HASHEMITE KINGDOM OF JORDAN

MINISTRY OF ENERGY AND MINERAL RESOURCES

THE GEOCHEMICAL SURVEY AND PROSPECTING WORKS FOR THE BRGM'S GEOCHEMICAL ANOMALY "ARAGEO-2"

SUMR ET-TAIBA MOUNTAINS AREA

Mineral Resources Studies Directorate

(Incomplete edition/Work in progress)

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2023

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1. INTRODUCTION

In response to the accelerating of global competition in production Precious, base metals & REE, the Jordanian government represented by the Ministry of Energy & Mineral resource (MEMR) has adopted new strategy targets expanding various type of metals exploration as well as optimal utilize of mineral resources, accordingly, plenty of mineral resources exploration projects were launched in the last five years included Phosphate, Potash, REE, Gold, and base metals according to the results of Geological & Geochemical studies that were implemented by MEMR represented by Natural Resources Studies Directorate (NRSD) and other global agencies over the country.

Based on the regional geochemical survey conducted by BRGM, which identified the Sumr et-Tayyiba Mountains area "ARAGEO-2 anomaly" as a potential target for the presence of gold and base metals mineralization, this follow-up geochemical survey, which has begun on 10/16/2022, aimed to continue the work on tracing the source of geochemical anomalies and identifying them more precisely to study and evaluate them by a joint team formed from the geological and geochemical surveys and prospecting studies divisions.

2. PREVIOUS STUDIES AND THE IMPORTANCE OF THE AREA

A regional geochemical survey of the basement rocks in the south of Jordan was carried out by the Geochemical Survey Division (MEMR), in cooperation with the French Geological Survey (BRGM), and a final report was published in 1994.

Stream sediments and heavy mineral concentrates were collected to determine the abnormal concentrations of elements indicative of mineralization.

As a result, several areas were identified as geochemical anomalies and recommended to follow-up. The Sumr et-Tayyibah Mountains is one of these anomalous areas within Wadi Araba region and is known, according to BRGM, as the ARAGEO-2 anomaly.

Seventeen (17) stream sediment samples and five (5) heavy mineral concentrates were collected by BRGM from the second-order streams within the study area with a sampling density of about 4 samples/km^2 (Fig. 1).

The study area “ARAGEO-2” contains anomalous concentrations of zinc and lead, in addition to shows of gold (Appendix A). The presence of such element association with concentrations above normal "background" makes the area potential for economic mineralization and therefore should be studied in detail.

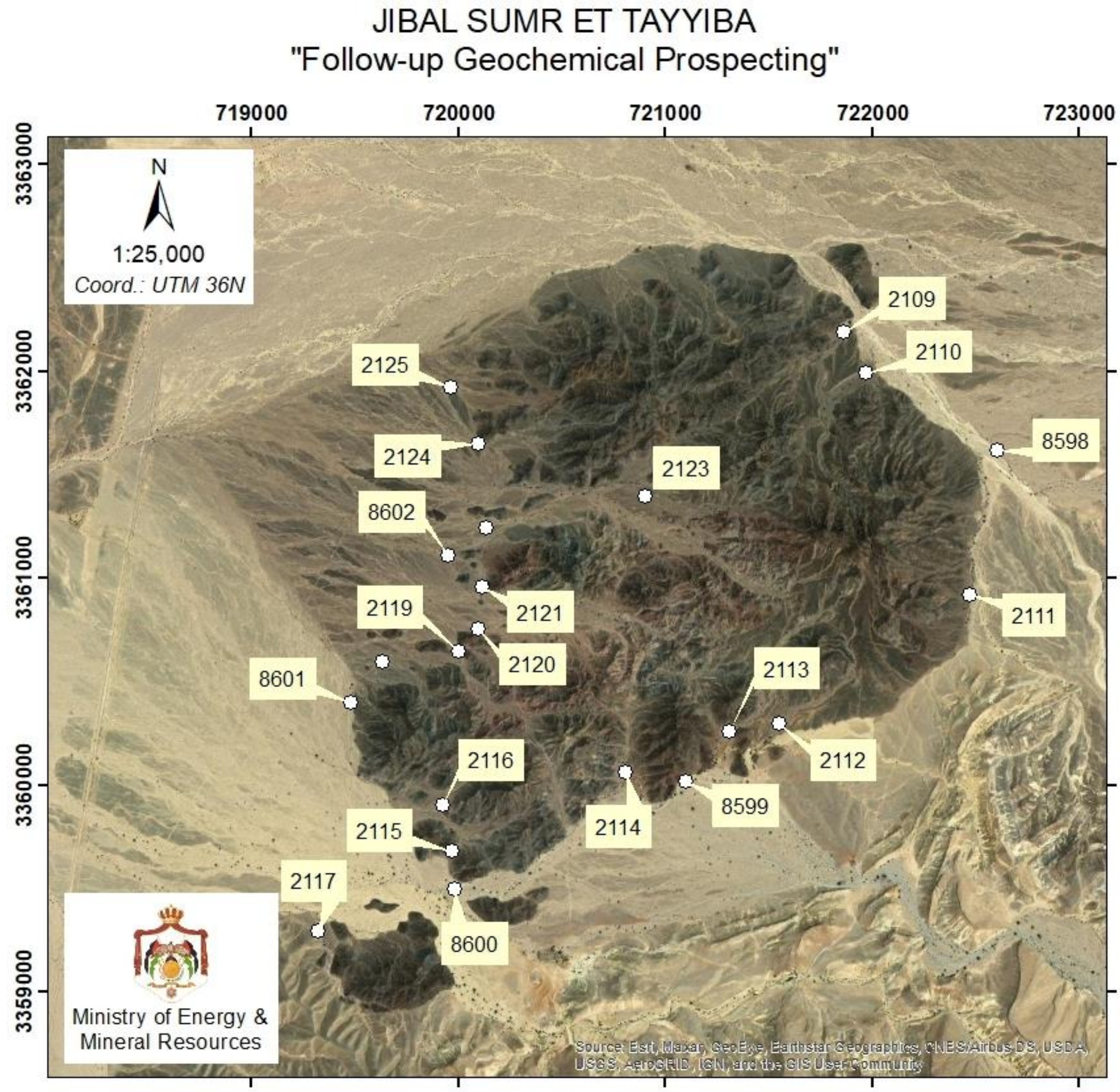


Figure 1: Distribution of Previous Survey Samples (BRGM).

3. LOCATION

The study area is in Wadi Araba, about 230 km south of Amman along the Dead Sea-Aqaba Road, and about 9 km south of Bir-Mathkour village and it can be accessed via dirt roads (Fig. 2).

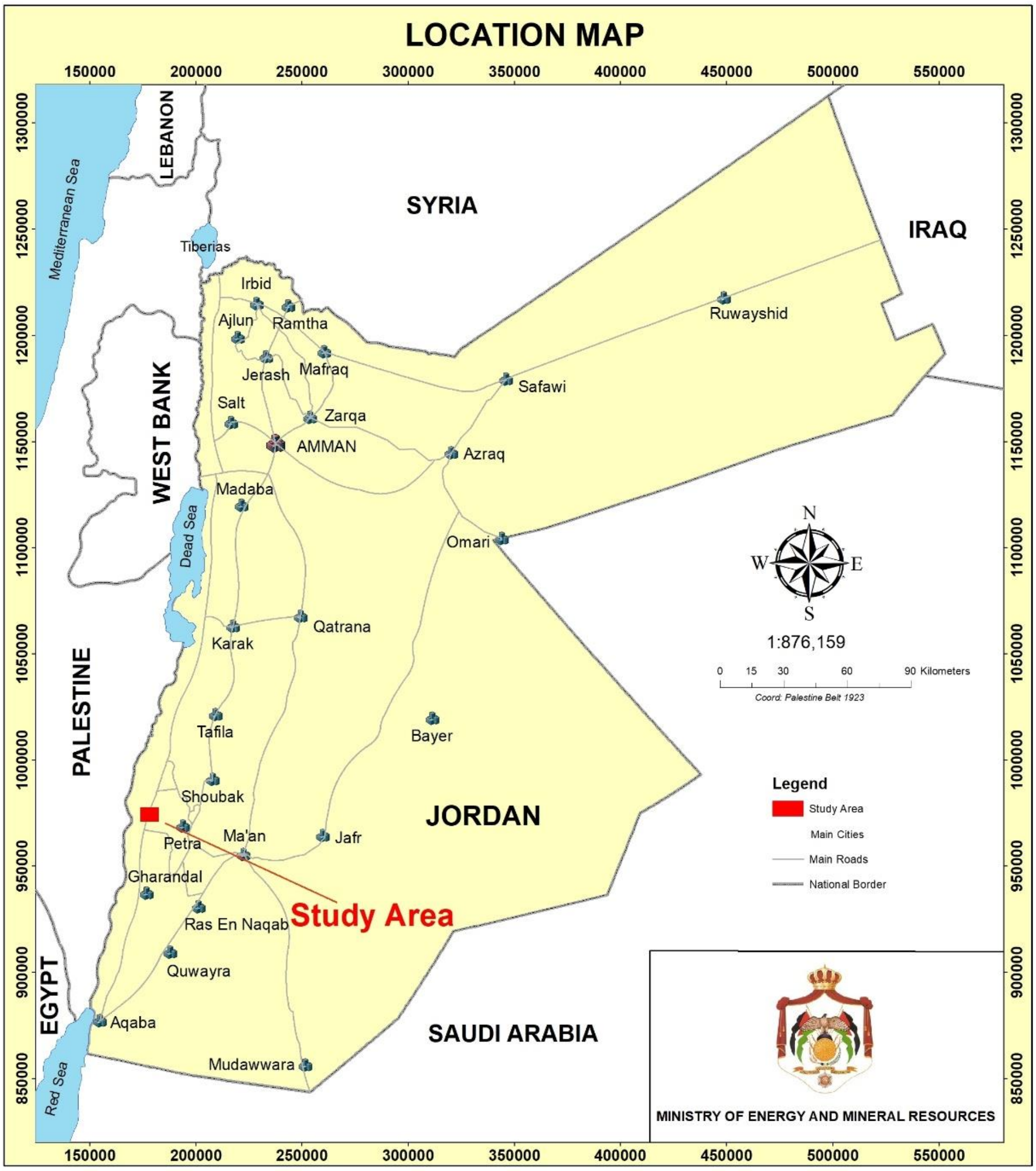


Figure 2: Location OF THE STUDY AREA

4. GEOLOGY AND TOPOGRAPHY OF THE STUDY AREA

From a geological point of view, the Sumr et-Tayyibah Mountains consist entirely of Pre-Cambrian rhyolite volcanic rocks “AM” surrounded by sediments of Pleistocene and Quaternary alluvial and flood plains (Fig. 3). On the south, it is structurally bordered by Cretaceous sedimentary rock units consisting of sandstone, limestone, argillites, marl, phosphate, and chert.

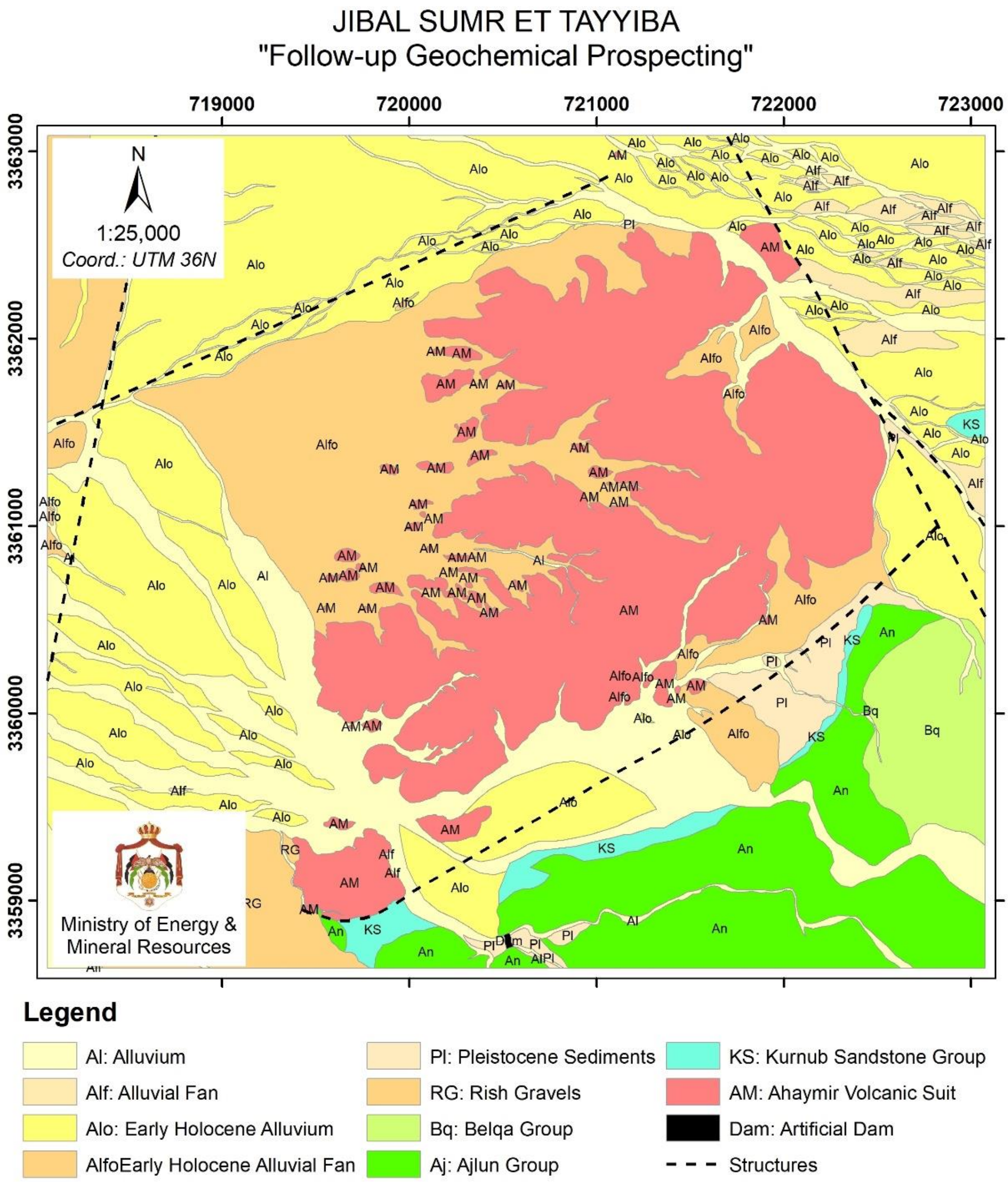


Figure 3: geology of the study area.

The main faults, which are believed to follow the Dead Sea Transform Fault System “DSTF”, surround the AM from all sides forming a semi-circular shape with peaks concave towards the west where the general inclination is (Fig. 4). Thus, it is likely that there are complex structures within the study area that need a detailed study.

The closest exposure of the same rock unit “AM” is located about 6 km to the east in Wadi Abu-Khusheiba.

The lowest altitude in the study area is about 175 m a.m.s.l in the west, while the highest altitude is about 400 m a.m.s.l in the east, with a height difference of about 225 m. Half of the study area is characterized by a flood plain terrain with a complex network of interlocking streams, while the mountainous areas, which are located in the middle of the study area, form the rhyolite volcanic rocks of the AM, and those in the southeastern corner, form the Cretaceous sedimentary rocks of the Kurnub Sandstone Formation “KS”, and carbonate formations belong to the Ajloun and Balqa Groups. The slope is generally gentle in most of the area of about 4o and reaching its maximum on the slopes of the high mountains.

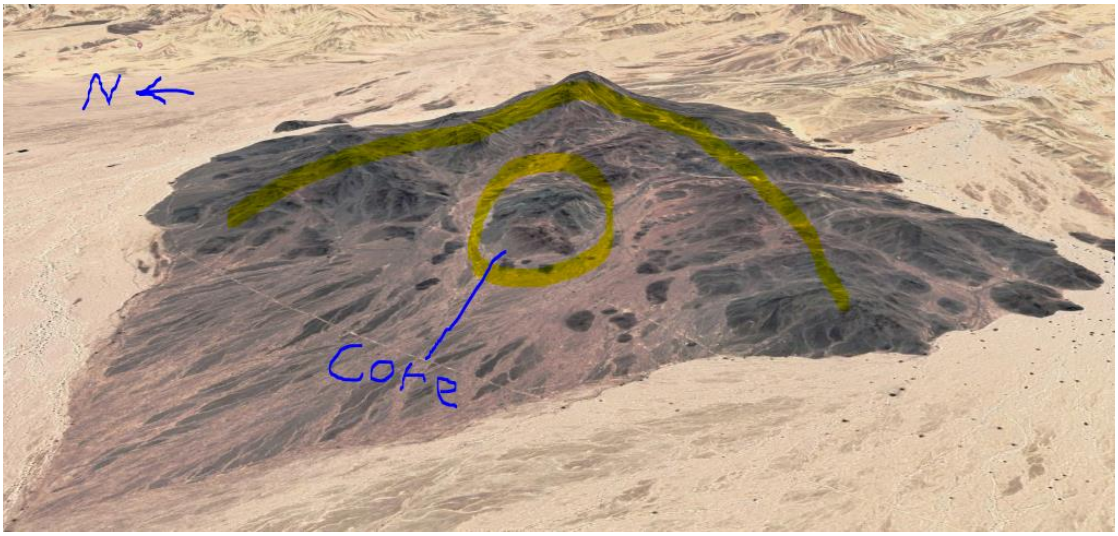


Figure 4: Distribution of AM Rock Unit.

5. GEOCHEMICAL FOLLOW-UP SURVEY FOR THE BRGM's GEOCHEMICAL ANOMALY "ARAGEO-2"

5.1. THE AIM OF THE STUDY

Based on the regional geochemical survey conducted by BRGM, which identified the Sumr et-Tayyiba Mountains area "ARAGEO-2 anomaly" as a potential target for the presence of gold and base metals mineralization, this follow-up geochemical survey, which has begun on 10/16/2022, aimed to continue the work on tracing the source of geochemical anomalies and identifying them more precisely to study and evaluate them by a joint team formed from the geological and geochemical surveys and prospecting studies divisions.

The rhyolitic rocks of the Aheimir Volcanic Suit "AM", which are considered the target rocks for being a potential target for the presence of gold and base metals, cover an area of about 6.5 km^2, which makes the task of exploration by sampling rocks very difficult and costly and takes a long time due to the large volume of rock samples that must be collected to identify the source of anomalies.

Therefore, stream sediments sampling method is the best option in such circumstance as the easiest and cheapest way to trace and locate the sources of mineralization. Since the stream sediments represent a secondary geochemical halo that follows the stage of mineralization formation, consequently it is necessary to identify the primary geochemical halo that was associated with the formation of these mineralization. The size of the primary dispersion halo varies, and, in all cases, it is considered small when compared to the secondary dispersion halo and most of its components can be caught in the stream sediments due to their availability in reasonable quantities and the ease of their disintegration and transportation by water in the streams of the valleys. They are known as the pathfinder elements. When components of the same ore are caught, such as gold, then it is considered as indicator.

The process of liberation and dispersion of pathfinder elements in the secondary dispersion halo is measured in parts per million (ppm), i.e., g per metric ton. Naturally, the concentration of pathfinder elements increases near the source (i.e., the primary dispersion halo) and decreases farther from it.

5.2. WORK METHODOLOGY

5.2.1. CATCHMENT AREAS DELINEATION

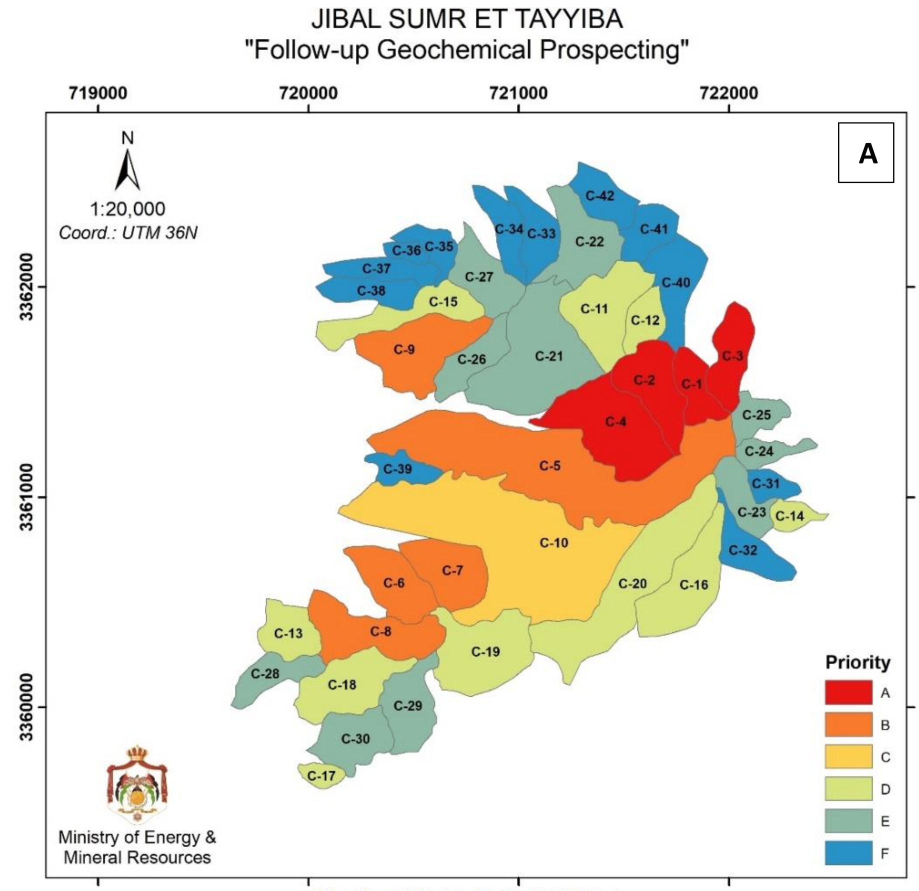
Satellite images and the topographical map of Petra (scale 1:50,000) were used to delineate the boundaries of the catchment areas in the study area.

The number of the delineated catchment areas is 42 catchments, of which 14 catchment areas contain small rocky outcrops and are located at the edge of the study area.

The catchment areas were classified into priority categories, from highest “A” to lowest “F”, based on the results of the BRGM survey for the concentrations of the elements gold, zinc, and lead (Fig. 5).

Catchment areas classified within categories “E” and “F” do not mean that they are of little importance, but due to the lack of information as they were not included in the previous sampling plan, and therefore they will be investigated during the current plan to identify their importance.

Additional samples have been planned for the catchment areas containing relatively long streams and for the high priority catchment areas resulting in additional 24 sub-catchment areas (Fig. 6).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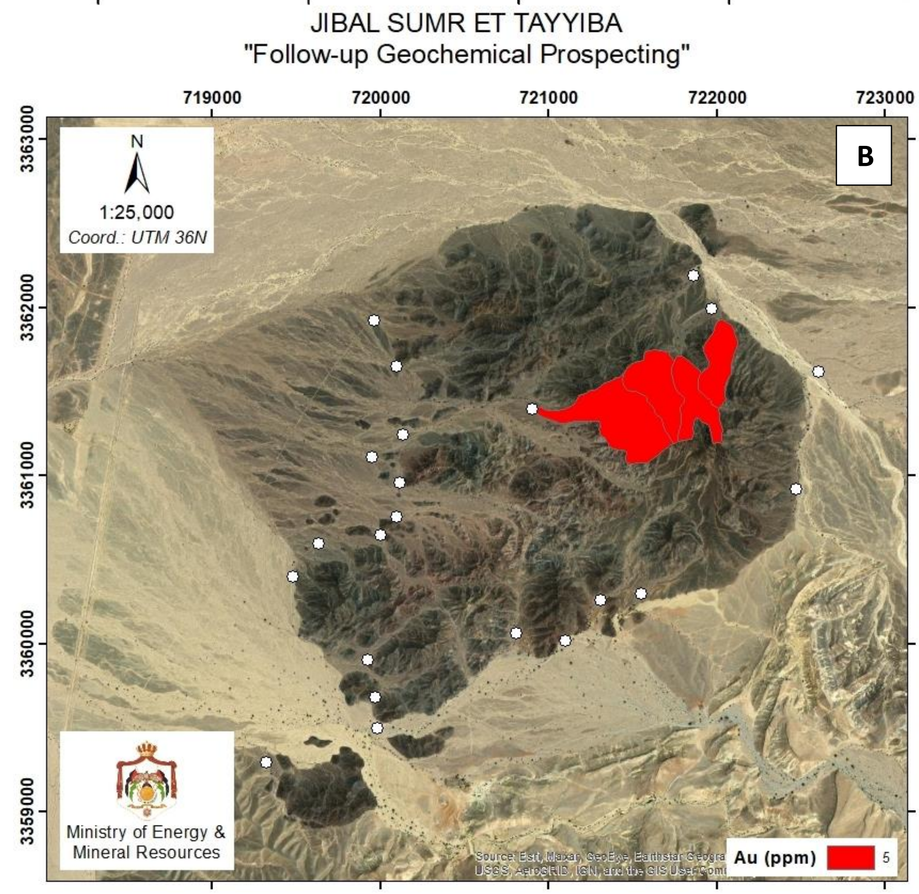
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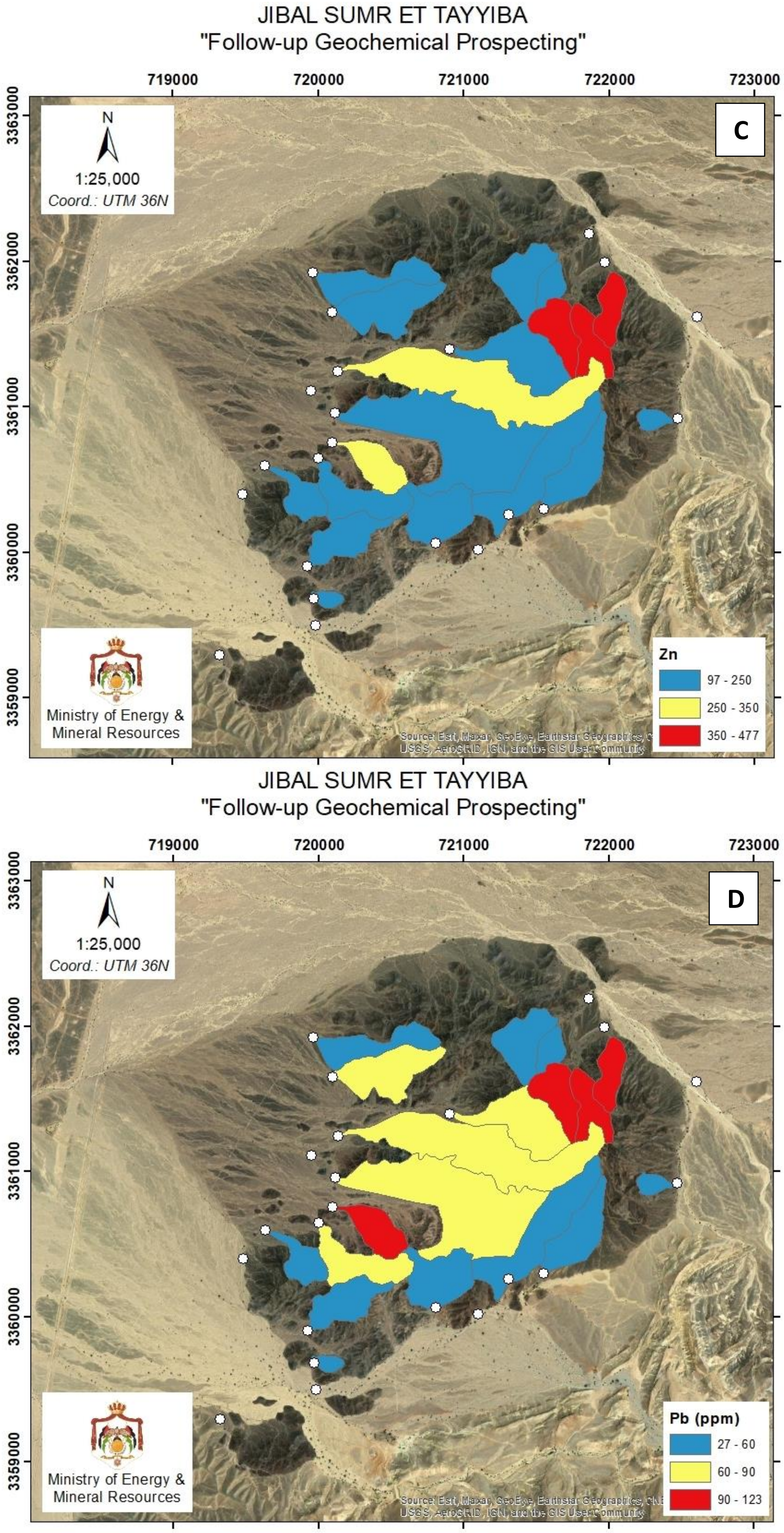

Figure 5: Prioritization of Catchment Areas (A) Based On Their Gold (B), Zinc (C), And Lead (D) Concentrations.

