PRE-FEASIBILITY STUDY REPORT

FOR

GEMSTONE MINE AT

ALIA AREA,

MWATATE SUB-COUNTY

BY

PAUL M.WACHENJE REG.GEOLOGIST-NO.123

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JANUARY 2022

Contents

CERTIFICATION

Feasibility study report has been done with reasonable skill, care and diligence in accordance with the New Mining Act 2016 and Mining (Work programs and exploration reports) Guide lines 2017, within the study limitations and resources/information provided by the project proponent.

I hereby certify that the particulars given in the report are correct and true in the best of my knowledge.

Proponent:

Name: ***H.G.SOLUTIONS LIMITED***

Address: ***PO BOX 100798-00101 NAIROBI***

Signature:……..

Date:……

CONSULTANT GEOLOGIST:

PAUL MWADIME WACHENJE

REG.GEOLOGIST NO.123

15/01/2022

SIGN:……..

1.0 EXECUTIVE SUMMARY

DR.CONSTATINE MWADIME an agent of **H.G.solutions Limited company** has applied for prospecting permit in an area located at Alia-Mgama ridge ,Mwatate Sub County,Taita/Taveta County.The proponent intends to prospect for gemstones;green garnet,ruby and any other minerals encountered while prospecting.

The proponent did some prospecting in the area and yielded ruby, tourmaline and green garnet gemstone samples worth thousands of dollars. The geology of the mines sites lie within the Mozambique gemstone belt hence the area is rated as prospective for gemstones mineralization.

Owner:H.G.solutions limited

Category:Prospecting Permit

Area:0.4826km2

Estimated investiment:10.0 million

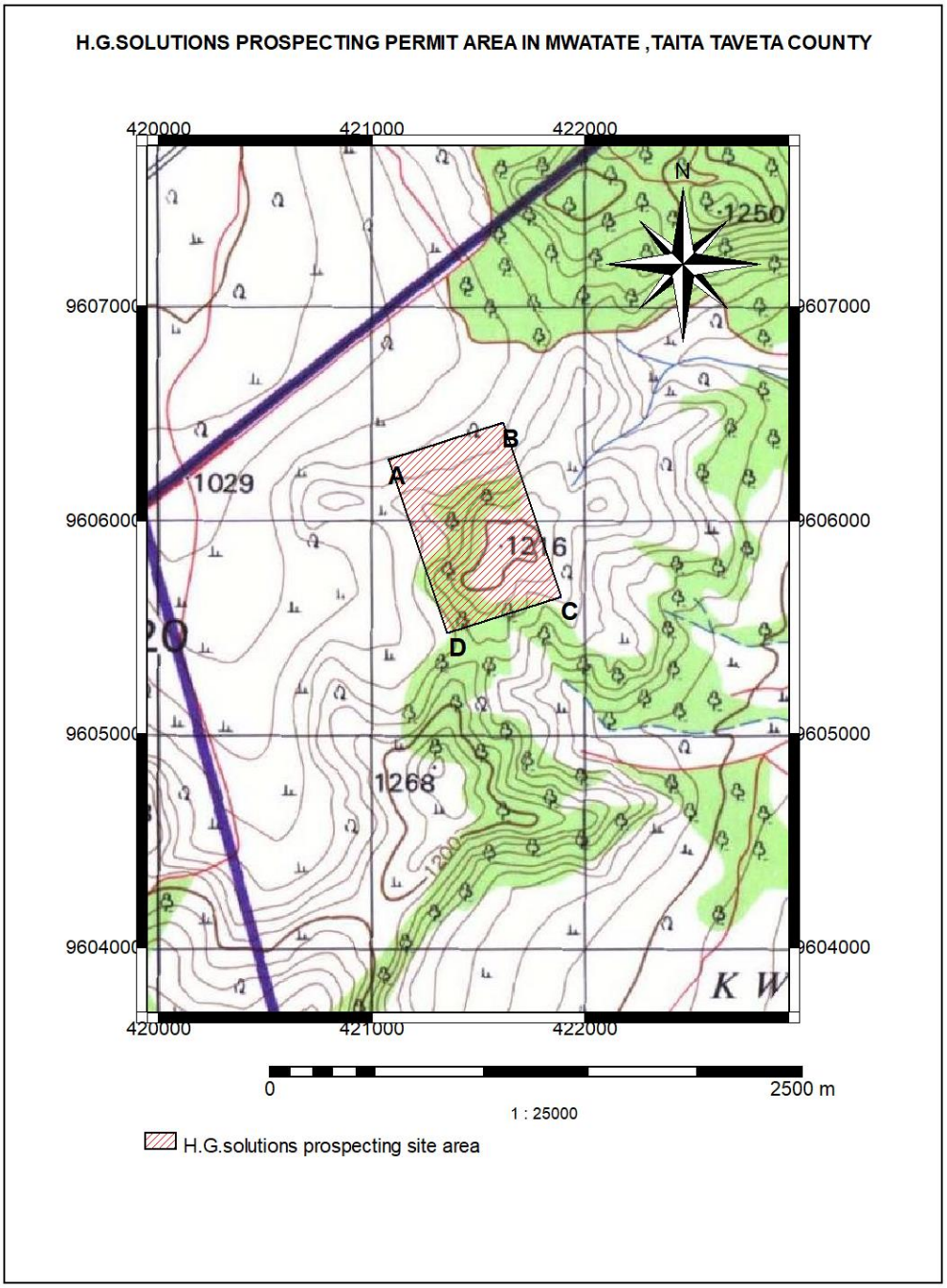
Estimated Production:20-100kg ruby/green garnet per month

