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AN OVERALL VIEW ON GEMSTONE MINING IN GILGIT-BALTISTAN: PROBLEMS AND MITIGATIONS

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ABSTRACT

Gilgit-Baltistan has tremendous amount of gemstone wealth and thousands of miners are busy to explore this wealth, but due to unscientific and crude mining methods this mineral wealth goes into waste in many ways, like fractures, damages and total destructions of gemstone due to ill blasting methods and lack of proper training. Gemstone mining is done in all districts of Gilgit-Baltistan. According to a careful survey in July 2007, 32 types of Gemstones (Precious and Semiprecious) are found in GB, out of total production of gemstones produced in Pakistan 95% come from GB. According to this survey there are more than 2000 mines which produce different variety of gemstones and numbers of miners involved in this mining industry directly or indirectly are more than 25000. Due to these crude and unscientific mining methods, improper camps without hygienic facilities, lack of proper mining equipment, lack of basic health facilities and safety tools and lack of mining equipment repairing facilities at mining sites, number of problems are arising. These problems include damage to the fauna and flora in mining areas, damage to the eco system due to blasting and flow of people; mountains are becoming vulnerable due to improper mines development, glaciers melting due to use of thermal generators, spreading of human filth and waste like plastic and at last polluting of the water. This research is based on the mitigation of all these problems to some extent. The damage to the fauna and flora may be reduced by controlling spreading of human filth and waste, controlled blasting may be done by using modern blasting techniques, proper mines of international standard may be developed by in forcing the mining rules, use of thermal generators may be prohibited by developing small hydro projects at sites and at last pollution of water may be controlled by training people to adopt the cleanliness drives time to time and equipment repairing facilities at sites as well.

KEYWORDS: Gemstones, fauna and flora, international standards, mitigation

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INTRODUCTION

Gemstone mining has a history in different parts of Gilgit-Baltistan like Hunza and Nager Valleys, Heramosh, Rondo, Shiger, Khapolo, Istak, Ghizer, Astore and Diamer. However, most of the gemstones mined are damaged, fractured

and destroyed due to crude and primitive mining methods. The miners may be trained to mine the gemstones by modern methods to explore the gems without damage, fractures or totally destroying them. Due to the climatic changes in GB the miners are facing great difficulties in locating the new prospects, due to flash flooding, erosions, land sliding, rock falling, debris flow and seismic activities. As we know that Gilgit-Baltistan is prone to active seismic activities due to the presence of MKT (Main Karakorum Thrust Fault) and MMT (Main Mantle Thrust Fault). The explosives (especially wahbox) used in gemstone mining is hazardous for the fauna and flora of the area and the noise produced during blasting is also harmful for the ecosystem in these mountains. The overall environment of the area is disturbed for many reasons.

The history of mining of Hunza Ruby was started in 1966, when a local shepherd found a ruby crystal somewhere in Hunza Ruby Belt area. The WIPDC Azad Kashmir and Northern Areas Mineral Development Project team conducted some exploratory operations on one of the pre-reported ruby horizons in Khoshi (now Faizabad) area during 1968-1969 through a short prospecting drift [1]. Later on, PMDC (Pakistan Mineral Development Corporation) in 1978 carried out exploratory works in different areas of GB like Heramosh and Istak Nalah to explore the gemstone wealth with the objectives to prove the feasibility of gemstone mining in Gilgit-Baltistan. Later on, different private mining companies were granted leases in different areas like Hunza, Istak and Shiger valley to explore this wealth. But these private companies destroyed the mines by illegal mining methods instead to develop them on modern lines. With the passage of time the local people became familiar with gemstones and started mining in different parts of GB. The local buyers and international buyers came to GB and paid reasonable amount of money to them. Due to the reason gemstone mining rush was started [2]. As we have discussed earlier that thousands of miners are busy in mining these gemstones without any safety and basic tools risking their lives as well as destroying this mineral wealth. All the gemstone mining is done illegally and it is difficult for the law enforcement agencies or minerals department officials to reach the sites due to height and resistance from the locals. It is the need of the hour to legalize the mining and enforce the mining rules to save lives as well destroying the mineral wealth. The miners may be trained to adopt the mining standards, health standards, avoiding damage to fauna and flora and stop to polluting the water. This study will help to mitigate the health risks, less damage to mineral wealth, minimization of threat to fauna and flora and polluting of water coming to valleys from these mining sites. The gemstone mining is a common practice worldwide in more than 20 countries. All these gems producing countries are very careful and adopt the international standards. They are very careful about the environment and government departments concerned are very active and enforce the government laws. Hence mining is done in its proper shape without damaging the environment of the area.