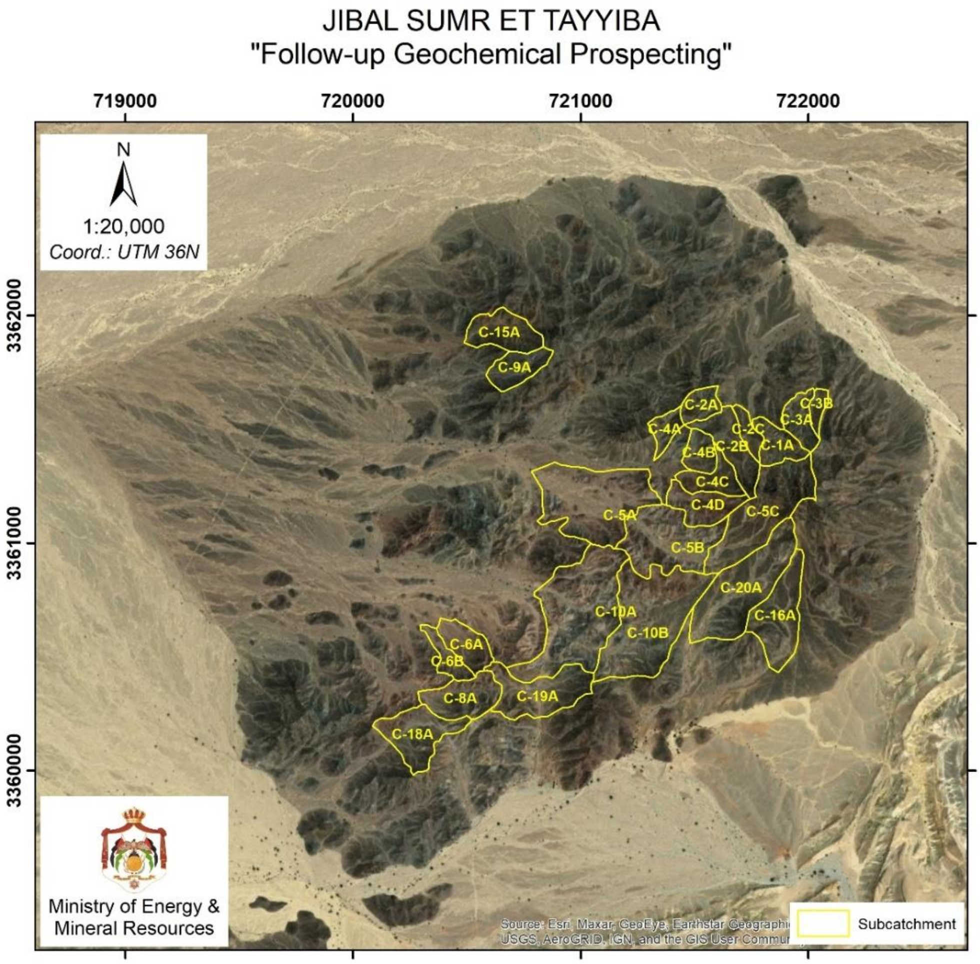

Figure 6: Additional Sub-Catchment Areas.

5.2.2. SAMPLING PLAN

The density of the proposed stream sediment samples has been determined at a rate of about 11 samples/km^2.

As a result, 53 proposed stream sediment samples were designed within the study area (Fig. 7). In addition to the stream sediment samples, heavy mineral concentrates will be collected from the same site as the stream sediment samples and based on the importance of the catchment area, which may reach 31 samples (Fig. 8). Thus, the initial total number of stream sediment samples and heavy mineral concentrates is about 84 (Appendix A). While the number of rock samples depends on the extent of change in the rock facies, especially the presence of alteration minerals. Rock samples will be adopted for catchment areas that contain small rock outcrops. In addition, rock samples will be collected from the stream sediment sampling sites and on both sides of the stream.

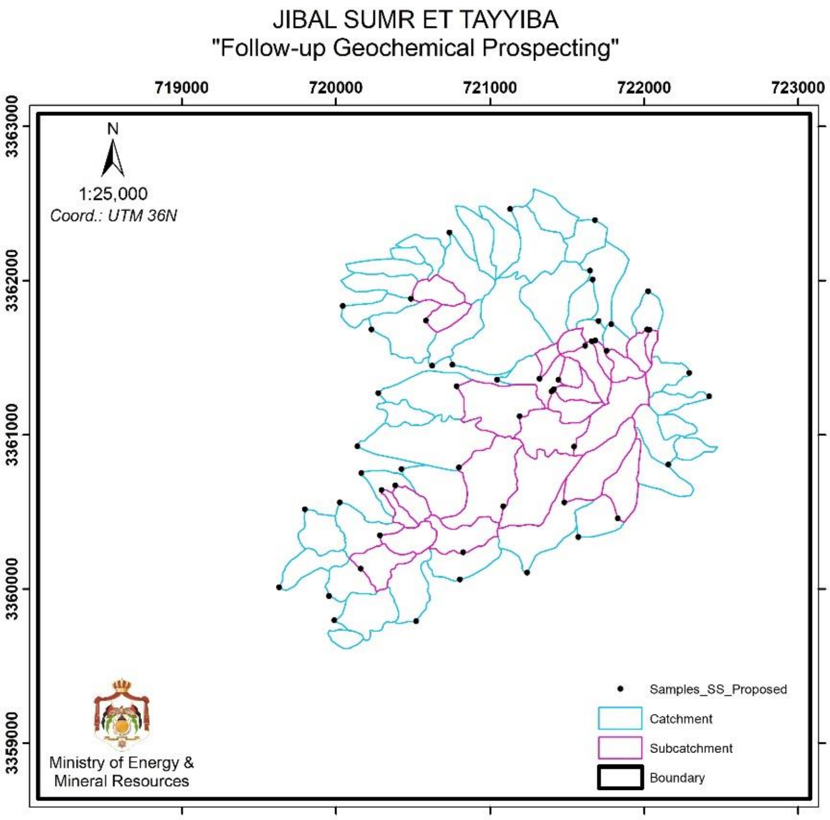

Figure 7: Proposed Stream Sediment Samples.

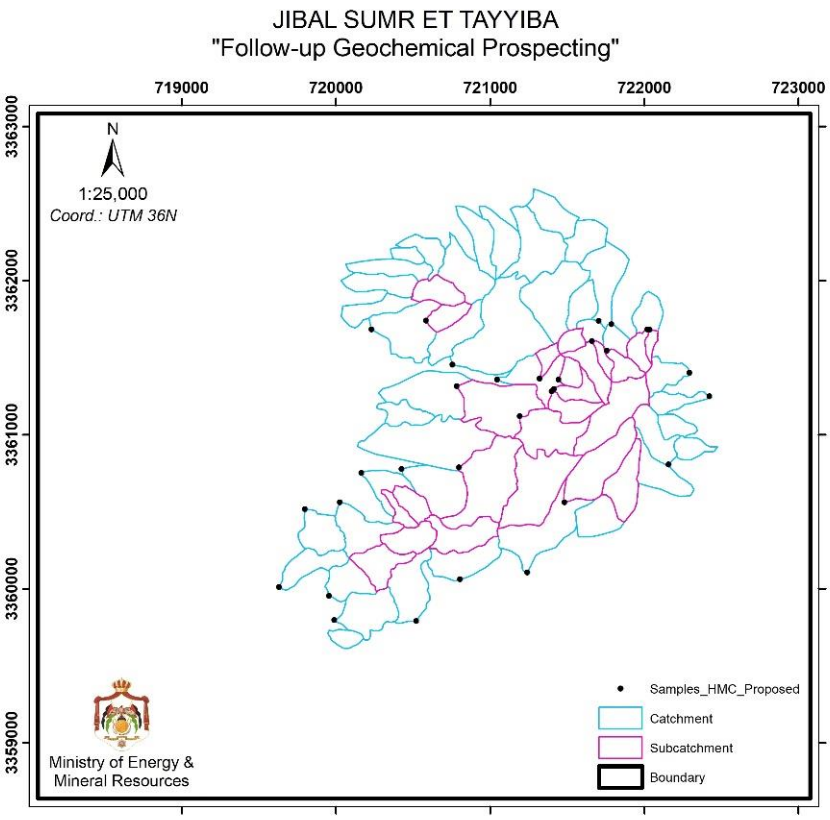

Figure 8: Proposed Heavy Mineral Concentrates Samples.

5.2.3. PREVIOUS SAMPLING METHOD

The previous survey (BRGM) was relied on regarding the method of sampling the stream sediments and heavy mineral concentrates, during which the areas were evaluated depending on the geological environment in terms of whether there is a sedimentary cover over the basement "igneous" rocks and the extent of the influence of aeolian sand on the results of laboratory analysis. Such mixing between these sediments and the basement rocks and mineralization, if any, causes what is known as noise in the results of chemical analysis, thus concealing the presence of any evidence or projection towards mineralization.

Since Wadi Araba region is generally characterized by the presence of a sedimentary cover over the basement rocks therefore the grain size of 250-500 microns was adopted to sample the stream sediments, while the grain size of less than 1 mm (-1 mm) was adopted for the heavy mineral concentrates.

Regarding the Sumr et-Tayyibah Mountains area, it is characterized by its isolation from the surrounding environment, therefore it is not interfering with the sediments coming through the surrounding streams and it is also devoid of any sedimentary cover. In most of the samples that were previously collected, the %SiO_2 content is identical to volcanic rhyolite rocks, meaning that most of the components are the product of erosion processes of the rocks belong to the same area without any significant external influence.

5.2.4. ORIENTATION SURVEY

To determine the optimal grain size for sampling the stream sediments, sieve No. 80 (#80 mesh) with a grain size of 177 microns, in addition to the recommended sieve No. 60 (#60 mesh) used in the previous survey with a grain size of 250 microns will be used. As for the heavy mineral concentrates, the same method used in the previous survey will be adopted, as it is not affected by the different geological environments, i.e., -1 mm grain size.

5.2.5. SAMPLING METHODOLOGY

Since the stream sediments and heavy mineral concentrates sampling method aims to track the increase in the concentrations of the pathfinder elements in parts per million (ppm), the sampling process under standard and controlled conditions is very important, as is the case regarding analysis methods and the quality of laboratories.

Based on the previous survey by BRGM, the most suitable (optimum) grain size for sampling the stream sediments in the Wadi Araba region and in the absence of a sedimentary cover over the basement rocks is between 250-500 microns, and for heavy mineral concentrates it is less than 1 mm.

Therefore, the grain size recommended by BRGM for the stream sediment samples will be used in this follow-up survey, which correspond to sieve No. 60 (250 microns), in addition to sieve No. 80 (177 microns), which will be used in the highest priority catchment areas.

The reason for using sieve No. 80 is due to the absence of a sedimentary cover and because the area is isolated, and therefore most of the materials in the streams are the products of local rocks erosion without external interference.

The results of the two sieves will be compared to adopt the best method and to generalize it to the rest of the area. The stream sediments from the most recent watercourse will be sampled by removing the upper sandy layer to reach the lower red layer where the pathfinder elements are concentrated. One sample will be taken from three locations close to each other (5-10m) along the watercourse and then sieved to obtain the required size of about 200-250g.

As for the heavy mineral concentrates that are important for detecting the presence of gold in this area, they will be taken from the heavy mineral traps such as the inner side of the stream curves, or crevasses on rocky stream floors, or behind obstacles, or by taking the sample at a depth of approximately 0.5-1m. The sample will be taken from three locations with a volume of about 24 liters and sieved to a size of -1 mm, and then panned the resulting sample using sea water in Aqaba city to get rid of light minerals and obtain about 200-250 g of concentrate. The resulting concentrate will be washed with tap water and dried in the sun or at ambient temperature.

Rock samples weighing approximately 2 kg will be collected from all rock facies to determine the geochemical characteristics of the area and to determine the natural “background” levels of the elements. From stream sediment sample locations, two representative rock samples will be taken on either side of the stream. For small catchment areas with small outcrops, only rock samples will be taken from all rock facies.

In addition to the proposed samples, 10% of the total samples will be taken as control samples to ensure the precision and to examine the extent of natural (inherent) variability in the area.

All samples will be halved so that the first half will be kept as a reference in the Rashidiyya base station, and the other half will be sent for laboratory analysis purposes.

All samples of stream sediments and heavy mineral concentrates will be prepared and halved at the Rashidiyya base station with weights measured before being sent for analysis to the accredited laboratory with a weight of about 100 g for each. The rock samples will be crushed to a size of 3 cm, then cone-quartered and sent in about 250 g for laboratory analysis.

5.2.6. LABORATORIES & INSTRUMENTATION

At this stage of prospecting, we need to analyze the samples into multi-element analysis ranging from 32-45 elements (depending on the laboratory) using the aqua regia for ICP-OES, in addition to assaying the gold with AAS and the major oxides with XRF. For rock samples, thin sections will be prepared for studying under the polarized microscope, in addition to XRD or the EPMA when necessary to determine the different mineral phases.

Precision is a very important factor characterizing this stage of prospecting, and since the concentrations are measured in parts per million (ppm) and perhaps in parts per billion (ppb), it is necessary to choose an accredited and high-quality laboratory in which all types of analyzes are available for most of the pathfinder elements including As, Sb, Cu, Pb, Zn, Bi, W, Sn, Hg, Ni and many others, as the pathfinder elements vary depending on the ore type and even may differ from one site to another for the same ore type.

It is also necessary to emphasize the continuation of analysis in the same laboratory to avoid the variability in the results of analysis in case of different laboratories.

5.3. DISCUSSIONS

5.3.1. LABORATORIES & RESULTS

The laboratories of the Ministry of Energy and Mineral Resources have been accredited to analyze the major oxides of rock samples using the XRF of fused beads, in addition to multi-element analysis of stream sediment samples and rock samples by digesting the samples with hydrofluoric (HF) and perchloric acids ($HClO_4$) according to ISO 14869-1 and analyzing them using the ICP-OES (ISO 22036). The Canadian SGS laboratories are accredited to analyze gold in heavy mineral concentrates by digesting them with aqua regia and analyzing them using the AAS. The laboratories of the Ministry of Energy and Mineral Resources will also be accredited for petrographic and mineral studies using a polarizing microscope and XRD. When necessary, other local or external laboratories will be asked to study the mineral content using the EMPA.

At first, sixteen (16) samples of stream sediments were sent to the laboratories of the Jordan Atomic Energy Commission (JAEC) for multiple elements analysis, and due to the lack of most of the important elements compared to those in the laboratories of the Ministry of Energy and Mineral Resources (MEMR) (Table 1), testing in the JAEC labs was stopped. The results of both laboratories will be compared for precision purposes.

Table 1: Elements Available for Analysis Table 1: Elements Available For Analysis In The Laboratories Of The Ministry Of Energy And Mineral Resources And The Atomic Energy Agency.

Laboratory	Available Elements for Analysis
MEMR	Ba-Cd-Cu-Cr-Ga-Li-Mn-Ni-Pb-Sr-Zn-Hf-Mo-Nb-Sb-Sn-W-Zr-Cs-Rb-V-Ce-Dy-Gd-Ho-La-Nd-Pr-Sc-Sm-Y-Yb-Er-Tb
JAEC	Ba-Bi-Cd-Co-Cr-Cu-La-Li-Mo-Ni-Pb-Th-U-W-Y-Zn-Zr

5.3.2. ORIENTATION SURVEY

The first sixteen (16) samples included eight (8) samples collected at the size of 250 microns and eight (8) samples collected from the same place at the size of 175 microns to determine the optimal size for sampling the stream sediments and to determine the difference in the results between the two sizes. This group of samples was analyzed in the JAEC and MEMR laboratories for comparison purposes between the two laboratories (Appendix A).

Despite the difference in the values themselves due to the different methods used in both laboratories, the results showed a significant correlation of more than 95% for all elements.

When plotting the results on a map insignificant difference can be seen, therefore sampling of the stream sediments will follow the recommended BRGM sieve size (#60 mesh) (Appendix A).

5.3.3. CONTROL SAMPLES

Only two control samples were included in the batch of sixteen (16) stream sediment samples that had been sent to the JAEC laboratories. They are ST-S-5 and ST-S-5a, which are replica for ST-S-4 (#60 mesh) and ST-S-3a (#80 mesh), respectively.

The analysis results of the control samples showed a perfect match and thus interpretation can be done at high confidence (Fig. 9).

The returned 16 samples from the JAEC laboratories were sent to the MEMR laboratories for comparison. The analysis results also retained a high precision and therefore, the MEMR laboratory was approved to analyze all project samples, in addition to containing analyzes of most of the elements required in the geochemical prospecting process.

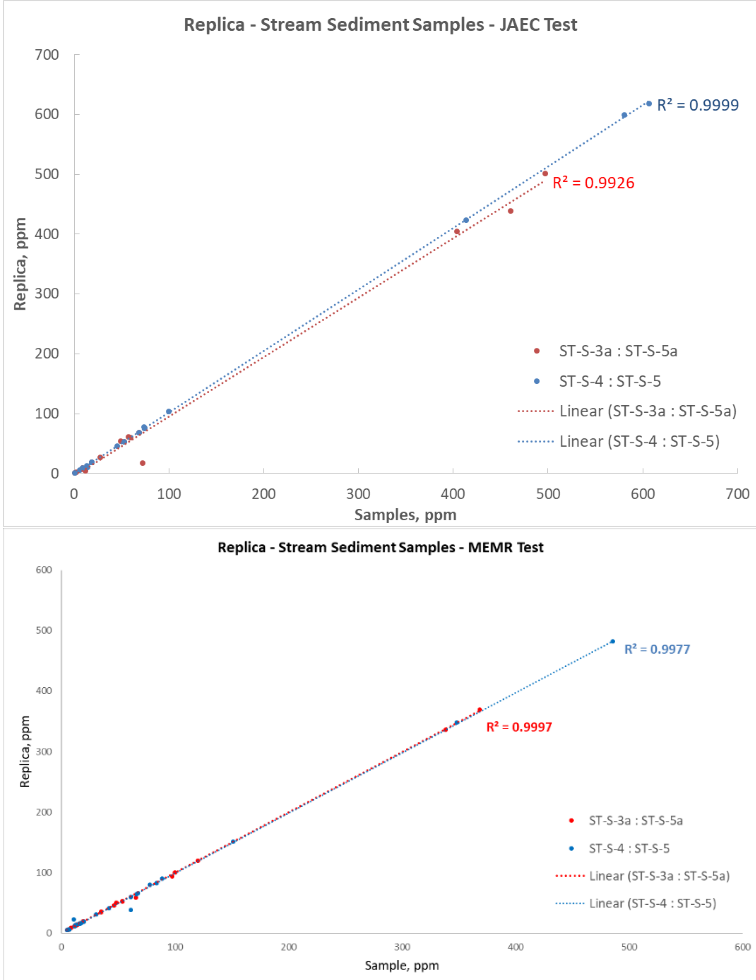

Figure 9: Analysis Results of Control Samples in The JAEC & MEMR Laboratories.

5.3.4. PROJECT STATUS

Sampling of stream sediments, heavy mineral concentrates and rocks is still going on simultaneously with limited exploration trenches but only few results have been obtained so far which can't be used for full interpretation purposes.

Even though, some results from the grab rock and trench samples showed high Pb, Zn, and Cu anomalies, as well as Li, indicating a potential mineralization body especially within the highest priority catchment areas.

Further follow-up geochemical prospecting, may accompanied by geophysical survey, is recommended to complete the area and to delineate the most prospective part for further detailed studies.

6. PROSPECTING FOLLOW UP STUDIES FOR ANOMALY WEAK ZONES OF SUMR ET-TAYYIBA MOUNTAINS "ARAGEO-2"

6.1. Aim of the Study

Integrated studies to explore the component, the environment condition and the major source of Precious, Base metals and REE in Sumr et-Tayyiba mountains with an area amounted 6.5 km2 are limited. Therefore, based on regional results of BRGM data, the geochemical and Prospecting studies were launched.

In the Geochemical survey, Sumr et-Tayyiba area was divided into total of 41 catchments. Group of surface samples were collected and subjected into certain kind of analysis included ICP-MS and XRF in the MEMR lab in addition AAS for gold in the SGS Canadian lab in order to determine the concentrations and anomalies of the target elements, consequently, total of four of weak zones bearing interesting concentration of base metals & REE are discovered within certain type of alteration layers in the catchment areas 01 & 02 (Fig. 10).

As follow up of integration studies, Prospecting studies had commenced in 5 Feb 2023 in the catchment areas 01 & 02 included trench excavation and drilling boreholes in order to determine the following requirements:

Measure the strike, dip & dip direction of the alteration layers in the weak zones.

- Define the type of base metals & REE deposited along the zones as well as their concentrations.

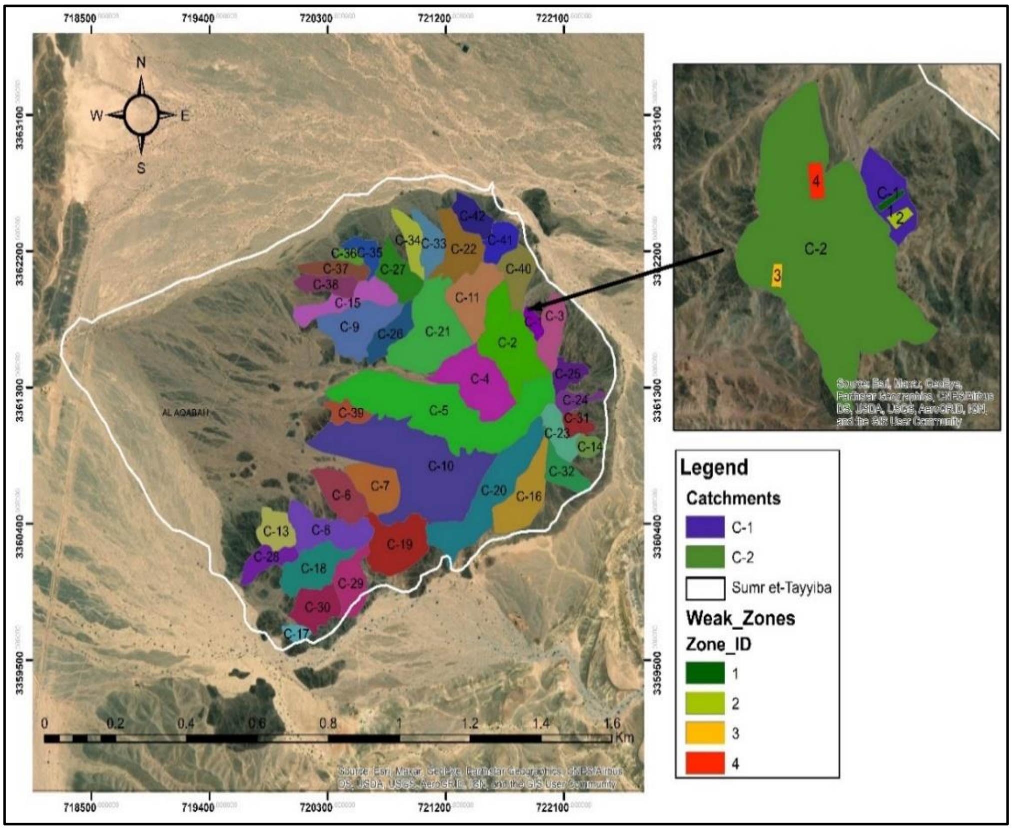

Figure 10: Catchments and Weak Zones in the study area

6.2. The Methodology

As per mentioned in above, total of four zones were determined in the catchment area 01 & 02. Trenches and drilling boreholes are prospecting methods were utilized to obtain further information regarding the base metals & REE within alteration layers along the weak zones.