2.0 Property description and location

The mining site is located almost 14 km South West of Mwatate town

The area can be accessed from:

- Voi-Mwatate tarmacked road 36km.
- Mwatate-Alia Mgama Ridge- to Mine site 13 km feeder roads.


H.G.SOLUTIONS PROSPECTING PERMIT AREA IN MWATATE ,TAITA TAVETA COUNTY
420000
421000
422000
N
1250
9607000
9606000
9605000
9604000
1029
A
B
C
D
1216
1268
1200
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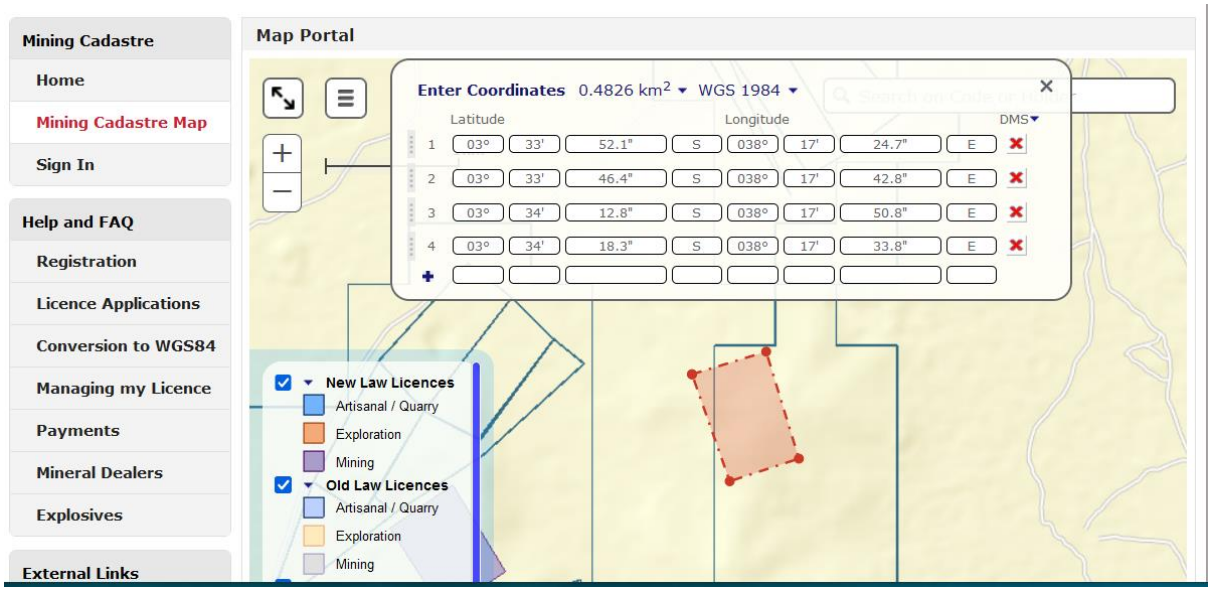
1 : 25000
H.G.solutions prospecting site area



