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Chrome Concentration in Some Sudanese Ores

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Abstract: *This study was performed to calculate the chromium component ratio in the Ingassana Hills in the Blue Nile region. Thirty samples were taken from the area. The samples were grinded into powder and each sample was 25 grams. The XRF was used to analyze the samples and identify the concentration of the elements in the sample.And by the concentration of each element in the sample. The analysis showed that the average chromium element concentration in the samples was 671550 PPM. The price of chromium is shown in the world markets, where it is seen that these concentrations are very important and can contribute to the economy if used correctly.*

Keywords: *Chromium mining, concentration of chromium, chromium in Sudan, chromium price*.

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I. Introduction

In Sudan, chromites ore deposits occur mainly in the Ingassana Hills in the Blue Nile region. Other occurrences have been reported at Hammissana, Sol Hamid in the Northern Red Sea Hills, the Nuba Mountains in Southern Kordofan, Jabal Rahib Northwest Sudan, and Jabal El-Tawil in Central Butana in Southern Sudan. The Ingassana chromite ore is considered as one of the largest chromite ore deposits in Sudan. Its chromite reserves was estimated to be 2 teragrams (Tg or million tons), with chromium oxide assay in the range from 20% to 51% Cr2O3 (Habashi and Bassyouni, 1982; Ahmed, 1998). The mining area at Ingassana Hills is connected to Khartoum, Port-Sudan and other important parts of Sudan with fairly maintained motor roads and railways through Damazine city, the capital of Blue Nile Governorate(1).

Chickay Chromite Mine in the Ingassana area is about 80 km from Damazine city. The Chromite ore in the Chickay Mine is in the form of a vein of complicated shape. Due to depletion of high grade Chromite ore, and the presence of a large amount of low-grade ore in the area, it was necessary to come up with a suitable mineral processing technique to upgrade these low-grade ores together with the leftover fines from the previous Chromite mining operations.

The flotation technique was attempted for enriching the Chickay Chromite ore. The assay of the feed to the flotation cell was 20.3% Cr2O3. Under optimum conditions, the Chromite concentrate assayed 28.7% Cr2O3 at a recovery of 94.5%. Of course, the assay of the obtained concentrate is not satisfactory, which indicates that the flotation is not the right technique to concentrate this type of ore (Tammam, 2010; Seifelnasr and Tammam, 2011). The main objective of the present work is to investigate the amenability of the Chikay low-grade chromite ore to be concentrated by gravity methods, utilizing the relatively large difference in the specific gravity of the main constituting minerals, chromite and serpentine, in particular by using the shaking table(2). Chromium is one of the most versatile and widely used elements. Its main uses in the metallurgical, chemical, and refractory industries are well known. It is an essential element in the production of a wide variety of stainless steels, tool and alloy steels, nickel-chromium heating elements, and plating metals. Its widespread use in the metallurgical industry is attributed to its capability of enhancing properties such as resistance to corrosion or oxidation, creep, impact strengths, and hardenability.

However, the Ingassana chromite ore is considered as one of largest chromite ore deposits in Sudan(3).

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However, the Ingassana chromite ore is considered as one of largest chromite ore deposits in Sudan(4).

Fig (1): Study Area of Chrome in Sudan (Ingassana)

The geology of the Sudan has very limited documentation. Our best available references being the geologic map of the Sudan republic Clarendon press- oxford, 1971 and a ground water survey by hunting.et al London consultants. The hunting report was available for reference at the rural water corporation office in Khartoum. Access was given to the open file reports and maps of the Sudan geological survey. These references notes from a shell – BP. reconnaissance in the N.W. Sudan in 1960, plus personal observation during a cursory surface investigation by W M C, constitute the background for this discussion. The oldest exposed rocks in the permit area are a suite of gneisses and less altered met sediments of Precambrian age. These rocks are exposed throughout the permit area but are very prominent in the nub mountain area west and in the north and south portion of the area. This basement complex is cut by a series of southeasterly and easterly trending syenite and granite [5].

II. Materials and methods

1. Area Description:

Ingessana Hills lies in the eastern part of the Blue Nile State between longitudes 33˚ 32´ N - 34˚ 15´ N. It is about 80 km from Damazin the capital of Blue Nile State and connected by fairly well maintained motor roads. Railways and roads connect Damazin with Khartoum, and other parts of the country. Damazin has an airstrip.The Ingessana Hills area is characterized by high (600 ft above sea level) and steep relief topography, due to the presence of ultramafic and other intrusive rocks. The plains surrounding the Ingessana massif are covered with thick bushes and tall grass. The eastern part of the massif drains to the Blue Nile, while the western part of the area drains to the White Nile [2].

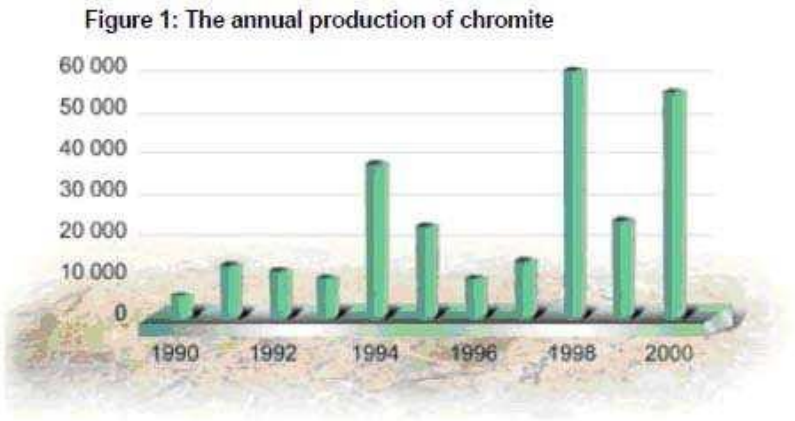


Figure (2): The annual production of chromite

2. Sample collection and Preparation:

Sample were crushed and ground to 2mm size, to facilitate chrome releasing and ending up in the leaching Solution .Sub-samples from bulk samples were taken using quartering technique which consists of piling the ore into conical heap , spreading this out into circles cakes , and dividing the cake into the quarters , taking opposite quarters . This process was repeated until a suitable sample was collected.

After collecting, the samples that were taking the dark gray to black color, when the samples were grinded and converted to powder, and take every 25 gram of the sample, and placed in the XRF device, and observe the results recorded on the results table on the device.

XRF Analysis Method:

Using in sample analysis XRF machine where were taken every 25 grams of powder sample and put it in the machine and calculate the percentage of chromium which is the study element.

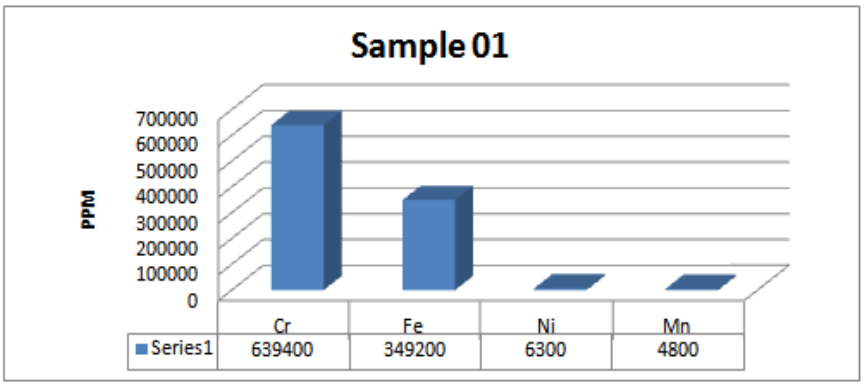
III. Results

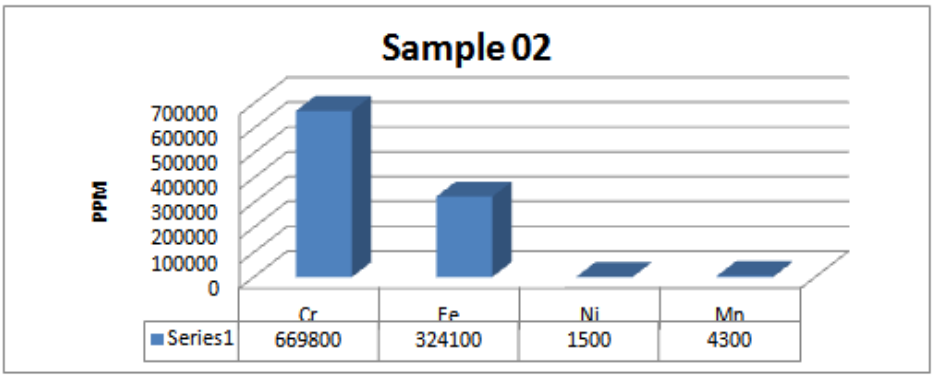
1. Appendices Appendix I Statistical Analysis of Element Concentrations.