The trenches were excavated perpendicular to the strike of the weak zones in order to expose as much as possible of alteration layers that are settled over there. Long over the trench, foot wall and hang wall are the main structural features indicate into the start and end of alteration occurrences. By using millimeter paper, the lithology and structure features of the trenches are documented including (Fig. 11, Trench 03 is an example):

- Distinguished in draw between alteration layer and mother rock layer (Rhyolite).
- The strike, dip, dip direction of alteration layers.
- Shows of exposed base metals or any related alteration minerals.
- Start & End of the trench.

- Sample's location

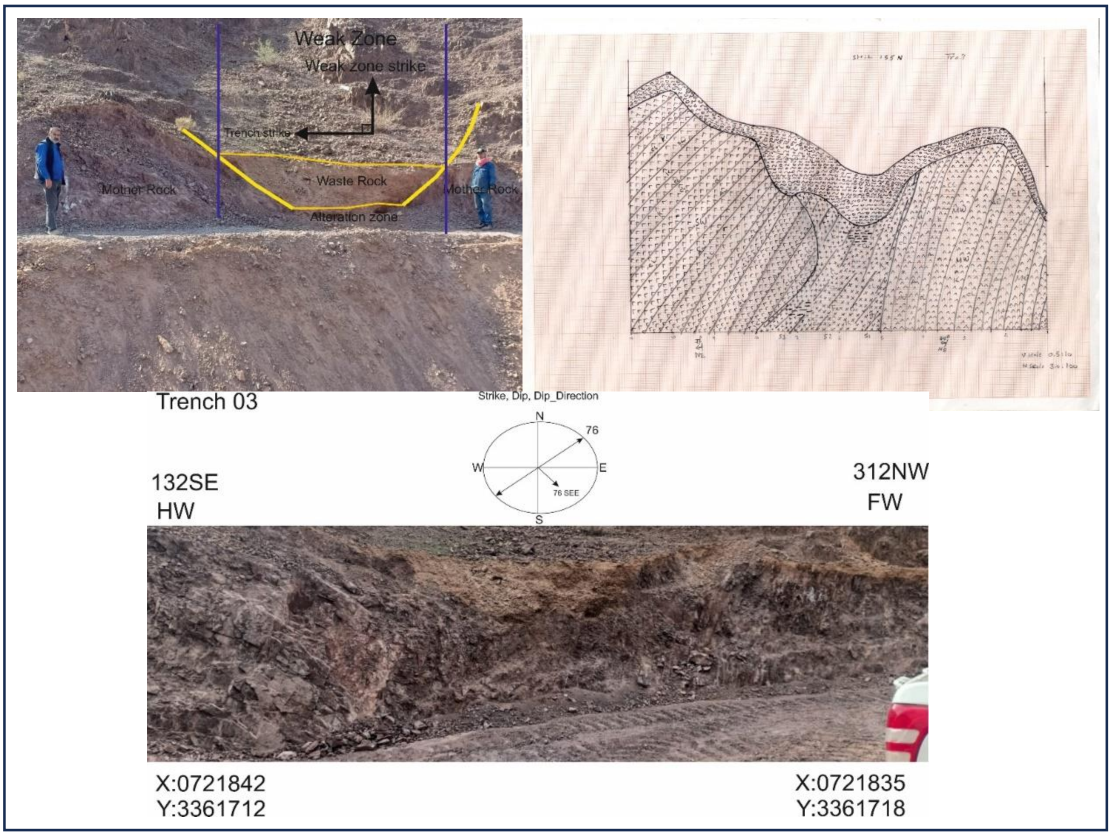

Figure 11: Workflow in Field.

Afterward, group of drawn trenches over certain weak zone have to digitize utilizing Arc-Map with declaration the following parameters (Fig. 12, Trench 03 is an example):

- Lithology type & structure features.
- Length.
- The base & REE concentration in PPM.
- Strike, Dip, Dip Direction of altered zones.

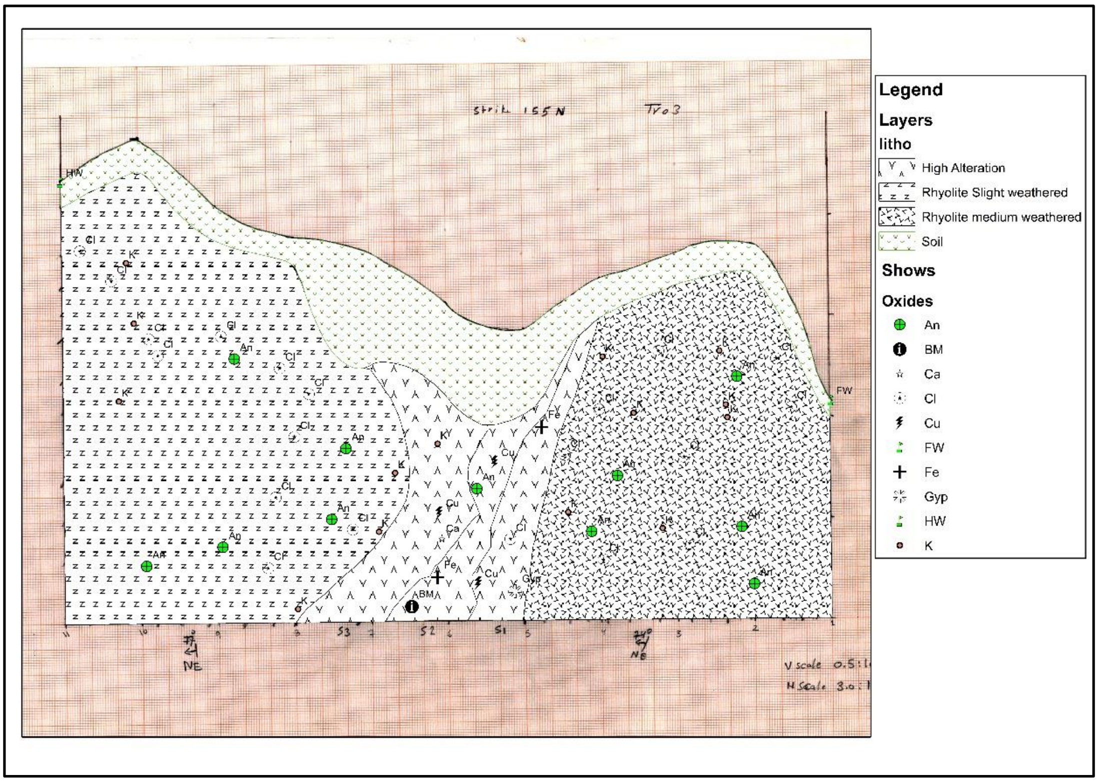

Figure 12: Digitized Trench Using Arc_ Map 10.6v.

Ultimately, by using Arc-Map the final outcome of strike, Dip, Dip Direction for particular group of drawn trenches over certain weak zones will determine, consequently, the second method_ drilling borehole of prospecting studies will commence in order to explore the subsurface extension of the altered zone. In other hand, the separated distance of the rig location than weak zone is measured based on the tan angle which is defined an angle extend from surface to the dip direction of the altered zone (Fig. 13, Zone 01 is an example).

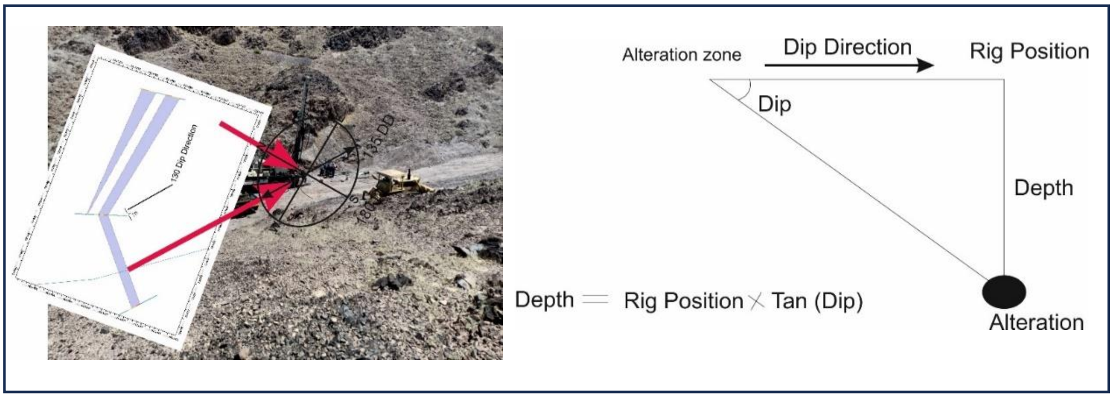

Figure 13: Borehole Location in The Weak Zone Based Tan Angle.

- Meanwhile, set of chemical analysis were proceeded in MERM lab including:
- XRF analysis for the following oxides:

Fe2O3 Wt.%	MnO Wt.%	TiO2 Wt.%	CaO Wt.%	CuO Wt.%	K2O Wt.%	SO3 Wt.%	SiO2 Wt.%	Al2O3 Wt.%	MgO Wt.%	Na2O Wt.%

- ICP-MS analysis for the following Base metals & REE:

Be	Cd	Co	Cs	Cu	Ga	Li	Ni	Pb	Sr
V	Zn	Hf	Mo	Nb	Sb	Sn	W	Zr	Ce
Dy	Gd	Ho	La	Nd	Pr	Sc	Sm	Y	Yb
Rb	Cr	Ti	Ba						

- XRD analysis to determine the following type of minerals group:

Major	Minor	Traces

6.3. The Results

The encountered four zones have been intensively investigated utilizing excavated trenches as well as drilling boreholes that will follow up later. The zones were documented in the following data results:

- Digitized trenches in millimeter paper.
- Determined the strike, dip and dip direction of each trench
- Represented ICP results of base & REE over the digitized trenches.
- Determined the extension, strike, dip and dip direction of the alteration layers over the weak zone by utilized group of trenches excavated over there.
- Represented ICP results of the alteration layers over the weak zone.
- Defined the background, threshold and anomaly for ICP results for each weak zone.
- Predominant minerals in the alteration layers explored by XRD.
- The mentioned data results in above will discuss in details for each zone separately.

- All chemical results details found in the appendix B.

6.3.1. The Results zone #01

Total of four trenches were excavated over there. The alteration layers were distinguished than mother rock (Rhyolite) in the digitized millimeter paper in addition to the length of each layer. The ICP results for the base metals and REE were represented as main function of indication into

alteration zone, therefore the Zinc has been nominated in the four weak zones to represent the rest of base metals & REE in the digitized millimeter paper in order to determine the alteration zones as well as it has been used over the trench lines to do the correlation over the weak zone.In the following Figures 14, 15, 16, the alterations were distinguished using Zn values in ppm, in addition to their length numbered in meter below the digitized paper.

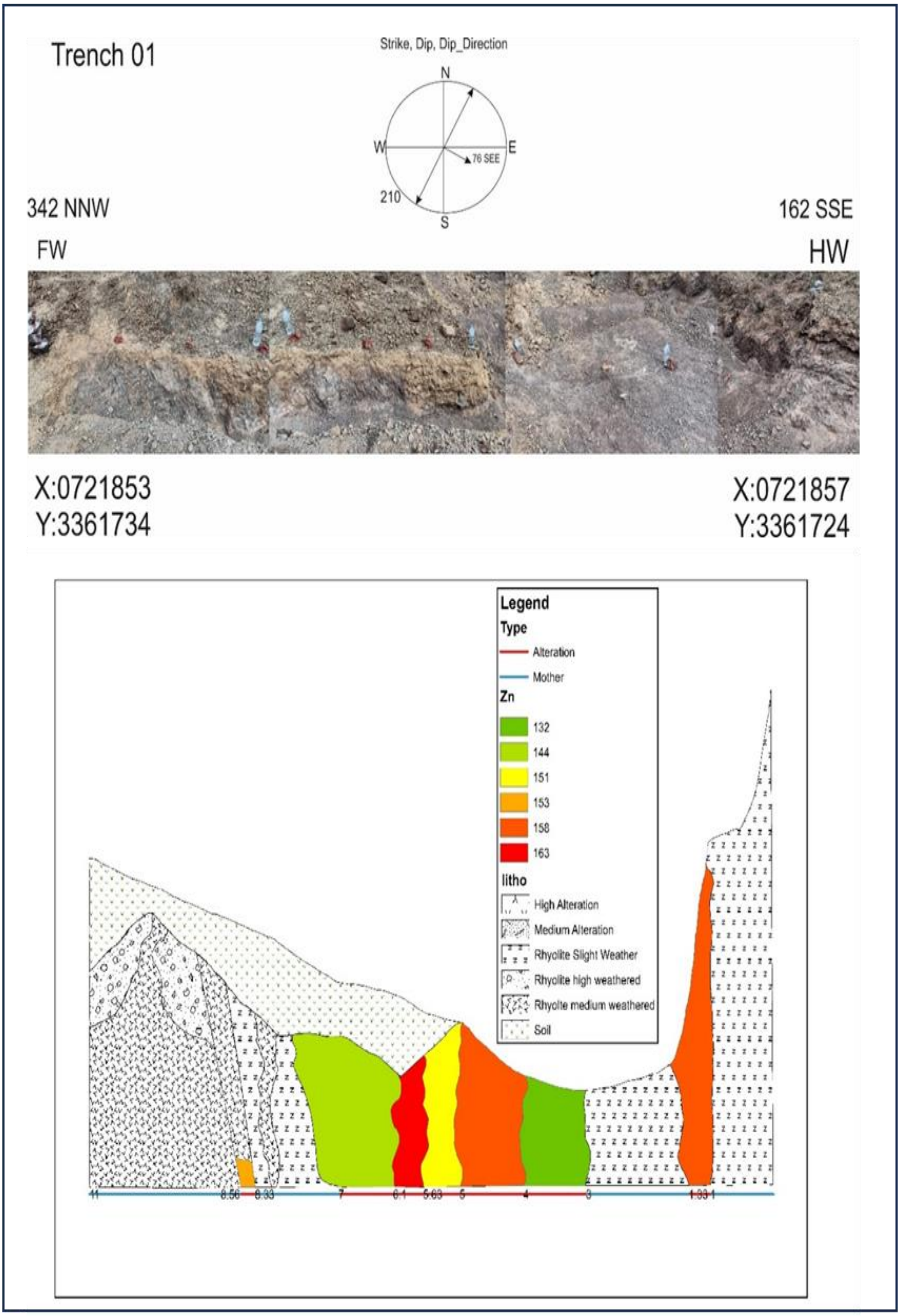

Figure 14: Weak Zone 01, Digitized & ICP 1 Zn In Trench 01

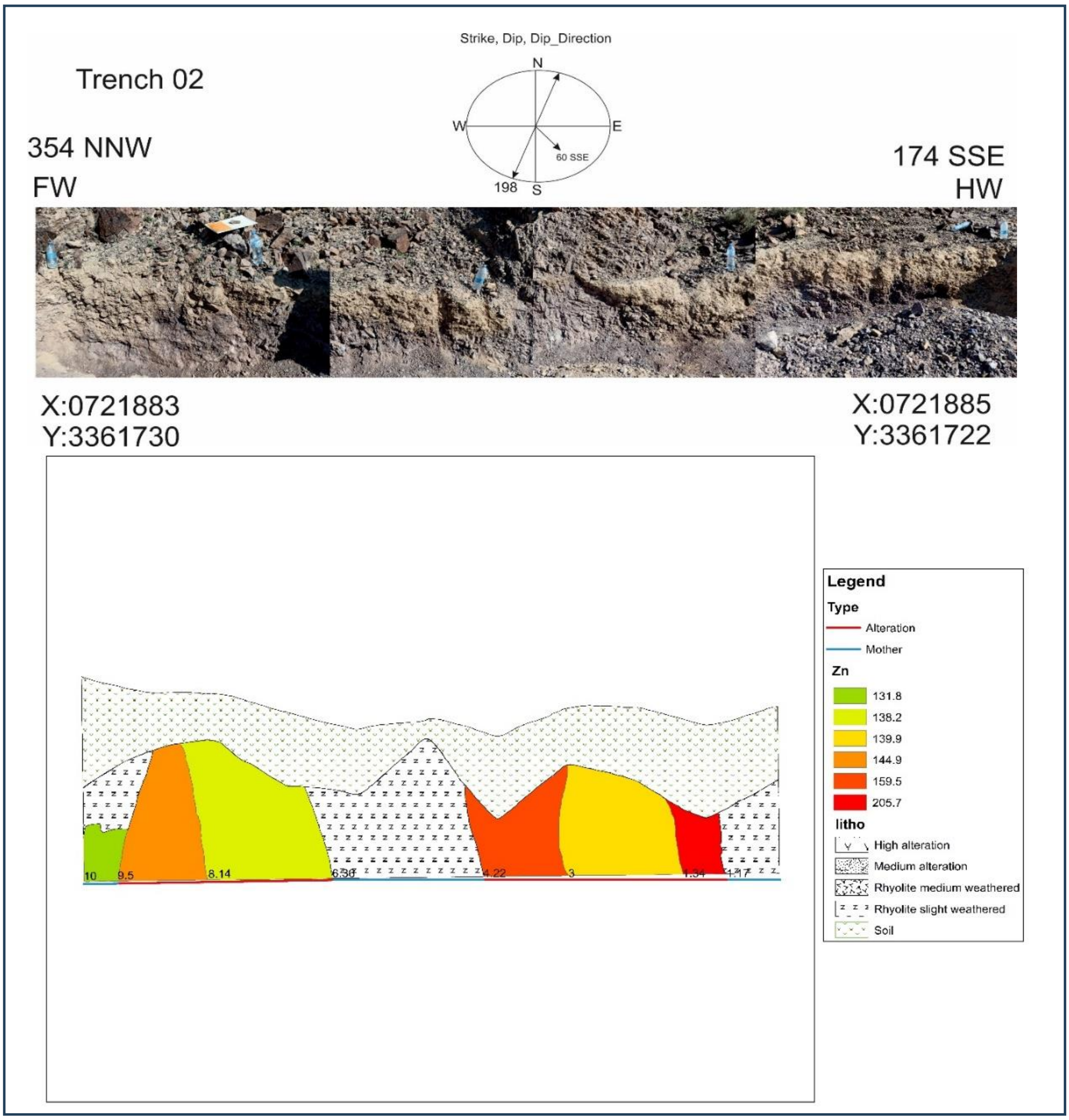

Figure 15: Weak Zone 01, Digitized & ICP Zn in Trench 02.

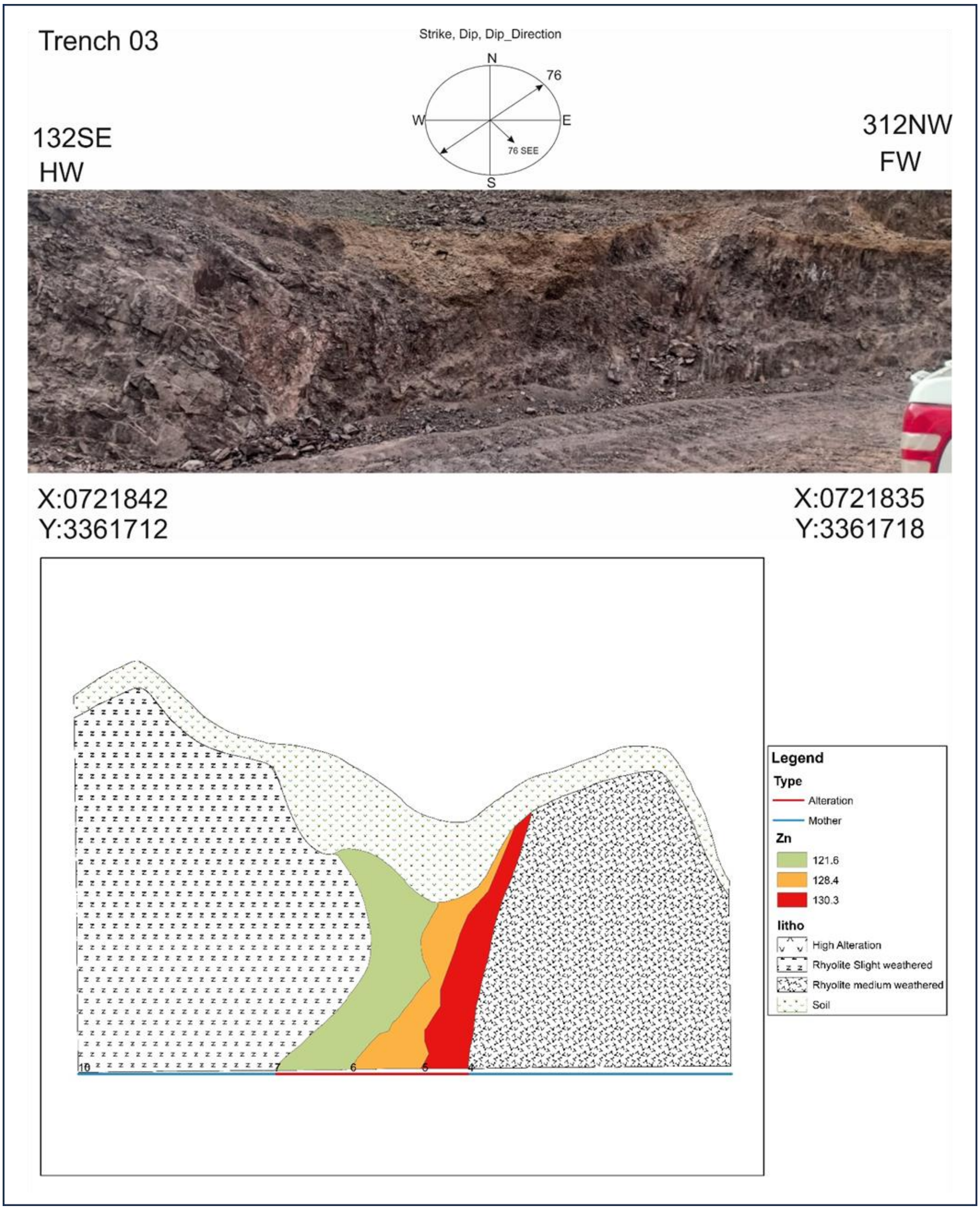

Figure 16: Weak Zone 01, Digitized & ICP Zn in Trench 03.

Based on the Alteration results, the correlation links the Trench 01, Trench 02 & Trench 03 together, it is given an alteration zone dipping toward south east of the study area (Fig. 17).

As result of further investigation in the in the weak zone 01, Trench labeled 11 was excavated (Fig. 17).

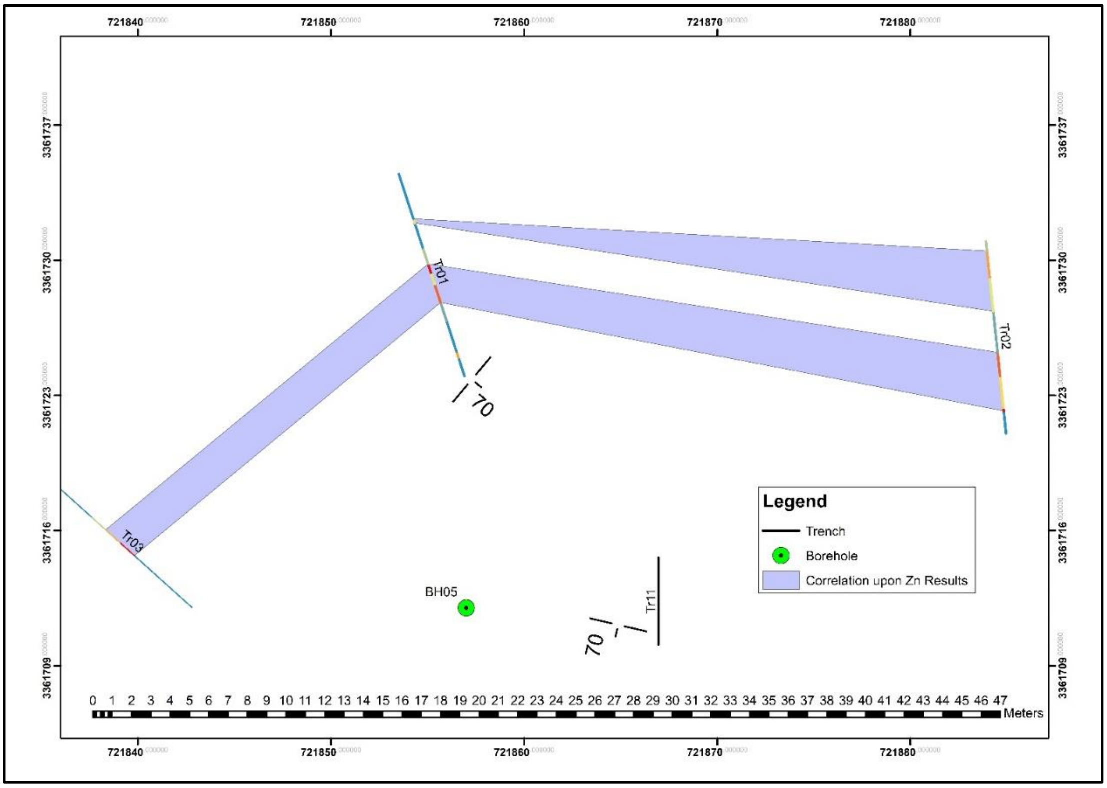

Figure 17: Alteration correlation in the Weak zone 01.