BEACONS	SOUTHINGS	EASTINGS
A	03⁰33'52.1"	038⁰17'24.7"
B	03⁰33'46.4"	038⁰17'42.8"
C	03⁰34'12.8"	038⁰17'50.8"
D	03⁰34'18.3"	038⁰17'33,8"

3.0 Climate information

The area experiences two rainy season in the year. The short rains occurs within the months of April-May and long rains on October to December. The area is semi-arid and hot during the dry periods and is favourable for cattle rearing. The area is classified as disease free zone and hence herds of cattle are brought here from different regions for fattening.

4.0 Infrastructure

The road from Mwatate to the mining site is untarmacked and can be challenging during rain seasons. The road is very dust when dry and slippery during rainy season but still passable.

4.1 Power supply.

The nearby three phase power supply is at Bura shopping centre which is almost 5 km SE to the site.

4.2 Communication

The area is well covered by airtel and safaricom mobile networks,

4.3 Labour

Both the skilled and unskilled labour force for prospecting and mining work can be found within Mwachabo location, Mwatate town, Wundanyi and Voi.

5.0 NEED FOR THE PROJECT AND ITS IMPORTANCE TO THE COUNTY/REGION

Gemstone's minerals are essential minerals for jewellery industries and medicinal for belivers. Mining is a process of extracting valuable minerals or other geological materials from the earth which are processed and used for production of materials of economic value. Mining of minerals plays a positive role in the process of economic of many countries. It has also played a great role in development of civilization and industrialization. Gemstone mining in the area will benefit the local people by the way of direct and indirect employment. Applicant will pay royalty for the gemstones to be produced from the mine, sales tax and other applicable taxes will be paid thereby contributing to the County and National revenue. The public revenue will be overall growth of the region in terms of educational, health, training, transport automobile, industry. The standard of living accordingly will also get uplifted on the positive side. Gemstone's production too will boost the economy of the region.

6.0 DEMAND SUPPLY GAP

Green garnet gemstone /green tourmaline are rare minerals which are found in few countries in the world. There is a gap between demand and supply of these gemstones in the region. The mining projects aims to marginally fill the demand supply gap through optimum expansion to meet the demand effectively.

7.0 BACKGROUND

Taita-Taveta is endowed with a number of gemstones and industrial minerals. The gemstones that are mined here include.

1. Garnets (Tsavorite, Rhodolite, red garnet, yellow garnet, Change colour etc.).
2. Corundum (Ruby and Sapphire).
3. Amethyst.
4. Tourmaline (yellow, green, black etc.).
5. Peridot.
6. Iolite.
7. Spinel.

Industrial minerals that occur and mined here include:

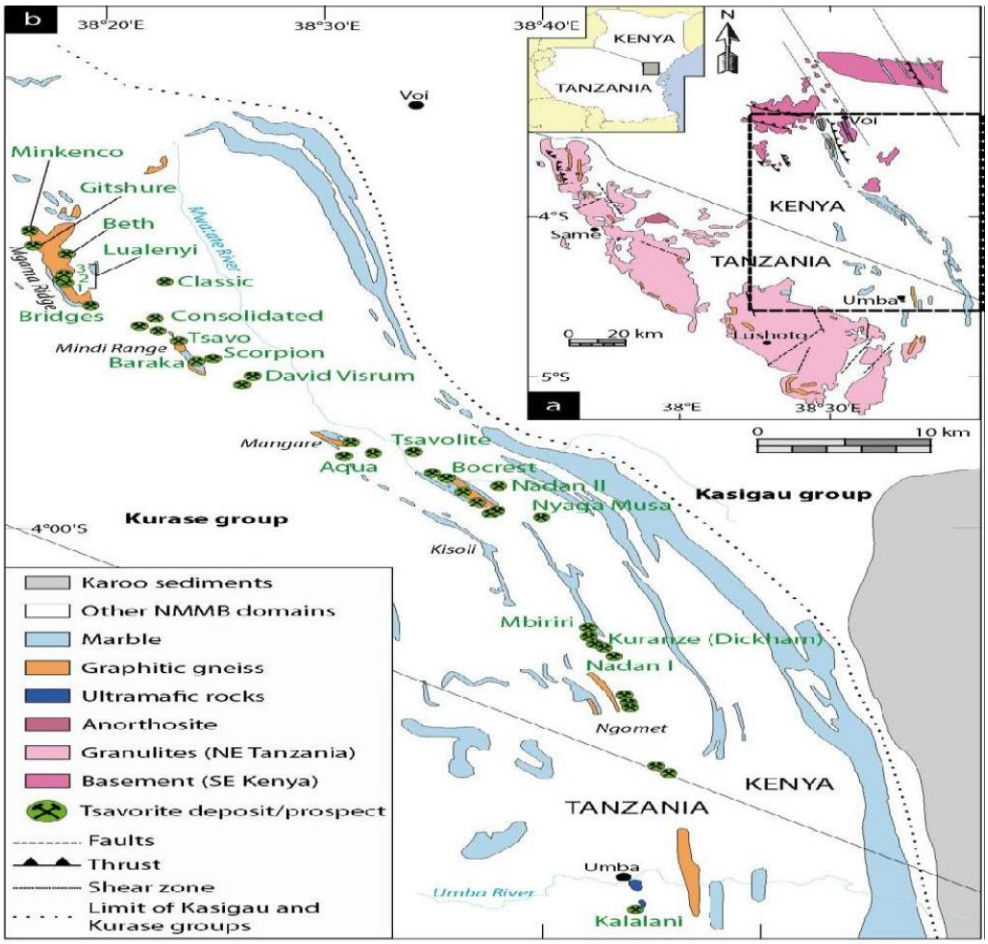
1. Iron ore
2. Limestone
3. Copper
4. Manganese
5. Marble
6. Magnesite
7. Asbestos
8. Graphite
9. Kaolin Clay
10. Mica
11. Building stones

8.0 Geology

This area lies entirely within the Mozambique Belt. It's completely within the domain of the suite of meta-pelites and meta-calcareous rocks named Kurase series by SAGGERSON (1962). The Kurase series is further subdivided into the following formations;

(1) The Mugeno Formation.
(2) The Mwatate Formation.
(3) The Mgama Mindi Formation.
(4) The Mtonga-Kore Charnockite Complex.
(5) The Lualenyi member.
(6) The Mtongore Formation.

The area of interest lies within Mgama-Mindi formation which is host gemstones such as green garnet,tourmalines ,rubies and various other gemstones.



Ge Fig.3

Map showing the gemstone belt in Southern Kenya

9.0 Prospecting and Mining History of the study area.

The area is covered by reddish brown thick loam sandy soil. Limestone rock exposures are encountered at the elevated South-Eastern side of the area.

Some of the prospecting pits and trenches dug at the middle of the claim yielded samples of rubies, green garnets, red garnets and tourmaline. The overburden soils varies from 0.5-3m deep.

For the prospector to increase chances of striking rich potential veins of the gemstones, systematic trenching and pitting; geophysics and geochemical survey are recommended.

10.0 Geology of the area and mineralization

The geology of the study area of about 0.4826 km2 which lies within Mgama-Mindi formation is composed of five major geological units as described below;

10.01 QS-Soils(residual)overlying undifferentiated Precambrian.

The soils are found on both sides of the study area .The overburden soils depth varies between 0.5-5m deep. The soils are reddish sandy brown soils and blackish fertile loam soils. The soils are due to weathering of the basement rocks.

10.02 G-Granitoid gneiss

Granitoid gneiss is a variety of metamorphic gneiss that appears to have bands of black and white minerals such as feldspar and mica. These bands form from the heating and squeezing of the rock although, granitoid gneiss may look very similar to the original granite rock. Granitoid gneiss is medium- to coarse-grained and occurs around the study area.

10.03 Gf-Quartz fespathic gneiss+-muscovite,silimanite al interbedded withg,gf,m,)

These rocks are leucocratic, usually fine to medium, sometimes coarse grained and are weathering to yellow or buff colour. Gradual changes to more mafic biotite gneisses may occur in places. Some gneisses exhibit migmatization. Graphite is a more or less frequently occurring constituent and gradual changes to graphite gneisses.