No	Cr (PPM)	Deviation
01	569000	-102550
02	635800	-35750
03	639400	-32150
04	640300	-31250
05	649800	-21750
06	650700	-20850
07	658000	-13550
08	665300	-6250
09	669600	-1950
10	669800	-1750
11	670300	-1250
12	670900	-650
13	673200	1650
14	673400	1850
15	675000	3450
16	675700	4150
17	676900	5350
18	678200	6650
19	678700	7150
20	679800	8250
21	682400	10850
22	683500	11950
23	684100	12550
24	687100	15550
25	689100	17550
26	690600	19050
27	699800	28250
28	691400	19850
29	700700	29150
30	738000	66450

(Average =671550)

2. Appendix II XRF Analysis Results of Element Concentrations

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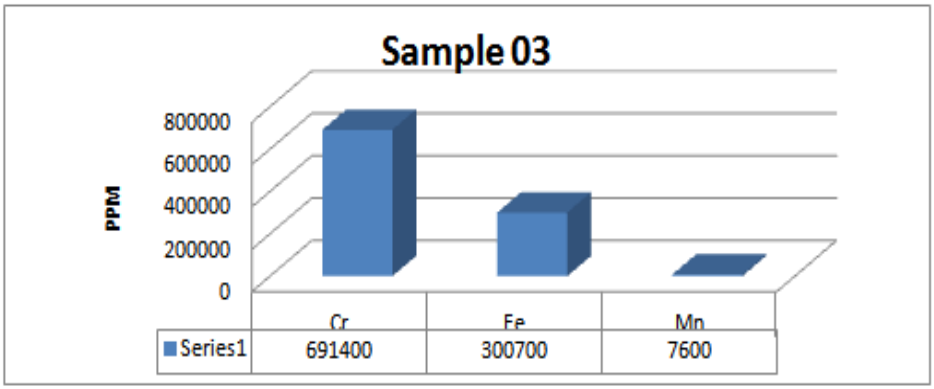
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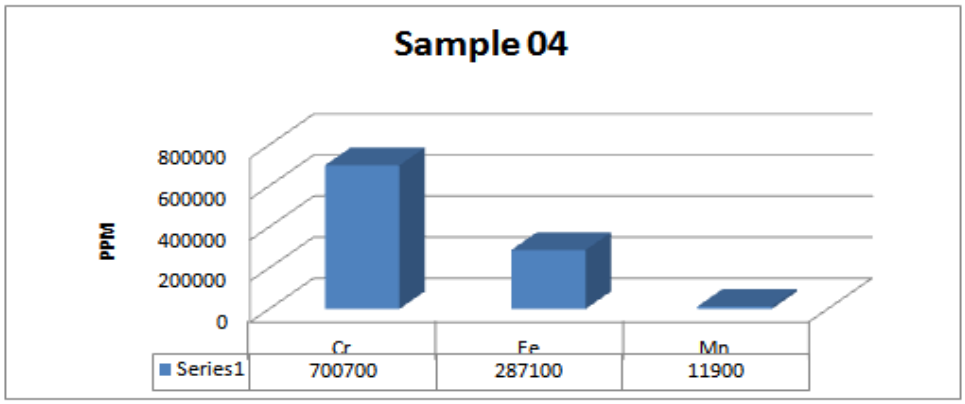
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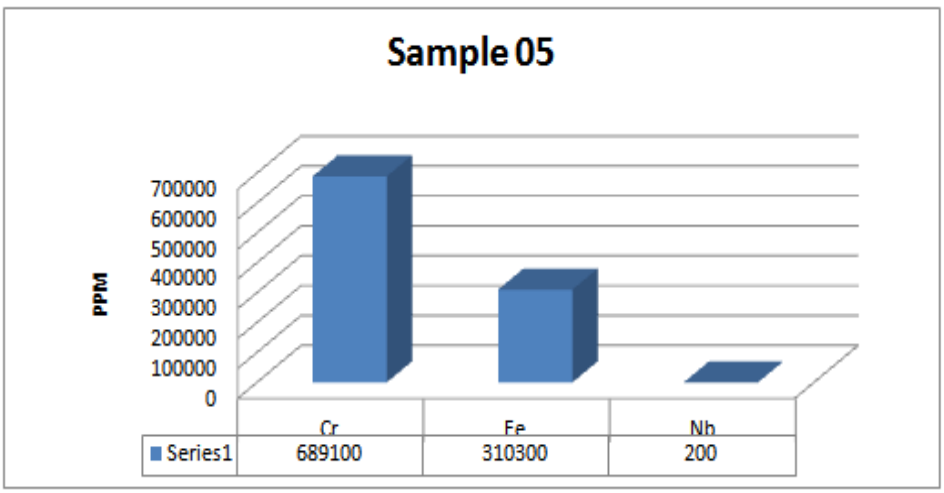
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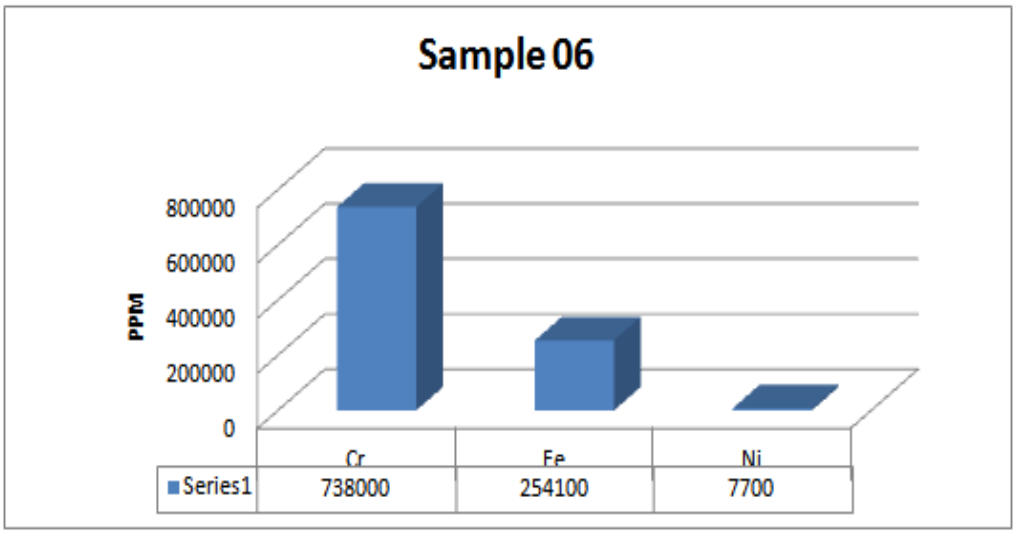
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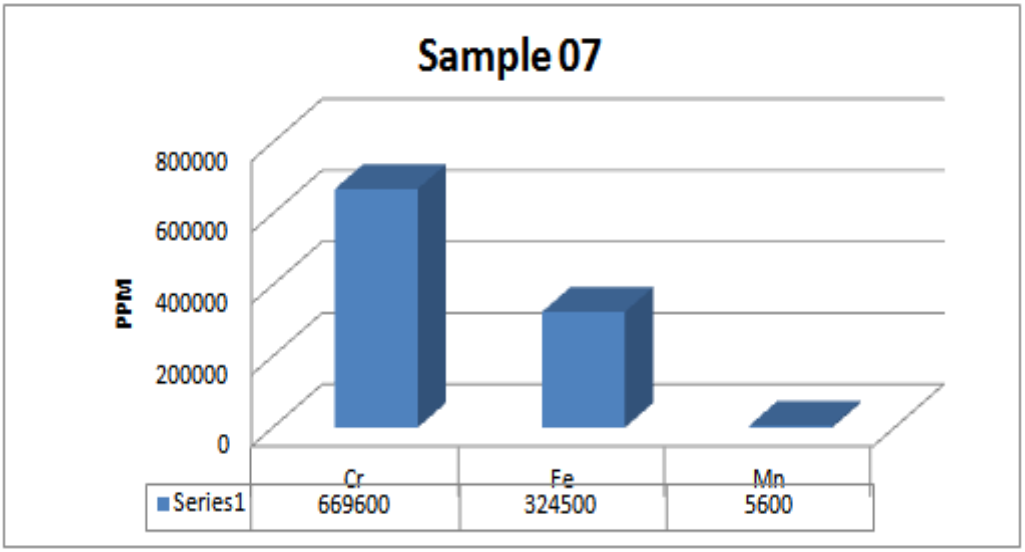
