CHROMITE MINERALIZATION AT SAISAQUINE WORKSITE, THABEIKKYIN TOWNSHIP, MANDALAY REGION

Hnin Min Soe[1*]

Abstract

The study of chromite deposits especially at Saisaquine worksite (Local name) is situated in the Thabeikkyin Township, Mandalay Region. The ophiolite rock suite of this area belongs to the Tagaung- Myitkyina Belt of Upper Ayeyarwady Provincewhich extends from the study area (Saisaquine worksite) Tagaung in the south to Myitkyina area in the north. Lithologic mapping in the ultramafic complex is difficult because of later modifications induced by extensive serpentinization and thermal metamorphism. Podiform chromite ores are main mineralization and they are hosted in serpentinized dunite and harzburgite. Mineralizations style occurred as irregular pocket or lens-shaped and fracture filling. Subcordant to discordant nature of the ore bodies which respect to their enclosing rocks and mostly found as massive and granular aggergates ores. Texturally, clot and pull-apart can be observed under microscope. In the field podiform chromitites can be seen as diverse types: they are massive, banded and disseminated, spotted or antiorbicular and nodular types. Nodular structure is characteristically of podiform chromite deposits and also as Alpine-type ultramafic rocks and primary magmatic feature. Low TiO_2 content indicates that the parental magma is a primitive Boninitic melt. The major objective of this paper is to review a chromite mineralization at Saisaquine worksite especially for major and minor elements by X-ray Analytical Microscope (XGT) method. Geochemically, MgO, major oxide content in chromitite ore is 9.32 to 29.8 in wt% by XRF chemical analysis and X-ray powder patterns are used for the identification of chromite mineral species: magnesio chromite is attempted**.** Due to sporadic podiform chromitedeposits of Saisaquine worksite area is a favourable for medium-scale mining operation.

Keywords*:* *Saisaquine worksite, Chromite Deposits, X-ray Analytical Microscope, Magnesiochromite*

Introduction

Location, Size and Accessibility

The study area is situated between latitude 23°30' N and 23° 38' N, and longitude 96° 05' E and 96° 12' E. It falls in 93 A/2, one inch topographic map and UTM map sheet No.2396(02) see in (Fig.1). The area lies in the Thabeikkyin Township, Mandalay Region and covers about (45) square kilometers. The study area can be reached from Mandalay by car. The satellite image shows the physiographic nature of the study area see in (Fig.2) and (Fig.3) shows 3Dview of the study area, looking N.

[*] Dr, Professor, Department of Geology, University of Mandalay, Myanmar

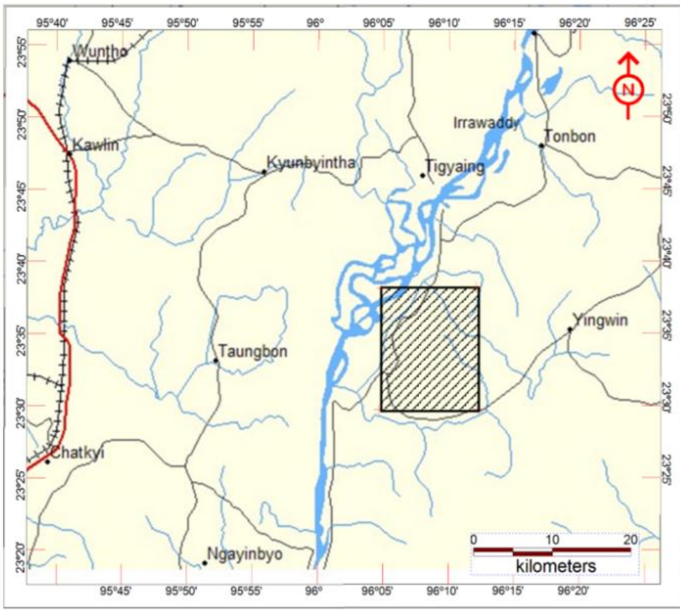

Figure 1 Location map of the study area.

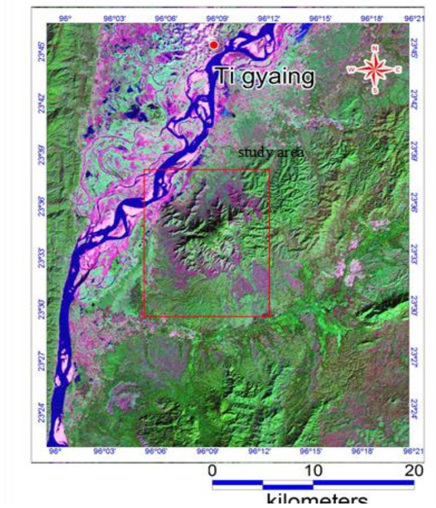

Figure 2 Satellite image of the study area.(Google Earth)

Purpose and Scope

The current research work is expected to contribute the following.

1. To construct the modified geological map of the study area.
2. To discuss the petrography and mineralogy of the Saisaquine worksite chromites.
3. To study the geochemistry and petrogenesis of the Saisaquine worksite chromites.

Methods of Study

Field Investigation

In the field, detailed outcrop mapping was carried out by using Brunton compass-type traverses. Representative samples of ores and host rocks were collected for subsequent analytical work and laboratory investigation. The GPS was used to locate the important outcrops, sample locations and measuring the geological structures and other necessary data.

Laboratory Investigation

The following works were done in the laboratory;

(1) Polished and thin sections of rocks and ore samples were studied under microscope through transmitted and reflected light.
(2) Identification of chromite mineral species by X-ray diffraction (XRD) analysis.
(3) Chemical analysis of rock and ore samples for major and minor elements by X-ray. fluorescence analysis (XRF) and X-ray Analytical Microscope (XGT).

