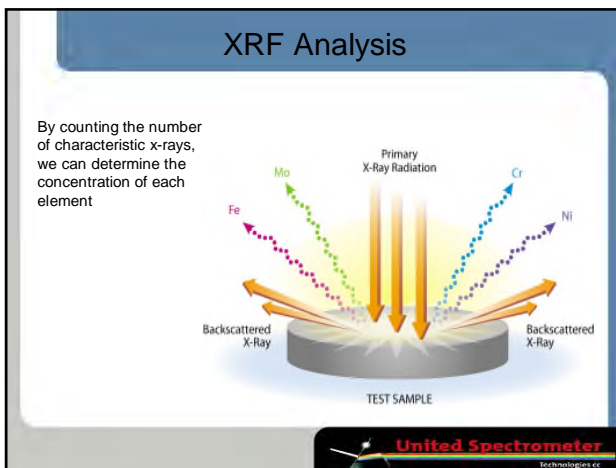


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X-ray source

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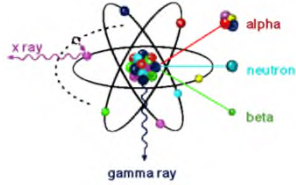


- ### This training presentation includes the following topics
- Basic Principles of Radiation
 - Dose & Dosimetry
 - Hazards and Relative Risk
 - Minimizing Exposure
 - Safe Use of NITON Analyzers
- United Spectrometer**
Technologies cc

- ### A Few Basic Terms
- **Radiation** is particles or waves of energy emitted from unstable atoms or electrons losing energy
 - **Ionization** is the removal of electrons from atoms when radiation interacts with material
 - **Source** small capsule that contains radioactive material which emits radiation
 - **X-Ray tube** used in place of a source. An x-ray tube is a vacuum tube that produces x-rays on demand.
- United Spectrometer**
Technologies cc

Types of Ionizing Radiation

- Alpha Particles
- Beta Particles
- Gamma rays
- X-rays



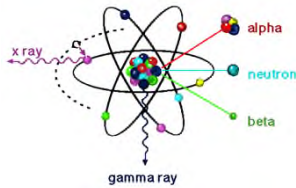
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Alpha Particle Radiation

- 2 neutrons & 2 protons
- Emitted from nucleus
- Low range (3 - 4 cm in air)
- Easily shielded
- Most dangerous when internally deposited

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Gamma and X Rays



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Gamma and X Rays

X-RAYS

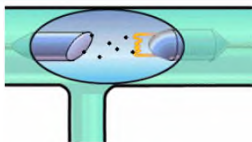
- X-Rays are emitted when an electron loses energy. This often occurs in the electron shells of an atom. It's a good thing this happens because these atomic, or fluorescent, x-rays are what a NITON analyzer measures to identify elements in a sample.

GAMMA RAYS

- Gamma rays originate in the nucleus of an atom when a nuclear transformation (or "disintegration") occurs there. These disintegration events are a natural process for some atoms that are referred to as radioactive.
- Gamma rays represent a high energy region of the electromagnetic spectrum.
- When emitted, gamma rays behave just like x-rays, although they are often more energetic and thus more penetrating.

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X-Ray Tube Basics



An x-ray tube is a vacuum tube that produces x-rays on demand. This slide illustrates how radiation is produced from an x-ray tube. At one end of the vacuum tube there is an electron emitter (often called a filament or cathode). These electrons are accelerated across the tube by applying a voltage potential between the cathode and a target at the other end. The target (often called an anode), absorbs the electrons. When the electrons lose their kinetic energy in the target, x-rays are produced. As we have mentioned earlier in this presentation, x-rays are produced when electrons lose energy.

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X-Ray Tube Basics


The x-rays are produced with various energies. This spectrum of energies ranges from zero keV up to the voltage potential applied to the tube. The most common energy is typically between a third and two thirds the maximum.