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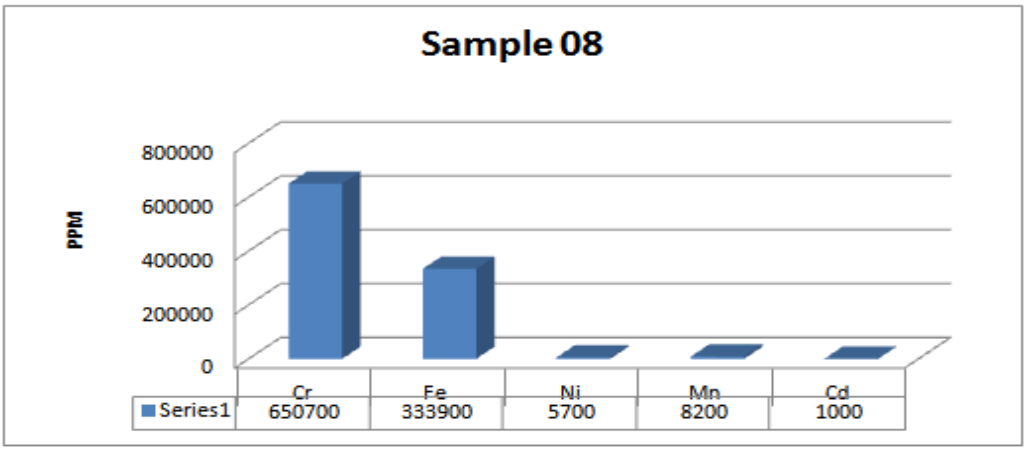
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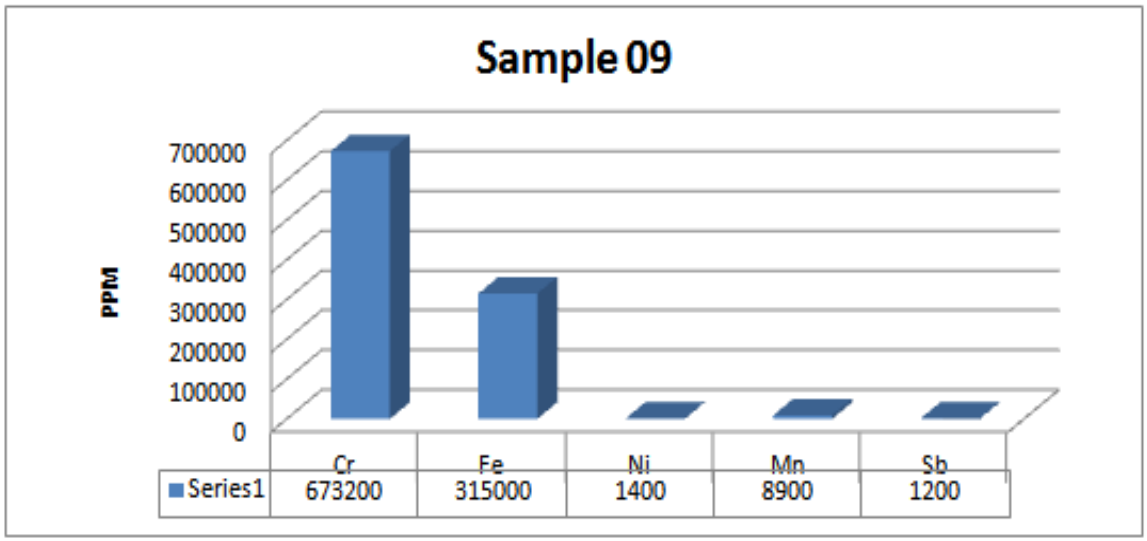
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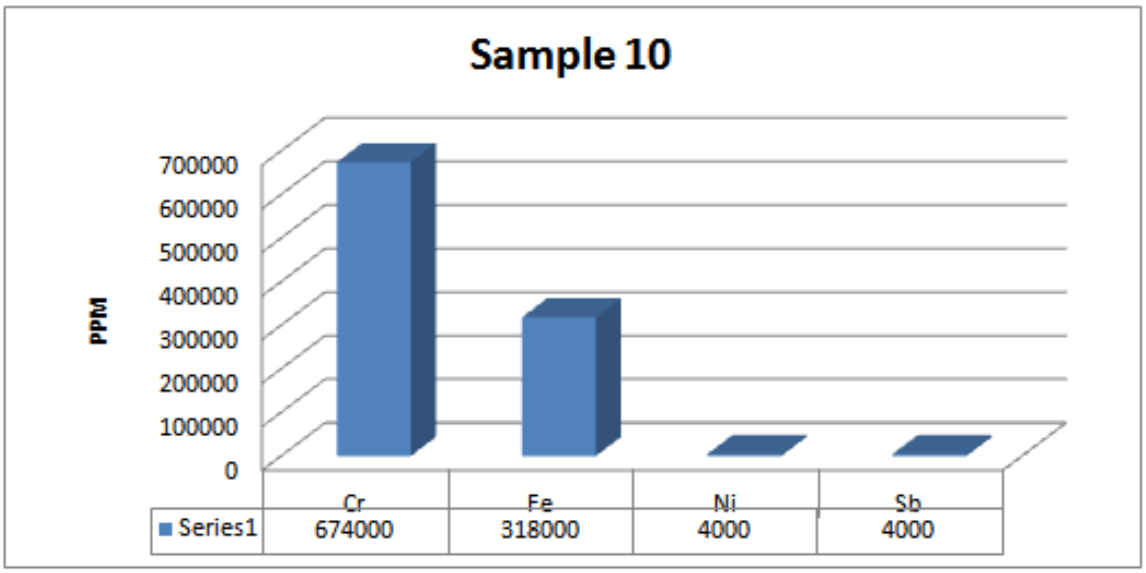
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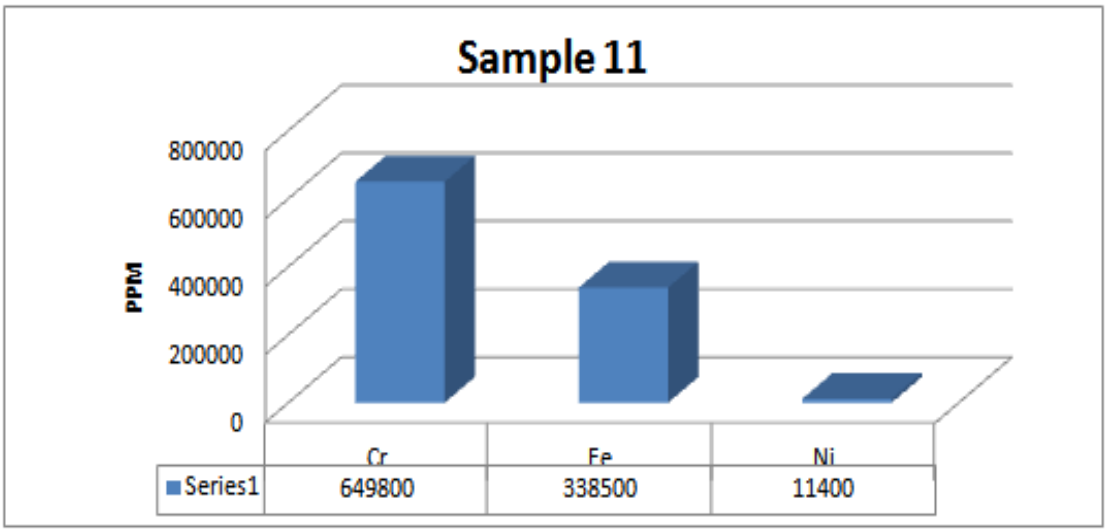
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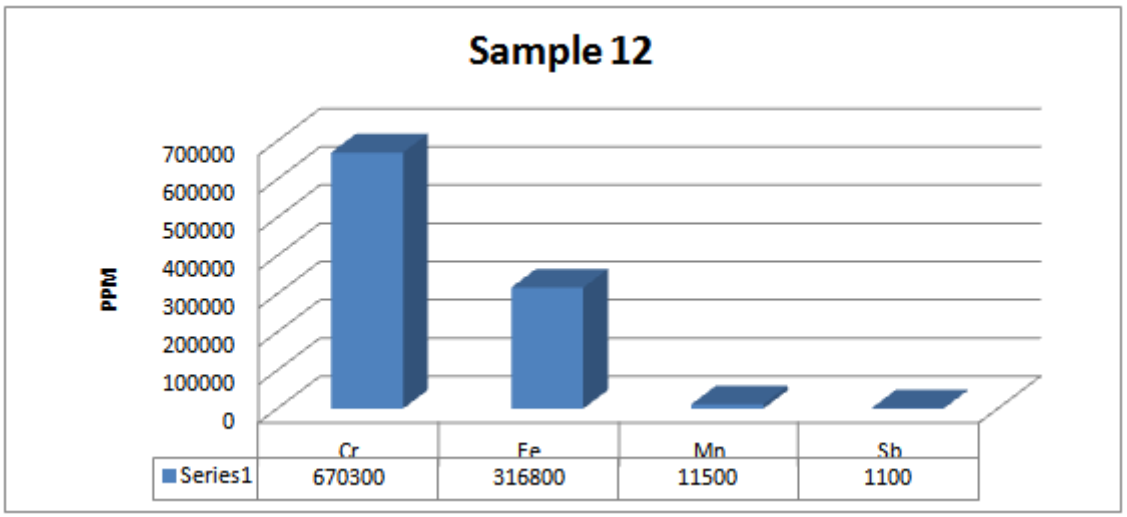
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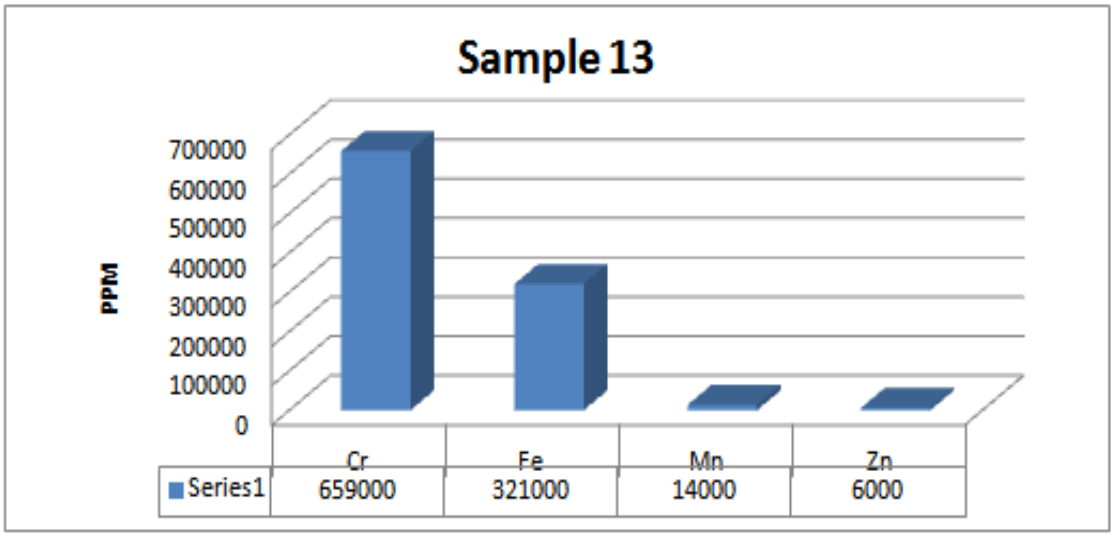