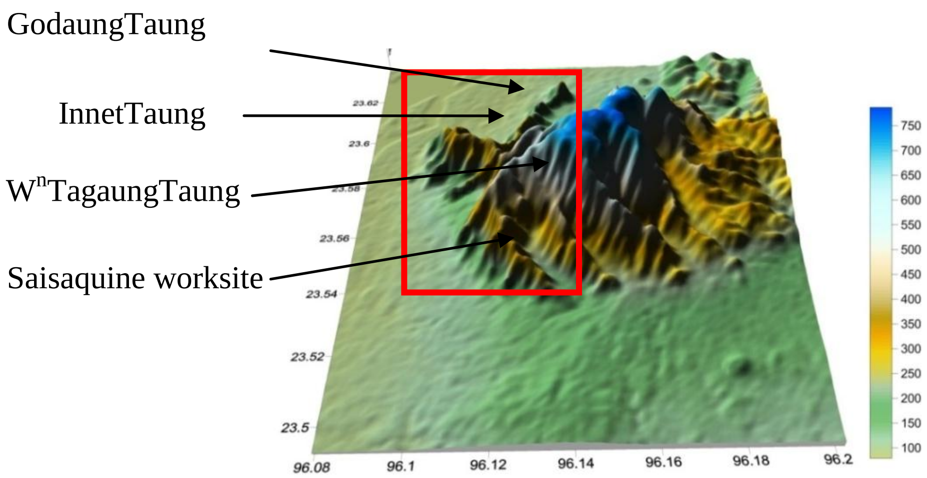

Figure 3 3D view of the study area, looking N.

Regional Geologic Setting

The study area is situated 12 miles south of Tigyaing in the east bank of the Irrawaddy River. This area also located in the southern part of the Tagaung-Myitkyina Belt of Upper Ayeyarwady Province (Mitchell *et al*, 1993).

The study area falls in the western edge of the Shan-Tennasserim Block and the eastern marginal zone of the Central Cenozoic Belt. The study area falls within the Mandalay-Jade Mine Ophiolite Belt according to Hutchison (1989). This ophiolite belt is situated along the western margin of the Sino-Burma Ranges (Fig. 4).

Ayeyarwady River runs nearly N-S directions, which flows north to south. The well-known Sagaing Fault, a right lateral strike-slip fault is trending nearly north-south to the west of the study area. According to Myint Thein *et al*.(1983) the Ngapyawdaw Chaung Formation and the Male Formation lie to west of the study area. Mesozoic age, Katha Metamorphics occupied in north of this fault.

To the south of this area is occupied by the complexes structure and lithology of Mogok Series of La Touche (1913). Twinnge-Momeik Fault is the southern boundary of this area. It separates the rocks of the study area in the north from those of the Mogok Belt in the south. The Katha-Gangaw Range running from Mogaung at the north through Naba-Katha to Tigyaing at the south, dies out to a plain at Tigyaing about 23 km north of the study area.

Stratigraphy

The study area comprises a sequence of ultramafic, sedimentary and metasedimentary rocks. The rock units are generally extended roughly NNE-SSW. The stratigraphic sequences of the study area are established by Than Than Oo (2006). The modified geological map of the study area is shown in (Fig 4).

Rock sequence and distribution of the study area (After Than Than Oo, 2006)

Six different stratigraphic units are recognized in the study area on the basic of lithology, stratigraphic position and fauna content and these units (from younger to older) are;

Stratigraphic Succession	**Age**
Sedimentary rocks	
Alluvial	Recent
Nickel laterite soil	Pleistocene
Fanglomerate	Pleistocene
Male Formation	Lower- Middle Eocene
Baingbin Conglomerate	Paleocene
That-tu Bedded Chert	Cretaceous
Metasedimentary rocks	
Twegauk schist	Cretaceous?
Igneous rocks	
Ultramafics	Early Jurassic?

Petrography and Mineralogy of Chromite Ore

Types of Chromites

Podiform chromitites of study area are texturally diverse. They are massive type, banded and disseminated type, spotted or antiorbicular type and nodular type.

(a) Massive Type

Massive chromitites typically have sharp contact with the enclosing dunite (Fig.5). Massive chromitites are hard and compact, steel grey to deep black in colour, and have a high specific gravity. They are coarse-grained rocks; composed of more than volume percent chromites. Individual chromite grains are mostly 1 to 5 mm interlocking euhedral, subhedral, or anhedral chromites containing very small quantity of talc or serpentinized olivine filling up the interspace.

(b)Banded and Disseminated Type

Disseminated chromitites grains about 20-70 volume percent are more or less uniformly scattered in dunite and peridotite. The chromites are arranged in persistent layers alternating with layer of altered silicate or serpentine (Fig.6). Small euhedral chromite grains with sharp margins enclosed within single crystallization of partly altered olivines were described as early magmatic by Chakraborty (1973) and Varma (1965). Both olivine and chromite in the banded chromites are considered as the products of in-situ crystallization where both the minerals scattered simultaneously.

(c) Spotted or Antiorbicular Type

Spotted chromites are widespread in this area. Spotted chromites are transitional type between massive and banded chromites. In chromitiferous dunite unit in which euhedral and subhedral chromites are partially or totally filled the interstices of the olivine (Fig.7). These textures are the result of the settling together under gravity of coarse cumulus and finer cumulus of chromites, followed by adcumulus (Wager *et al*, 1960).

(d) Nodular Type

Nodular texture is a critical feature that distinguishes podiform deposits from stratiform deposits (Thayer,1964). Nodular chromites consist of rounded or ellipsoidal chromite aggregates; interlocked subhedral to anhedral chromite aggregates, usually massive in nature (Fig.8). The structure range from sphere to oblate and vary in size from about 2 mm to 20 mm in the longest dimension. The nodules are embedded in dunite or serpentine in a manner of pebbles in conglomerate. It is characterized by concave-convex embayment of grain boundaries. Core of some nodules are intergrown with silicates. Various mechanisms have been proposed to explain the origin of this structure.