The predominant constituents are quartz and feldspar, amounts of mica, normally muscovite, are usually less frequent. Alkali feldspar, partly microline, partly orthoclase, is the main feldspar, but also plagioclase may dominate. Muscovite (if present) is always strongly altered and obviously unstable. Garnet occurs in places, mainly in strongly fractured idioblasts. Rutile, apatite, zircon and opaque matter are common accessories. The quartz-feldspar gneisses contain a certain amount of graphite, locally remarkably increased; this often results in a distinct schistosity. Quartz is present in abundance, with more or less strong adulatory extinction. It occurs in places in platy grains and clusters, or has a granoblastic texture in the more gneissose rocks. It is arranged in distinct layers and partly scattered.

10.04 Graphite Gneiss

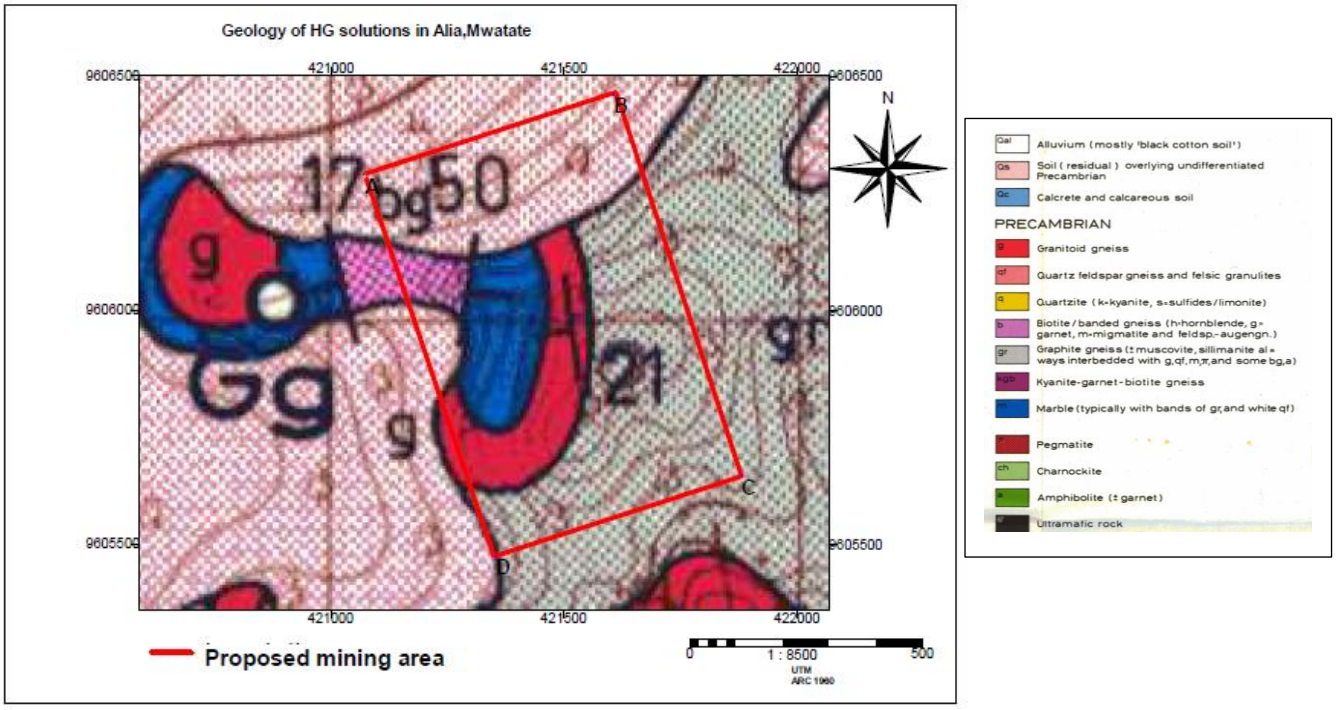
The graphite was formed by high-grade regional metamorphism of originally carbonaceous, alumina-rich politic sediments and occurs commonly in form of flakes of various size and shape.