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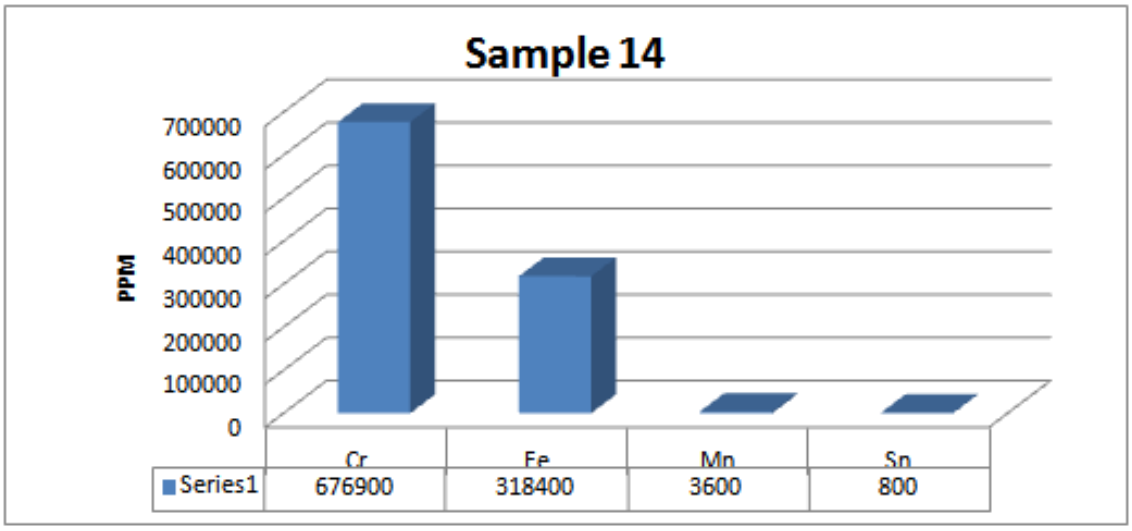
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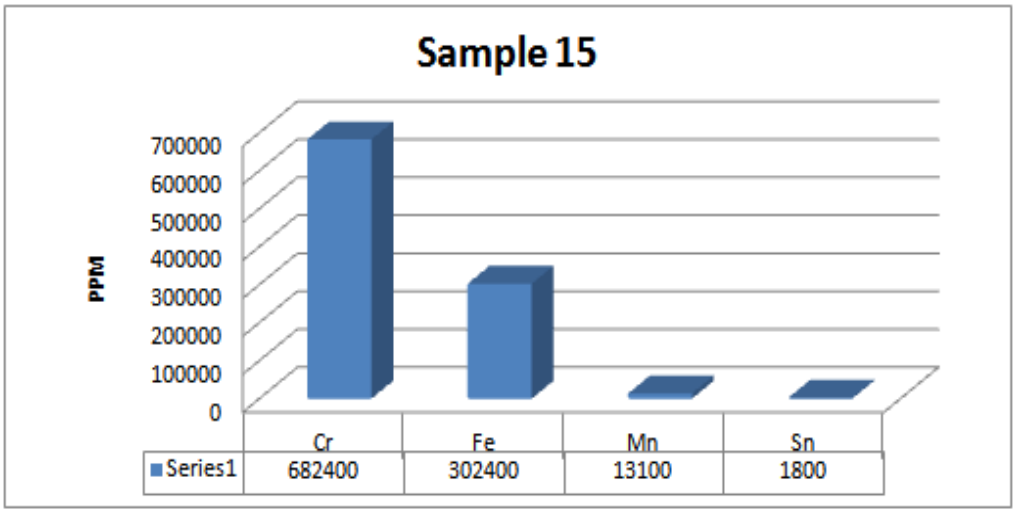
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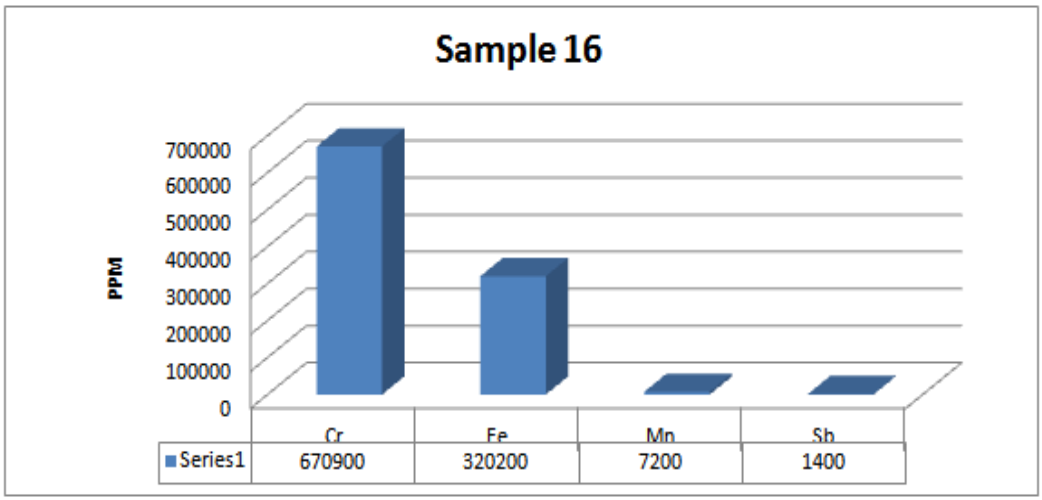
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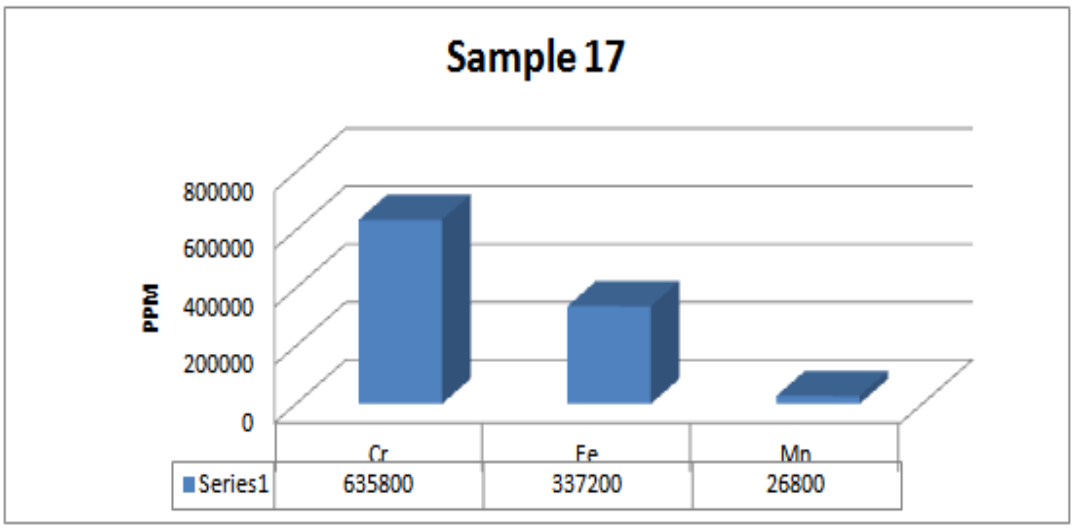
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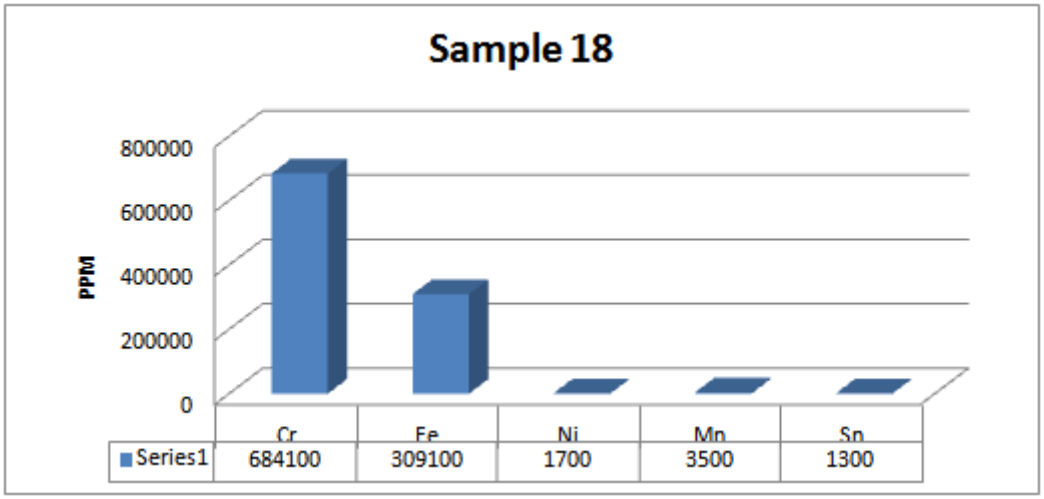
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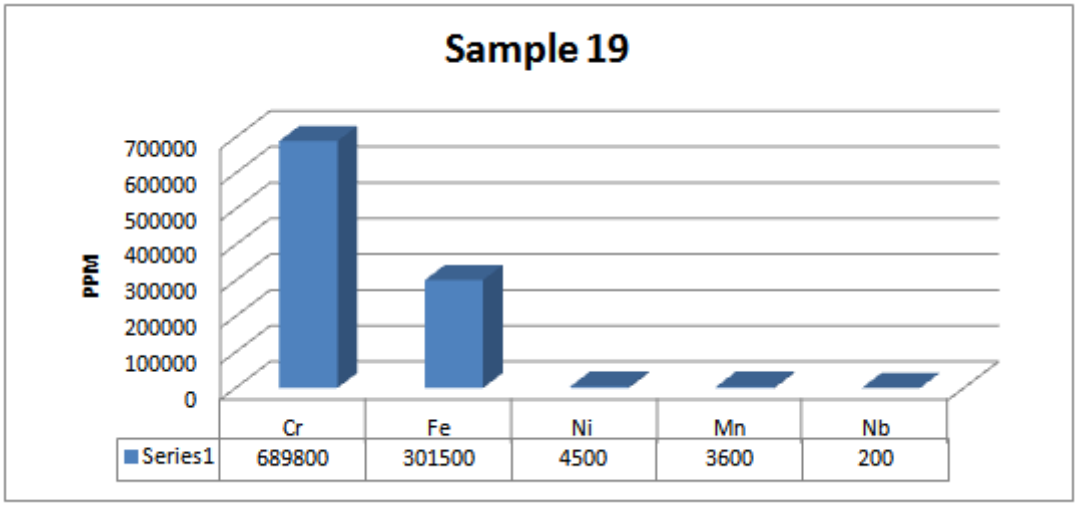