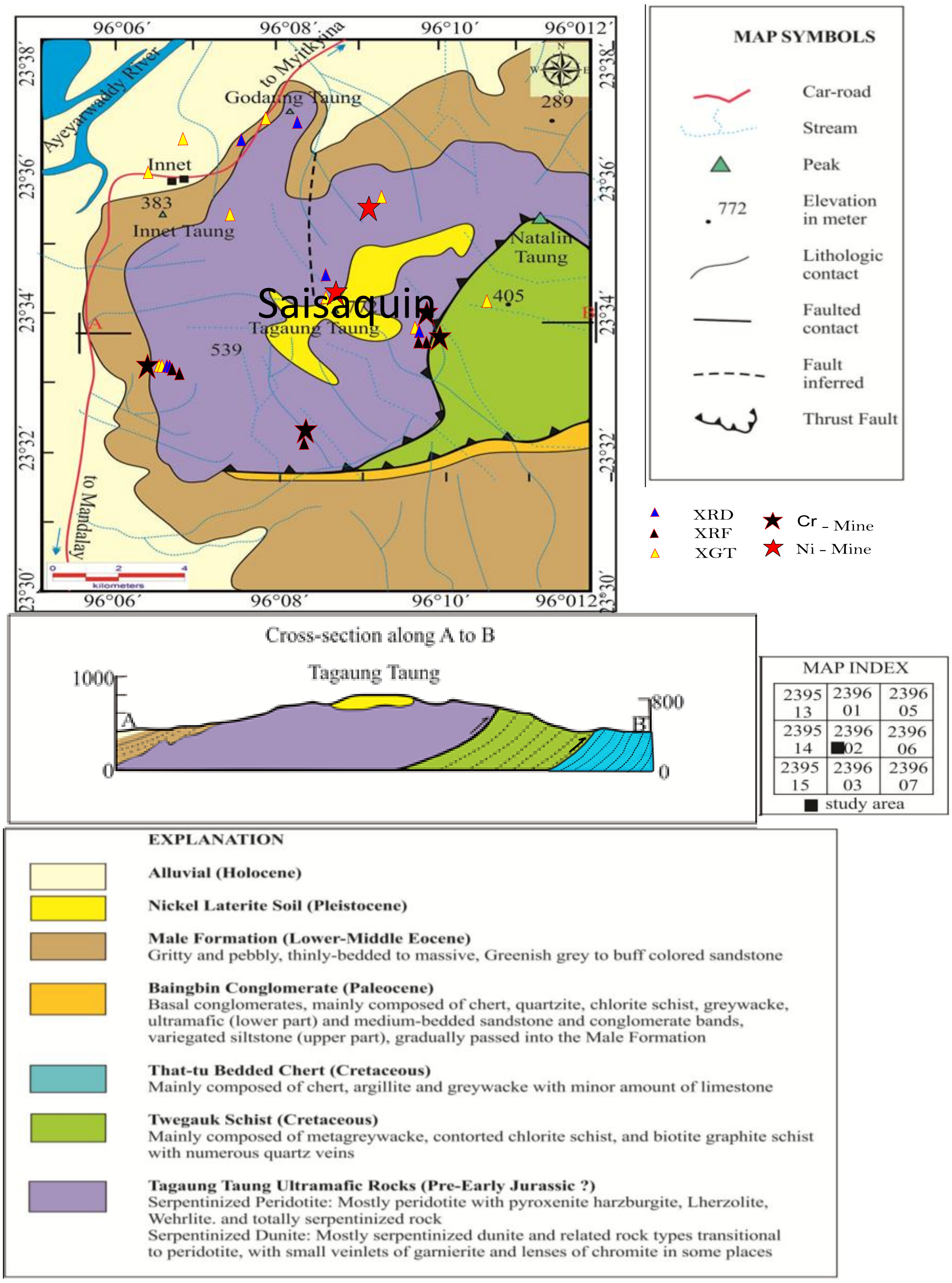

Figure 4 Geological map of the study area (Modified after Than Than Oo, 2006).

Figure 5 Massive chromitites enclosed in dunite exposures, western part of study area.

Figure 6 Serpentine (green) & chromites (black) are arranged in alternating layers.

Figure 7 Spotted type chromitites formed by partially or totally fill the interstices between olivine grains at Saisaquine worksite.

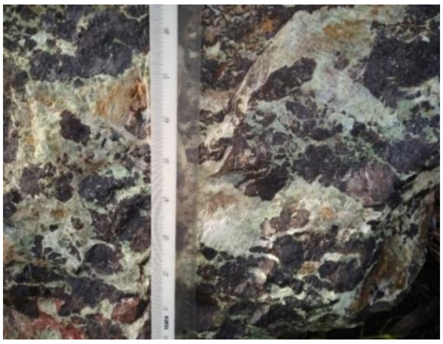

Figure 8 Nodular type chromitites consist of rounded or ellipsoidal chromite aggregatesin a matrix of serpentine at Saisaquine worksite area.

Megascopic Description

Chromites are composed of chromian spinel and silicate matrix with various proportions. The predominant ore mineral are chromites with the primary silicates like olivine, enstatite and dillage. Olivine, antigorite, tremolite, kammerite and uvarovite are the gangue minerals for this mineralization. Generally, the chromitites occur as compact and massive, (Tiger ore) and granular aggregates with subordinate amounts of silicate gangue matrix, (Leopard ore). Chromitites ore can be found as opaque, jet black to dark grayish, with a brownish black, brilliant shining and submetallic to dull in color.

Microscopic Description

In thin section, the chromite grains show zonal oxidation extending from the opaque to translucent reddish brown in the centre of the grains. Some translucent chromites have opaque borders and fracture networks. Cracking and crushing are common in it. The silicate inclusions are very characteristic in chromitites (Fig.9). Inclusions of olivines, orthopyroxenes, clinopyroxenes and sulphides are found in chromite grains.

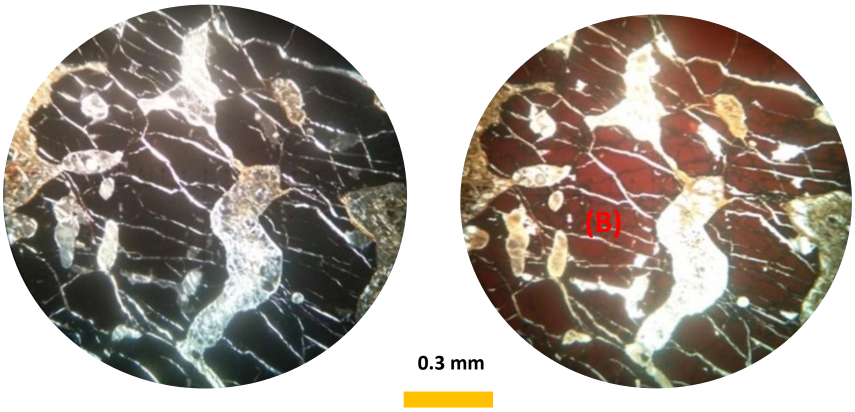

Figure 9 Photomicrograph showing silicate inclusions occurred in chromite crystal, pyroxene, olivine grains and vein serpentines (A) PPL and (B) XN.