10.05 M-Marble(typically with bands of gr,and white gf)

Marbles forms low, heavily-bushed ridges trending NW-SE across the entire area and are interlayered especially with biotite-garnet gneisses and various graphite gneisses and schists, indicating frequent environmental changes during deposition of these sequences.

A number of small, probably lenticular bodies of calc-silicate gneisses, compact calc-silicates faccies and layers of calc-silicate nodules were

observed in the gem-belt area. The latter gained some importance because of the occurrence of gemmy yellowish – green to dark – green coloured grossular(green) garnet.



11.0 Gemstones

The main gemstones found in the study area are green garnet,rubies,red garnet,yellow garnet and green tourmalines.

11.01Green Garnet(Tsavorite).

Tsavorite is the green grossularite garnet and occurs in a suite of silimanite-bearing graphite gneisses in the upper part of Lualenyi member in the Mgama-Mindi area. It occurs as scattered porphyroblasts 5-19cm with kelyphitic rims. It is associated with vanadium calc-silicate such as zoisite (tanzanite), sphene and diopside. An association of graphite gneisses and marble is mandatory for the formation of green garnets. Local stretching lineation appear as good guide to pockets. The genesis of green grossularite (tsavorite), a unique precious stone of Kenya and Tanzania, is controlled by the presence of vanadium as the main coloring agent, deriving from bituminous matter in the country rocks. The gem-grossularite originated during the formation of cal-silicate nodules caused by reactions between politic host rocks and thin intercalations of calcareous bands. During high-grade metamorphism the bituminous matter was transformed to graphite, while the trace metals were mobilized and absorbed by the grossularite.

The occurrences of garnet of gemstone quality, i.e. of green grossularite seem to be confined to the metamorphic Lualenyi member of the Kuranze group. Only primary deposits were observed sofar. The mineralization is much less intensive compared to the sometimes-coarse nodules of corundum in pegmatites. There are only scattered miniature pockets of small crystals usually occurring in reaction zones between graphite rocks and cal-silicates or marble.

The graphite-bearing rocks with intercalations of cal-silicates are the lithological control of the mineralization. The availability of trace metals such as V, Mn, Cr and Fe in a highly metamorphic environment are contributing agents.

11.02 Green Tourmaline

Green tourmaline are associated either with ultramafic rocks or with meta-limestone. The colour is related to the presence of Ti, V and/or Cr. They also occur in pegmatite, in fault zones, and in the ultramafic rocks. At Alia hills, Magnesium tourmaline occurs in mica rich vein let cutting across marble.

12.00 Prospecting for gemstones.

The program for Prospecting for gemstone deposits in this location shall be carried out at least in two phases:

- Use of Indicator Rocks and Minerals; and
- Direct Methods

12.01 Use of Indicator Rocks and Minerals

The use of minerals which in a wider sense associated with the geological environment favorable for gemstones grossularite deposits ("indicator minerals") applies the same practices as outlined above for the direct search. Minerals which may be considered to indicate green garnet potential are: Epidote; Chlorite; Zoisite; Tremolite;Diopside;GreenishMuscovite(Fuchsite); Green Tourmaline.
The first minerals indicate the Cal-silicate environment, while the two last ones reflect the elevated trace-metal content in the rocks.
"Indicator rocks" are sulfide – rich graphite schists and gneisses, preferably with marble and Cal-silicate bands and/or boudins. Unfortunately, these rocks are hardly recognized in natural out crops, but rather in pits and trenches.

12.02 Direct Methods (Detailed Prospecting).

Direct methods of gemstones prospecting include visual inspection of soil, debris rock outcrops, and alluvium, calcrete, and ant hills for tiny chips of the mineral while traversing prospective areas. Much more involved and time – consuming is the sieving of soil, in order to separate the grain size which most probably contains gemstones chips from larger rock fragments and the fine

dust. Generally the fraction between 0, 2 and 2 mm diameter will be most advantageous.

Sieving should preferably be carried out in water (for example in a 200lt drum cut in half and filled with water), as the color of the tiny chips will then be more readily recognized.