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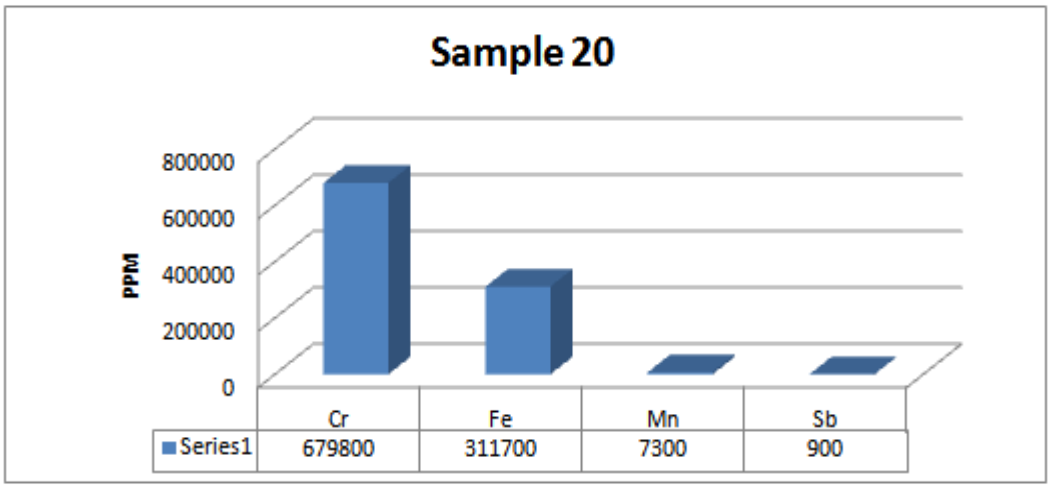
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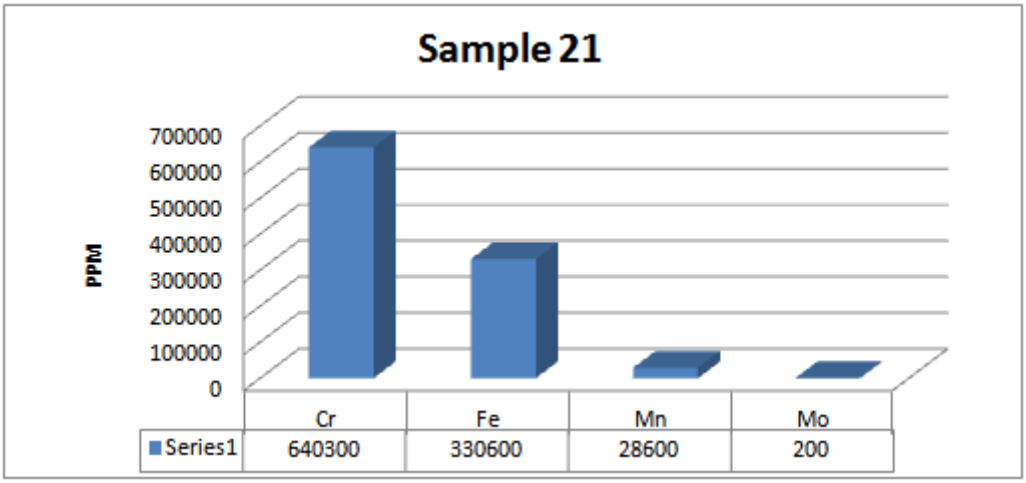
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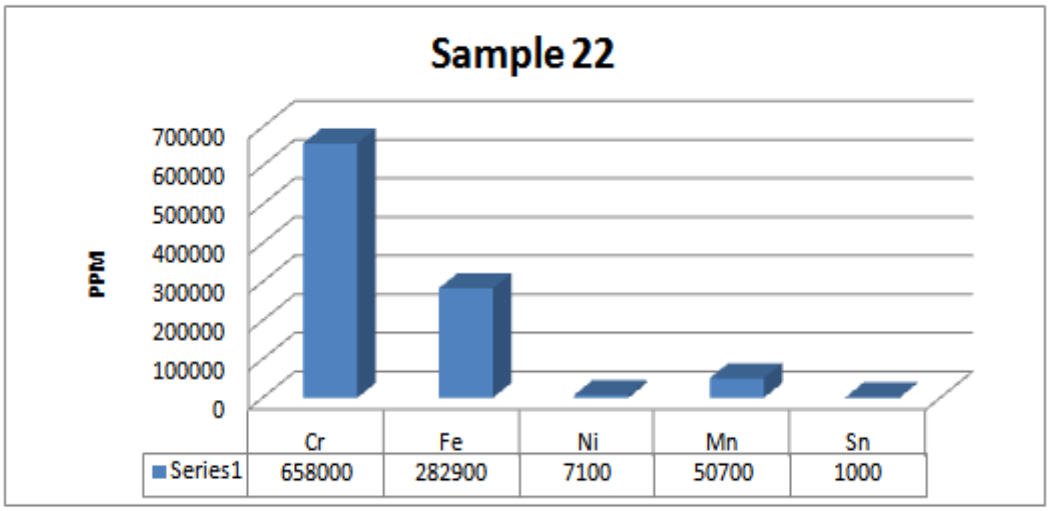
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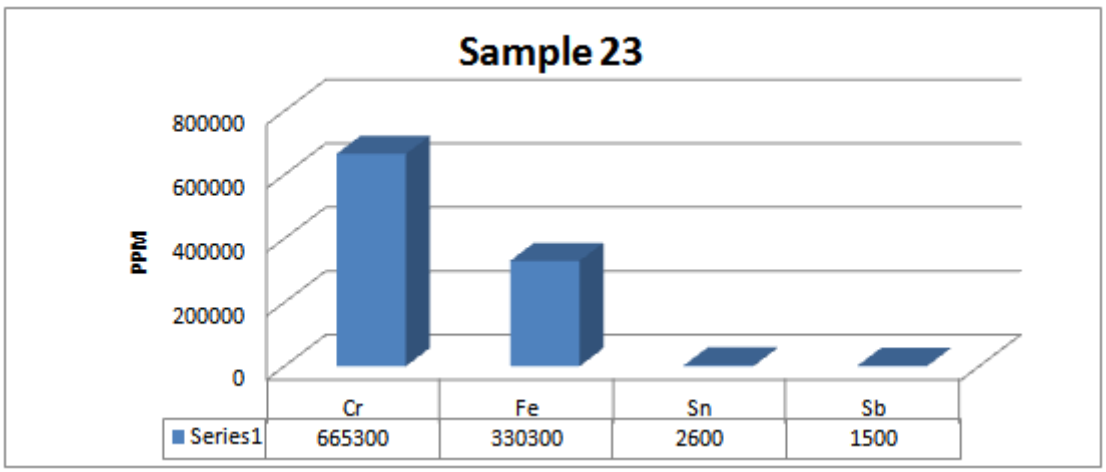
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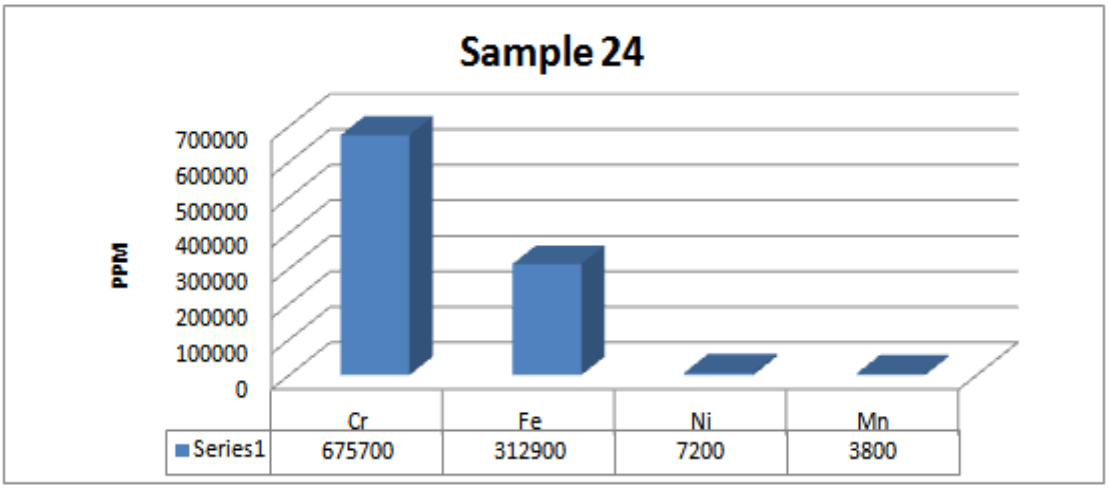