Textures of Chromitites

Clot texture

Segregation of finer subhedral or subrounded grains in the interspaces of coarsely granular chromite mosaic was described as clot texture by Mukherjee (1969) (Fig.10). Varma (1965) considered as xenolithic inclusions of late magmatic chromite surrounded by coarsely crystalline hydrothermal chromites. According to Mukherjee (1969), the fine grained clots are formed by rapid cooling of the residual chrome rich liquid.

Pullapart texture

Pullapart texture is very characteristic of massive chromites. Pull-apart texture is well-exposed in coarse-grained chromite normal to the axis of stretching (Fig.11). The chromite grains are fractured and the fracture planes being commonly filled up with serpentine gangue.

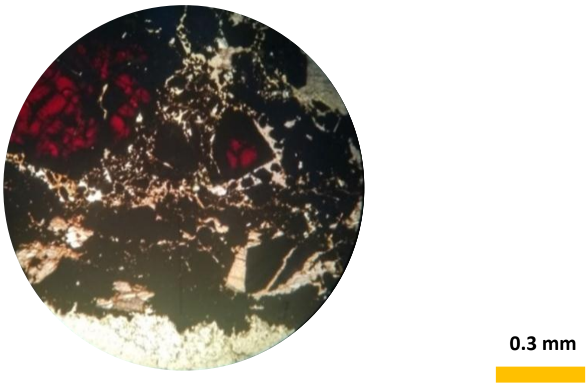

Figure 10 Finer grains in the interspaces of coarsely chromite mosaic can be seen as clot texture, between (XN).

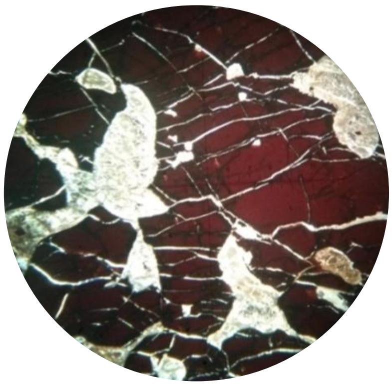

Figure 11 Fractured and the fracture planes of chromite grains are filled up with serpentine gangue, forming pull-apart texture.

Chromite Mineralization

The study area is entirely made up of a massive ultramafic complex which was emplaced in the tectonic zone by an up thrust movement. Serpentinites and highly fractured dunites are dominant ultramafic members. Widespread chromite mineralization is hosted in dunite and surround area, Saisaquine (local name) (Fig.12) and Kyauklaung stream sections (Fig.13), occupying the south and southwest of the study area. Faults and fractures are the evident of structural controls mineralization in this area. The chromite deposits occurred as floats, fragments and lenticular ore body (podiform) but the major concentration are seen in the dunite. According to the field evidence, along the Kyauklaung Chaung section is the potential area for future chromite exploration.

Saisaquine worksite chromite ore is generally found as deep blackish in color, pods and pockets shaped, irregularly distributed in the ultramafic rock (Fig.14). Size and shape are very variable and unpredictable. Two types of chromite ore are observed, such as (1) Primary and (2) Secondary (placer). Primary ore are (1) Massive (Tiger ore) deep blackish in color, (2). Impure chromite ore (Leopard ore) black and (3) Chrome dioxide dark (Black mixed with greenish colour). (U Hla Myint, U Maung Maung Htwe, U Maung Maung,1997).

Chromium content is more in massive ore (Tiger ore) (Fig.15) than leopard ore. They are occurred in different places or intimately in some places. Massive ore is always overlain by leopard ore (Fig.16). Massive type chromite ore is associated with dunite and occurred as lenticular (podiform) (Fig. 17) about a few feet long too many masses. Some occurrences show well developed pullapart texture indicating tectonic influence on chromite mineralization. The average chromium content is about 52.03 % (MU Research Center,2018).

Figure 12 Chromite mineralization at Saisaquine (local name) open pit mine.

Figure 13 Chromite mineralization near the Kyauklaung stream section.

Figure 14 Close-up view of **Pockets-**shaped chromite (deep blackish) in the study area.

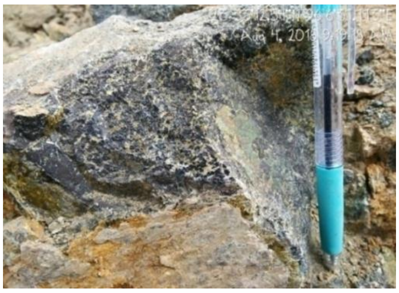

Figure 15 Massive ore (Tiger ore) has more chromite than Leopard ore in the study area.

Figure 16 Impure chromite ore (Leopard ore) is less chromite content in the study area.

Figure 17 Lens-shaped chromite found near the car road in the study area.

Geochemistry and Petogenesis of the Saisaquine Worksite Chromitites

Geochemical Characterization of Chromitites

Analytical procedure

Chemical composition of chromites was determined by XRF and XGT systems with an energy dispersive spectrometer at the Mandalay University's Research Center and XRD analyzed data at Department of Atomic Energy, Ministry of Science and Technology. Analyses were performed on polished and thin sections which represent to both rocks and ore samples.

Experimental results and discussions

The chromitites of Saisaquine worksite are composed of both chromite and serpentinized olivine. The chromitites composition ranges from 38 to 52 volume percent chromite. Representative chemical results by X-ray Analysis of chromitite ores from study area is shown in Table-A and the content of Mg element is noticeable. X-ray pattern is illustrated in (Fig.18) and XGT photomicrogaphs of Cr with Mg, Fe, Al and Ni are shown in (Fig. 19,20,21,22 and 23).