The Trench 11 has dipping toward south west which is crossed the main correlation in the weak zone 01. Recently, it was digitized in the millimeter paper which is revealed total of five alteration layers that were sampled and sent to the MEMR lab (Fig. 18).

In other hand, based on the correlation of weak zone 01 (Fig. 17), borehole was drilled to total depth 43 meter with sampling. Based on the lithology description, the alteration layers were encountered at depth 10 m and continued to depth 20 m. Accompany with drilling, Total of 43 samples were sent to MEMR lab and waiting the results.

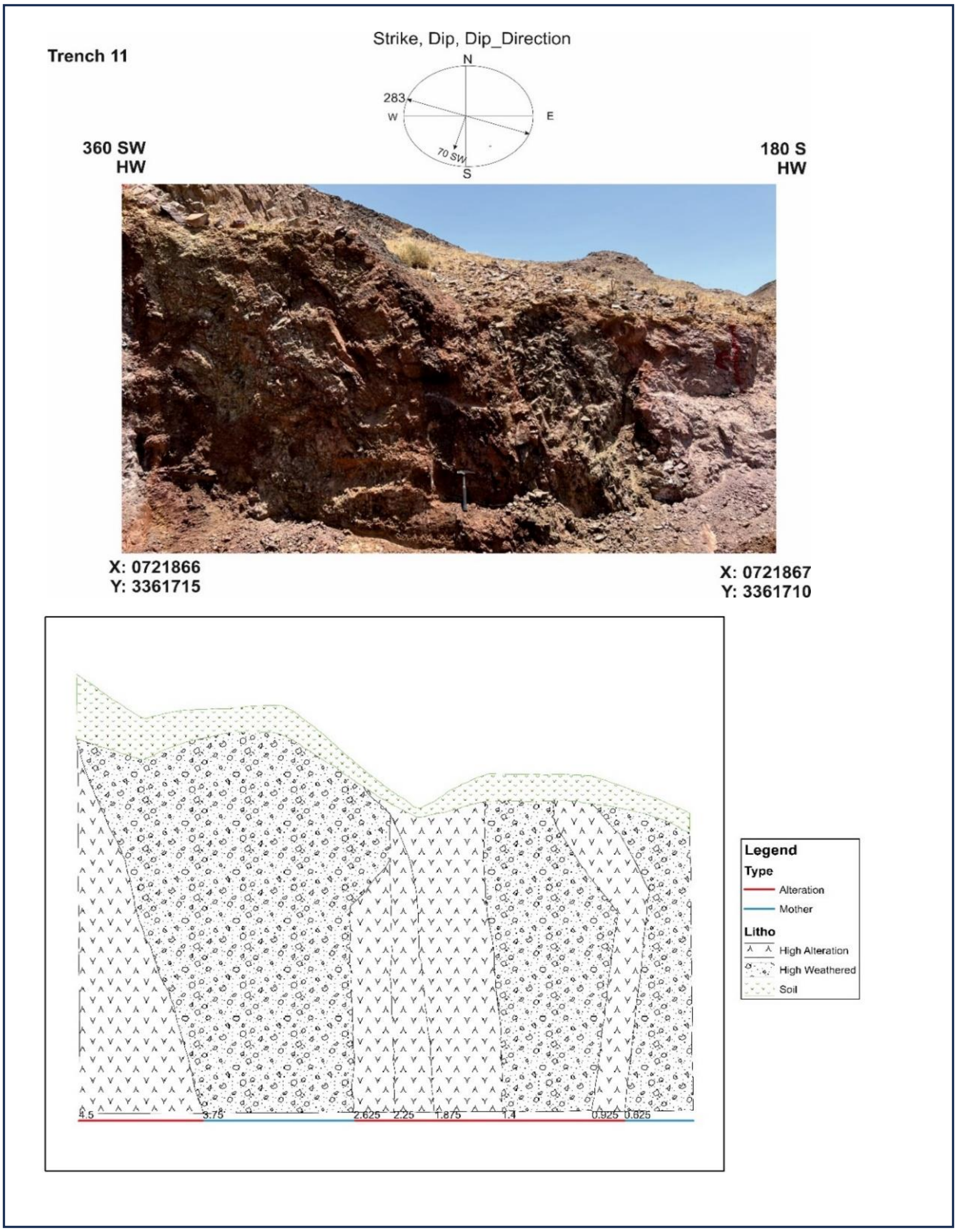

Figure 18: Weak Zone 01, Digitized Trench 11.

The ICP results (ppm) for the Trenches 01, 02, 03 have been classified into background and maximum value for each element in order to figure out prosperous surface concentrations.

Table 2: ICP_Results of Base Metals & REE for Weak Zone 01.

	Be	Cd	Co	Cs	Cu	Ga	Li	Ni	Pb	Sr
Background	7.40	6.49	26.30	17.07	201.11	35.25	109.82	107.86	64.88	118.88
Max.	7.20	5.00	21.70	14.70	20.50	28.30	17.80	210.60	28.90	224.70
	V	Zn	Hf	Mo	Nb	Sb	Sn	W	Zr	Ce
Background	78.93	624.59	19.75	6.41	53.73	7.79	19.28	140.84	703.27	220.49
Max.	12.80	205.70	16.40	7.70	40.50	16.20	22.90	213.70	843.20	207.30
	Dy	Gd	Ho	La	Nd	Pr	Sc	Sm	Y	Yb
Background	12.45	19.49	5.00	99.39	99.19	29.95	11.78	18.81	92.79	6.84
Max.	15.60	20.20	5.00	98.60	97.50	27.90	5.00	21.40	83.50	8.60
	Rb	Cr	Ti	Ba						
Background	177.85	244.80	12391.62	878.69						
Max.										

- Based on the table 02, the base metals exceeded their background values are:

  <u>W, Sn</u>

- Whereas REE are:

  <u>Ni, Sr, Sm, Dy, Gd</u>

Furthermore, total of five samples were selected randomly earlier from Trench 11 and sent to the Jordan Atomic Energy Commission (JAEC) lab for analysis. The ICP (Table 03) results showing interest values that are indicated into alteration zone has certain strike, dip & dip direction embedded in the trench 11.

Table 3: ICP_Results Of Base Metals & REE For Trench 11.

	Be	Cd	Co	Cs	Cu	Ga	Li	Ni	Pb	Sr
Background	7.40	6.49	26.30	17.07	201.11	35.25	109.82	107.86	64.88	118.88
Max.	4.00	5.00	38.00		80.00	54.00	225.00	72.00	78.00	140.00
	V	Zn	Hf	Mo	Nb	Sb	Sn	W	Zr	Ce
Background	78.93	624.59	19.75	6.41	53.73	7.79	19.28	140.84	703.27	220.49
Max.	190.00	1318.00	4.00	5.00	24.00	5.00	5.00		160.0	53.00
	Dy	Gd	Ho	La	Nd	Pr	Sc	Sm	Y	Yb
Background	12.45	19.49	5.00	99.39	99.19	29.95	11.78	18.81	92.79	6.84
Max.	4.00	5.00	5.00	26.00	30.00	7.00	18.00	6.00	19.00	
	Rb	Cr	Ti	Ba						
Background	177.85	244.80	12391.62	878.69						
Max.		95.00	12664.00							

- Based on the Table 03, the base metals exceeded their background concentration are:

  V, Zn

- Whereas REE

  Li, Nb, Ti, Sr,

Ultimately, the XRD results are showing the major minerals deposited along the alteration layer extends over this zone "Quartz, Feldspar" and traces of "Muscovite, Hematite and Clay".

6.3.2. The Results zone #02

In the weak zone 02 total of four trenches were excavated. Each one was digitized on millimeter paper in addition to the structural measurements were documented (Fig. 19, Fig. 20, Fig. 21, Fig. 22). Unfortunately, the chemical results are still not released from the MEMR lab, however, they will be represented on the millimeter papers and correlation when are released.

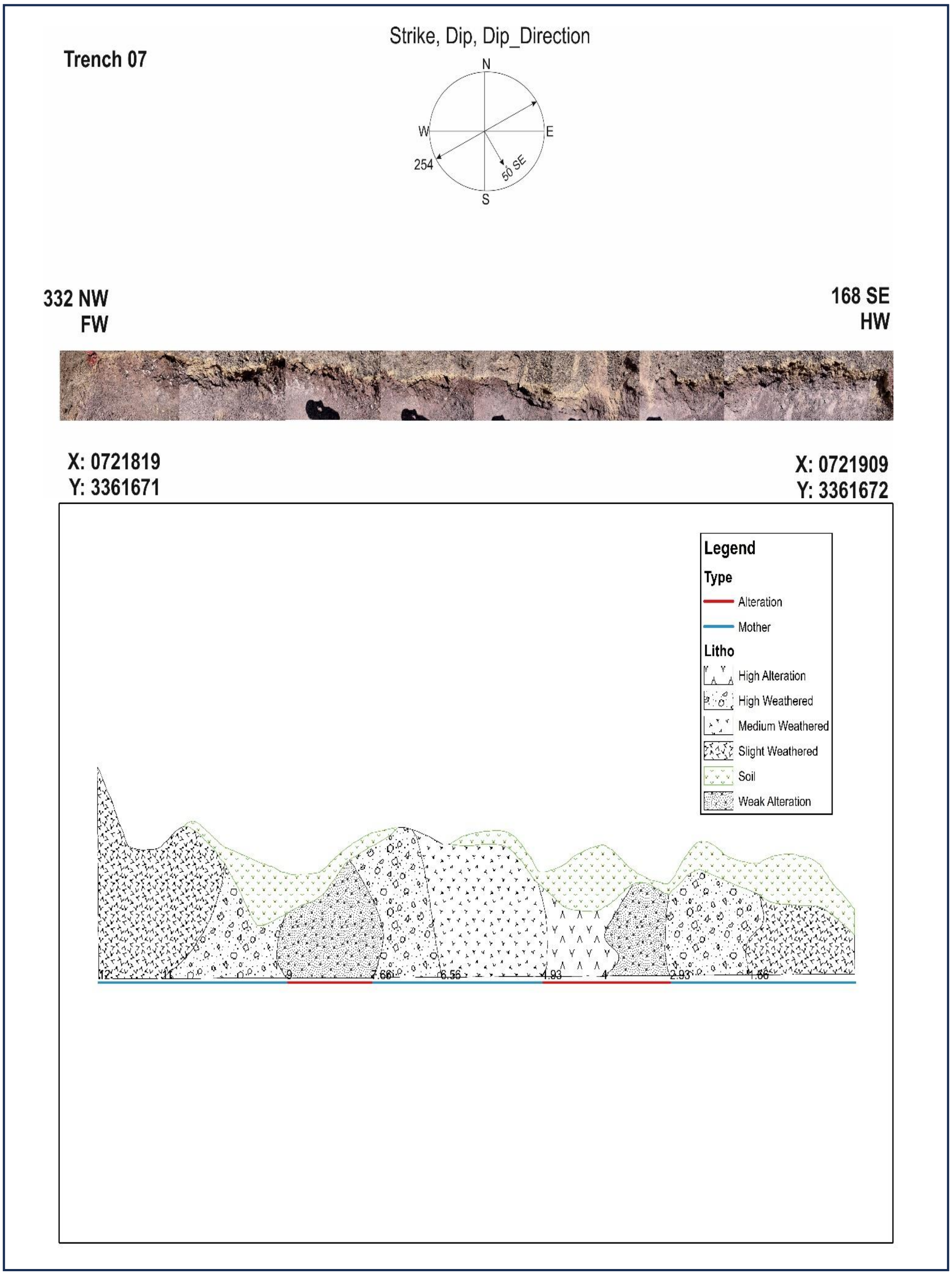

Figure 19 Weak Zone 02, Digitized Trench 07.

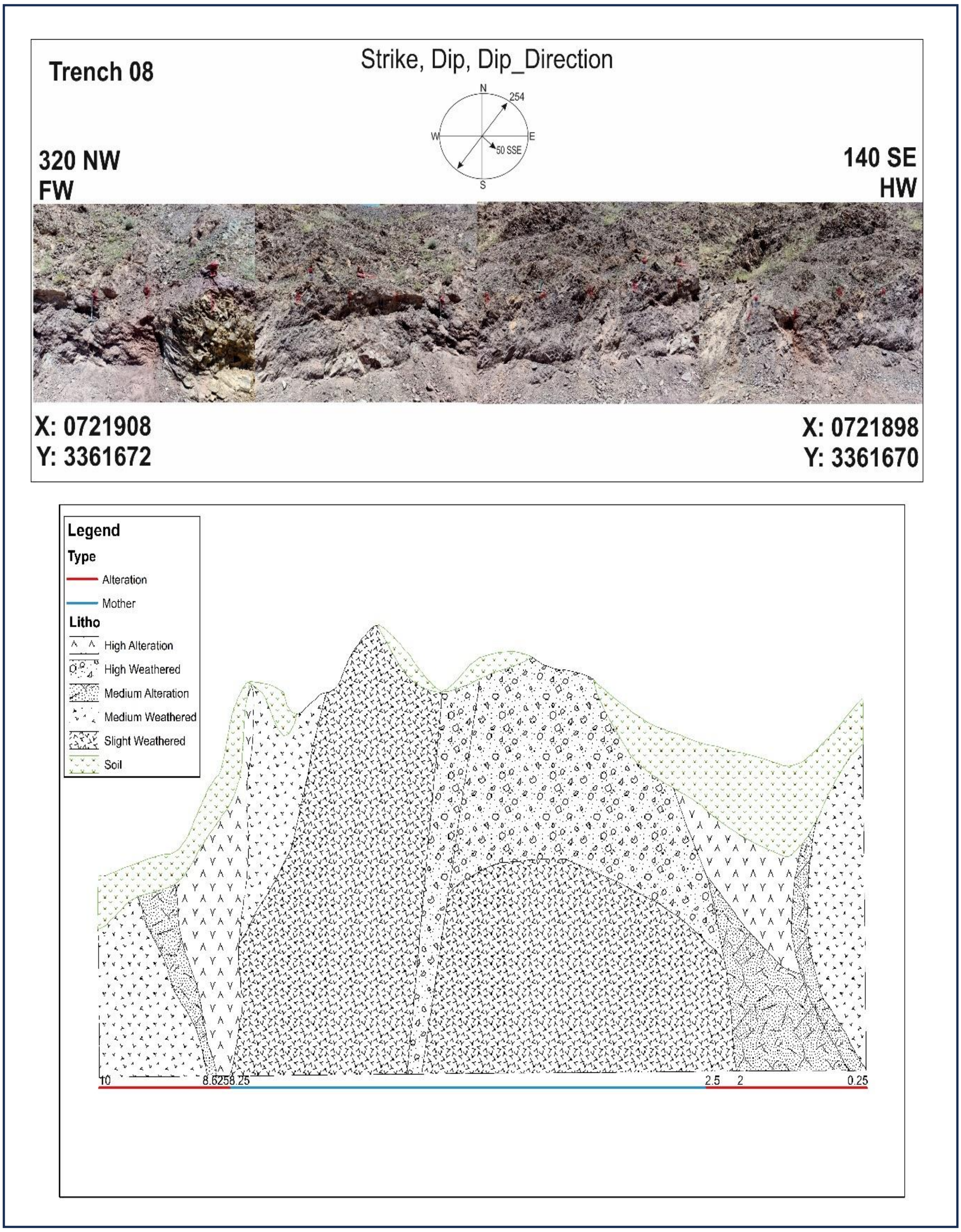

Figure 20: Weak Zone 02, Digitized Trench 08.

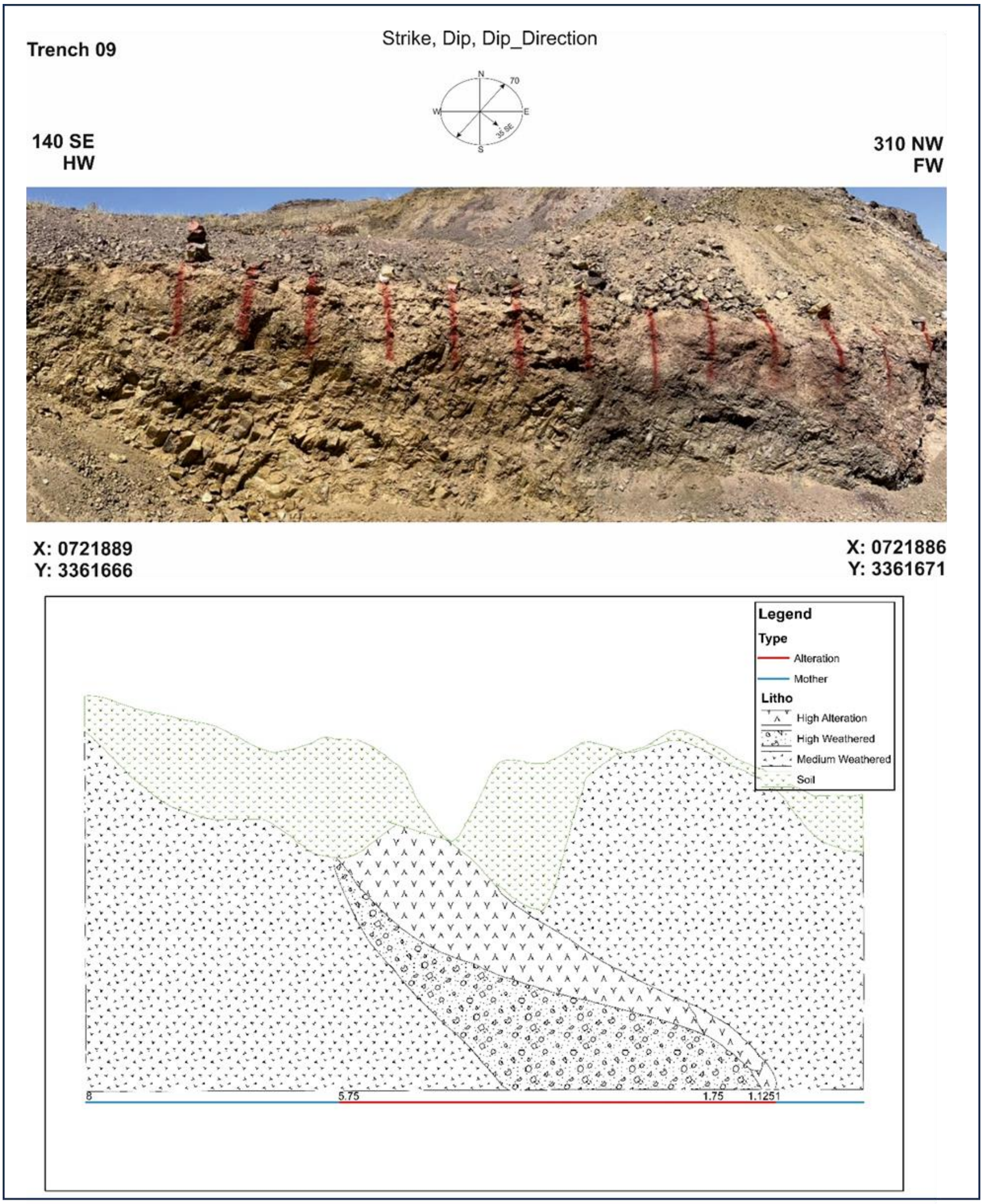

Figure 21: Weak Zone 02, Digitized Trench 09.

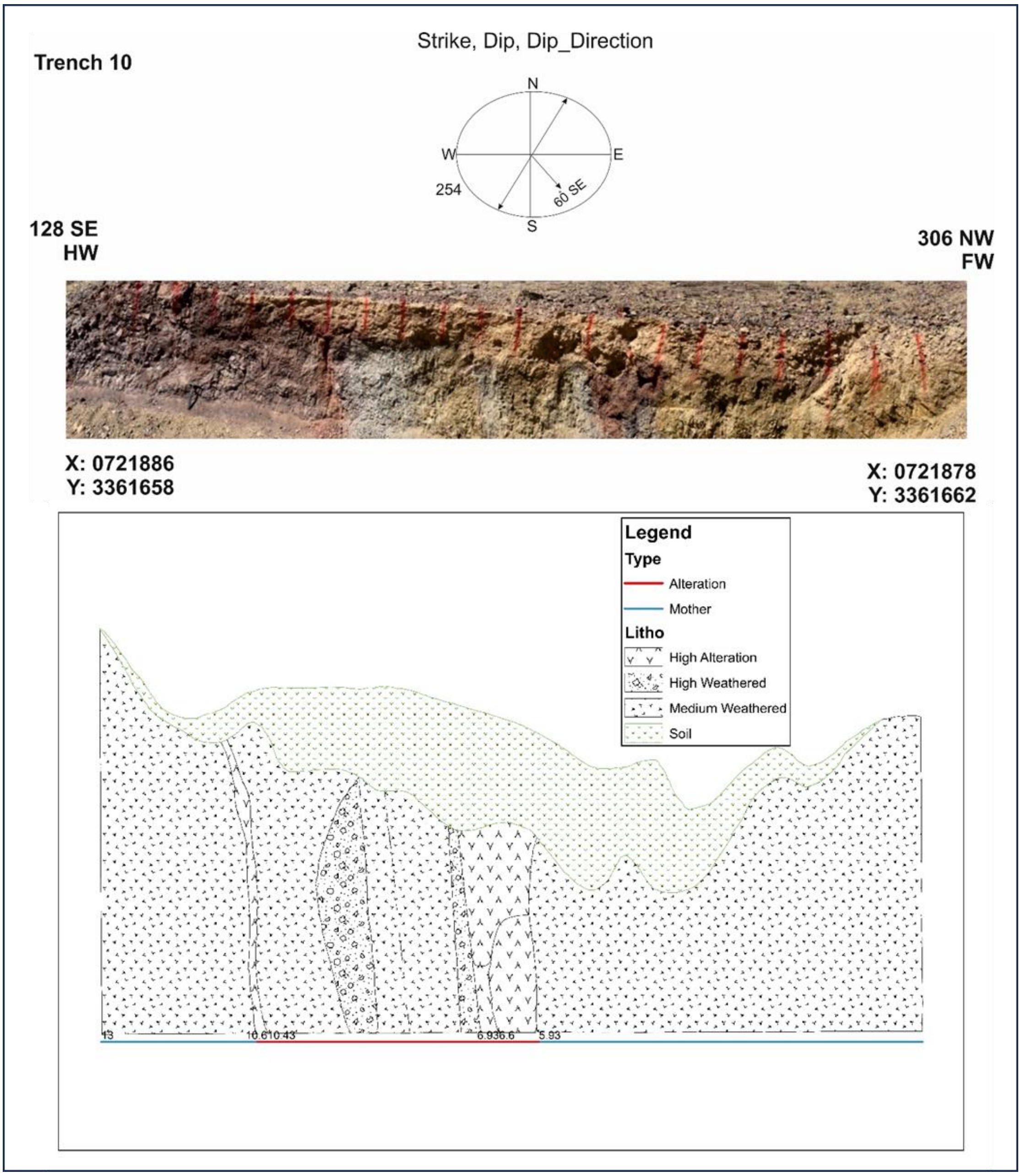

Figure 22: Weak Zone 02, Digitized Trench 10.

Remarkably, upon the digitized millimeter paper, the alteration layers been determined and utilized to correlate the alteration over the weak zone 02.

According to the alteration layer extends over the weak zone 02, the correlation was established which is showing an alteration dipping toward south east of the study area (Fig. 23).

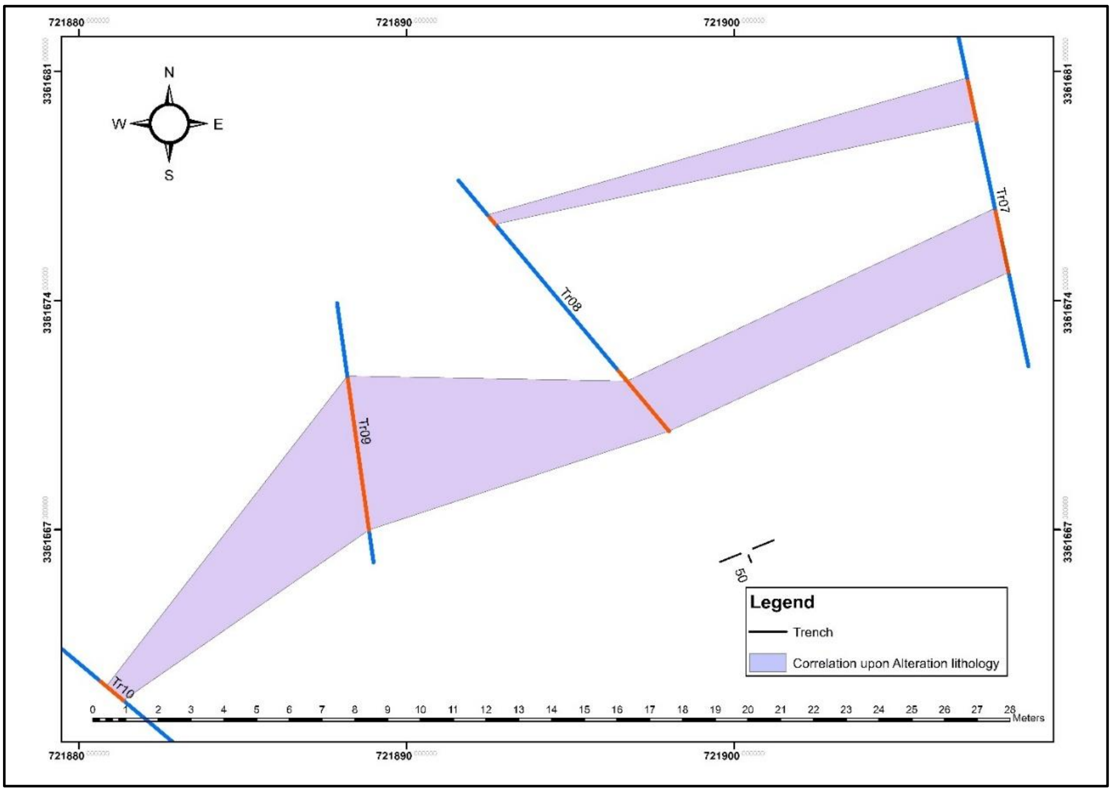

Figure 23: Alteration Correlation in The Weak Zone 02.