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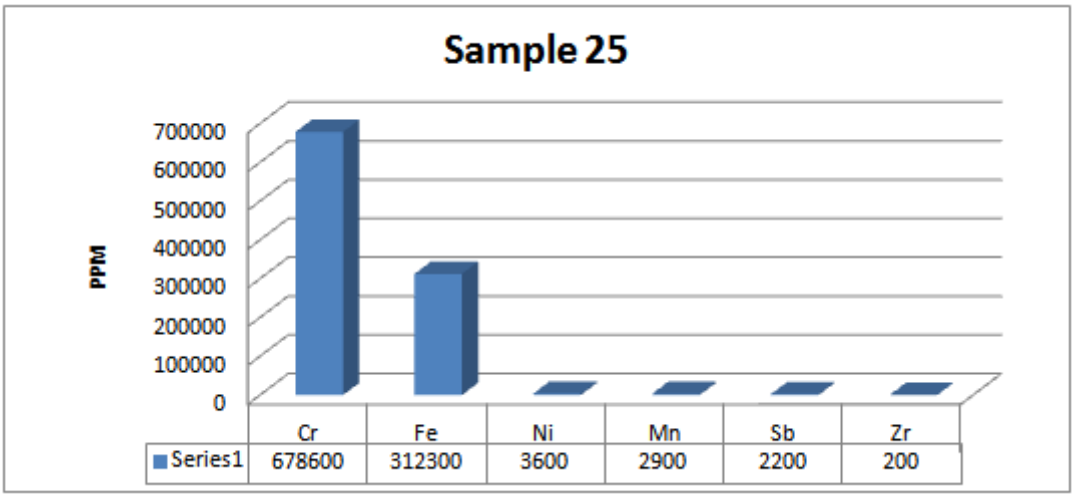
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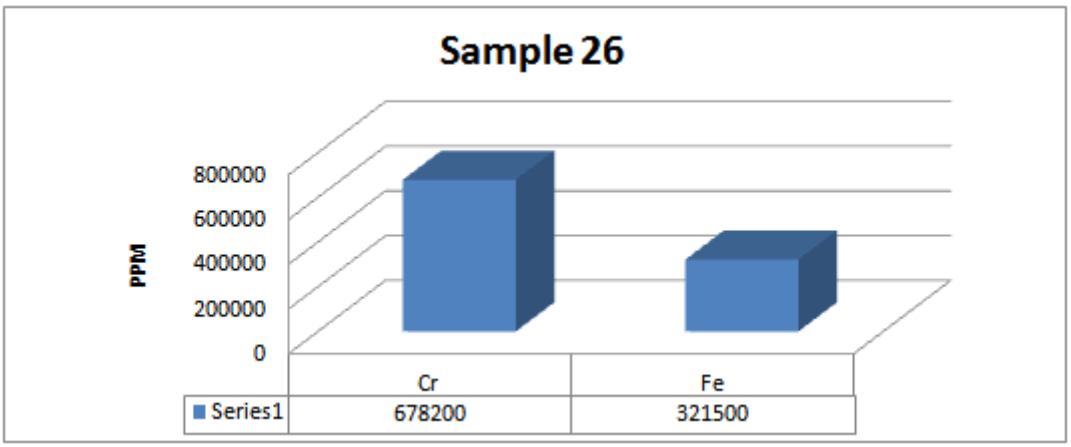
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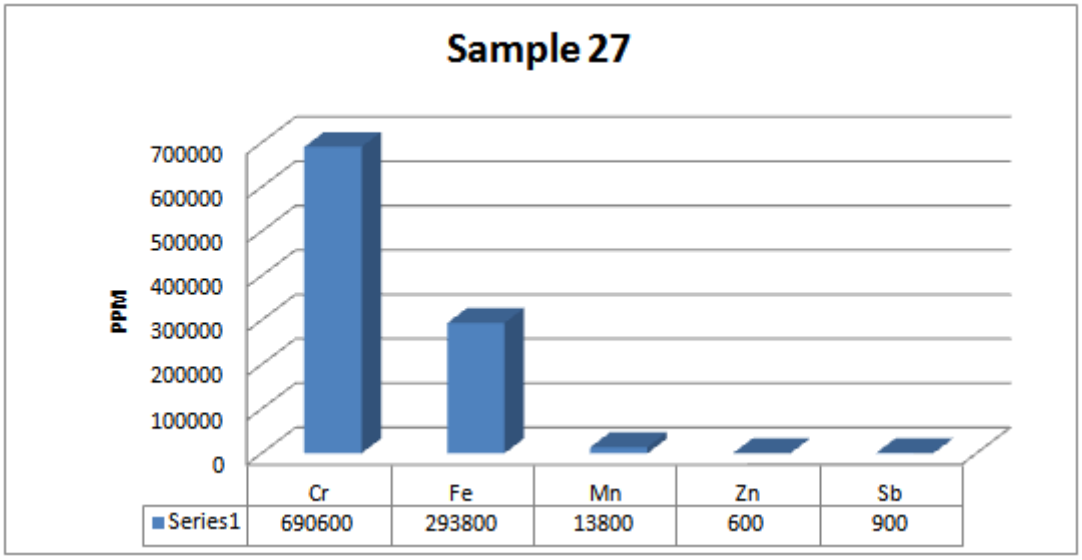
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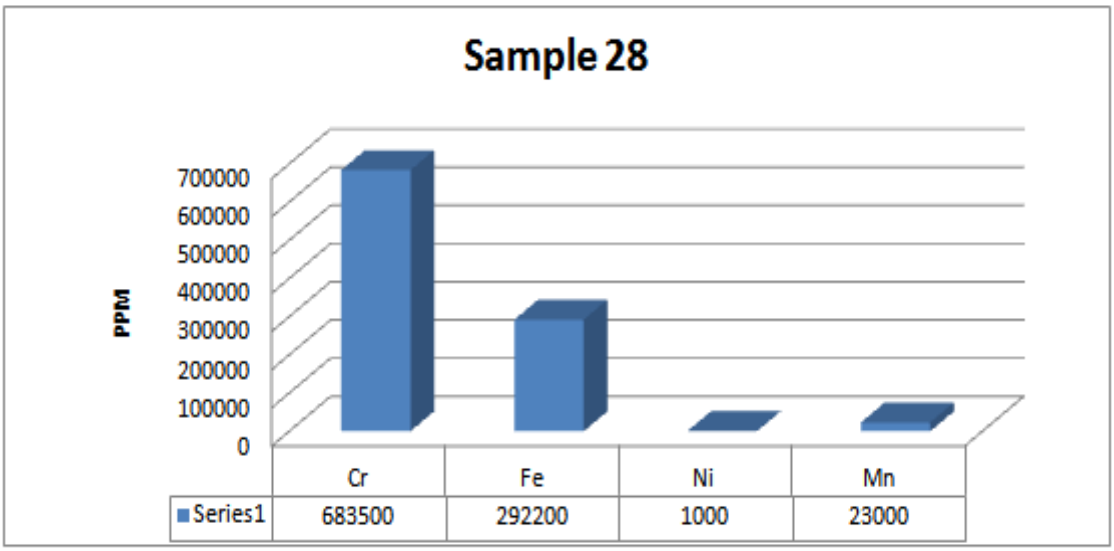
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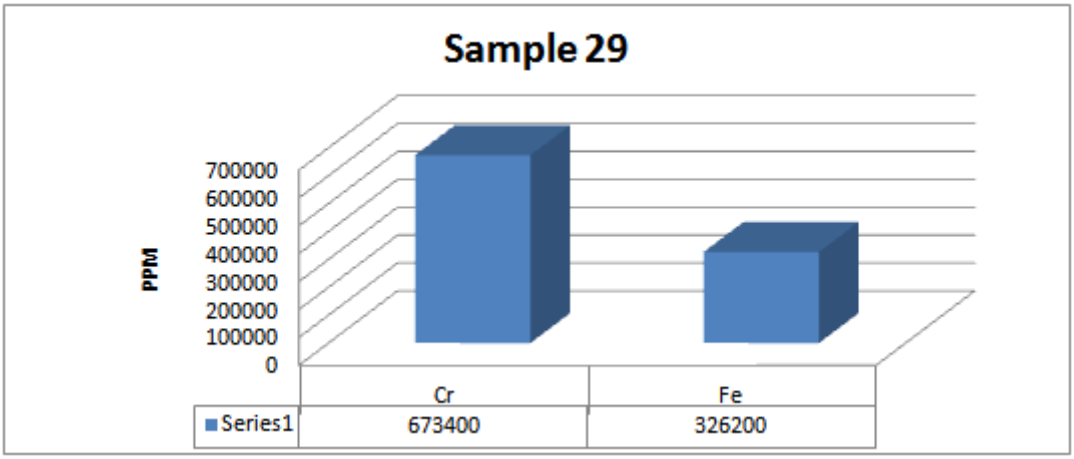
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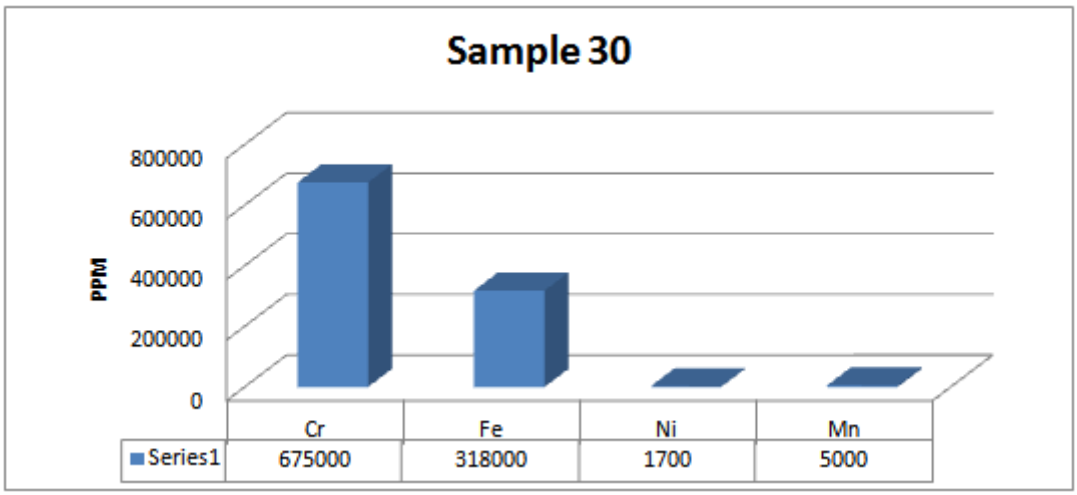