XRF chemical data of representative chromite concentrates with significant amount from the study were carried out and show a broad range of major oxide content; 0.48 to 4,28 wt % Cr_2O_3; 0.26 to 0.67 wt% NiO, 0.42 to10.3 wt % AL_2O_3; 4.71 to 27.7wt% Fe_2O3; 9.32 to 29.8 wt % MgO in Table-B.

Table (A) The Chemical Results of gangue and ore minerals in the study area examined under X-ray Analytical Microscope (XGT)

Elements	S_1	S_2	S_3	S_4	S_5
Mg	8.28 %	12.03%	8.11%	13.69%	11.22%
Al	7.57	14.65	6.93	5.83	6.45
Si	3.26	6.72	5.35	8.60	3.16
K	0.09	0.06	-	-	-
Sc	0.28	-	-	-	-
Ti	0.06	0.05	0.17	0.18	0.11
V	0.10	0.11	0.07	0.06	0.08
Cr	51.47	38.68	51.01	49.07	52.03
Fe	15.66	16.18	17.56	16.13	15.02
Ni	0.27	0.28	0.25	0.36	0.16
Zn	0.04	0.11	0.08	0.02	0.04
Pm	12.53	11.15	9.86	5.61	11.10
Ta	0.07	0.00	0.01	0.01	0.01
Bi	0.32	-	0.18	0.42	0.19
S	-	-	0.43	0.01	0.40
Os	-	-	-	-	0.04
Total	**100**	**100**	**100**	**99.99**	**100**

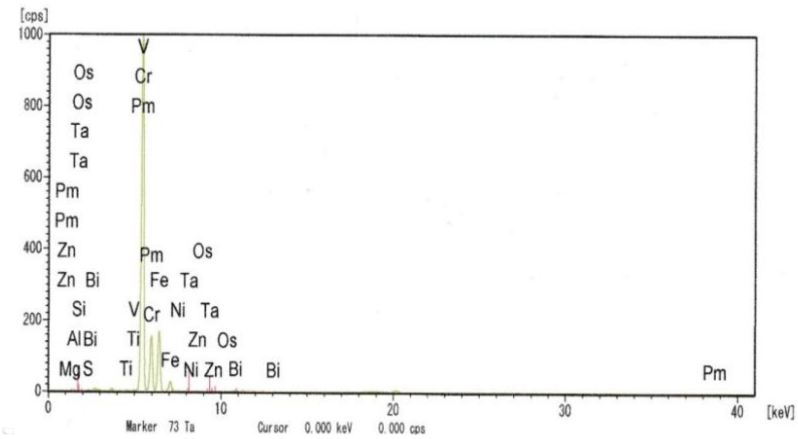

Figure 18 XGT pattern of the chromitite at Saisaquine worksite

Figure 19 Sample-(A1b). XGT photomicrogaph of Cr with Mg, Fe, Al and Ni.

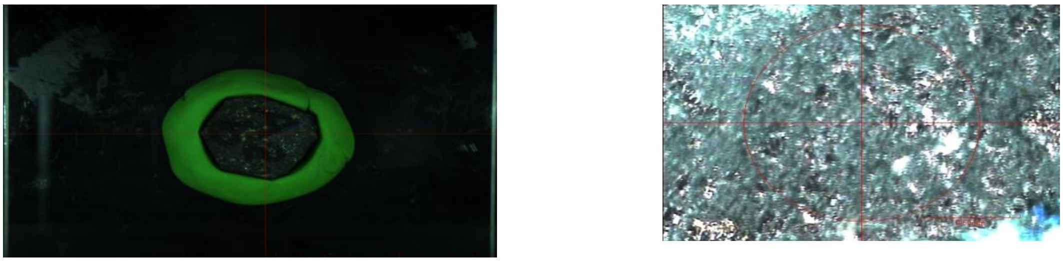

Figure 20 Sample-(A2b). XGT photomicrogaph of Cr with Mg, Fe, Al and Pm (promethium).

Figure 21 Sample-A5. XGT photomicrogaph of Cr with Mg, Fe, Al and P

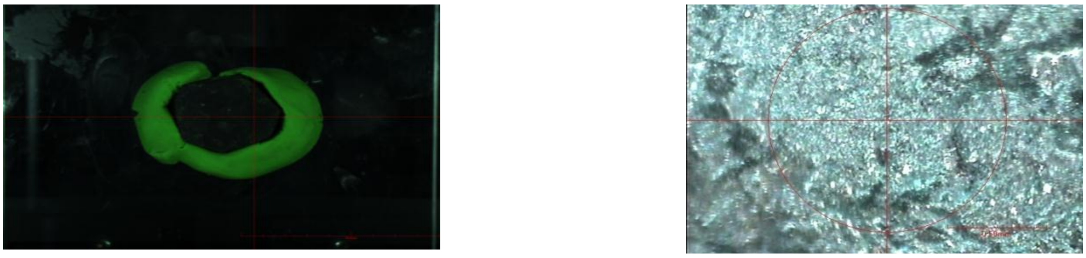

Figure 22 Sample-(B20a). XGT photomicrogaph of Cr with Mg, Fe, Al and Pm.

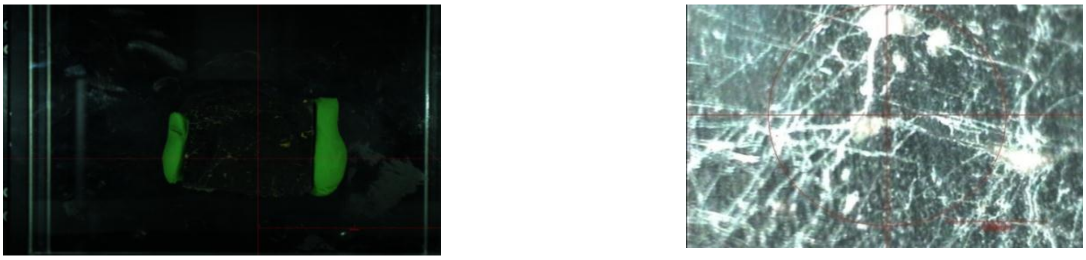

Figure 23 Sample-(E5). XGT photomicrogaph of Cr with Mg, Fe, Al and Pm.