One can increase the number of x-rays produced by increasing the current that flows through the cathode. One can increase or decrease the maximum energy of the x-ray spectrum by adjusting the voltage potential across the tube accordingly.

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Potential Hazards

- Increased Cancer Risk
- Tissue Damage (e.g. Skin Burn)





ALARA

- **As Low As Reasonably Achievable**
- Take reasonable steps to minimize exposure (even if you are below regulatory limits)
- Time
- Distance
- Shielding



ALARA

- Time
- Distance
- Shielding


ALARA

The use of time, distance and shielding is integral in radiation protection and in maintaining radiation exposures as low as reasonably achievable (ALARA).

Let's Start with Time
 Assuming that "all things are equal," radiation dose is directly related to the amount of time of the exposure. By reducing the amount of exposure time, you will correspondingly reduce your dose. *You can incorporate this into use of a NITON analyzer by analyzing samples only as long as is necessary to get the result and appropriate level of precision you need.*



Now let's look at Distance
 By maintaining as much distance as is reasonably achievable between you and a source of radiation, you can reduce your dose significantly. The relationship between radiation exposure (dose) and distance follows the inverse square law. *You can incorporate this concept into use of a NITON analyzer by keeping hands and other body parts away from samples during an analysis.*

Finally Shielding
 Shielding simply means having something that will absorb radiation between you and the source of emission. The amount of shielding required to protect against different kinds of radiation depends on how much energy they have. Most of the radiation from the primary beam of a NITON analyzer can be stopped by about a millimeter of lead. *Use of a test stand for analyzing small or low density samples takes advantage of shielding.*




ALARA

Practice ALARA
As Low As Reasonably Achievable

Units of Radiation Exposure (Dose)

- **rad** is a measure of the energy deposited per unit mass of material (tissue)
- **rem** is based on the rad but takes into account correction factors for the type of radiation and the type of tissue. Outdated since 1985
- Sv1 rem = 0.01 Sv = 10 mSv
- **Quality Factor**(rem=rad X Quality Factor, QF for X-rays and gamma rays = 1, alpha = 20)



Exposure Levels

- RAD = Radiation Absorbed Dose
- RAD = 0.01 Joule per kg
- 100 RAD = Gray

- REM = Roentgen Equivalent Man
- REM = RAD x w_R
- w_R = Radiation Weighting Factor



Typical Radiation Doses Received (Source: NCRP 1987)

Category	Dose in mRem	Dose in mSv
Average total dose in US (annual)	360	3.6
Average worker exposure (annual)	210	2.1
Average exposure for an underground miner	400	4.0
Exposure for airline crew (1,000 hours at 35,000 ft)	500	5.0
Additional from living in Denver at 5300' (annual)	25	.25
Additional from 4 pCi/l radon in home	1,000	10.0
Typical Chest X-Ray	6	0.06
Typical Head or Neck X-Ray	20	0.2
Typical pelvis/hip x-ray	65	0.65
Typical lumbar spine x-ray	30	0.3
Typical Upper G.I. x-ray	245	2.45
Typical Barium enema x-ray	405	4.05
Typical CAT scan	110	1.10



Deep, shallow, and extremity exposure from a properly used Niton XL3t analyser should be **less than 200 mRem per year**

•The risk of cancer depends on the dose and begins to build up even with very low doses. There is no "minimum threshold."

•Position Statement of The Health Physics Society
 "...below 50 –100 mSv (which includes occupational and environmental exposures), risks of health effects are either too small to be observed or are non-existent."
 50-100 mSv = 5 – 10 Rem = 5,000 – 10,000 mRem
www.hps.org www.radiationanswers.org



- 1 Gy (Gray) = 100 000mrem – Niton less than 200 mRem per year

The only anticipated exceptions to the 200 mRem maximum annual dose are:
 1) routine and frequent analysis of plastic samples without use of a test stand, backscatter shield, or similar additional protective measures, or
 2) improper use where a part of the body is in the primary beam path.

Radiation in general.