6.3.3. The Results zone #03

In this zone total of two trenches were excavated, digitized and represented by ICP data as well (Fig. 24, Fig. 25).

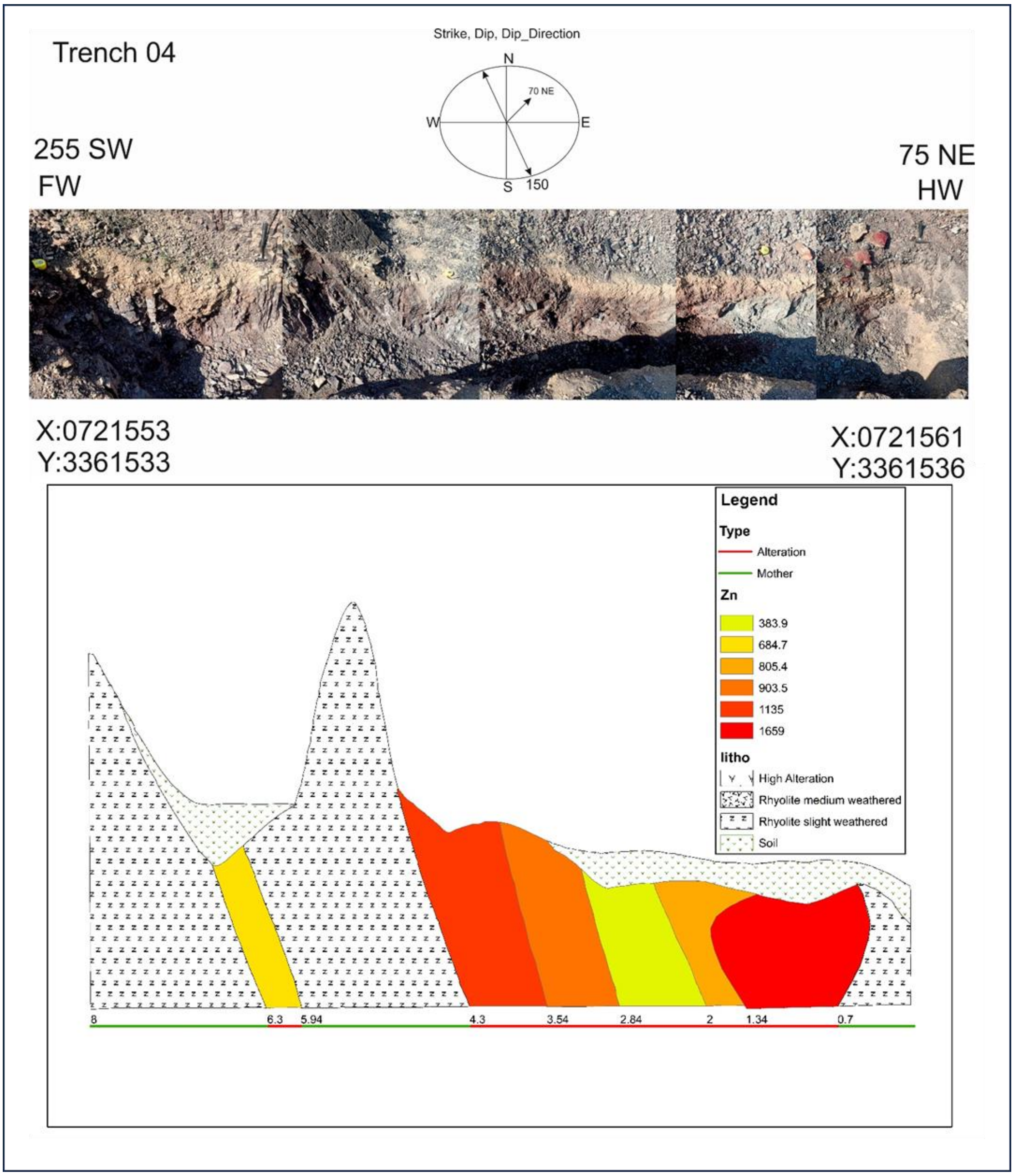

Figure 24: Weak Zone 03, Digitized & ICP Zn in Trench 04.

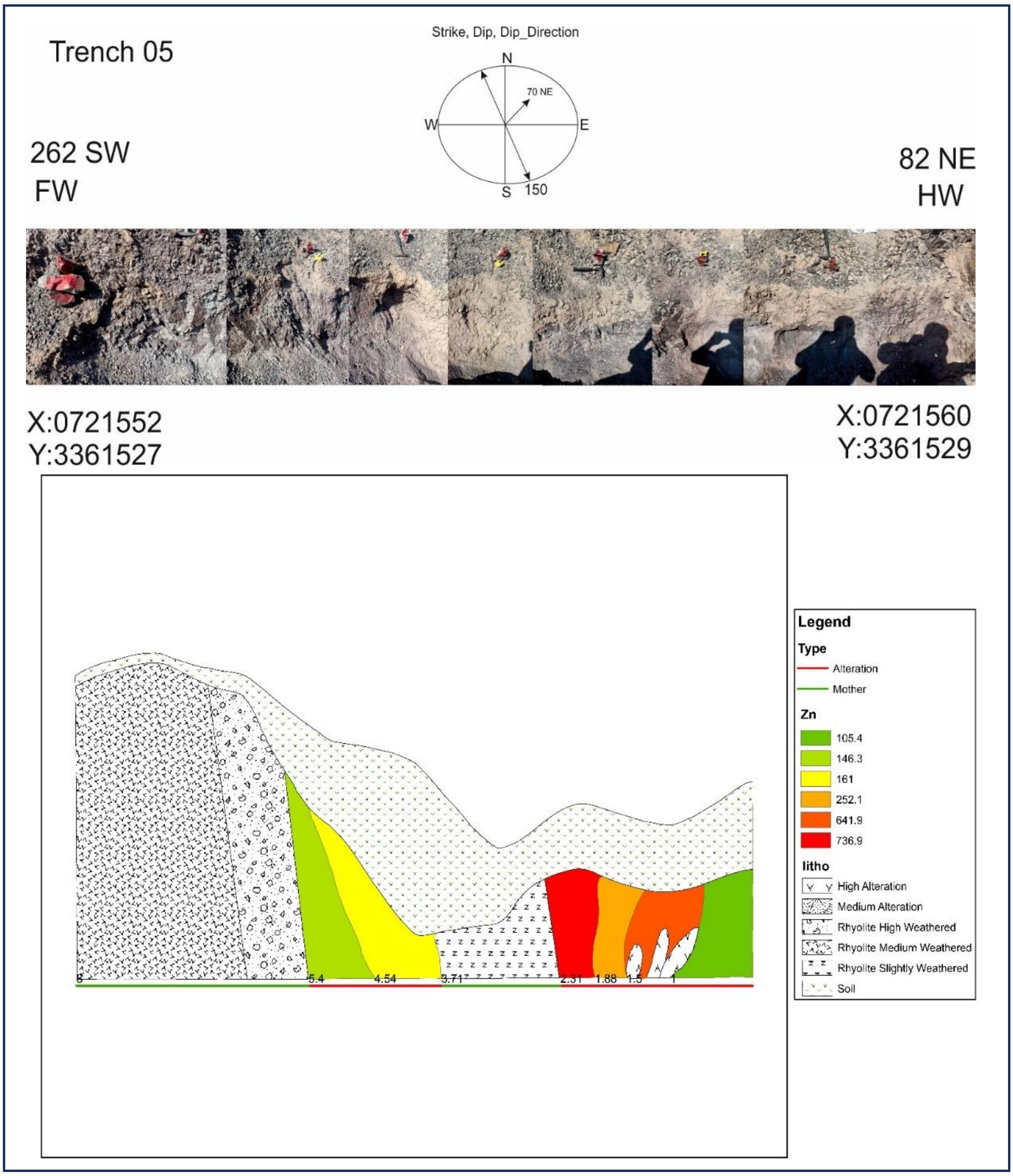

Figure 25: Weak Zone 03, Digitized & ICP Zn in Trench 05.

The correlation links among the trenches 04 & 05 dipping toward north east of the study area (Fig. 26). The correlation was established based on the ICP-Zn in ppm which represented the rest of base metals & REE.

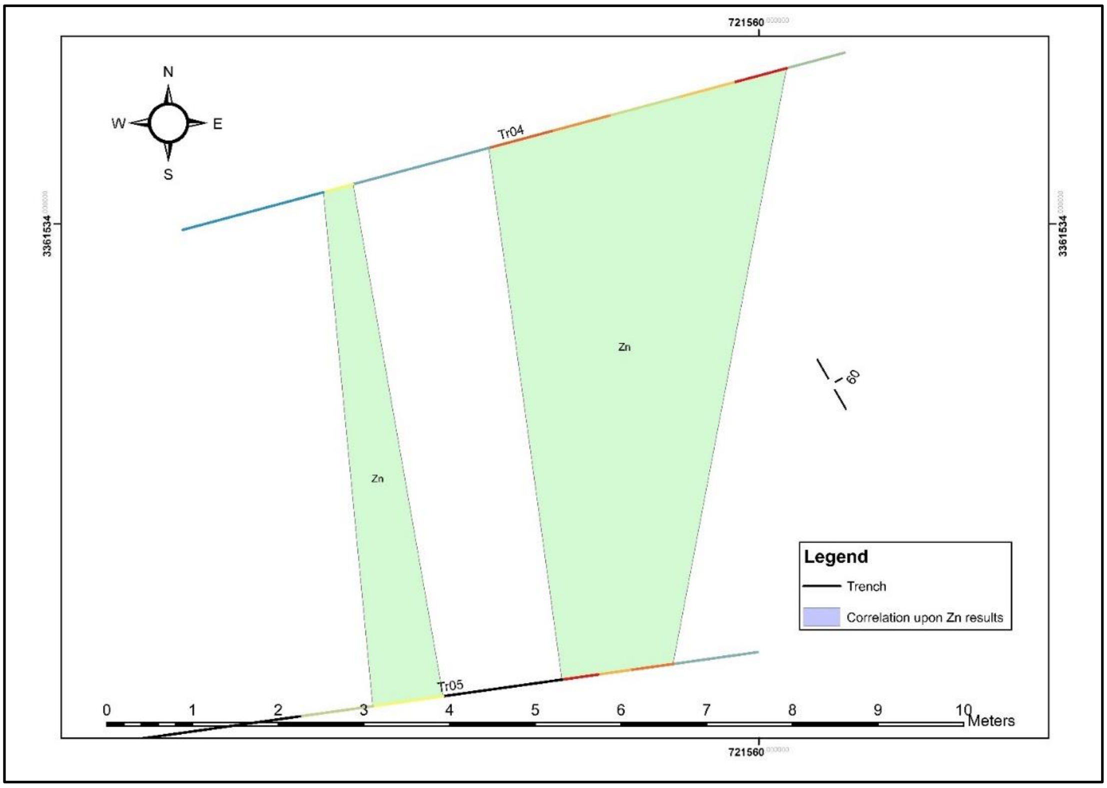

Figure 26: Alteration Correlation In The Weak Zone 03.

Similar status of ICP results classification in the weak zone 02, it has followed in the Weak Zone 03 as well. It has values overwhelmed results of the following Weak zones 01 & 04.

- As shown in the Table 04, the main base metals exceeded the background concentration are:

  V, Cu, Rb, Cr

- Whereas some of REE exceeding their background in little difference are:

  Be, Co, Cs, Li, Ni, Sr, Sn, Pb

Table 4: ICP_Results Of Base Metals & REE In The Weak Zone 03.

	Be	Cd	Co	Cs	Cu	Ga	Li	Ni	Pb	Sr
Background	7.40	6.49	26.30	17.07	201.11	35.25	109.82	107.86	64.88	118.88
Max.	9.3	5	35.5	37.3	1587	38.3	183.1	169.4	93.7	325.1
	V	Zn	Hf	Mo	Nb	Sb	Sn	W	Zr	Ce
Background	78.93	624.59	19.75	6.41	53.73	7.79	19.28	140.84	703.27	220.49
Max.	202.1	1659	22.1	9.2	53.6	5	34.2	94.5	831.3	187.5
	Dy	Gd	Ho	La	Nd	Pr	Sc	Sm	Y	Yb
Background	12.45	19.49	5.00	99.39	99.19	29.95	11.78	18.81	92.79	6.84
Max.	14.3	19.5	5	93.2	86.8	26.1	26.9	20	79.4	8.1
	Rb	Cr	Ti	Ba						
Background	177.85	244.80	12391.62	878.69						
Max.	203.9	389.4								

- The XRD hasn't analyzed in this weak zone in respond to the similarity results to the weak zone 01in term of alteration lithology characteristics.

6.3.4. The Results zone #04

Total of three trenches excavated over there labeled Tr06A, Tr06B & Tr06C, they are revealed two of alteration layer with different dipping direction.

The trenches have been digitized and represented by ICP-Zn data in order to clarify the alteration layer in term of strike, dip, dip direction & lithology (Fig. 27, Fig. 28, Fig. 29).

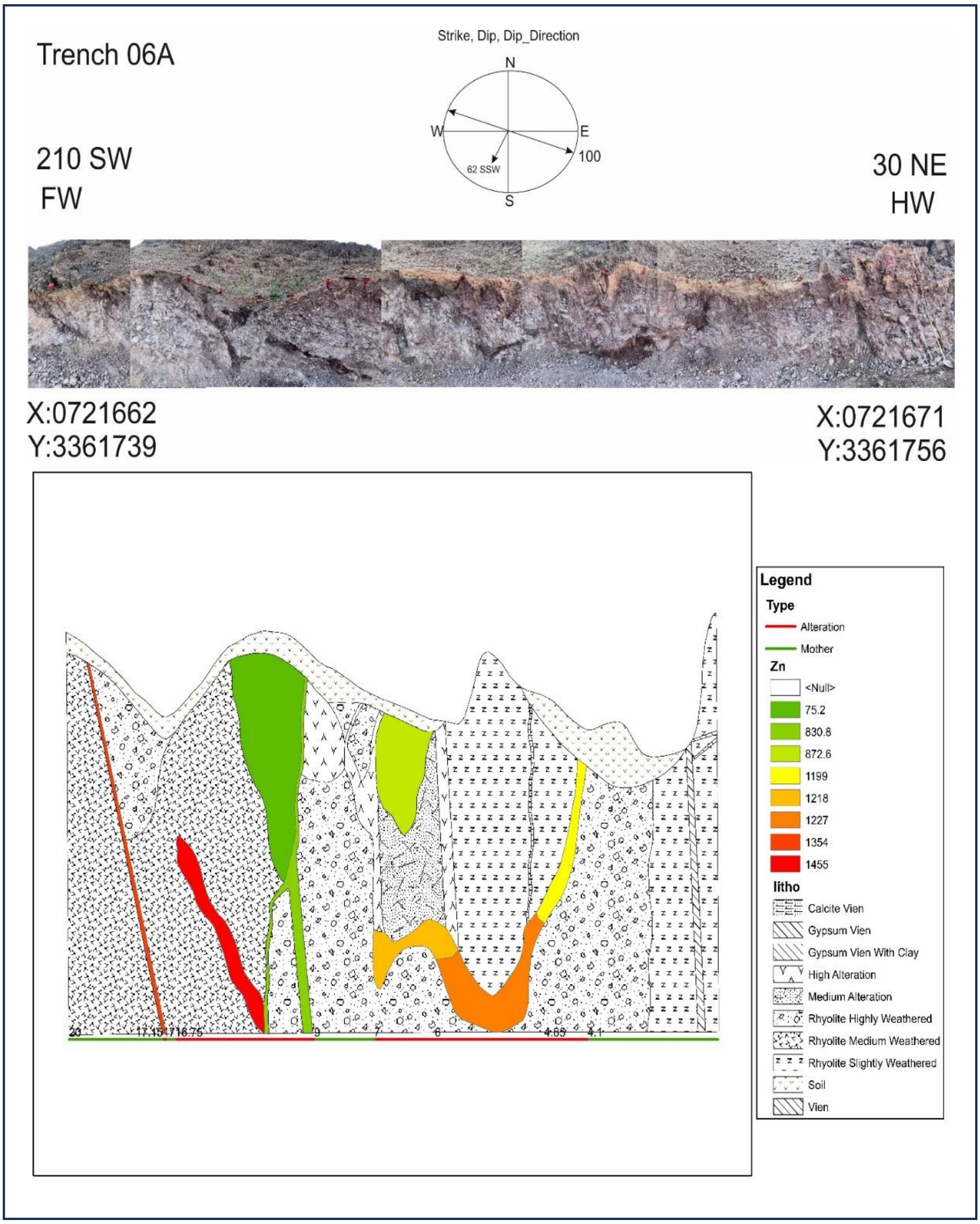

Figure 27: Weak Zone 04, Digitized & ICP Zn In Trench 06A

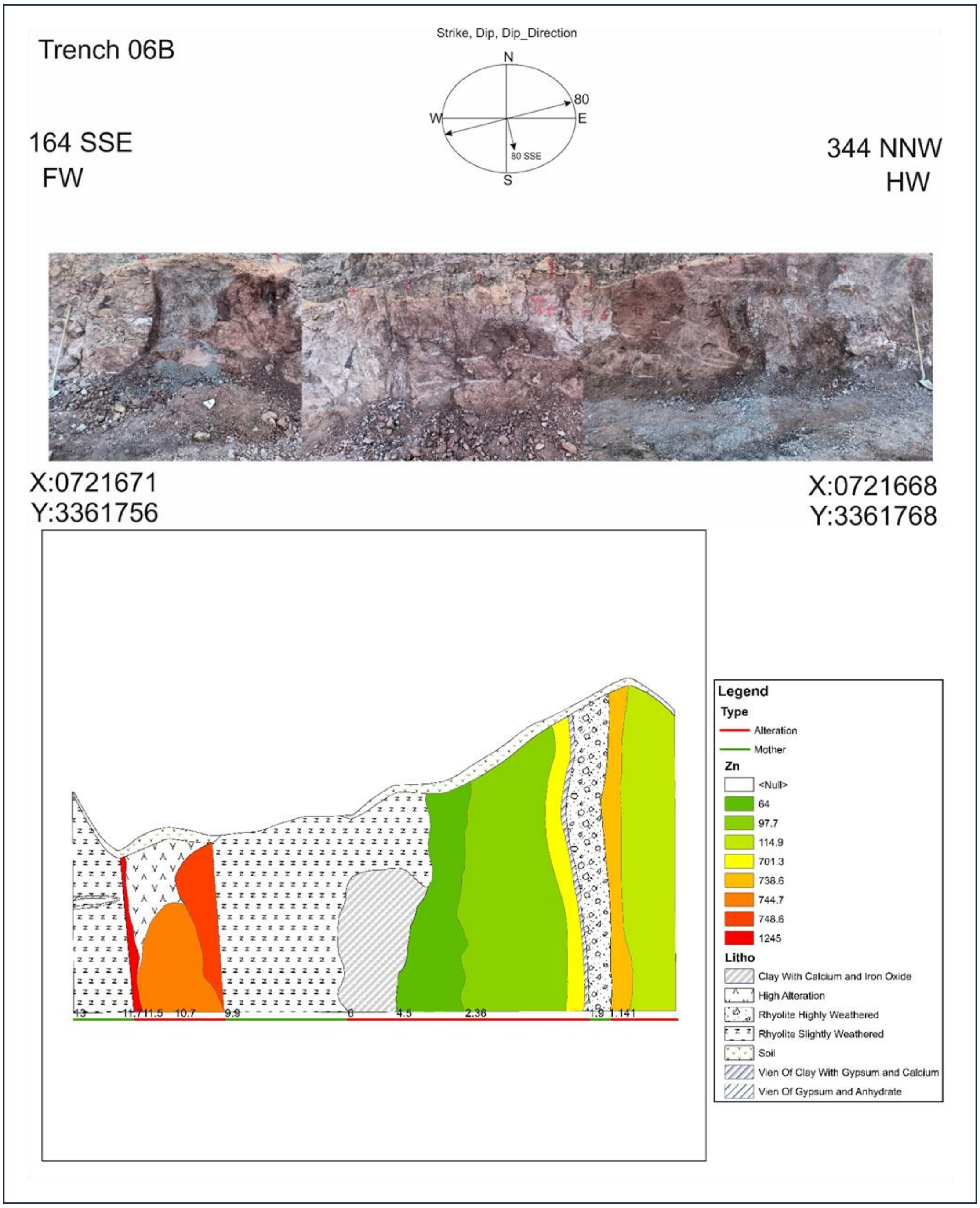

Figure 28: Weak Zone 04, Digitized & ICP Zn In Trench 06B.

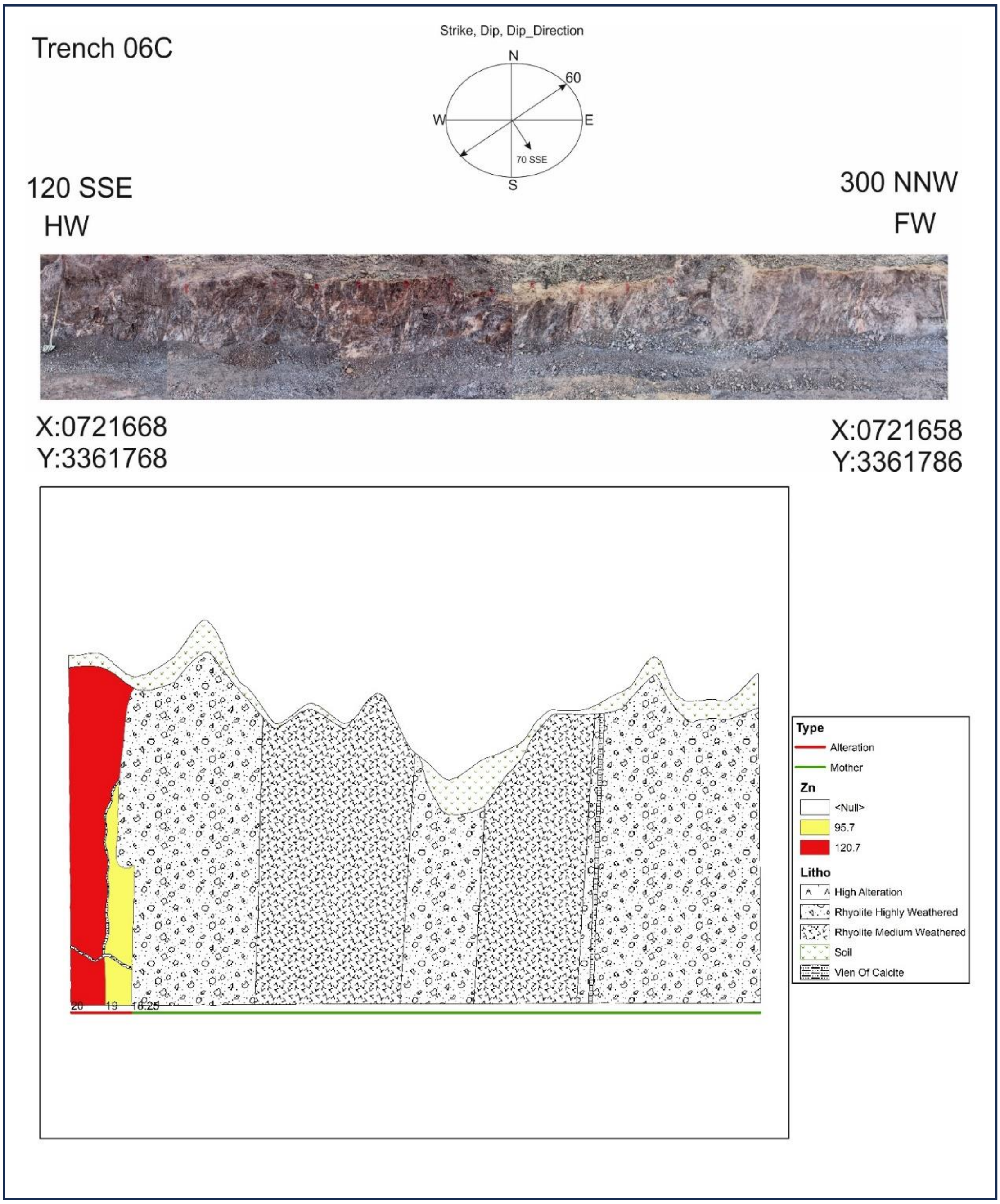

Figure 29: Weak Zone 04, Digitized & ICP _Zn In Trench 06C.

As mentioned in above, those trenches are revealed into two different dipping direction where Tr06A has dipping direction to the south west of the study area whereas Tr06B & Tr06C have dipping direction to the south east of the study area (Fig. 30).