Table (B) XRF Chemical composition results of ultramafic rocks.(Major elements in wt%)

Oxide	**F8**	**D8**	**F7**	**E2**	**F5**	**C3**	**C5**
MgO	26.2	23.0	25.7	14.2	27.2	29.8	9.32
Al_2O_3	1.35	1.22	0.428	10.3	1.35	0.813	1.07
SiO_2	55.5	58.8	58.6	52.6	54.7	54.9	56.4
P_2O_5	0.118	0.0926	0.101	0.0760	0.0878	-	-
Cl	0.0271	0.0919	0.0590	-	0.0253	-	0.0018
K_2O	0.104	0.157	0.141	0.297	0.112	0.103	0.122
CaO	0.437	1.01	0.381	12.9	1.31	0.682	0.521
V_2O_5	0.0294	-	-	-	-	-	-
Cr_2O_3	2.39	0.488	0.536	4.28	0.980	0.522	0.547
MnO	0.187	0.214	0.214	0.0799	0.207	0.194	0.409
Fe_2O_3	13.1	14.3	13.2	4.71	13.5	12.3	27.7
NiO	0.519	0.612	0.582	0.261	0.546	0.668	3.85
ZnO	0.0114	-	0.0131	-	-	0.0141	-
SO_3	-	0.0791	0.0367	-	0.0102	-	-
CO_2O_3	-	0.0318	0.0299	-	-	-	-
TiO_2	-	-	-	0.268	-	-	-
Total	**99.855**	**99.3865**	**100**	**99.9719**	**100**	**99.9961**	**99.9408**

Petrogenesis of the Host Rocks

Dunite and serpentinized-dunite of ophiolite suite are the main host of chromite ores in the study area. The formation of ophiolites will be explained in terms of their igneous development demonstrating that ophiolites occurred as closely associated assemblages. Their origins are polygenetic. Ophiolites are generated in several tectonic environments characterized by distinct sets of chemical signature. There are differences between the two major types of ophiolites; Mid Ocean Ridge (MOR) and Supra-Subduction Zone (SSZ). Discussion will be based on the variations of the degree of partial melting between these two ophiolite groups.

Mineral identification by XRD analysis

The representative chromite samples were analyzed in the XRD laboratory of the Department of Atomic Energy, Ministry of Science and Technology. X-ray powder patterns are the only certain means of identifying chromite mineral species. The X-ray diffraction (XRD) powder patterns are illustrated in (Fig.24), magnesiochromite species can be observed.

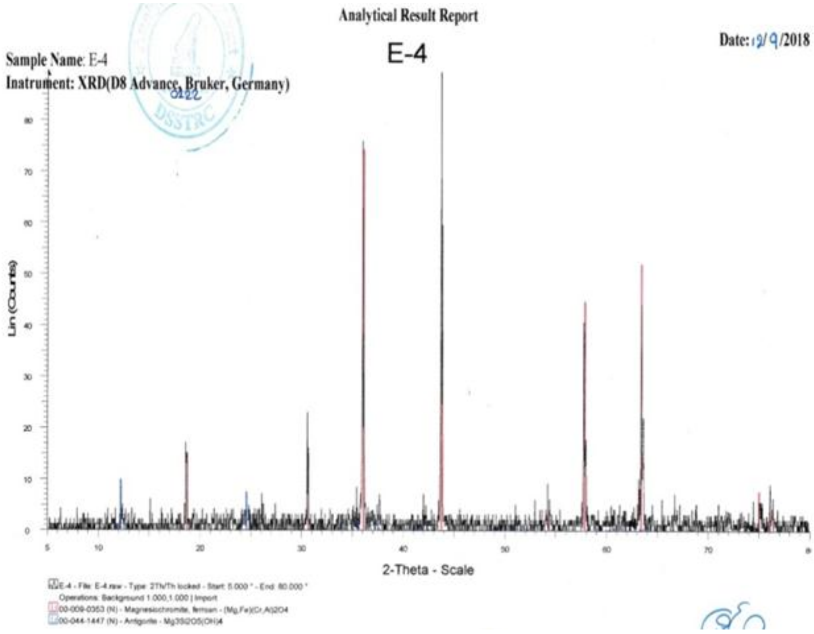

Figure 24 Contain major amount of magnesio- chromite and minor amount of antigorite.

Statistical Treatment of Geochemical Data from Saisaquine Worksite

The geochemical distribution pattern of the elements around the chromite mineralization is the basis for the development of the geochemical exploration techniques which shows about the associated minerals. The X-Ray analytical microscope (XGT) and X-Ray Fluorescence (X.R.F) results at Saisaquine Worksite chromite mining is shown in table (A and B). The elements of PbO, ZnO, CaO, MgO, SiO_2 and Fe_2O_3 were determined. These results from geochemical analysis were treated by statistical method using geostatistical software by calculating the values of Mean ($\overline{X}$) and Standard Deviation (S).

Distribution of Chromite: The concentration of chromite in ore samples ranges from 38.68% to 52.03%. The mean value of chromite is 48.45% and standard deviation is 5.578%.

Distribution of Nickle: The concentration of nickle in ore samples ranges from 0.168% to0.36%. The mean value of nickleis 1.55% and standard deviation is 2.347%.

Nickle has negative correlation with chromite. R square linear is 0.093. The chromite and nickle frequency histograms of chemical results and the variation diagram of negative relationship between chromite and nickle are shown in (Fig 25- A,B,C).

Distribution of Titanium: The concentration of titanium in ore samples ranges from 0.05% to 0.18%. The mean value of chromite is 0.11% and standard deviation is 0.06%. Titanium has positive correlation with chromite. R square linear is 0.221. The chromite and titanium frequency histograms of chemical results and the variation diagram of positive relationship between chromite and titanium are shown in (Fig 26- A,B).

Distribution of Silica: The concentration of silica in ore samples ranges from 0.05% to 0.18%. The mean value of silica is 0.11% and standard deviation is 0.06%. Silica has negative correlation with chromite. R square linear is 0.093. The silica frequency histograms of chemical results and the variation diagram of negative relationship between chromite and silica are shown in (Fig 27- A,B).