- Total body exposure of 100 000 mRem causes radiation sickness.
- Total body exposure of 400 000 mRem causes radiation sickness and death in half the individuals. Without medical treatment, nearly everyone who receives more than this amount of radiation will die within 30 days.
- 1000 000 mRem causes almost immediate unconsciousness and death within an hour



Annual Occupational Dose Limits for Radiation Workers (Source: Code of Federal Regulations Title 10, Part 20)

Category	Dose in mRem	Dose in mSv
Whole Body	5000	50
Pregnant Worker <i>(Not more than 50 per month during gestation period)</i>	500	5
For a Minor below 18 years of age	500	5.0
Eye Dose Equivalent	15,000	150
Shallow dose equivalent to the skin or any extremity or organ	50,000	500
Maximum allowable dose for the general public	100	1.0

This limit covers radiation exposure of all types, except those arising from background radiation and medical procedures



Permissible Dose

The US Food and Drug Administration's current regulations state, "The amount of radioactive material to be administered shall be such that the subject receives the smallest radiation dose with which it is practical to perform the study without jeopardizing the benefits to be obtained by the study. Under no circumstances may the radiation dose to any adult research subject from a single study, or cumulatively from a number of studies conducted within one year, be generally recognized as safe if such doses exceed the following:

Single dose for an adult - 3,000 mRem;


Annual total dose - 5,000 mRem.



Annual Dose Limits

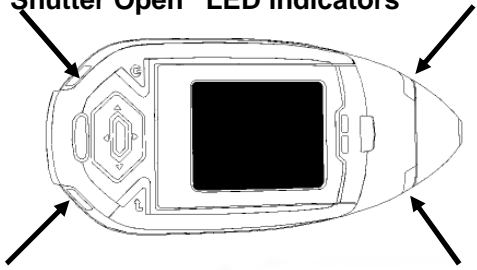

Objective

Whole Body	5 rem (50 mSv)	Limit Risk of Cancer
Skin, Extremities	50 rem (500 mSv)	Prevent Threshold Effects
Eye	15 rem (150 mSv)	Prevent Threshold Effects
Member of Public	0.1 to 0.5 Rem 1 to 5 mSv	Limit Risk of Cancer Support Training of Occupational Workers

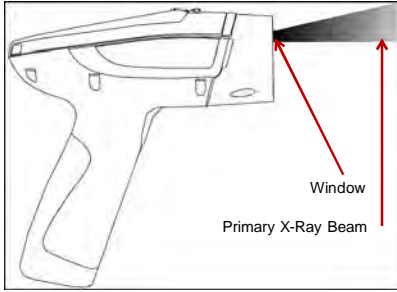



Know where the beam is

- “Shutter Open” LED indicators






Primary X-Ray Beam


Safe Use of NITON Analyzers

- Know where the beam is


Niton XL3t Radiation Profile – In Beam Measurements - Rem/hr

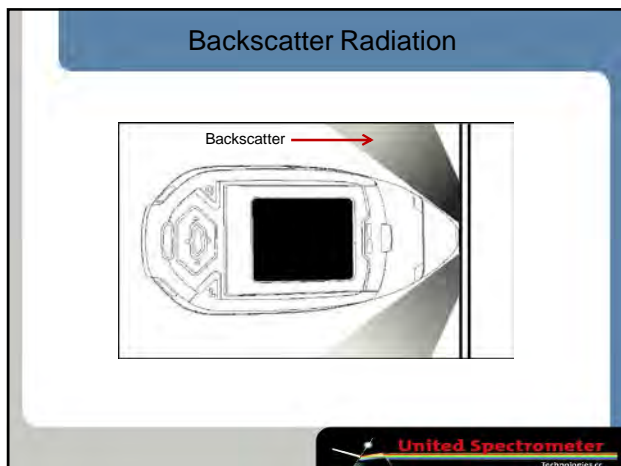
kV	uA	Range	Contact Deep	Contact Shallow	5cm Deep	30 cm Shallow
50	40	Mining (Main Filter)	150	380	36	2.2
50	40	Mining (High Filter)	44	130	7.4	0.53
15	133.3	Mining (Low)	24	1300	5.0	0.23
8	200	Mining (Light)	0.030	1700	0.010	<0.0003