IV. Uses of chromium

Most chromium consumption is closely related to the metallurgical industry,spite the fact that the ore is used by the refractory and chemical industry aswell[1]. Distribution of chrome ore consumption in the United State, reveals that56% was used in ferroalloys manufacture, 33% in making of refractors and11% was used in chemical production[6].Most of the chrome refractors are usedby the metallurgical industry for lining and patching furnaces, and a fairpercentage of the chemicals is used for metal treating and plating and themanufacture of chromium metal[6]. A large portion of chromium produced isused in production of steel alloys that are very hard and strong[7]. Stainlesssteel, which usually contains chromium and some nickel, is used in themanufacture of cutlery because of its corrosion resistance[7].Nonferrouschromium alloys include nichrome and chromel (Ni and Cr) which are used invarious heating devices because of their electrical resistance property[7].Chromium is widely used as a protective and decorative coating for othermetals such as plumbing fixtures[7].Chromium is also used as paint pigmentsand mordent[7].potassium chromate and sodium dichromate are used as oxidizing agents[8] .Sulphuric acid solutions of chromium (VI) are powerfully oxidizing agentsthat are widely used in organic chemistry, and as cleaning solution forlaboratory glassware[9].The cleaning action is largely due to oxidation ofgrease and organic residues [9]. Potassium dichromate is largely used as anoxidizing agent in the manufacture of other chromium compounds such aschrome alum, lead chromate in dyeing industry, in the preparation of insolublepigments, and in manufacture of inks[10].Dichromate solutions in concentratedsulphuric acid are used in degreasing glassware[10].Potassium and ammonium chrome alums are a source of chromium sulphate,which can be converted into basic salts by the addition of alkali[11] .Thechromium sulphates has penetrating power and poor tanning properties, but on being made basic, it forms basic cationic chromium salts with good tanningproperties. The chrome alums are useful for making white" leather:

$K2SO4Cr2(SO4)3 + H2O + Na2CO3 = Cr2(Sa4)2(OH)2 + CO2 + Na2SO4 + K2SO4$.

Golbally demand for stainless dropped sharply during the slowdown consequentlythe market for feroochrome which fines 90% of its use in stainless steel manufacturing contracted severely[12].

V. Conclusion

Through this study, the presence of chromium in the Blue Nile region of the Angsana Hills was verified after samples were taken from this area. The concentration of chromium in the analyzed samples was found to be highly variable. The average concentration of this element was 671550 PPM, after the statistical work of the results obtained. The samples were analyzed using XRF technique.

This element can be utilized because it enters into many industries.

This study, conducted on the Ingassana Hills in the Blue Nile region, shows that the element of chromium is found in large quantities that can be used in the economy of the country by mining, processing and exporting, but it is difficult to provide water and fuel for that and also difficulties in obtaining the appropriate drilling equipment and operators locally, Of the study of the matter accurately and requires a great effort to evaluate the project before the start of work, which is costly in terms of material, and must evaluate the necessary equipment and drilling equipment for work and transport means and study all aspects of the project, and the desirability of the work environment and the provision of hands The necessary package for that project.

Sudan has a considerable potential of chromite, which as yet has to be evaluated. The already evaluated resources at Ingessana must be best exploited. Grinding and gravity concentration will definitely add value to

the mined high grade ores of the Ingessana area.Low-grade ores likewise, can be upgraded and used locally for the production of chromium salts.

Ophiolitic belts in other parts of the Sudan must be explored for chromite resources. Evidence of chromite mineralisation exist in most of them. The possible total reserve have been estimated as 250 million tons with 60% iron content.

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