Samples for wet-sieving can be collected from the base of the humid soil layer (mostly less than 10cm in the area) or slightly deeper (from the bottom of a pit as deep [as a shovel's blade). If the size of the samples is uniform, grid-pitting and counting of garnet-chips per sample may lead to maps of the distribution of gemstones in the soil, which will help to place prospecting pits and trenches more intelligently. The distance of sampling could be wide for a preliminary survey (about 20 m square along the prospective horizon), and much smaller (down to 3m) once a prospective area has been located and pitting or trenching is indicated.

The economy of the method should be obvious when comparing the amount of labor necessary to dig only one short and shallow trench, to the quick and easy sampling of sandy soil at 20-0 cm depth, and wet – sieving of about one kilogram of the material collected. Adverse geological conditions, however, may lead to errors when applying the method indiscriminately: a soil – cover not derived from weathering of the local underneath, but transported from elsewhere, may effectively obscure even the richest green grossularite deposit underneath. In such a case, only geological reasoning, or wild- cat pitting and/or trenching may be successful in finding the deposit.

Important is the point, that prospecting should be most intensive along strike (laterally) of a once recognized productive horizon. Here is the best chance to find more enriched parts. The prospects found by earlier work now have to be subjected to detailed search for green grossularite deposits. Methods used would be wet- sieving of soil samples, pitting and trenching at regular intervals wherever chips of the mineral have been found.
Every green – garnet occurrence located will primarily be developed along strike, in order to get data on the location of the richest parts. This phase of detailed prospecting will pass into mining, wherever marketable material is encountered.

13.0 Mining methods

The nature of the deposits of gemstone deposits predetermines the possible methods of exploitation. Restraints are added in the area by the absence of abundant and cheap water.

Present conditions in the area allow the application of simple open –pit and underground mining methods only. The resulting labour – intensity however, cannot a priori be considered as a disadvantage considering the minutely dispersed garnet gem-stone. Owing to the nature of the mineralization, extension of present production and introduction of more mechanized mining is problematic.
Exploitation of gemstones deposit in the Mine site area involves the following steps:

- Removal of overburden/ or driving underground along the productive horizon
- Mining of the rock containing gemstones.
- Preliminary sorting to remove larger nodules or aggregates of gemstones.
- (Wet) sieving of the finer material, removal of the grain size – 1mm. sorting out all gemstones grains and chips.
- Cleaning of the gemstones from its matrix (tools used may be a small hammer, chisels, pincers, wire brush, etc.)
- Sorting of the gemstones according to color, transparency, and size. Well crystallized specimen may find a better market among mineral collectors, and should not be destroyed before a careful evaluation as to where a higher return may be realized.

14.0 Machinery

The mining machinery that can be used in this area:

1. Excavator:-The excavator is used at the initial stage of prospecting to dig prospecting pits and trenches. The trenches and pits are dug up to the level just above the base rock. The gravels are wet sieved to check for any minerals grains. The use of excavator hasten the process of prospecting.
2. Bulldozers:-Bulldozer is very useful in the removal of the overburden soil and rocks. This will enable the prospector to easily locate the mineralized / cal-silicate veins that are exposed on the rock or wall surfaces.
3. Compressor and jack hammers: - the compressor and jack hammer is a very useful tool in mining/exploration. The compressor has three main use in mining .It can be used to drill holes for explosives; break the rocks and pump in the air in the underground mines.

Commercial explosives are used to break hard and resistant rocks.Mine plan depends on the direction of the productive reefs. The reefs will determine which direction the tunnels will follow in the case of tsavorite gemstone. Once

a pocket of tsavorite is encountered, it is isolated and stored in a strong room. A day is set up when the nodules are removed from The strong room in the presence of the owner of the mine and individual crystals of tsavorite knocked from the nodules.

15.0 Marketing Green Grossularite

The fluctuation of production figures of the past years illustrates the difficulty of producing a steady supply of well- balanced quality form the irregular deposits of green grossularite. In order to achieve the best prices,

- A steady supply of reasonably constant quality, and
- Well-sorted parcels, not run-of- mine material.