Niton XL3t Radiation Profile – In Beam Measurements - Rem/hr

kV	uA	Range	Contact Deep	Contact Shallow	5cm Deep	30cm Deep
50	40	GM, PM, M, S, IP (Main)	150	380	36	2.2
15	133.3	GM (Low)	24	1300	5.0	0.23
8	200	GM, P, M (Light)	0.030	1700	0.010	<0.0003





Niton XL3t GOLDD Plus Radiation Profile - Scatter Measurements - mRem/hr

kV	uA	Range	Substrate	Max @ 5cm	Max @ 30 cm	Max @ Trigger
50	40	Mining (Main Filter)	Soil	4	0.09	<0.01
50	40	Mining (High Filter)	Soil	2	0.04	<0.01
20	100	Mining (Low Filter)	Soil	<0.01	<0.01	<0.01
8	200	Mining (Light Filter)	<0.01 (no detectable scatter radiation) at any location for steel, aluminum, soil, or plastic sample types			

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Niton XL3t GOLDD Plus Radiation Profile - Scatter Measurements - mRem/hr

kV	uA	Range	Substrate	Max @ 5cm	Max @ 30 cm	Max @ Trigger
50	40	GM, PM, M, S, IP (Main)	Steel	0.3	<0.01	<0.01
50	40	GM, PM, M, S, IP (Main)	Aluminum	4	0.01	0.01
50	40	GM, PM, M, S, IP (Main)	Soil	4	0.09	<0.01
15	133.3	GM (Low)	Steel	<0.01	<0.01	<0.01
15	133.3	GM (Low)	Aluminum	<0.01	<0.01	<0.01
8	200	GM, P, M (Light)	<0.01 (no detectable scatter radiation) at any location for steel, aluminum, soil, or plastic sample types			

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Annual Dose Limits

Lowest Time to reach limit (on window contact)

Whole Body	5 Rem 50 mSv	2.1 minutes (unless to an extremity)
Skin, Extremities	50 Rem 500 mSv	1.57 minutes anywhere
Member of Public	0.1 to 0.5 Rem 1 to 5 mSv	2.5 to 9.5 seconds !! (depending on where and how)

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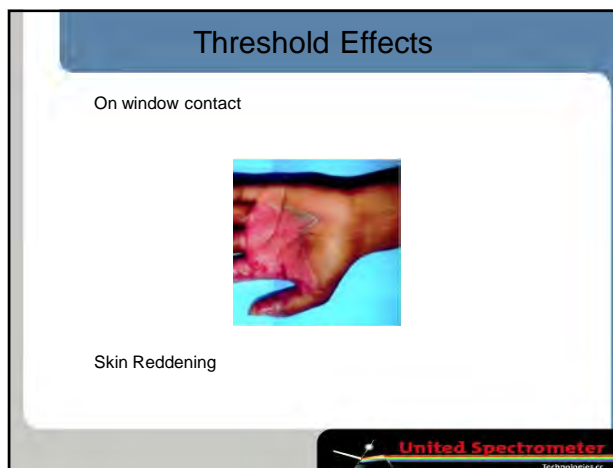
Threshold Effects

On window contact

Effect	Threshold Dose	Time to Reach Effect (estimated)
Skin Reddening (Erythema)	300 - 500 Rem 300,000 - 500,000 mRem	9.5 minutes !!
Skin burns (Transepidermal injury)	1000 Rem 1,000,000 mRem	32 minutes
Tissue Death (Dermal radionecrosis)	2000 - 3000 Rem 2,000,000 - 3,000,000 mRem	1 hour


Deep, shallow, and extremity exposure from a properly used Niton XL3t analyzer should be **less than 200 mRem per year**

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Threshold Effects

On window contact




Skin burns

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Threshold Effects

On window contact



Tissue Death

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Is our device safe to operate?