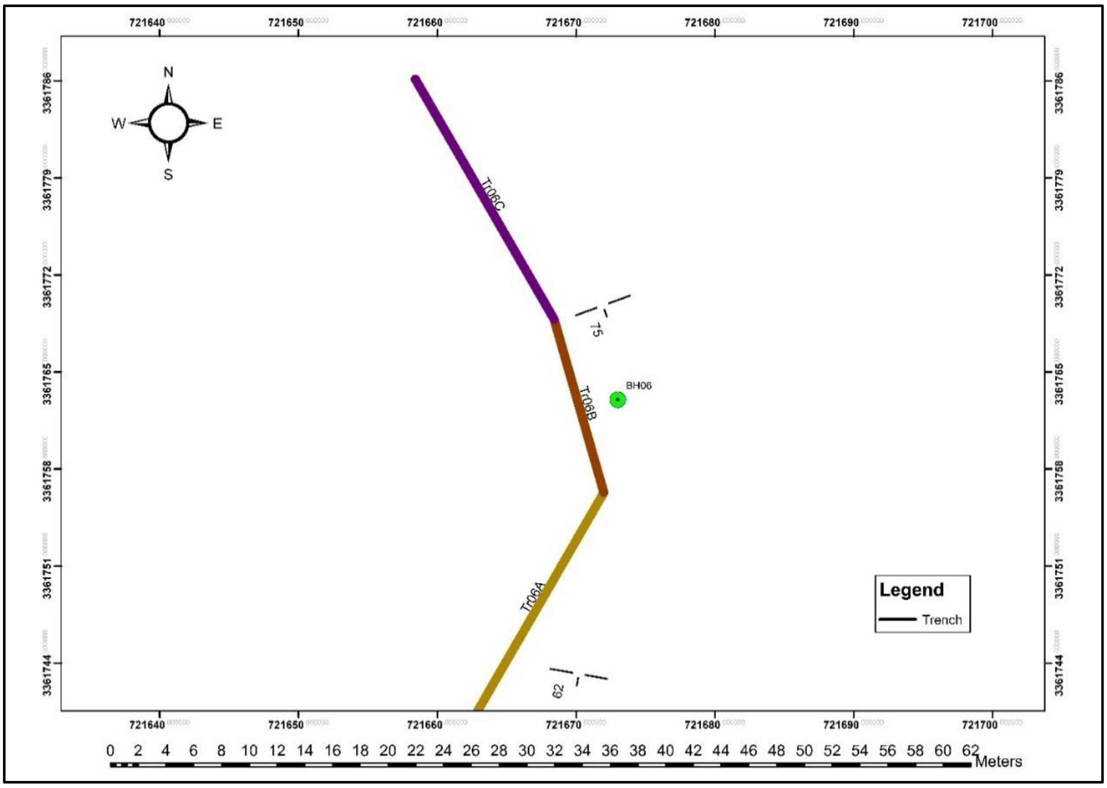

Figure30: Dipping Direction Trench 06A & Trench 06B_06C.

Borehole labeled BH06 was appointed close to the Tr06 corresponding to the dip direction. Total depth drilled out is 7.5 m accompany with total of five samples were collected and sent to the MEMR lab. In response to the follow up of prospecting studies in Sumr et Tayyiba, the samples borehole ICP chemical results will represent within column log when the results release from the lab.

In respond to two different dipping direction were determined in the weak zone 04. The chemical results ICP for trench 06A will declare separately than trenches 06B &06C.

The Chemical Results ICP for trench 06A are given in the Table 05:

Table 5: ICP_Results of Base Metals & REE for Trench 06A.

	Be	Cd	Co	Cs	Cu	Ga	Li	Ni	Pb	Sr
Background	7.40	6.49	26.30	17.07	201.11	35.25	109.82	107.86	64.88	118.88
Max.					124		332.8	107	88.6	
	V	Zn	Hf	Mo	Nb	Sb	Sn	W	Zr	Ce
Background	78.93	624.59	19.75	6.41	53.73	7.79	19.28	140.84	703.27	220.49
Max.		1455							612	
	Dy	Gd	Ho	La	Nd	Pr	Sc	Sm	Y	Yb
Background	12.45	19.49	5.00	99.39	99.19	29.95	11.78	18.81	92.79	6.84
Max.										
	Rb	Cr	Ti	Ba						
Background	177.85	244.80	12391.62	878.69						
Max.		308.6		1434						

Total of eight of ICP results had released from MEMR lab while the rest will update in the follow up of prospecting studies.

- Based on the Table 05, the base metals record concentration higher than its background are:

  Zn, Li

- Whereas REE record higher than its background is:

  Pb, Cr, Ba

In other hand, ICP chemical results for Tr06B & Tr06C are given in the Table 06:

Table 6: ICP_Results of Base Metals & REE For Trenches 06B & 06C.

	Be	Cd	Co	Cs	Cu	Ga	Li	Ni	Pb	Sr
Background	7.40	6.49	26.30	17.07	201.11	35.25	109.82	107.86	64.88	118.88
Max.					281.6		240.5	65.5	78.2	
	V	Zn	Hf	Mo	Nb	Sb	Sn	W	Zr	Ce
Background	78.93	624.59	19.75	6.41	53.73	7.79	19.28	140.84	703.27	220.49
Max.		1245							735.8	
	Dy	Gd	Ho	La	Nd	Pr	Sc	Sm	Y	Yb
Background	12.45	19.49	5.00	99.39	99.19	29.95	11.78	18.81	92.79	6.84
Max.										
	Rb	Cr	Ti	Ba						
Background	177.85	244.80	12391.62	878.69						
Max.		104.8		1686						

- According to record Table 06, the highest base metals observed are:

Cu, Zn, Li

- Whereas REE are:

  Pb, Ba

Zircon element wasn't considered within base metals or REE as it represents the main component in the mother rock (Rhyolite).

Regarding XRD analysis, the results were obtained in the weak zone01 has been represented to this zone as well due to the similarity of alteration characteristics.

6.4. Discussion & Conclusion

According to the ICP_ base metals & REE results in the four weak zones, the alteration layers deposited in the weak zone 03 & weak zone 04 are recorded the highest values of base metals & REE. In addition to the alteration layer deposited along the strike trench 11.

In the weak zone 03, the Zn, Li and Cu are the most interest base metals were determined over there, whereas in the weak zone 04, the Li, Zn and some type of REE are more predominant over there.

Trench 11, the Li, Zn & Ba are the highest record values versus other of base metals & REE.

Ultimately, such this discovered kind of alteration layers' interest with strike, dip & dip direction as well as remarkable concentration of base metals & REE are indicating into vast subsurface mineralization taken place within certain environment of epithermal sulfidation process which is divided into high sulfidation, intermediate sulfidation and low sulfidation.

Generally, Gypsum, carbonate, epidote are the most lithified indicators encountered in the alteration layers as they are playing major proves for alteration process occurred within particular condition of halo oxidation which is resulted by low to intermediate epithermal sulfidation process.

In conclusion, Sumr et Tyyiab has to subject into further of developed prospecting studies including Geophysical studies, tilted angle of core drilling, advance chemical analysis in order to figure out the main source of alteration layer as well as the subsurface bodies of mineralization ore.

7. APPENDICES

7.1. APPENDICES A

7.1.1. TABLES

Appendix 1: Results of stream sediment samples and HMC (BRGM).

S_ID	X_UTM	Y_UTM	Type	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	K_2O	MnO	TiO_2	P
2109	721863	3362188	SS	84.4	8.9	4.6	4.5	1.3	3.6	0.1	0.72	1764
2110	721970	3361991	SS	103	12.7	11.4	5.5	2.4	4.9	0.3	2.19	2795
2111	722476	3360920	SS	73	8.6	4.1	11.9	1.6	3.5	0.1	0.68	2206
2112	721549	3360293	SS	81.2	9.8	5.5	7	1.5	4.1	0.1	1.16	2831
2113	721310	3360257	SS	91.4	9.6	2.9	4.8	0.4	4.9	0.1	0.26	527
2114	720804	3360062	SS	93.1	10.3	3.1	3.4	0.6	5.2	0.1	0.34	597
2115	719967	3359680	SS	76.9	8.6	3.2	2.5	0.5	-0.1	0.1	0.29	477
2116	719921	3359901	SS	74.7	7.1	3.2	3.8	0.3	3	0.1	0.24	403
2117	719318	3359288	SS	80.6	2.3	1.6	7.5	0.2	1.4	0	0.11	1066
2118	719632	3360593	SS	74.8	7.7	3.7	2.9	0.4	2.9	0.1	0.29	435
2119	720001	3360646	SS	70.4	8.3	4.6	2.5	1	3.2	0.1	0.56	774
2120	720098	3360754	SS	71.2	8.7	5	2.4	1.2	3.1	0.1	0.58	1011
2121	720114	3360958	SS	73.3	8	5.4	2.8	0.8	3.4	0.1	0.91	1379
2122	720136	3361245	SS	69.6	8.6	6.3	4.2	1.8	3.6	0.2	1.07	1758
2123	720903	3361394	SS	76.8	7.8	4.8	2.9	0.8	3.1	0.1	0.56	948
2124	720093	3361650	SS	76	7.8	5.4	2.5	1	3.4	0.1	0.74	1208
2125	719959	3361925	SS	82.8	9.5	3.5	2.8	0.9	3.6	0.1	0.39	614
8598	722605	3361620	HMC	45.7	1	10.3	20.6	3.5	0.3	0.2	2.31	61503
8599	721101	3360017	HMC	85.4	0.8	3.6	7.4	0.8	0.3	0	0.41	3561
8600	719979	3359495	HMC	80.9	0.7	4.7	7	0.7	0.3	0	0.46	4098
8601	719478	3360400	HMC	83.3	0.9	3.8	7.1	0.7	0.4	0.1	0.54	3392
8602	719951	3361108	HMC	66.1	3.3	21	3.5	1.7	0.9	0.5	8.7	2442
S_ID	Li	Be	B	V	Cr	Co	Ni	Cu	Zn	As	Sr	Y
2109	28	6	32	42	25	14	25	16	206	-31	105	68
2110	57	9	37	125	31	23	34	35	477	-34	142	91
2111	27	4	32	40	24	18	29	14	168	-6	193	52
2112	20	5	32	64	38	14	26	16	134	1	195	68
2113	14	5	32	20	11	10	20	10	97	-26	92	75
2114	19	5	30	24	12	9	21	20	113	-33	83	74
2115	-2	6	37	28	7	-3	10	6	126	46	5	61
2116	12	6	36	21	12	15	25	5	116	83	73	68
2117	5	2	36	16	13	14	26	24	41	33	54	24
2118	17	6	35	30	15	16	27	5	188	78	52	74
2119	28	5	33	54	20	19	30	8	237	100	64	60
2120	31	6	31	61	32	18	32	14	289	100	67	60
2121	16	5	31	66	16	20	31	12	172	92	67	65
2122	22	5	31	87	32	22	43	15	308	111	78	61
2123	15	7	34	49	24	19	33	9	207	81	51	77

2124	16	6	35	53	20	19	29	13	208	97	49	75
2125	21	6	37	35	12	-4	9	19	166	-16	87	70
8598	11	2	48	224	133	18	98	32	241	60	639	56
8599	5	1	41	49	28	8	35	23	76	54	110	21
8600	5	1	59	56	28	20	44	17	105	78	101	27
8601	6	1	47	42	23	24	45	12	98	71	132	23
8602	18	3	41	485	49	46	70	25	687	104	91	50

S_ID	Nb	Mo	Ag	Sn	Ba	La	Ce	W	Pb	Bi	Zr	Au
2109	44	12	0.6	21	271	69	146	22	39	30	784	
2110	74	19	0.5	30	511	105	228	40	124	14	917	5
2111	34	16	0.8	28	403	49	128	22	35	28	575	
2112	48	18	0.4	24	436	73	170	30	44	8	822	
2113	45	14	0.6	20	337	73	172	31	34	57	809	
2114	46	15	0.4	22	368	75	170	27	39	20	779	
2115	42	-4	-0.4	5	227	60	144	64	39	-25	628	
2116	52	5	1.4	25	333	62	153	68	50	-21	854	
2117	20	0	1.2	20	224	25	63	49	37	-1	317	
2118	53	7	1.2	25	145	71	175	68	56	-3	830	
2119	47	7	1.2	27	302	58	144	79	76	6	633	
2120	47	7	1.2	25	304	60	143	80	100	9	615	
2121	55	8	1.4	26	227	63	163	76	63	10	776	
2122	49	6	1.4	30	310	53	132	79	61	-9	685	
2123	57	7	1.4	28	180	69	167	76	61	-3	915	5
2124	58	7	1.3	29	152	76	178	79	63	14	889	
2125	43	-4	-0.7	7	203	67	147	39	27	13	732	
8598	36	0	0.1	4	4376	50	59	29	104	-8	146	
8599	21	6	0.2	19	488	28	31	27	53	-8	935	
8600	28	17	1.1	26	698	34	42	32	52	-18	1658	
8601	26	18	1.3	34	342	35	52	28	56	-10	1298	
8602	99	28	0.6	35	265	67	129	48	81	-43	2020	

Appendix 2: Summary of catchment & sub-catchment areas and the number of proposed samples within the study area.

CATCHMENT AREAS								
Catchment ID	Priority	BRGM Results (ppm)			Area (sq.m)	No. of Samples		Notes
		Au	Pb	Zn		SS*	HMC*	
C-1	A	5	123	477	53542	2	2	Zn, Pb, (Au) anomalies
C-2	A	5	123	477	101691	4	2	Zn, Pb, (Au) anomalies
C-3	A	5	123	477	74271	3	2	Zn, Pb, (Au) anomalies
C-4	A	5	61	207	173625	5	5	Zn, Pb, (Au) anomalies
C-5	B	-	61	308	458458	4	2	Zn, Pb anomalies
C-6	B	-	100	289	93069	3	1	Zn, Pb anomalies
C-7	B	-	100	289	97133	1	1	Zn, Pb anomalies
C-8	B	-	76	237	125321	2	1	Zn, Pb anomalies
C-9	B	-	63	208	140435	2	2	Zn, Pb anomalies
C-10	C	-	63	172	512066	3	1	Pb anomaly & high Zn background
C-11	D	-	39	206	124213	1	0	Zn anomaly
C-12	D	-	39	206	42483	1	0	Zn anomaly
C-13	D	-	56	188	62301	1	1	High Zn & Pb background
C-14	D	-	35	168	26468	0	0	Rock sampling prospecting
C-15	D	-	27	166	91815	2	0	Moderate Zn & low Pb background
C-16	D	-	44	134	128326	2	0	Zn & Pb shows
C-17	D	-	39	126	19544	0	0	Rock sampling prospecting
C-18	D	-	50	116	113072	2	1	Zn show & high Pb background
C-19	D	-	39	113	145440	2	1	Zn show & high Pb background
C-20	D	-	34	97	235055	2	2	Zn show & moderate Pb background
C-21	E	-	-	-	228064	1	1	Close to gold shows
C-22	E	-	-	-	109409	1	0	Close to gold shows
C-23	E	-	-	-	57319	1	1	Close to gold shows
C-24	E	-	-	-	32737	1	1	Close to gold shows
C-25	E	-	-	-	41172	1	1	Close to gold shows
C-26	E	-	-	-	62352	1	0	Close to Zn & Pb anomalies
C-27	E	-	-	-	79401	1	0	Close to Zn & Pb anomalies
C-28	E	-	-	-	55710	1	1	Close to Zn & Pb anomalies
C-29	E	-	-	-	86044	1	1	Close to Zn & Pb anomalies
C-30	E	-	-	-	83557	1	1	Close to Pb anomaly
C-31	F	-	-	-	27856	0	0	Rock sampling prospecting
C-32	F	-	-	-	61454	0	0	Rock sampling prospecting
C-33	F	-	-	-	60093	0	0	Rock sampling prospecting
C-34	F	-	-	-	54304	0	0	Rock sampling prospecting
C-35	F	-	-	-	37651	0	0	Rock sampling prospecting
C-36	F	-	-	-	16857	0	0	Rock sampling prospecting
C-37	F	-	-	-	49843	0	0	Rock sampling prospecting

Continue

C-38	F	-	-	-	53243	0	0	Rock sampling prospecting
C-39	F	-	-	-	37758	0	0	Rock sampling prospecting
C-40	F	-	-	-	86403	0	0	Rock sampling prospecting
C-41	F	-	-	-	52725	1	0	Rock sampling prospecting
C-42	F	-	-	-	57160	0	0	Rock sampling prospecting
					Sum	**53**	**31**	

*SS: stream sediment samples, *HMC: heavy mineral concentrates.

Subcatchment(أحواض التصريف المائي الثانوية)						
Catchment ID	**Priority**	**BRGM Results (ppm)**			**Area (sq.m)**	**Notes**
		Au	**Pb**	**Zn**		
C-1A	A	5	123	477	29238	Zn, Pb, (Au) anomalies
C-2A	A	5	123	477	20750	Zn, Pb, (Au) anomalies
C-2B	A	5	123	477	45883	Zn, Pb, (Au) anomalies
C-2C	A	5	123	477	14590	Zn, Pb, (Au) anomalies
C-3A	A	5	123	477	26249	Zn, Pb, (Au) anomalies
C-3B	A	5	123	477	10543	Zn, Pb, (Au) anomalies
C-4A	A	5	61	207	16922	Zn, Pb, (Au) anomalies
C-4B	A	5	61	207	22089	Zn, Pb, (Au) anomalies
C-4C	A	5	61	207	30456	Zn, Pb, (Au) anomalies
C-4D	A	5	61	207	39067	Zn, Pb, (Au) anomalies
C-5A	B	-	61	308	341856	Zn, Pb anomalies
C-5B	B	-	61	308	206772	Zn, Pb anomalies
C-5C	B	-	61	308	108049	Zn, Pb anomalies
C-6A	B	-	100	289	33531	Zn, Pb anomalies
C-6B	B	-	100	289	19458	Zn, Pb anomalies
C-8A	B	-	76	237	50799	Zn, Pb anomalies
C-9A	B	-	63	208	31723	Zn, Pb anomalies
C-10A	C	-	63	172	318250	Pb anomaly & high Zn background
C-10B	C	-	63	172	153237	Pb anomaly & high Zn background
C-15A	D	-	27	166	44689	Moderate Zn & low Pb background
C-16A	D	-	44	134	70289	Zn & Pb shows
C-18A	D	-	50	116	59196	Zn show & high Pb background
C-19A	D	-	39	113	71202	Zn show & high Pb background
C-20A	D	-	34	97	114654	Zn show & moderate Pb background

Appendix 3: Results of the orientation survey stream sediment samples in the laboratories of JAEC and MEMR.

- JAEC laboratory

هيئة الطاقة الذرية الأردنية															
ID	Ba	Bi	Cd	Co	Cr	Cu	La	Li	Mo	Ni	Pb	Y	Zn	Zr	Th	U
ST-S-1	528.29	<18.29	<1.81	78.03	<105.89	93.38	<50.62	<136.20	<36.96	41.25	98.18	53.72	411.57	474.57	55.90	7.00
ST-S-1a	479.38	<18.29	<1.81	74.86	<105.89	85.04	<50.62	<136.20	<36.96	40.06	<71.93	49.58	426.19	432.76	<8.75	<4.78
ST-S-2	491.52	<18.29	<1.81	73.52	<105.89	93.26	51.34	<136.20	<36.96	40.40	<71.93	57.41	391.58	500.03	8.96	<4.78
ST-S-2a	482.69	<18.29	<1.81	64.36	<105.89	85.09	<50.62	<136.20	<36.96	36.51	<71.93	56.00	424.21	489.50	<8.75	<4.78
ST-S-3	471.79	<18.29	<1.81	<37.38	<105.89	49.98	65.06	<136.20	<36.96	27.03	72.92	65.69	419.30	560.11	9.88	<4.78
ST-S-3a	460.87	<18.29	<1.81	<37.38	<105.89	49.42	57.30	<136.20	<36.96	27.22	72.34	59.44	403.94	497.04	11.46	<4.78
ST-S-4	580.86	<18.29	<1.81	<37.38	<105.89	45.33	73.41	<136.20	<36.96	<26.31	99.80	74.43	413.40	606.57	13.66	6.15
ST-S-4a	551.30	<18.29	<1.81	<37.38	<105.89	46.49	72.85	<136.20	<36.96	<26.31	84.56	69.19	406.33	571.06	9.06	4.89
ST-S-5	599.00	<18.29	<1.81	<37.38	<105.89	45.69	78.28	<136.20	<36.96	<26.31	103.81	75.59	423.63	618.82	10.42	5.36
ST-S-5a	438.75	<18.29	<1.81	<37.38	<105.89	54.63	60.85	<136.20	<36.96	26.62	<71.93	59.81	404.52	501.68	<8.75	<4.78
ST-S-6	512.49	<18.29	<1.81	<37.38	<105.89	42.77	83.46	<136.20	<36.96	<26.31	77.94	77.60	441.10	640.10	11.30	5.67
ST-S-6a	465.72	<18.29	<1.81	<37.38	<105.89	40.20	72.05	<136.20	<36.96	<26.31	77.93	67.72	418.72	545.20	<8.75	<4.78
ST-S-7	545.70	<18.29	<1.81	56.52	<105.89	85.79	67.62	<136.20	<36.96	33.98	89.16	67.29	656.73	582.04	8.80	<4.78
ST-S-7a	644.48	<18.29	<1.81	47.90	<105.89	80.15	86.02	<136.20	<36.96	<26.31	152.16	69.73	541.85	607.66	<8.75	<4.78
ST-S-8	808.05	<18.29	<1.81	51.66	<105.89	94.26	84.19	<136.20	<36.96	28.85	163.02	72.45	591.02	630.60	10.47	5.11
ST-S-8a	469.57	<18.29	<1.81	52.32	105.97	83.78	55.30	<136.20	<36.96	28.15	83.45	56.30	592.42	486.46	<8.75	<4.78

- MEMR laboratory

MEMR Laboratory																						
#	S.ID	Co_ppm	Cs_ppm	Cu_ppm	Ga_ppm	Li_ppm	Ni_ppm	Pb_ppm	Sr_ppm	V_ppm	Zn_ppm	Hf_ppm	Zr_ppm	Ce_ppm	Dy_ppm	Gd_ppm	La_ppm	Nd_ppm	Pr_ppm	Sc_ppm	Sm_ppm	Y_ppm	Yb_ppm
1	ST-S-1	35.3	5.1	58.2	25.5	40.4	82	88.3	139.3	270.6	346.6	8.7	369.7	115.4	21.4	21.9	50.8	53.7	15.9	10.7	17.2	45.5	5.7
2	ST-S-1a	32.3	2.5	58.8	23.8	38.6	88.8	66.3	144.8	237.5	369.3	7.7	333.2	110.1	6	20	49.3	52.2	15.1	10.6	16.4	40.7	5.2
3	ST-S-2	31.5	2.5	60.5	26.3	37.7	72.9	69.3	137.2	236.5	333.1	9.3	384.2	112.9	10.3	21.5	52.1	55.1	15.8	10.4	17.8	47.2	5.7
4	ST-S-2a	27.1	2.5	48.1	22.3	35.8	74.1	51.5	115.3	205.2	351.4	8.4	364.4	106.2	9.1	18.9	48.2	50.4	13.8	9.2	15.6	44.7	5.3
5	ST-S-3	14.4	5.8	36.5	22.2	37.5	62.8	69.1	96.8	96.7	340.8	9.5	412.6	130.1	12.3	17.2	58.2	57.4	15.3	6.1	14	51.2	5.4
6	ST-S-3a	13.9	5.6	34.7	19.3	35	48.3	65.5	99.7	97.3	338.4	8.4	368.4	120.3	11.3	16	53.5	53.5	14.4	6.1	12.9	46.3	2.5
7	ST-S-4	12.2	6.6	30.7	10.9	41.9	61.2	88.4	83.6	77.7	348.2	11.5	485.9	151.4	16	19.4	67.4	65.9	17.8	2.5	15.2	61.2	6.4
8	ST-S-4a	14	6.2	33.8	22.2	44.2	48	100.5	92.4	79.7	371.5	9.5	411.8	145.1	13.2	17.7	63.6	63	16.3	5.4	14	52.1	5.5
9	ST-S-5	13.2	6.5	30.8	22.7	41.4	38.5	90.1	82.9	80.1	348	11.3	482.4	151	15.4	19.1	65.8	64.7	17.3	2.5	14.9	59.6	6.2
10	ST-S-5a	14.2	5.5	35	19.8	36	50.9	59	100.7	93.9	336.5	8.5	369.4	120.2	11.6	16.1	52.3	53.1	14.3	6.1	12.9	46	2.5
11	ST-S-6	16.3	6.7	35.5	17.2	49.5	101.9	69.1	83.3	56.8	348.9	11.3	477.7	154.6	14.5	18.1	68.5	66.7	18.1	2.5	14.7	58.9	6.1
12	ST-S-6a	10.8	6.3	26.6	20.7	42.1	40.9	65.5	81.3	59.2	349.5	10.1	433.4	102.7	12.4	16.4	64.5	62.6	17.2	2.5	14	54.4	5.6
13	ST-S-7	25.8	7.8	61.8	24.9	37.6	75.8	100.9	108.5	188.6	576.2	11	438.3	143.2	12	21.4	62.7	63.8	17	9	18.1	52.5	6.1
14	ST-S-7a	18.4	8.1	54.3	23.9	27.2	68	146.2	85.3	167.5	465.6	11.3	473	181	7	22.4	80	79.4	21.4	6.8	20.1	58.1	6.8
15	ST-S-8	21.9	8.5	58.5	25.5	31	72.4	160.2	89.8	177.8	490.5	11.7	507.2	182.6	6.4	24.4	79.3	76.8	21.5	7.2	19.6	60.1	7.1
16	ST-S-8a	21.5	7.1	54.7	21.6	32	78.1	81.2	97.1	165.3	505.9	9.2	387.9	129.9	12	18.7	58.1	58.6	15.7	8.2	17.2	47.6	5.4

7.1.2. MAPS

Appendix 4: Maps of Pb, Zn, and Cu results from JAEC & MEMR laboratories.