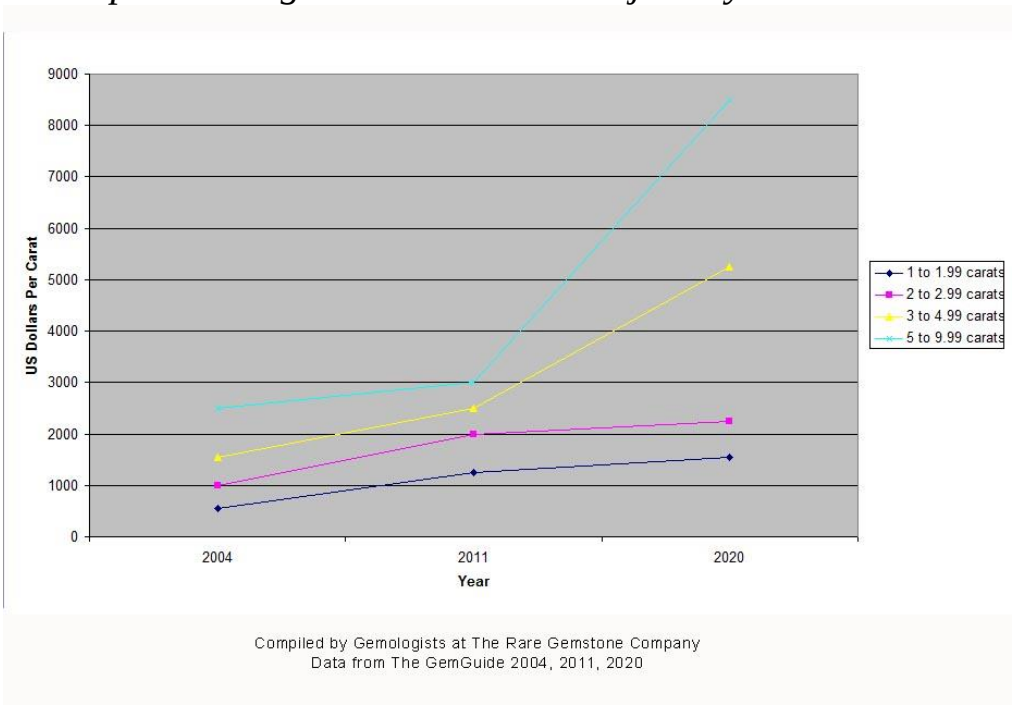
It is obvious from the figures given below that not only quality but also the size/weight issue is of critical importance.

Green grossularite with a diameter of more than 3 mm, and a weight of more than 3 carats are quite rare, and a weight of more than 3 carats are quite rare, and command special prices, which are negotiated between buyer and seller for each specimen.

15.01 TSAVORITE/GREEN GROSSSULITE PRICES

Tsavorite prices have shown a steady upward trend for the past 2 decades. The graph below illustrates the value increase in pricing for the very top grades since 2004 for different size ranges.

Graph Showing Tsavorite Price Trajectory 2004 to 2020



The graph is compiled using data from the GemGuide wholesale price index in years 2004, 2011 and 2020. It clearly illustrates the significant

upwards price trajectory of per carat prices. The raw data is listed below:

Carat Range	2004	2011	2020
1 to 1.99 carats	$550 per carat	$1,250 per carat	$1,550 per carat
2 to 2.99 carats	$1,000 per carat	$2,000 per carat	$2,250 per carat
3 to 4.99 carats	$1,550 per carat	$2,500 per carat	$5,250 per carat
5 to 9.99 carats	$2,500 per carat	$3,000 per carat	$8,500 per carat

The most significant price increases have come in the 3+ and 5+ sizes reflecting their incredible rarity.

15.02 OTHER CONSIDERATIONS

IS TSAVORITE A HARD GEMSTONE? : Yes, Tsavorite is 7 1/2 on the Mohs Scale and as such is considered a durable gemstone. It is often used in engagement rings for this reason, and Tsavorite Jewelry is featuring more and more on the world stage,

16.0 Conclusions and Recommendations

The area under application is very prospective for various gemstones as it lies within the gemstone belt. The initial prospecting pits and trenches have produced green garnets/tourmalines worth thousands of dollars.

In order for the miner to increase his production we recommended that the miner to:-

- Use machinery for both prospecting and mining: and
- Use a geologist or an experienced prospector to guide the miner in prospecting and mining.

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