YES!



WHEN USED PROPERLY

Note: This is also true of cars, power tools, laser pointers, etc.

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Safe Use of Niton

#1 Rule Never Aim Primary Beam at Yourself or Others!!



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Safe handling of samples

There is **always** a **safe way** to take a measurement

- Never hold a sample during analysis
- Consider test stands, sample holders, and sample placement
- Use common sense

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Safe handling of samples

Safe handling of samples



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Small or Irregularly Shaped Samples

CHALLENGE



This sample is small and irregularly shaped

Careful positioning might be essential to proper measurement

EASY SAFE SOLUTION



Here, a versatile clamp is used to maintain proper positioning of the sample

Samples that Roll Away

CHALLENGE



This sample tends to roll away from the measurement window

The operator should not hold any sample to prevent this

EASY SAFE SOLUTION



Placing an object behind the sample can keep it positioned safely

Safe Use of Niton

- Participate in a dosimetry program
- Wear dosimeter appropriately

Measuring a Person's Dose

Dosimetry

Wrist



Finger



Body



Good Practises

- Never leave unit unattended
- Store unit in a safe place
- Transport in a shock-proof case
- Never aim at yourself or others
- Be aware of primary beam indicator lights
- Handle and Use with Respect



Good Operating Practice

- Follow manufacturer's instructions
- Follow state and federal guidelines

Good Operating Practice

Deep, shallow, and extremity exposure from a properly used Niton XL3t analyzer should be less than 200 mrem per year, (2.0 mSv per year) even if the analyzer is used as much as 2,000 hours per year, with the shutter open continuously. The **only** anticipated **exceptions** to the 200 mrem maximum annual dose are:

- 1) **routine and frequent analysis of plastic samples without use of a test stand, backscatter shield, or similar additional protective measures, or**
- 2) **improper use where a part of the body is in the primary beam path.**



Good Operating Practice

- Treat radiation with respect, as you would high voltage or your laptop



Training record

A training record should be created for individuals receiving radiation safety training. Such a record should include:

- Name and signature of student
- Name and signature of presenter (if applicable)
- Date of training
- A copy of the training material or a summary of topics covered

Note: The material in this presentation may not be sufficient to satisfy all training requirements



Questions



Sample Preparation



Thermo Scientific Niton XRF Analyzers
WHAT ARE THE TEMPERATURE LIMITS FOR MY ANALYZER?

Analyzer	Niton XL2	Niton XL3t	Niton XL3p & Niton XL3pi	Niton XLp & Niton XLI	HotFoot
Window type	Propylene PN 187-1555 Fiberglass® PN 187-1454	Propylene PN 187-1555 Fiberglass® PN 187-1454	Kapton® PN 187-1557	Kapton PN 187-718	Protects instrument and operator's hand during rapid PMA analysis of hot surfaces up to 800°C Niton XL3i - PN 430-426 Niton XL3pi - PN 187-969
Max. Temperature without Hot work standoff	150°C/300°F	150°C/300°F	400°C/750°F	400°C/750°F	Hot work standoff Protects workbench during rapid PMA analysis of hot surfaces PN 430-220
Max. Temperature with Hot work standoff	500°C/930°F	500°C/930°F	500°C/930°F	Not Available	
Max. Temperature with HotFoot™ hot surface adaptor	Not Available	450°C/840°F	450°C/840°F	450°C/840°F	

Note: Thermo Fisher Scientific recommends rapid sample times (3 seconds or less) to ensure damage does not occur to the window or analyzer.