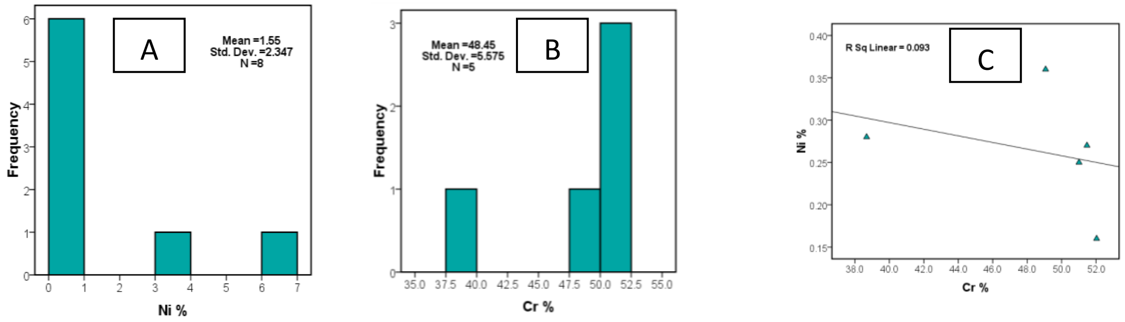

Figure 25 (A,B,C) Chromite and nickle frequency histograms and variation diagram of negative correlation between chromite and nickel.

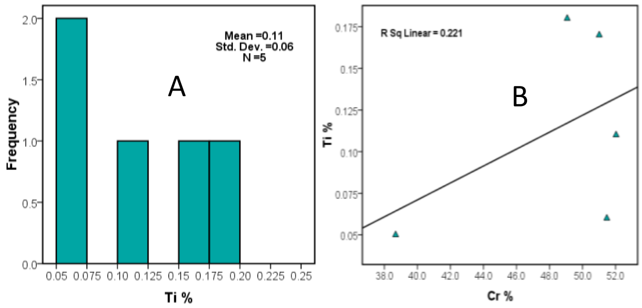

Figure 26 (A,B) Titanium frequency histogram and variation diagram of positive correlation between chromite and titanium.

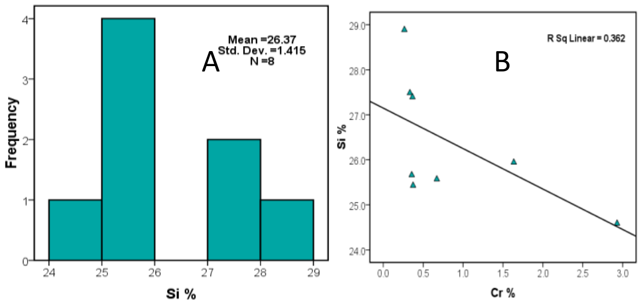

Figure 27 (A,B) Silica frequency histogram and variation diagram of negative correlation between chromite and silica.

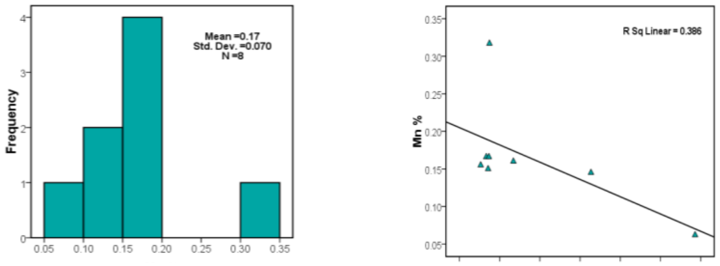

Figure 28 (A,B) Manganese frequency histogram and variation diagram of negative correlation between chromite and manganese.

Distribution of Manganese: The concentration of manganese in ore samples ranges from 0.079% to 0.409%. The mean value of manganese is 0.17% and standard deviation is 0.070%.

Manganese has negative correlation with chromite. R square linear is 0.386. The manganese frequency histogram of chemical results and the variation diagram of negative relationship between chromite and manganese are shown in (Fig 28- A,B).

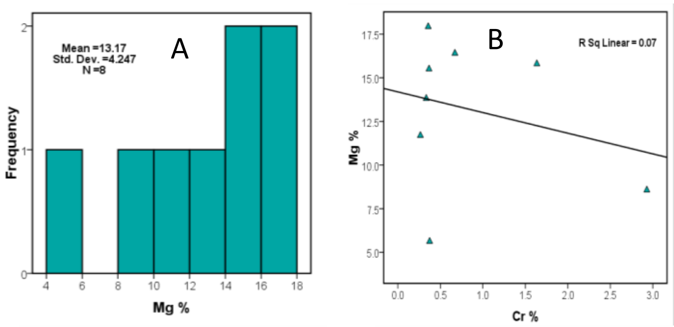

Figure 29 (A,B) Magnesium frequency histogram and variation diagram of negative correlation between chromite and magnesium.

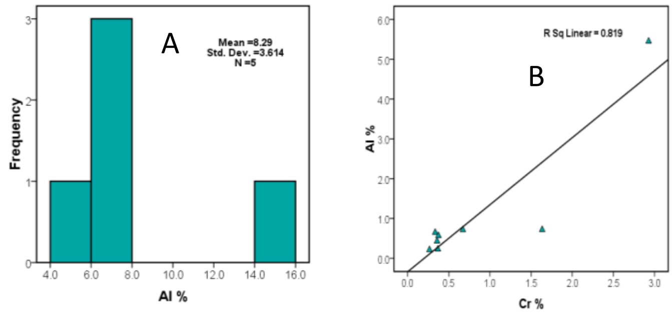

Figure 30 (A,B) Alumium frequency histogram and variation diagram of positive correlation between chromite and alumium.