Study Area

The study area includes the entire gem bearing areas of Gilgit-Baltistan like Hunza, Chumar Bakoor and Hoper (Distt. Nager), Heramosh (Distt.Gilgit), Bulachi (Distt. Astore), Istak (Distt. Skardu), Shiger (Distt.Shiger), Braldo and Basha valley, Ghizer and Diamer districts.

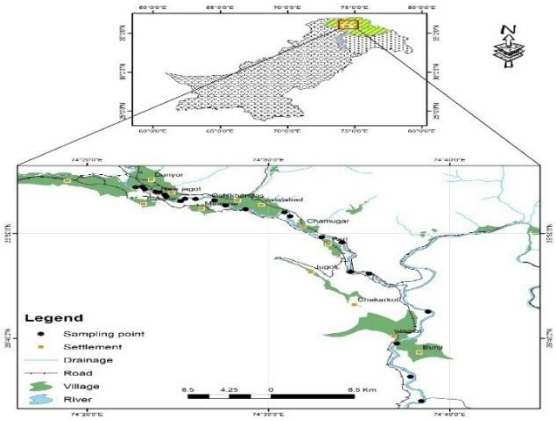


Figure 1. Map of study area with gem bearing points in Gilgit-Baltistan.

Geology of the study area

The Gilgit Baltistan province is very significant for gemstone resources because of hosting two main sutures like northern Indus and Karakoram (Shyok Suture). The high temperature created by geodynamics and tectonic collision of Indo-Pak subcontinent, so their sutures are producing gemstones and significant for further exploration. Gemstones like aquamarine from Askere, Shingus, Dusso and Tisgtung of Gilgit; emerald from Khaltaro of Gilgit; moonstone from Shingus and Bulechi (Gilgit); quartz from Gilgit and Skardu; red ruby and spinel (magnesium aluminate) from Hunza are more attractive than Burma, and pargasite cabochons (green amphibolite; locally purchased as Hunza emerald) from Hunza valley; rose quartz from Dusso pegmatites near Skardu; topaz from pegmatites from Bulechi, Shingus and Gone near Dusso in Skardu; gem tourmaline (pink, blue, green and black) from pegmatites of Haramosh Range like Stak Nala between Gilgit and Skardu, Bulechi and Shingus; beautiful pyrite, malachite and azurite in pegmatite near Gilgit[3].

Ruby bearing area in Hunza is constituted by the metasedimentary rocks of the Darkot group pierced from place to place by intrusive bodies of mainly acidic character with a common emplacement period of early to late tertiary. The largest and the most persistent intrusive body is the Karakorum Granodiorite which may be termed as Karakorum Batholith [4]. The Hunza Ruby Belt is constituted by one of the members of the Darkot group (Permo-Carboniferous) which attains an apparent thickness of 7000 to 10000 feet and is persistent to at least 15 accessible miles with mineralization [5].

The Chumar Bakoor mines are located at the height of about 15000 feet. The location of the area is Longitude 33˚ 43′66″ and Latitude 73˚ 45′ 90″.