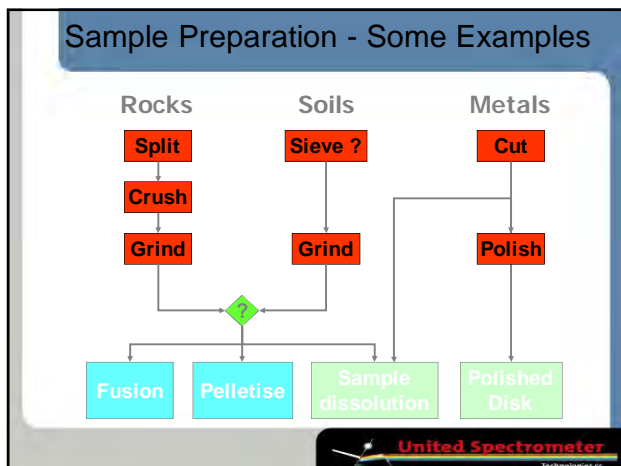
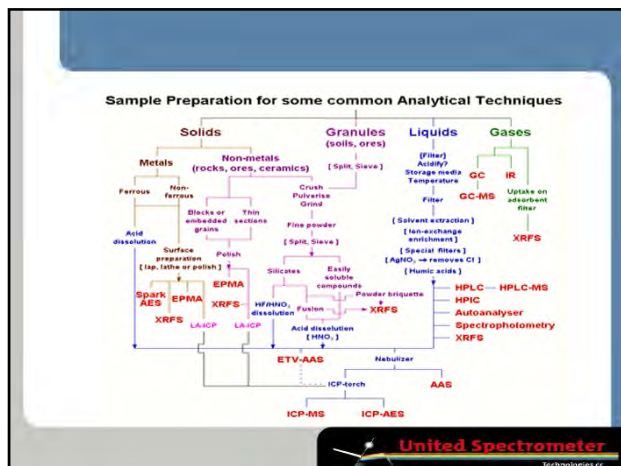
Address:
Thermo, 540 S.E. 17th St.
Miami, FL 33135, USA
Phone: +1 305 874 2000
Fax: +1 305 874 2000
E-mail: order@thermo.com

Energy Media and More:
Hot Surface Adaptor
HotFoot™ Standoff
Part No. 430-220
Fax: +1 305 874 2000
E-mail: order@thermo.com

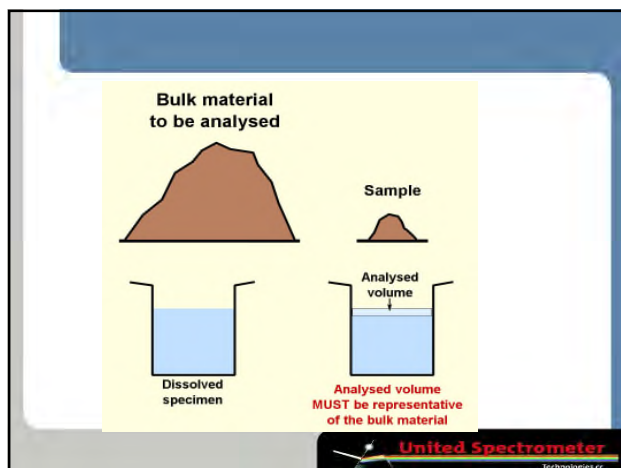
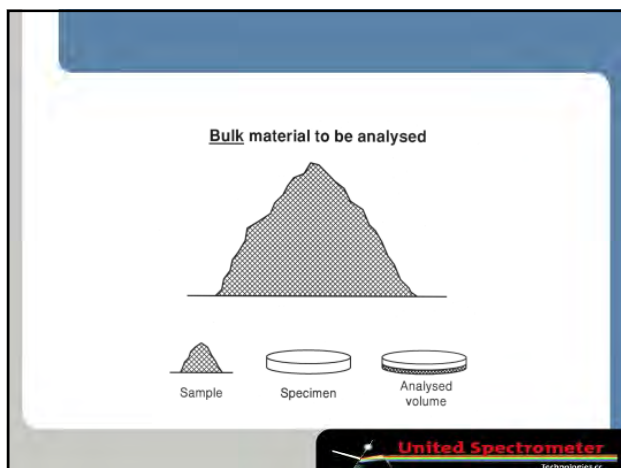
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Asia, Singapore, Hong Kong
Phone: +852 2608 8625
Fax: +852 2608 8625
E-mail: 400public@thermo.com