- **Pb maps**

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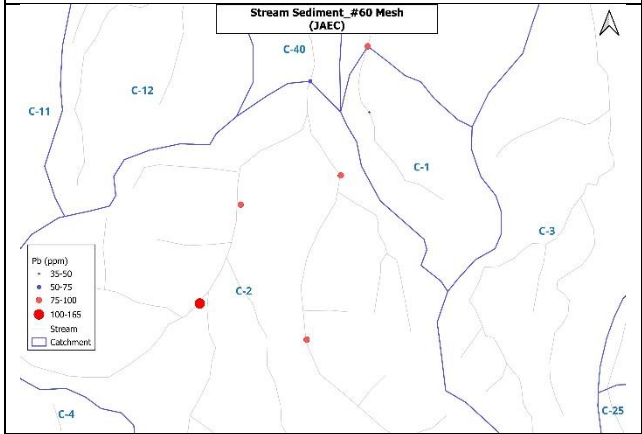

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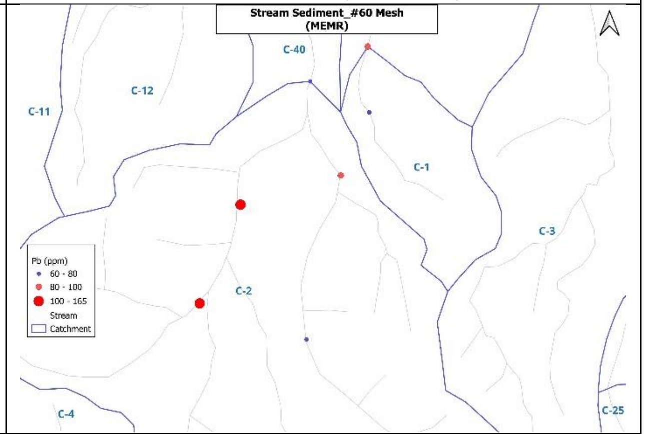

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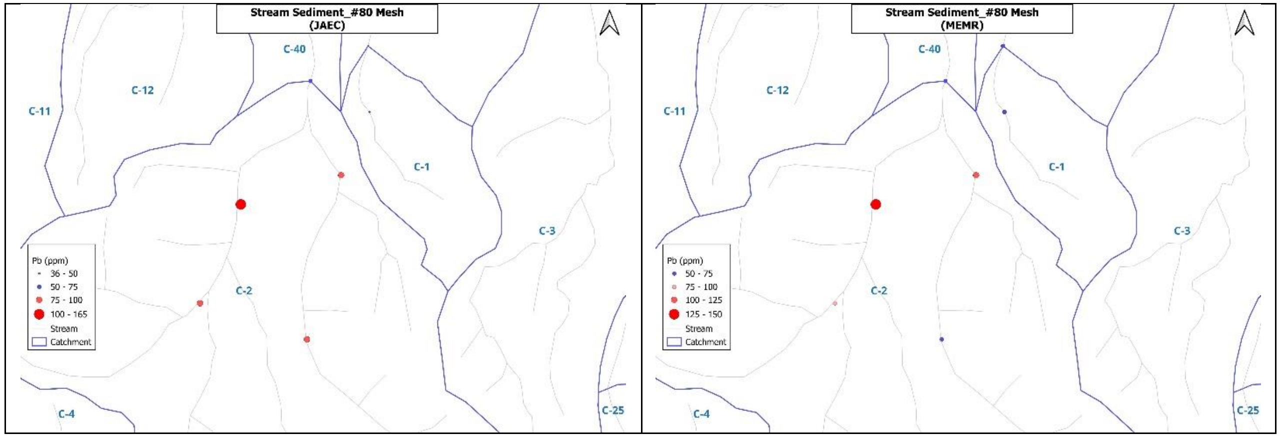

- **Zn maps**

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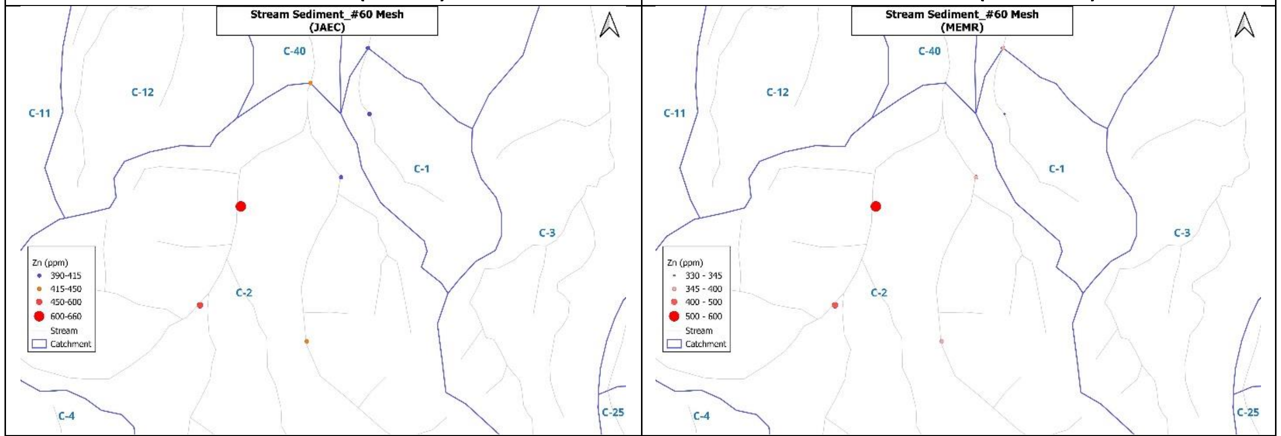	
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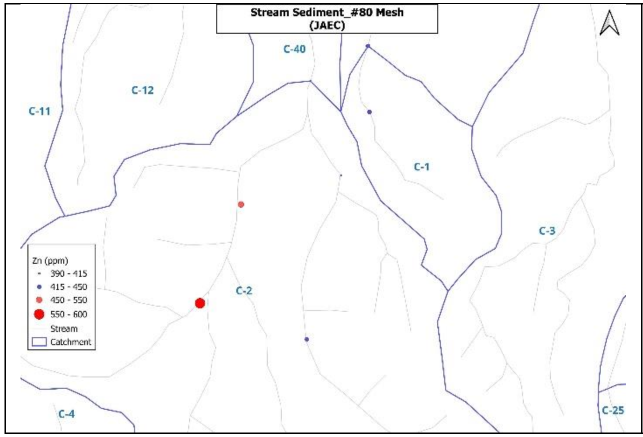	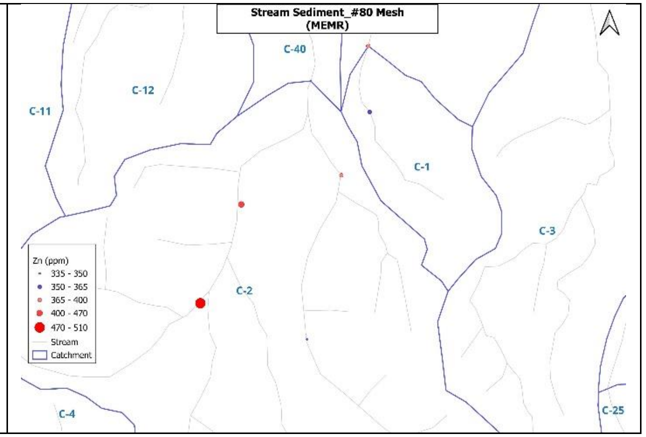

- **Cu maps**

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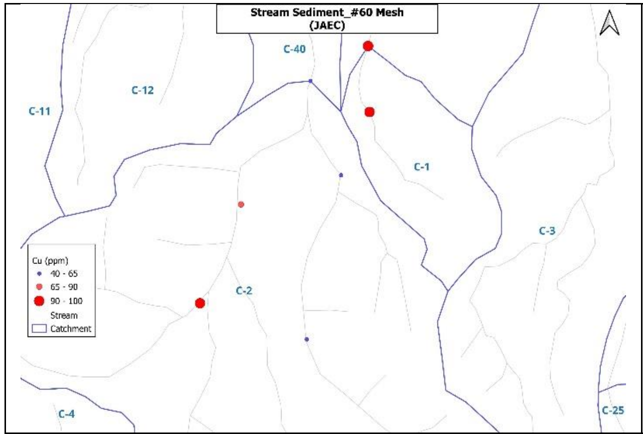
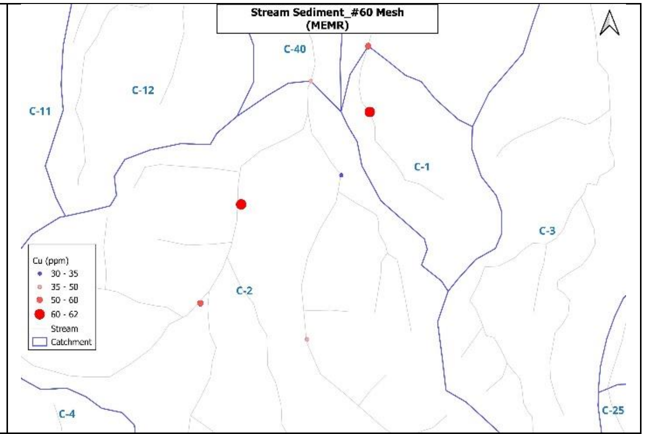
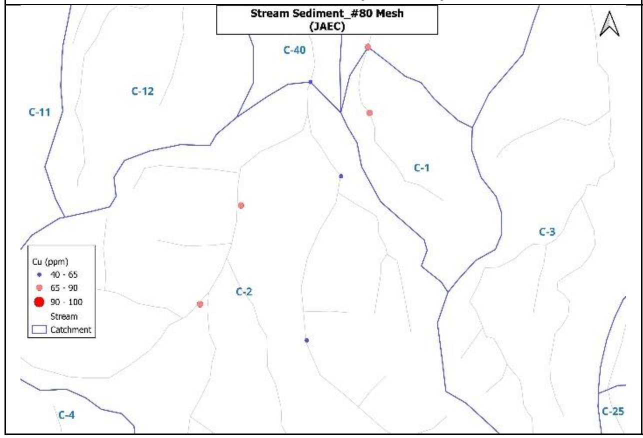
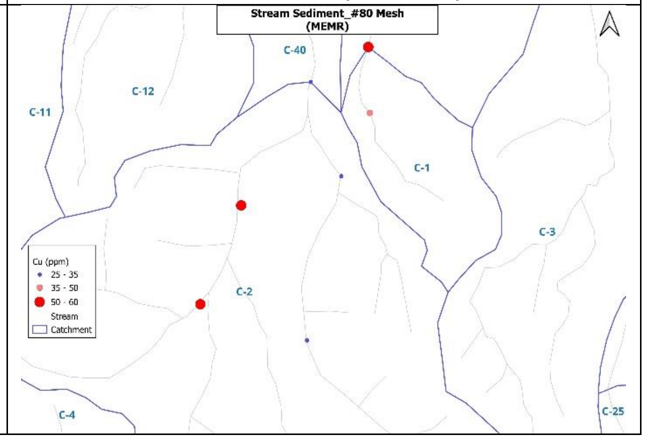




#80 Mesh (JAEC)	#80 Mesh (MEMR)





7.2. APPENDICES B

7.2.1. Trenches Informative Data

one +A3:Y62n	X	Y	Z	TR. ID	T.R Dimension						T.L.(m)	T.D(m)	Overburden(cm)		Trench drilling info.			Altration Zone							Altration Orientation			Geologist
					Trench Line	Wall Type	Direction	Coordinates X	Coordinates Y	Coordinates Z			Min	Max	Start	End	Drilling Activity	From	To	Width	Intesity	Type	Style	Mineralization	Strike	Dip	Dip Direction	
1	721838	3361722	276	Tr. 01	Start Point	Hang wall	162 SSE	721857	3361724	279	11	1	0.1	0.4	1/26/2023	1/30/2023	hammar & Track loader	1	1.33	0.33	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate	210	76	SEE	Ezaldeen & Alaa
																		3	4	1	medium	propylitic	oxidation halos	fe-mn, sulfide, carbonate				
																		4	5	1	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate				
																		5	5.63	0.63	medium	propylitic	oxidation halos	fe-mn, sulfide, carbonate				
					End Point	Foot wall	342 NNW	721853	3361734	278								5.63	6.1	0.47	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate				
																		6.1	7	0.9	medium	propylitic	oxidation halos	fe-mn, sulfide, carbonate				
																		8.33	8.56	0.23	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate				
				Tr. 02	Start Point	Hang wall	174 SSE	721885	3361722	281	10	1	0.1	0.5	1/24/2023	1/25/2023	hammar & Track loader	1.17	1.34	0.62	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate	198	60	SEE	Ezaldeen & hamidi
																		3	4.22	1.25	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate				
																		6.36	8.14	1.78	medium	propylitic	oxidation halos	fe-mn, sulfide, carbonate, black mineral, calcite				
					End Point	Foot wall	354 NNW	721883	3361730	280								8.14	9.5	1.36	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate, salt				
				Tr. 03	Start Point	Foot wall	312 NW	721835	3361718	277	10	5.5	0.3	1.5	30-Jan-23	1/31/2023	Track loader	4	5	1	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate, chlorite, copper, epidote	76	76	SSE	Ezaldeen & Alaa
																		5	6	1	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate, chlorite, copper, epidote				
					End Point	Hang wall	132 SE	721842	3361712	278								6	7	1	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate, chlorite, copper, epidote				
				Tr.11	Start Point	Hang wall	180 S	721867	3361710	278	5.4	2.5	0	0.1	20-Jun-23	6/20/2023	Track loader	0	3.1	3.1	strong	propylitic	oxidation halos	fe-mn, clay, sulfides, sulfer	283	70	SW	Alaa, Ez
					End Point	Foot wall	360N	721866	3361715	276																		
2	721891	3361666	274	Tr.07	Start Point	Hang wall	168 SSE	721909	3361672	278	12	1	0	0.25	10-Apr-23	4/12/2023	Hammar	3	4	1	Slightly	propylitic	oxidation halos	fe-mn, sulfide, carbonate, chlorite	254	50	SE	Azmi
					End Point	Foot wall	332 NNW	71906.486	3361683.7	278								4	5	1	Strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate, chlorite, Blue mineral	254	50	SE	
				Tr.08	Start Point	Hang wall	140 SE	721898	3361670	250	10	2	0	0.4	2-May-23	2-May-23	Track loader	0	0.25	0.25	Medium	propylitic	oxidation halos	Gypsum, Carbonate	254	50	SE	Ali Al Smadi, Alaa, Ez
																		0.25	1.6	1.35	strong	propylitic	oxidation halos	Carbonate, Caly	254	50	SE	
					End Point	Foot wall	320 NW	721891.58	3361677.7	250								8.275	8.425	0.15	Strong	propylitic	oxidation halos	Clay	230	50	SSE	
																		8.425	8.525	0.1	strong	propylitic	oxidation halos	Carbonate, Clay	230	50	SSE	
				Tr.09	Start Point	Foot wall	232 NNW	721886	3361671	280	8	1.75	0	0.65	6-Jun-23	7-Jun-23	Track loader	0.95	1.1	0.15	strong	propylitic	oxidation halos	fe-mn, carbonate	250	35	SE	Alaa, Azmi
					End Point	Hang wall	172 SSE	721889	3361666	280																		
				Tr.10	Start Point	Foot wall	214 NW	721878	3361662	283	13	2	0	0.6	6-Jun-23	7-Jun-23	Track loader	5.9	6.83	0.93	strong	propylitic	oxidation halos	fe-Mn, Carbonate	254	60	SE	Alaa, Alaa, Qasim
					End Point	Hang wall	130SE	721886	3361658	281								9.3	9.5	0.2	strong	propylitic	oxidation halos	Fe-Mn, Clay	254	60	SE	
3	721553	3361516	294	Tr. 04	Start Point	Hang wall	75 NE	721561	3361536	296	8	1	0	0.3	6-Feb-23	8-Feb-23	hammer	1.34	2	0.66	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate, chlorite, copper, epidote	150	70	NE	Azmi
																		2	2.84	0.84	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate, chlorite, calcite				
																		3.54	4.3	0.76	strong	propylitic	oxidation halos	e-mn, sulfide, carbonate, chlorite, calcite, salt, gypsu				
					End Point	Foot wall	255 SW	721553	3361533	297								5.94	6.3	0.36	strong	propylitic	oxidation halos	fe-mn, sulfide, carbonate, chlorite, copper, epidote				
				Tr. 05	Start Point	Hang wall	82 NE	721560	3361529	296	8	1.4	0.05	0.7	13/02/2023	15/02/2023	hammer	0	1	1	Strong	propylitic	oxidation halos	fe-mn, sulfide, calcite, black minerals.	150	70	NE	Jawal & Ez
																		1	1.5	0.5	Strong	propylitic	oxidation halos	fe-mn, sulfide, calcite.				
																		1.5	1.88	0.38	Strong	propylitic	oxidation halos	fe-mn, sulfide, calcite.				
					End Point	Foot wall	262 SW	721552	3361527	297								1.88	2.31	0.43	Strong	propylitic	oxidation halos	fe-mn, sulfide, calcite, copper				
																		3.71	4.54	0.83	medium	propylitic	oxidation halos	fe-mn, sulfide, calcite, carbonate				
																		4.54	5.4	0.86	strong	propylitic	oxidation halos	fe-mn, sulfide, calcite.				
4	721671	3361756	275	Tr. 06A	Start Point	Hang wall	30 NE	721671	3361756	275	20	2.8	0.15	0.45	27/02/2023	27/02/2023	Track loader	4.1	4.85	0.75	strong	propylitic	oxidation halos	fe-mn, sulfide, calcite, gypsum, BM	100	62	SSW	Jawal & Ez
																		6	7	1	strong	propylitic	oxidation halos	fe-mn, sulfide, gypsum, Anhydrite.				
																		9	10	1	strong	propylitic	oxidation halos	fe-mn, sulfide, gypsum, calcite, BM.				
																		11.5	12.5	1	strong	propylitic	oxidation halos	fe-mn, sulfide, gypsum, calcite.				
					End Point	Foot wall	210 SW	721662	3361739	278								13	13.35	0.35	strong	propylitic	oxidation halos	fe-mn, sulfide, gypsum.				
																		13.35	15	1.65	medium	propylitic	oxidation halos	Carbonate				
																		15.95	16.75	0.8	strong	propylitic	oxidation halos	Sulfides, calcite				
																		17	17.15	0.15	strong	propylitic	oxidation halos	sulfides.				
				Tr. 06B	Start Point	Hang wall	344 NNW	721668	3361768	275	13	4.35	0.1	0.15	13/02/2023	15.02/2023	Track loader	0	1	1	strong	propylitic	oxidation halos	Calcite, carbonate				
																		1	1.4	0.4	strong	propylitic	oxidation halos	sulfides, calcite.				
																		1.9	2.36	0.46	strong	propylitic	oxidation halos	sulfides, calcite.				
																		2.36	4.5	2.14	strong	propylitic	oxidation halos	sulfides, iron oxide, calcite				
					End Point	Foot wall	164 SSE	721671	3361756	275								4.5	6	1.5	strong	propylitic	oxidation halos	sulfides, iron oxide, calcite				
																		9.9	10.7	0.8	strong	propylitic	oxidation halos	sulfides, iron oxide, calcite				
																		10.7	11.5	0.8	strong	propylitic	oxidation halos	sulfides, iron oxide, calcite				
																		11.5	11.7	0.2	strong	propylitic	oxidation halos	sulfides, iron oxide, calcite	80	80	SSE	Jawal & Ez
				Tr. 06C	Start Point	Foot wall	300 NNW	721658	3361786	275	20	2.75	0.8	0.38	28/02/2023	28/02/2023	Track loader	18.25	19	0.75	strong	propylitic	oxidation halos	manganise oxides, Iron oxides, Calcite.	60	70	SSE	Jawal & Ez
					End Point	Hang wall	120 SSE	721668	3361768	275								19	20	1	strong	propylitic	oxidation halos	manganise oxides, Iron oxides, Calcite.				
				Tr. 06D	Start Point	Foot wall	200NNW	721669	3361750	275					2/13/2023	2/15/2023	Track loader	4	7	3	strong	propylitic	oxidation halos	manganise oxides, Iron oxides, Calcite.				
					End Point	Hang wall	110 SE	721667	3361765	275	15	6	0	0.5				12	15	3	strong	propylitic	oxidation halos	manganise oxides, Iron oxides, Calcite.				Ali Al Smadi