Geologically the area is composed of Garnet Mica Schist, graphitic schist, amphibolites and aplites. The pegmatite bodies are in the form of dykes and sills. The pegmatites are ½ m to 1 ½ meter thick. The gemstones are also found here in the form of pockets. The formation of gemstones in the pegmatites of Chumar Bakor is due to the reason of activity at the margins of the Karakorum Batholith, which is in the vicinity of the Chumar Bakoor. These pegmatites are formed from waters that separate from magma in the late stages of recrystalization, this activity has occurred in small pockets along the margins of the Karakorum Batholith. These pegmatites may also be formed in fractures that develop on the margins of the Karakorum Batholith.

The Pegmatites of Bulachi area are situated between Heramosh and Istak Nalah on the Gilgit-Skardu road. This pegmatite swarm includes those along the Indus River, the area around Heramosh, the Istak

Nalah mines and the mines within the Astore district on the south side of the Indus River. These Pegmatites generally have zones extending out from their parent rock type. There

are zones of phosphates, zones that are beryllium rich and lithium rich (LCT Type) pegmatites. Most of these pegmatites produce beryl, aquamarine, black tourmaline, topaz and fluorite. At Istak Nalah the pegmatites are lithium rich (LCT Type) and produce multi colored tourmaline rather than black ones. There are also granitic pegmatites in the area which produce aquamarine, black tourmaline, topaz, apatite and garnet.

The pegmatite swarm of this area is spread out over an area of about 150 square kilometers [7]. The Shiger valley pegmatites are classified into two groups. Group one pegmatites are gem bearing and group two pegmatites are barren. Gem bearing pegmatites are further divided into two groups. One is muscovite schorl-beryl garnet pegmatites and another one is muscovite schorl pegmatites [3]. Based on field features we can assume that the pegmatites of Braldo and Basha valleys are of the same origin as discussed above. These pegmatites are coarse grained and zoned.

Dassu area contains granitic gneisses. Pegmatites are intruded and composed of quartz, feldspar, muscovite and black tourmaline. The mine in Dassu visited is at the elevation of 7913 feet. The location of the area has longitude 34° 22′ 593″ and latitude 72′ 94′ 505″.

METHOD

The gemstone mining sites in Gilgit-Baltistan are mostly at greater heights except the ruby mines of Hunza, which are near the Karakorum highway or at the top of villages like Aliabad, Dorkhan, Hassan abad etc which are easily accessible. Similarly, the Ruby-Emerald mines in Shiger valley are also accessible easily. But most of the mines are not accessible easily like Chumar Bakor, Istak, Shiger, Heramosh, Bulachi, Braldo and Basha valleys. It is a bit difficult job to reach the actual mining sites, to meet the miners, to know about the miners and their problems and to know about the mines to examine the gemstones. So 25 days field work was conducted in all the areas discussed, reached the actual sites, met with miners, examined and observed the gemstones mined from the area and confirmed about the gemstones mined. Pictures of the mines, gemstones and miners were taken. Interviews from the miners were conducted also [7].

Problems

After conducting interviews with the miners and observing the conditions of the miners we concluded the following problems faced by the miners of Gilgit-Baltistan.

Due to severe hard work and lack of training and basic facilities, the miners are suffering from different diseases, such as 20 to 30% miners have breathing as well as eye infection problems. Due to difficult terrain it is very hard to carry the machinery to the actual mining sites such as drilling machines, compressors and other mining tools. Miners are facing problems such as ventilation, lighting and drilling after 150 to 200 feet of drivage. All the mines visited are not of the standard as specified in the mining rules. Miners are working without basic safety equipment like helmet, mining shoes, gloves, googles and masks by risking their lives[7]. Miners spent less money and want to earn more from the mines, hence they are not maintaining the mines according to the standards. Most of the miners are suffering from the disease Silicosis (a kind of disease which slowly damages the lungs) due to the explosives and the dust. Repairing of the machinery at the mining sites is severely needed to save the time of the miners. Due to uncontrolled mining and use of explosives extensively the fauna and flora are becoming extinct.

Mitigation

To mitigate the problems faced by the miners of Gilgit-Baltistan following solutions are suggested which are useful to decrease the problems to some extent [8].