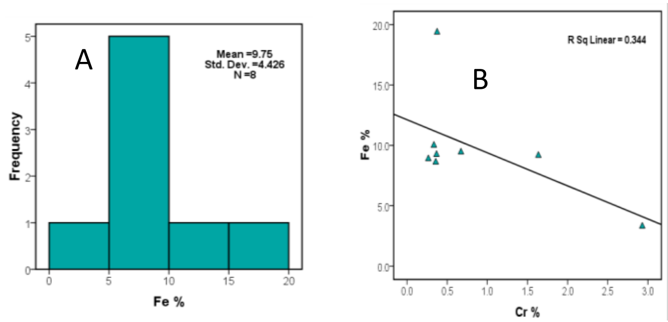

Figure 31 (A,B) Iron frequency histogram and variation diagram of negative correlation between chromite and iron.

Distribution of Magnesium: The concentration of magnesium in ore samples ranges from 8.11% to 13.69%. The mean value of chromite is 13.17% and standard deviation is 4.247%.

Magnesium has negative correlation with chromite. R square linear is 0.07. The chromite and magnesium frequency histograms of chemical results and the variation diagram of negative relationship between chromite and magnesium are shown in (Fig.29- A,B).

Distribution of Aluminium: The concentration of aluminium in ore samples ranges from 5.83% to 14.65%. The mean value of alumium is 8.29% and standard deviation is 3.614%.

Aluminium has positive correlation with chromite. R square linear is 0.819. The aluminium frequency histograms of chemical results and the variation diagram of positive relationship between chromite and aluminium are shown in (Fig.30- A,B).

Distribution of Iron: The concentration of iron in ore samples ranges from 15.02% to 17.56%. The mean value of iron is 9.75% and standard deviation is 4.426%.

Iron has negative correlation with chromite. R square linear is 0.344. The iron frequency histogram of chemical results and the variation diagram of negative relationship between chromite and iron are shown in (Fig.31- A,B).

Cluster Analysis of ore samples at Saisaquine Worksite Area

Cluster analysis of elements in ore samples is performed by the weighted pair group method. This investigation is based on eight ore samples results of X.R.F analysis from Saisaquine Worksite chromite deposit, as shown in above Table. The constructed dendrogram is shown in (Fig.32).The dendrogram drawn through cluster analysis of ore samples from Saisaquine Worksite chromitedeposit indicates that six associations of elements are observed in the clusters.

The first group of associated elements is Fe –Mn (0.997) and the second group is Cr –Al = (0.905). The third cluster, Ni-Si = (0.614) and fourth cluster is SiNi-FeMn = (0.170). Fifth cluster is Fe Mn Si Ni Mg = (-0.245) and Sixth cluster is Fe Mn Si Ni Mg Al Cr = (-0.488).

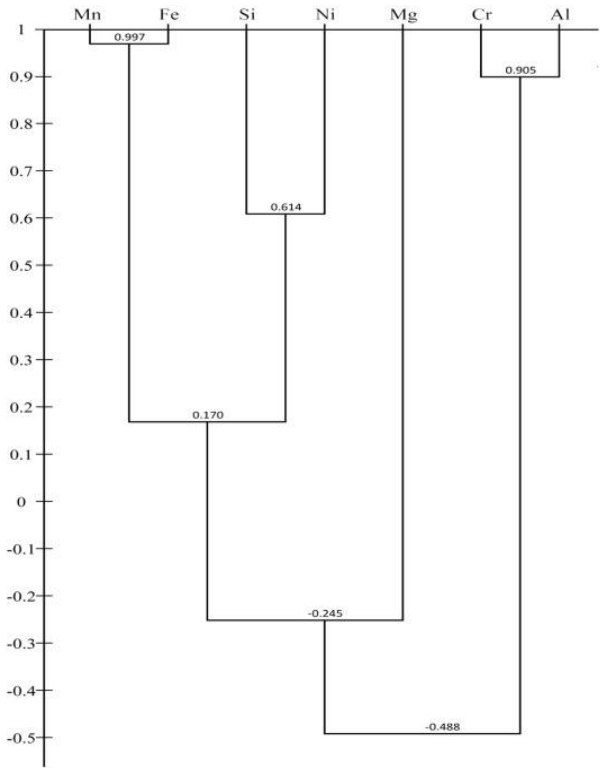

Figure 32 Dendrogram constructed by weight pair group method at Saisaquine Worksite chromite mineralization.

Conclusions

The Saisaquine worksite area lies within latitudes 23° 30' N and 23° 38' N, and longitude 96° 05' E and 96° 12' E. It falls in the UTM map sheet No.2396-02, one-inch topographic map N0. 93-A/2. The study area occupies in the Thabeikkyin Township, Mandalay Region.

The Saisaquine worksite ultramafic rocks are occupied nearly half of the study area. The major rock types are dunite, peridotite (harzburgite, lherzolite) and serpentinite. Most of them are partially to completely serpentinite. Serpentinites are alteration products from ultramafic rocks such as dunite and harzburgite. Harzburgite and dunite predominate over the other rock types. Mineralization host rock are serpentinized-dunite body near the harzburgite unit.

The chromitites are of the orogenic Alpine- type or the Podiform type that occurred as lens-shaped, nodular disseminated and massive forms. The ore bodies are small, erratic but occurred over and extensive area at Tagaung Taung area. Many of the orebodies are subcordant to discordant. The chromitites are composed of chromium spinel and silicate matrix. Chromite is the predominant ore mineral with olivine and serpentine (antigorite).

Texturally, Pull-apart texture is characteristic of the massive varieties, developed normal to the axis of stretching and the fracture commonly filled with serpentine gangue. Clot texture is segregation of finer subhedral or subrounded grained in the interspaces of coarsely granular chromite mosaic.

The geochemistry and the petrogenesis of the chromitites of the Saisaquine worksite area with à significant chemical data available from the analyzed samples studied by the aid of XRD, XRF and XGT systems. The petrogenesis of the ophiolites will be explained in terms of their igneous development and their polygenetic origins.

Low TiO_2 content in XRF results indicates that the parental magma is a primitive Boninitc melt. Geochemically, MgO, major oxide content in chromitite ore is 9.32 to 29.8 in wt% by XRF chemical analysis and X-ray powder patterns give the identification of chromite mineral species: magnesio chromite specie is identified**.** According tothefield observation and chemical data, sporadic podiform chromitedepositsof Saisaquine worksite area is a favourable for medium-scale mining operation.

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