7.2.2. ICP_Result

ID	From	To	Diff	Lab	Be(ppm)	Cd(ppm)	Co(ppm)	Cs(ppm)	Cu(ppm)	Ga(ppni)	Li(ppm)	Ni(ppm)	Pb(ppm)	Sr(ppm)	V(ppm)	Zn(ppm)	Hf(ppm)	Mo (ppm)	Nb(ppm)	Sb(ppm)	Sn(ppm)	W (ppm)	Zr (ppm)	Ce(ppm)	Dy(ppm)	Gd(ppm)	Ho(ppm)	La(ppm)	Nd(ppm)	Pr(ppm)	Sc(ppm)	Sm(ppm)	Y(ppm)	Yb(ppm)	Rb(ppm)	Cr (ppm)	Ti	Ba
S.T.Tr02-01	1.17	1.34	0.17	memr	4.7	1	16.8	5	20.5	23.5	13.9	210.6	24.9	224.7	12.8	205.7	16	5	40.2	16.2	5	89.4	513.4	188.8	15.1	11.4	5	87.5	85.2	26.1	5	12.9	79.1	5				
S.T.Tr02-02	1.34	3	1.66	memr	4.9	1	19.4	5	15.3	23.2	8.8	79.8	25	17.2	8.5	139.9	16.4	5	40.5	8.2	5	78.8	490	159	13.7	9	5	70.1	70.8	21.7	5	11.4	69.8	5				
S.T.Tr02-03	3	4.22	1.22	memr	6	1	17.3	5	12.6	26.2	12	88.4	23.3	24.2	12.4	159.5	15.9	5	38	5	5	66.4	480.4	181.8	14.5	9.8	5	79.5	80.8	25	5	12.5	73.6	5				
S.T.Tr02-04	4.22	6.36	2.14	memr	6.2	1	19.7	5	15	27	9.3	176.2	25.2	13.2	8	114.4	15.8	5	40.3	5	5	70.5	485.6	195.2	14.8	10.2	5	80.7	82.6	25.4	5	13.2	78.3	5				
S.T.Tr02-05	6.36	8.14	1.78	memr	6.8	1	15.1	5	10.7	28	8.2	70.4	25.3	13.3	8.7	138.2	16.3	5	39.2	5	5	64.1	494.8	186.4	15.6	10.6	5	86.4	88.7	26.8	5	13.5	83.5	5				
S.T.Tr02-06	8.14	9.5	1.36	memr	6.4	1	14.7	5	11.5	28.1	10.1	72	26	22.5	10.4	144.9	15.5	5	38.4	5	5	50.4	444.1	195.7	15.4	10.5	5	89.8	91.9	27.7	5	13.6	78.9	5				
S.T.Tr02-07	9.5	10	0.5	memr	6.2	1	11.8	5	14.8	27.3	12.7	70.6	24.3	27.9	9.3	131.8	14.4	5	34.4	5	5	46.2	399.7	195.4	14.8	10.2	5	87.4	88.1	27.4	5	13.5	74.8	5				
ST.Tr01.S01	1	1.33	0.33	memr	6.7	5	17.1	6.2	6.6	28.3	11.3	35.8	18.6	16.2	5	157.5	15.6	7.2	124.3	10.9	22.9	158.6	837.7	190.2	5	19.9	5	89.6	90.9	23.6	5	18.5	73.8	8.6				
ST.Tr01.S02	3	4	1	memr	7.2	5	18.8	5	6	27.2	8.5	37.1	18	13.8	5	132.5	15	7	120.3	10.8	22.3	169.7	794.8	194.1	5	20.2	5	86	86.6	23.1	5	18.5	80.8	8.5				
ST.Tr01.S03	4	5	1	memr	6.6	5	19.5	5.9	8.6	27.7	10.9	35.9	18.3	18.5	5.1	158	13.5	7.2	118.6	10.7	22.4	196.7	721.6	186.9	5	19.4	5	98.6	97.5	26	5	18.9	72.9	8.1				
ST.Tr01.S04	5	5.63	0.63	memr	6.3	5	16.9	5.7	8.2	26.7	12.4	49.1	20.7	24.3	7.1	151.2	13.7	7.7	115.0	10.5	21.8	150.7	728.1	207.3	5	19.9	5	93.6	93.7	25.3	5	19	74.1	8.2				
ST.Tr01.S05	5.63	6.1	0.47	memr	6.6	5	20.2	5.9	9.3	27.8	11.4	38.7	21.8	22.4	6.5	163.1	13.2	7.3	118.5	10.7	22.5	202.1	712.8	203.1	5	20.2	5	93.1	93.5	27.9	5	21.4	77.1	8.4				
ST.Tr01.S06	6.1	7	0.9	memr	6.6	5	14.4	5.6	8.4	27	11	54.6	19.1	18.5	5.1	143.6	13	7.4	120.7	10.8	21.7	148.2	702.4	193.4	5	19.1	5	88.6	88.4	26.1	5	20.6	71.2	8.3				
ST.Tr01.S07	8.33	8.56	0.23	memr	6.2	5	17.2	5	7	27.5	17.8	50	17.5	16	5	153.3	11.1	7.4	120.7	10.9	21.9	170.3	589.3	201	5	18.7	5	93.6	91.6	26.8	5	20.6	65.6	7.9				
ST.Tr03.S01	4	5	1	memr	5.9	5	21.7	7.3	6.7	26.7	5.2	47.9	28.9	17.5	7.1	130.3	15.9	7.5	115.5	10.6	22.1	213.7	843.2	179.6	5	18.7	5	85.3	85.7	22.7	5	18.5	77.3	8.2				
ST.Tr03.S02	5	6	1	memr	5.6	5	11.8	8.9	8.2	26.1	10.1	66.3	26.9	35.4	10.6	128.4	15.7	7.3	113.2	10.7	21.9	99.7	835.9	174.5	5	19.2	5	84.5	82.8	21.9	5	18.2	78.3	8.6				
ST.Tr03.S03	6	7	1	memr	5	5	15.7	14.7	7.5	24.5	8.7	42	22.7	39.9	11.2	121.6	12.6	7.3	99.3	10.3	20.2	153	666.8	153.6	5	15.6	5	80	71	19.9	5	14.5	66.9	7.2				
ST.S01	-	-		memr	5	5	32.9	36.3	29.9	13.3	215.7	73.5	55.1	142.2	191.9	1179.4	5	7.9	27.3	7.5	17.1	34.4	160.9	45.6	9.6	14.9	5	22.5	26.8	7.2	24.6	9.4	19.1	5				
ST.S02	-	-		memr	5	5	29.4	34.6	26.3	26	313.8	70.1	44	218.3	152.5	1113.5	5	7.6	24.6	7.5	17	32.1	155	39.2	10.2	14.4	5	23.3	25.7	6.3	23.4	8.7	17.6	5				
A03.S01	X:0718227	Y:3346895		memr	5	5	23.2	12.6	66	22.8	10.4	81	10.4	57.4	7.2	10	5	7.4	28.4	8.3	20.7	194.5	30.9	15.9	12	5	5	7.5	6.6	2.1	5	1.2	5	5				
A03.S02	X:0718190	Y:3346858		memr	5	5	17.8	10	24.2	18.6	6.8	45.1	10.9	150.7	7	20.8	5	7.2	16.9	7.6	18.5	163.2	65.5	175.6	8.2	6.4	5	36.5	27.6	7	5	3.6	5	5				
A03.S03	X: 0718183	Y: 3346771		memr	5	5	32.8	6.5	10.6	9.8	12	57.5	5	45.2	5	21.9	5	7.4	14.7	8	18.6	283.2	33.8	7.5	5	5	5	3.4	2.5	0.8	5	0.7	5	5				
ST-Tr04-S01	0	0.7	0.7	memr	6.8	5	15.5	6.3	9.9	27.5	20.5	95	15.6	21.4	13.4	174.1	21.4	5	51.4	5	11.8	78.8	821.7	156.2	14.1	16.8	5	69.7	71.5	21.4	5	17.2	69.6	7.5	147.1	87		
ST-Tr04-S02	0.7	1.34	0.64	memr	3.4	5	35.5	14.8	14.2	19	108.1	144.6	23.3	325.1	202.1	1659	5	5.6	5.8	5	5.3	11.5	130.1	68.6	11.2	12.8	5	30.1	35.2	9.5	26.9	9.2	14.8	5	104.2	389.4		
ST-Tr04-S03	1.34	2	0.66	memr	5.7	5	19	37	16.2	27.8	113.6	77.2	56.3	179.4	88.8	805.4	5	6	5	5	5.5	9.4	103	65.4	8.1	12.1	5	36.1	34.2	9.2	17.8	10.1	11.6	5	184.8	102.2		
ST-Tr04-S04	2	2.84	0.84	memr	4.5	5	9	9	14.5	23.7	53.7	64.3	26.6	62.3	64.7	383.9	16	6.4	38.1	5	8.6	27.4	626.7	109.8	13.4	14.8	5	40.7	48	13.9	5	9.6	61.9	6.2	132.7	80		
ST-Tr04-S05	2.84	3.54	0.7	memr	6.6	5	22.4	33.5	36.4	27.8	129.8	98.5	58.7	168.8	96	903.5	5	5	5.2	5	5.1	9.1	108.4	67.2	8.4	12.2	5	34.9	35.9	10.2	19.6	11	13.1	5	173.6	159.3		
ST-Tr04-S06	4.3	5.94	1.64	memr	7.3	5	13.7	7.6	9.3	29.4	14.9	169.4	18.8	15.7	11.2	157	21.6	5	52.2	5	12.2	76.2	797.8	159.8	10.3	15.6	5	70.6	69.2	20.6	5	16.5	60.8	7.1	140	225.3		
ST-Tr04-S07	5.94	6.3	0.36	memr	8.7	5	19	11.3	13	38.3	107.4	81.4	33.4	48.8	45.5	684.7	16.6	5.1	39.3	5	10.2	33.1	634.3	144.1	14.3	18.4	5	69.6	71.3	20.8	7.5	17.7	59.1	6.2	176.1	20.4		
ST-Tr04-S08	6.3	8	1.7	memr	7.3	5	16.8	8	16.1	29	14.6	149.2	19.9	15.4	16.3	136.1	20.2	5	53.4	5	12.3	94.5	773.2	170.2	12.1	16.9	5	79.2	80.2	23.7	5	18.2	63.9	6.9	147.8	190		
ST-Tr04-S09	3.54	4.3	0.76	memr	9.3	5	32.6	37.3	19	21.1	183.1	132	53.3	175.8	148.5	1135	5	5.2	6.4	5	5.7	11.2	150.4	74.7	11.1	13.2	5	38.8	40.1	11.4	23.4	9.9	17	5	147.2	307.8		
ST-Tr05.S01	0	1	1	memr	5	5	9.4	5.5	9.2	24.8	12.7	52	25.4	20.3	26.9	105.4	19.7	9.2	41.7	5	11.4	49.1	733.9	148.5	5	19.2	5	93.2	81.8	25.2	5	18.3	78.7	7	171.7	51.2		
ST-Tr05.S02	1	1.5	0.5	memr	7.9	5	16.2	20.8	13.6	26.8	127.9	76.2	45.6	103.8	71.5	641.9	11.7	5	25.6	5	8.4	19.5	422	108.8	8.6	14.7	5	52.7	54.3	15.2	10.9	12.4	41.3	5	154.6	72.2		
ST-Tr05.S03	1.5	1.88	0.38	memr	5.2	5	7.7	6.9	207.6	21.8	39.9	54.6	24	114.1	33.5	252.1	14.6	5	33.9	5	9.3	23.1	555.2	111.9	11.9	14	5	51.4	53	15.2	5	3.6	54.7	5.4	144.2	40.1		
ST-Tr05.S04	1.88	2.31	0.43	memr	5.9	5	11.5	28.5	1587	26.4	72.8	76.8	93.7	111.3	41.2	736.9	13.9	5.6	32.5	5	34.2	27.7	527.4	109.6	10.1	14.2	5	47	47.6	13.2	5.7	12.1	53.5	5.4	203.9	36.2		
ST-Tr05.S05	3.71	4.54	0.83	memr	6.5	5	10	5	15.6	28.3	16.5	102.3	21.2	89.2	8	161	22.1	5.2	53.6	5	12.2	51.3	831.3	181.2	5	18.2	5	81.1	80.1	24	5	18.9	77.2	8	169.3	98.2		
ST-Tr05.S06	4.54	5.4	0.86	memr	6.7	5	12.2	5	10.8	27.8	19	49.2	28.9	99.6	7.4	146.3	21.6	5	51.8	5	11.8	63	815.1	187.5	5	19.5	5	85.7	86.8	26.1	5	20	79.4	8.1	161	30.5		
ST-3A				JAEC	3	5	37		72	54	203	48	60	65	171	1003	4	5	24	5	5		160	53	4	5	5	26	30	7	18	6	19			83	12664	
ST-4A				JAEC	4	5	38		80	30	225	44	64	52	167	1318	3	5	16	5	5		141	46	3	5	5	22	26	6	15	5	17			83	11736	
ST-5				JAEC	3	5	37		49	30	99	72	78	140	162	1030	4	5	15	5	5		139	45	3	4	5	21	24	6	15	6	15			95	10616	
ST-6				JAEC	3	5	33		64	49	95	45	52	69	182	1039	4	5	14	5	5		137	42	4	5	5	20	24	6	17	5	18			77	11918	
ST-7				JAEC	3	5	38		13	53	141	44	49	80	190	1057	4	5	15	5	5		145	44	4	5	5	21	25	6	18	6	17			71	11708	
S.T.Tr 06A-1	4.1	4.85	0.75	MEMR					32.9		165.5	78.4	60.2			1199							349.8													155.9		695.5
S.T.Tr 06A-2	6	7	1	MEMR					75.6		234.9	99.1	86.6			1227							168													286		1251
S.T.Tr 06A-3	9	10	1	MEMR					27		258.5	107	78.4			1218							185.3													308.6		1434
S.T.Tr 06A-4	11.5	12.5	1	MEMR					27.6		235.6	62.4	62			872.6							145.8													69.2		494.2
S.T.Tr 06A-5	13	13.35	0.35	MEMR					42.4		162.4	31.1	53.9			830.8							398.7													51.7		342.4
S.T.Tr 06A-6	13.35	15	1.65	MEMR					2.7		20.1	15.6	20.5			75.2							612													45.7		123.8
S.T.Tr 06A-7	15.95	16.75	0.8	MEMR					124.8		310.7	52	88.6			1455							244.4													65		380.7
S.T.Tr 06A-8	17	17.15	0.15	MEMR					84.6		332.8	46.8	78.2			1354							231.3													77.4		462
S.T.Tr 06B-1	0	1	1	MEMR					3.2		19.8	13.6	26.5			114.9							659.1													39.1		253.4
S.T.Tr 06B-2	1	1.4	0.4	MEMR					14.3		170.5	55.3	26.4			738.6							111													68.4		1199
S.T.Tr 06B-3	1.9	2.36	0.46	MEMR					48.9		150.9	65.5	23.3			701.3							131.8													88.1		1080
S.T.Tr 06B-4	2.36	4.5	2.14	MEMR					13.8		38	14.3	17.7			97.7							493.4													23.8		767.5
S.T.Tr 06B-5	4.5	6	1.5	MEMR					24		23.2	18.9	21.5			64							370.8													22.4		1173
S.T.Tr 06B-6	9.9	10.7	0.8	MEMR					281.6		146.4	33.4	78.2			748.6							275.3													64.5		828.3
S.T.Tr 06B-7	10.7	11.5	0.8	MEMR					33.9		200.9	42.1	63.1			744.7							151.2													81.1		1686
S.T.Tr 06B-8	11.5	11.7	0.2	MEMR					55.2		240.5	52.7	52.6			1245							178.8													104.8		1003
S.T.Tr 06C-1	18.25	19	0.75	MEMR					16.4		18.5	24.8	34.5			95.7							657.6													44.3		561.8
S.T.Tr 06C-2	19	20	1	MEMR					9.8		18.3	24.9	34.7			120.7							735.8													60		393.5
S.T.Tr 06D-1	0	3	3	MEMR					26.9		230.1	95.6	54			1000							168.4													255.8		616.2
S.T.Tr 06D-2	3	5	2	MEMR					48.9		82.9	93.6	42.5			859.1							401.4													267.6		514.9
S.T.Tr 06D-3	5	6	1	MEMR					121.8		18.1	133.1	38.8			153.1							776.5													657.9		175.2
S.T.Tr 06D-4	6	7	1	MEMR					19.6		18.6	81	28.7			116.2							727													319.2		366.5
S.T.Tr 06D-5	7	8	1	MEMR					22.4		43.9	82	28			297.2							469.4													329		478
S.T.Tr 06D-6	8	10	2	MEMR					35.9		18.2	81.2	28.9			107							351.7													171		557
S.T.Tr 06D-7	10	12	2	MEMR					197.7		58.5	103.8	53.2			672.3							546.3													345.4		384.5
S.T.Tr 06D-8	12	13	1	MEMR					23.2		13.6	152.3	27.7			155.5							698.7													774.2		177.9
S.T.Tr 06D-9	13	15	2	MEMR					16.8		9.7	87.3	41.6			152.1							856.9													434.9		207.9
S.T.Tr 06D-10	8	10	2	MEMR					20.8		7.7	73	13.4			73.5							87.2													157.3		555.5
S.T.Tr 08-1	0	2	2	MEMR					55.1		21.9	56.5	25.8			183.4							169.1													97.8		162.7
S.T.Tr 08-2	2	4	2	MEMR					62.2		51.8	71.2	33.5			236							182.3													114.8		317.7
S.T.Tr 08-3	4	6	2	MEMR					93.5		16.1	82.9	20.1			109.4							241.6													117.8		488.5
S.T.Tr 08-4	6	8	2	MEMR					146.2		37.2	74.2	307.8			1384							249.9													91.1		620.2
S.T.Tr 08-5	8	9	1	MEMR					96.7		51.6	72.6	79.3			844.3							396.1													131.2		431.4
S.T.Tr 08-6	9	10	1	MEMR					6.2		11.9	44.8	25.2			129.6							618.3													122.8		279.7
S.T.Tr 08-7	10	12	2	MEMR					6.1		9.8	41.2	19.9			120.9							578.1													109		73.8

7.2.3. XRF Results

S.ID.	From	To	Fe2O3 Wt.%	MnO Wt.%	TiO2 Wt.%	CaO Wt.%	K2O Wt.%	SO3 Wt.%	SiO2 Wt.%	Al2O3 Wt.%	MgO Wt.%	Na2O Wt.%	L.O.I Wt.%
ST-TR01- S01	1	1.33	3.15	<0.050	0.21	0.33	4.48	0.035	76.07	10.48	0.5	3.15	1.34
ST-TR01- S02	3	4	2.98	<0.050	0.2	0.48	4.31	0.029	76.29	10.32	0.31	3.62	1.22
ST-TR01- S03	4	5	3.05	<0.050	0.21	0.44	4.52	0.018	76.09	10.51	0.49	3.25	1.2
ST-TR01- S04	5	5.63	3.07	<0.050	0.22	0.64	4.32	0.045	76.13	10.14	0.5	3.11	1.6
ST-TR01- S05	5.63	6.1	3.16	<0.050	0.21	0.44	4.51	0.071	75.98	10.29	0.47	3.19	1.45
ST-TR01- S06	6.1	7	2.92	< 0.050	0.21	0.47	4.61	0.021	76.08	10.36	0.39	3.31	1.33
ST-TR01- S07	8.33	8.56	3.03	< 0.050	0.2	0.53	4.6	0.013	75.9	10.38	<0.28	3.68	1.16
S.T. Tr02-S# 01	1.17	1.34	3.59	<0.050	0.22	2.36	3.54	< 0.060	74.68	8.54	0.5	2.61	3.91
S.T. Tr02-S# 02	1.34	3	2.88	< 0.050	0.19	1.57	3.84	< 0.060	76.51	9.08	0.77	2.77	2.36
S.T. Tr02-S# 03	3	4.22	2.93	0.062	0.22	2.02	3.92	< 0.060	74.4	9.52	0.79	2.97	3.16
S.T. Tr02-S# 04	4.22	6.36	3	0.053	0.2	1.64	3.98	< 0.060	75.08	9.92	0.48	3.41	2.23
S.T. Tr02-S# 05	6.36	8.14	2.91	0.057	0.2	1.32	4.28	< 0.060	75.18	10.11	0.65	3.28	2.02
S.T. Tr02-S# 06	8.14	9.5	2.95	< 0.050	0.21	1.3	4.3	< 0.060	75.09	10.06	0.7	2.68	2.65
S.T. Tr02-S# 07	9.5	10	3	0.066	0.21	1.67	4.21	< 0.060	74.56	10.02	0.54	2.92	2.79
ST-Tr03- S01	4	5	3.05	<0.050	0.21	0.31	4.95	0.083	76.43	10.48	0.29	2.9	1.06
ST-Tr03- S02	5	6	2.86	< 0.050	0.2	1.16	4.7	0.091	74.9	10.12	0.59	2.25	2.89
ST-Tr03- S03	6	7	2.96	< 0.050	0.2	1.42	5.11	1.02	72.88	9.79	0.69	1.72	3.87
ST-S01	-	-	11.05	0.3	1.96	2.71	3.76	0.52	39.5	15.21	8.91	2.19	12.37
ST- S02	-	-	11.02	0.33	1.95	3.91	4.11	0.085	40.7	15.05	10.49	1.49	9.76
A03-S01	-	-	0.71	0.073	0.036	0.58	5.41	0.019	73.61	14.29	0.31	3.31	1.41
A03- S02	-	-	0.59	<0.050	0.85	0.44	4.62	0.05	72.93	14.09	<0.28	4.09	1.27
A03- S03	-	-	0.3	<0.050	0.029	0.48	1.86	0.022	88.49	5.93	<0.28	1.54	0.94
S.T.Tr 04- 1	0	0.7	3.04	0.058	0.21	2.17	4.06	0.22	73.44	9.88	0.34	3.76	2.61
S.T.Tr 04- 2	0.7	1.34	10.37	0.22	1.77	5.16	3.20	0.16	45.63	15.27	8.65	1.44	6.77
S.T.Tr 04- 3	1.34	2	8.95	0.33	1.22	16.51	5.90	0.005	32.97	10.25	6.39	0.17	16.36
S.T.Tr 04- 4	2	2.84	3.58	0.46	0.26	9.31	4.17	0.073	60.16	8.43	2.19	1.54	9.51
S.T.Tr 04- 5	2.84	3.54	8.62	0.27	1.29	12.97	6.29	0.040	37.30	11.29	7.00	0.34	13.53
S.T.Tr 04- 6	4.3	5.94	3.08	0.05	0.20	0.53	5.21	0.069	75.40	10.41	0.28	3.26	1.40
S.T.Tr 04- 7	5.94	6.3	5.70	0.16	0.60	0.90	4.87	0.052	67.69	11.55	2.78	2.64	2.66
S.T.Tr 04- 8	6.3	8	3.14	0.05	0.20	0.72	4.24	0.23	75.59	10.28	<0.28	4.05	1.20
S.T.Tr 04- 9	3.54	4.3	9.58	0.34	1.62	4.93	5.19	0.10	44.80	13.63	9.56	0.93	8.10
S.T Tr 05-01	0	1	3.67	0.052	0.18	0.81	5.32	0.14	75.67	10.23	0.42	1.88	1.62
S.T Tr 05-02	1	1.5	6.21	0.17	0.77	5.77	4.33	2.23	55.80	11.16	3.93	1.99	7.30
S.T Tr 05-03	1.5	1.88	2.87	0.18	0.26	8.11	4.48	3.90	59.96	8.58	1.45	1.48	8.68
S.T Tr 05-04	1.88	2.31	4.17	0.15	0.45	4.93	5.92	2.91	61.76	9.64	2.69	0.63	6.59
S.T Tr 05-05	3.71	4.54	3.04	0.051	0.20	1.21	4.39	0.76	73.82	10.14	0.53	3.28	2.56
S.T Tr 05-06	4.54	5.4	2.90	< 0.050	0.19	2.03	4.31	1.23	72.27	9.80	0.52	<0.34	3.52
S.T.Tr 06A-1	4.1	4.85	8.68	0.47	0.97	2.96	3.74	2.47	51.3	10.96	7.85	1.63	8.01
S.T.Tr 06A-2	6	7	11.26	0.51	1.44	2.8	3.33	1.78	42.2	12.73	12.73	1.15	8.8
S.T.Tr 06A-3	9	10	10.35	0.47	1.45	3.97	3.81	1.15	42.12	12.71	12.97	1.07	8.87
S.T.Tr 06A-4	11.5	12.5	7.83	0.34	1.35	8.94	2.69	10	32.9	10.71	8.01	1.06	15.14
S.T.Tr 06A-5	13	13.35	7.19	0.3	1.1	1.55	3.15	4.75	56.68	12.04	4.64	3.27	4.75
S.T.Tr 06A-6	13.35	15	2.72	0.054	0.18	2.06	4.2	0.95	72.4	10.23	0.38	3.38	3.33
S.T.Tr 06A-7	15.95	16.75	10.07	0.6	2.01	3.41	1.94	1.27	46.82	14.05	9.33	3.02	6.77
S.T.Tr 06A-8	17	17.15	10.75	0.6	2.37	1.9	2.42	0.13	45.83	15.8	9.94	2.78	6.68
S.T.Tr 06B-1	0	1	2.81	0.077	0.19	2.56	4.21	1	71.58	9.52	0.68	2.49	4.76
S.T.Tr 06B-2	1	1.4	9.2	0.65	1.36	12.38	3.66	0.33	36.78	12.01	7.36	1.49	14.41
S.T.Tr 06B-3	1.9	2.36	8.05	0.56	1.21	15.24	4.77	0.23	34.82	11.45	6.8	0.72	15.77
S.T.Tr 06B-4	2.36	4.5	2.92	0.41	0.17	10.18	5.72	0.12	61.68	8.05	0.99	<0.34	9.63
S.T.Tr 06B-5	4.5	6	2.31	1.76	0.1	19.61	4.49	0.23	47.46	5.75	1	<0.34	17.2
S.T.Tr 06B-6	9.9	10.7	7.55	0.49	1.24	9.5	3.86	1.95	45.02	11.36	5.86	1.36	11.1
S.T.Tr 06B-7	10.7	11.5	9.9	0.45	2.09	4.56	4.21	0.97	42.74	16.14	8.1	2.03	7.82
S.T.Tr 06B-8	11.5	11.7	8.63	0.42	2.13	3.35	3.5	1.18	44.08	15.52	9.5	2.62	8.06
S.T.Tr 06C-1	18.25	19	2.51	0.84	0.16	7.95	5.16	0.087	64.26	8.6	0.79	1.04	8.61
S.T.Tr 06C-2	19	20	2.81	0.27	0.18	4.69	4.86	1	68.77	9.29	0.61	1.81	5.71
ST.Tr 6D-1	0	3	7.49	0.38	2.05	6.40	5.55	0.53	41.14	15.14	9.86	0.34	11.60
ST.Tr 6D-2	3	5	6.76	0.23	1.25	5.79	4.51	0.28	50.05	12.93	4.89	0.34	12.39
ST.Tr 6D-3	5	6	4.33	0.058	0.21	1.13	5.51	0.06	73.70	10.71	0.35	1.67	2.32
ST.Tr 6D-4	6	7	3.22	0.13	0.19	3.54	6.96	0.06	71.83	9.60	0.65	0.34	4.40
ST.Tr 6D-5	7	8	3.03	0.33	0.36	13.44	5.05	0.084	55.13	8.14	1.84	0.34	13.06
ST.Tr 6D-6	8	10	2.78	2.90	0.11	25.20	3.30	0.27	38.00	4.69	0.49	0.34	21.42
ST.Tr 6D-7	10	12	6.59	0.20	0.84	2.18	5.74	0.11	63.55	12.24	2.75	1.47	4.26
ST.Tr 6D-8	12	13	4.64	0.10	0.21	2.87	4.05	0.06	71.88	9.98	0.40	2.79	3.02
ST.Tr 6D-9	13	15	3.83	0.093	0.19	1.46	5.10	0.06	74.50	10.24	0.44	1.64	2.48
ST.Tr 6D-10	8	10	1.03	1.39	0.059	47.10	0.95	0.26	9.92	1.63	0.27	0.34	36.91
ST.Tr8-1	0	2	9.37	0.16	2.83	5.53	0.41	2.95	46.98	11.06	7.65	0.34	11.56
ST.Tr8-2	2	4	14.13	0.22	2.83	7.28	1.07	0.16	45.37	10.53	7.44	0.64	9.30
ST.Tr8-3	4	6	13.59	0.22	4.03	6.90	1.87	ND	46.24	15.25	4.75	2.57	3.21
ST.Tr8-4	6	8	14.81	0.50	4.07	5.56	3.91	ND	43.01	13.96	4.72	2.34	5.83
ST.Tr8-5	8	9	9.56	0.24	2.46	3.95	3.62	1.36	55.76	12.04	3.80	1.86	4.42
ST.Tr8-6	9	10	3.46	0.05	0.22	1.27	5.05	0.34	75.81	9.97	0.28	1.82	1.42
ST.Tr8-7	10	12	3.25	0.05	0.20	2.72	3.71	2.29	70.40	9.57	0.30	2.81	4.34

7.2.4. XRD Results

Sample ID	From	To	Phase Identification			Uncertainty (if required)
			Major	Minor	Trace	
Tr0l-S1	1	1.33	Quartz, Feldspar(Albite, Microcline, Orthoclase)	-	Hematite	NA
Tr0l-S2	3	4	Quartz, Feldspar(Albite, Microcline)	-	Hematite, Clay	NA
Tr0l-S3	4	5	Quartz, Feldspar(Albite, Microcline, Orthoclase)	-	Hematite, Clay	NA
Tr01-S4	5	5.63	Quartz, Feldspar(Albite, Microcline, Orthoclase)	-	Hematite, Clay	NA
Tr01-S5	5.63	6.1	Quartz, Feldspar(Albite, Microcline, Orthoclase)	-	Hematite	NA
Tr0l-S6	6.1	7	Quartz, Feldspar(Albite, Microcline, Orthoclase)	-	Clay	NA
Tr0l-S7	8.33	8.56	Quartz, Feldspar(Albite, Microcline, Orthoclase)	-	Clay	NA
T03-S1	4	5	Quartz, Feldspar(Albite, Microcline)	-	-	NA
T03-S2	5	6	Quartz, Feldspar(Albite, Microcline, Orthoclase)	-	Hematite	NA
T03-S3	6	7	Quartz, Feldspar(Albite, Microcline, Orthoclase)	-	Gypsum, Hematite	NA
ST-S0l	-	-	This sample is amorphous			NA
ST-S02	-	-	Feldspar(Microcline, Orthoclase), Hematite, Augite, Faujasite	Chlorite, calcite	-	NA
A03-S1	-	-	Quartz, Feldspar(Albite, Microcline, Orthoclase)	-	Muscovite	NA
A03-S2	-	-	Quartz, Feldspar(Albite, Microcline)		Muscovite	NA
A03-S3	-	-	Quartz	Feldspar(Albite, Microcline, Orthoclase)	Muscovite	NA
ST.Tr6-10	-	-	Calcite		Quartz	NA
ST.BH3-5	-	-	Quartz, Feldspar(Albite, Microcline)		Hematite	NA
ST.Tr8-4	-	-	Anorthite, Feldspar(Albite, Microcline)	Augite	Quartz, Hematite	NA
ST.Tr8-6	-	-	Feldspar(Albite, Microcline), Quartz		Gypsum, Hematite	NA