Man Powered Ventilation System

Ventilation problem is one of the problems faced by the miners of Gilgit-Baltistan. Due to tough terrain and cliffs, it is rather impossible to develop a ventilation system in the mines. So, a simple ventilation system may be adopted to solve this problem of ventilation, called man powered ventilation system. For this purpose, a ten-speed bicycle may be used for ease of gaining speed (rpm) and the rear wheel as a large pulley to drive the fan. This simple homemade machine may be installed in the mine to drive out the dust and explosive fumes out of the mine. It is simple and not expensive. It may be run by miners turn by turn to out the fumes from the mines [8].

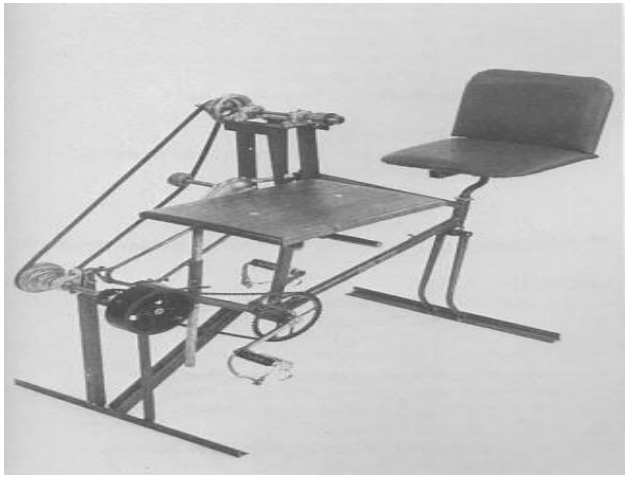


Fig 2. A homemade pedal machine

Roof Support using Timber

In most of the visited areas the roof support is not a problem. The only areas that required some support were the detached blocks. In seismically active areas or the mines near to MKT (Main Karakorum Thrust Fault) and MMT (Main Mantle Thrust Fault), shearing zones may encountered and need timbering. The timber is placed as close to the direction of rock wants to move, usually downward. In stops the timber is usually placed perpendicular to the slope. Locking all parts together is important to keep the set from moving in any direction. The kicker which is nailed to the bottom of the cap keeps the posts from moving into the drift. The scabbing is nailed to the post and holds the brace up which keeps the post and cap from moving either direction up or down the drift. The brace fits in between sets trying the structure together [8]

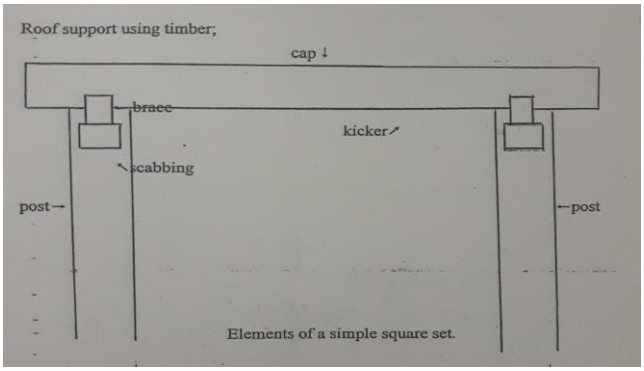


Fig.3 Wooden wedges are used to tighten up the structure by placing a wedge between a block of wood and the structure and pounding it tight with a sledge hammer. There are as many ways to lock timber together as there are different mines in GB. Each major mine should develop their own method of timbering based on their particular circumstances.

Blasting Technique

Blasting techniques play a vital role in mine development and gemstone exploration. The proper loading sequence is to place the blasting cap at the bottom of the hole so the blast propagates upwards. If a full stick of explosive is used, carefully slit the upper portion of the explosive with a knife. Safety fuse is bended alongside of the stick is placed and capped end into the hole. Explosive stick is pressed until it is expanding. It should not be pressed hard and cap should be placed well

inside the explosive and it should not touch the rock.