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- ### Objectives Of Sampling And Specimen Preparation
- The sample selected from the bulk material and used to prepare the specimen should be representative of the bulk.
 - The prepared specimen should be representative of the sample.
 - The volume of the specimen analyzed should be representative of the entire specimen.
 - Therefore, the analyzed volume of the specimen will be representative of the bulk material.
- United Spectrometer Technologies cc



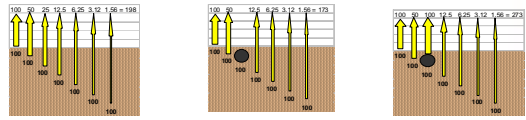
Sample considerations

- Particle Size and Sample Heterogeneity 'most important'
- Sample Type (e.g. heavy clay, rock face, surface soil, blast holes)
- Element Concentration Distribution (Pb/As, Fe/Co)
- Moisture (up to 10% OK)



Sample considerations

- Particle size is critical due to depth of penetration of the X-Rays into the sample



- Sample thickness is also a consideration



Sample considerations

- Due to the nature of the sample area, Heterogeneity is very important.
- What ever is in the area of excitation will be analysed and measured and reported.



- If homogeneous samples are not available several measurements may need to be taken on the same sample -> use the average function!



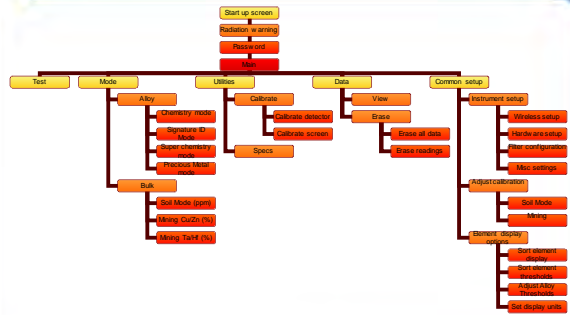
Sample considerations

Ideal samples:

- Pulp – Small particle size, homogenous, mixed samples
- Sieved – If sieved below 100 micron a similar results to pulps can be achieved



Basic Operation




Software installation




Installation

1. Insert NDT CD
2. Autorun or Explore and double click installer
3. Switch on analyzer and connect to PC using USB cable
4. Windows install USB driver or if prompted look on CD




Installation


5. Open NDTR.
6. If prompted choose Comm Port as Thermo Scientific Port
7. Baud Rate 115200
8. Save settings.
9. Open NDT.
10. Click download
11. Connect using Thermo Scientific Port




External Features




- Tilt-able Color Touch Screen
- Extends 90 degrees from horizontal



- Narrow, tapered snout for easy access into corners
- Carbon filled Resin front
- Little to no Background
- 600 F melting point




- Sealed Communications Ports in Instrument, not battery
- USB, Serial, Remote Trigger and Power inputs




- Molded in multi-function keypad
- More Robust

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XL3 - Internal Features




- 6 Position filter wheel
- Improved detector and X-Ray tube heat sinking



- Single Unit X-Ray Tube
- 50kv, 2Watt Au anode



Modular design for easier assembly and testing



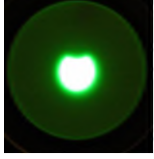
Improved structural design to eliminate cracking

77

The X-Ray Tube

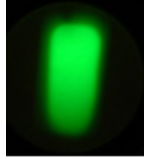
- 2 Watt Au Anode X-Ray Tube
 - 50kV & 40uA
 - 40kV and 50uA
 - 15kV and 100uA
- Supplied by both NSI and Moxtek

XL3 Spot



Well Focused.
~8mm diameter

XL1 Spot



Less Focused.
~1.5 cm x 1cm

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