ANFO (Ammonium Nitrate and Fuel oil mixture) may be used and a small end of explosive may be used to detonate the ANFO. The hole diameter for ANFO should not be smaller than 3.75cm. If small diameter holes are drilled should not use ANFO. ANFO can be poured down a whole if near vertical or plastic tubing can be used and the ANFO loaded like sausages. It should be tamping tightly.

Stemming is used to confine the expanding gases to keep the explosives from blowing back out of the hole. Almost anything can be used as stemming. Pea gravel works very well when placed in a plastic tube for ease of loading. Vertical or downward holes the stemming can be poured in and tamped [8].

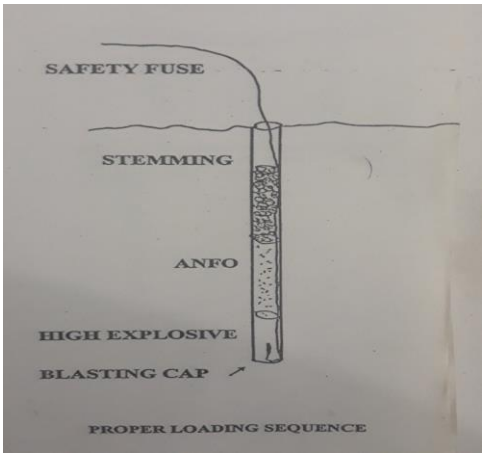


Fig.4 Blasting Technique

Sanitation

Sanitation is a big problem in the mining areas where the miners work extensively such as Chumar Bakor, Shiger, Istak and Heramosh area. Due to spreading of the human filth the fauna and flora has the devastating effect. To reduce the destruction to fauna and flora following simple sanitation methods may be at the mining sites.

The ventilated improved pit (VIP) latrine reduces substantially the two main problems associated with conventional pit latrines: smell and flies. The essential improvement is the insulation of a screened vent pipe. Sun heats the vent pipe, causing an upward movement of air and subsequent circulation from the pit and the main chamber upwards and out through the vent pipe. Odour and flies are thus kept away from the main chamber. Wind flowing across the vent Flies are attached to the top of the vent pipe since this is the area where the smells are the strongest. Fly proof gauze prevents them from entering. Some flies may enter via the main chamber is kept dark; the strongest light source is at the top of the vent pipe. Since flies are attracted to the light, these will fly up the pipe. They are prevented from escaping by the fly proof gauze and so eventually die and fall back into the pit. This control; is effective. In a 78 day comparison of a conventional and improved pit latrine, 13,953 flies were caught in the main chamber of the conventional design compared to 147 flies in the improved version.

In the VIP latrine it is very important that a lid is not placed over the squat hole, otherwise air circulation is impeded. Above figures illustrate the essential construction details for both a ferrocement version and a brick made structure [8].

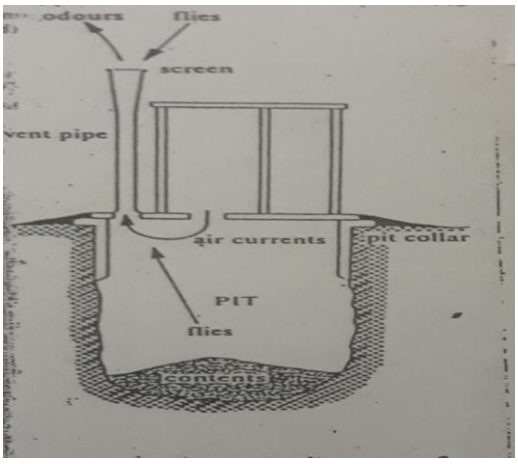
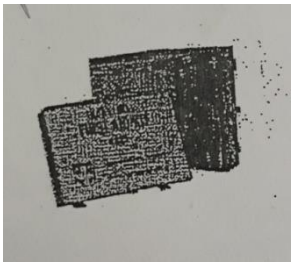


Fig 5. Exploded schematic diagram of ferrocement Spiral VIP latrine.

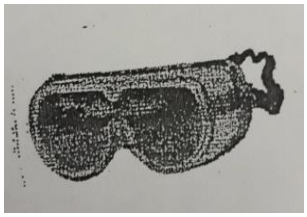
Personal Protection Equipment (PPE). First Aid Kit. White Cross industrial first aid kit. Serves up to 25 people. Assorted supplies for miners. All steel case. Can be wall mounted.



Polythene Caps. High density polythene caps with rain trough. Easily replaceable. Adjustable to sizes. Slip-Lok attachment accepts face shields and welding helmets quickly and easily. Can be front or side embossed.

Assorted quilted hard-hat liner. Outer shell flame retardant. Liner at soft flannel. Adjustable chin strap. One size fit all.

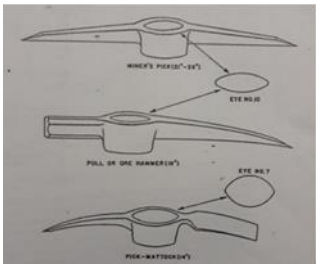
Goggles. Flexible frame with perforated sides for comfort. Protects from flying particles and dust. Fits over personal glasses.



Safety hearing protectors. Noise reduction rating. Light weight and adjustable. Hear the difference.

Ear Plugs. Convenient hearing protection. Noise reduction. Soft foam type plugs expand to comfortably seal off unnecessary noise.

Tools. Several types of shovels are useful for the collector and prospector. The center shovel is useful and smaller than either of the shovels. It may be operated by unscrewing the collar just above the blade; this permits the shovel blade to be folded to a right-angle position or folded back on the handle to reduce the total size for showing in a knapsack. Several useful tools are designed also for picking, hammering and digging.



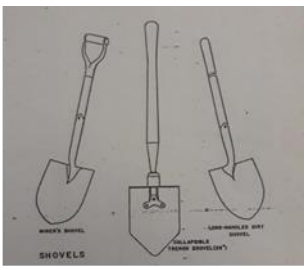
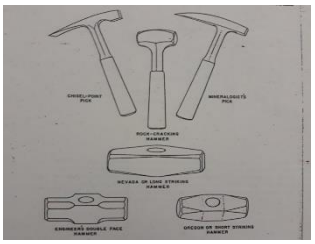


Fig. 8 Different Tools used in Mining Gemstones.

Pick, Striking Hammer, Sledge Hammer and Splitting Tools. The best all round hammer is the mineralogist pick. Similarly, small rock cracking hammer is also extremely useful in situations where considerable rock must be broken to free specimens or a hammer or medium weight is required to drive chisels and gads. The Nevada sledge hammer is better for cracking rocks than either of the other sledges illustrated but the broader faces of the engineer and Oregon hammers make them less likely to miss in striking drills or gads.



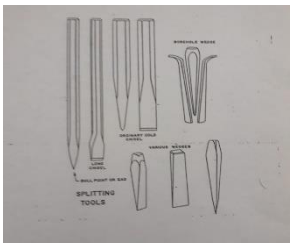


Fig 9. Various tools used in mining of Gemstones.

A variety of useful tools for splitting rock. The borehole wedge is meant to be used in drilled holes to split rock. The side pieces or feathers are inserted in the holes, followed by the tapered pin or plug. Repeated blows on the pin

cause exertion of enormous pressure on the rock. Although this is a professional piece of equipment, similar sets can be made up from wedges and plates of sheet steel [8].

CONCLUSION

After the entire visit of gemstone mining sites of Gilgit-Baltistan, we have conclude that GB has tremendous gemstone potential. Due to difficult terrain and short working season the miners are in great pressure and some have psychological problems as well. All these problems may be solved to some extent by adopting all these mitigation methods by the miners. All this equipment may be provided to the miners by Government or by NGOs [9]. Trainings at actual sites should be given to minimize the damaging factor of gemstones. Their ventilations problems may be solved, when this is solved the miners will have fresh air in mines and they will be saved from disease like silicosis and eyes itching etc. The damage to fauna and flora may be stopped by adopting the sanitation method as described. The tools may be used in mines to extract the gemstones properly without damages.

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