Quarrying in Hong Kong Since Second World War

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1. Introduction

Hong Kong is a small place with a land area of about 1,100 square kilometers and a total combined sea and land surface area of about 2,700 square kilometers. The topography is rugged and hilly with slopes rising steeply from the sea with little coastal plain. Much of the current urbanized flat coastal fringe is the result of various stages of manmade reclamation in the past years. The quarrying industry is one of the oldest industries in Hong Kong, dated back to the early period of Qing Dynasty. In the past 170 years the quarrying industry has made valuable contributions to the development of Hong Kong by providing the materials for construction of a metropolis with its vast infrastructure. At present, although there are less than a hundred workers in two active quarries, its contribution to the development of Hong Kong still continues.

The geology of Hong Kong is predominantly volcanic and intrusive igneous rocks (Figure 1). The igneous rocks, mainly fine to medium grained granites, are an excellent stone for building. Granite has been used as the basic raw material for the territory construction and building industries since the 1840s; originally as dressed stone for building blocks and latterly as aggregates in concrete. Construction of warehouses and residential houses for overseas traders, barracks and fortresses for the armies, buildings for the government, reservoirs and embankments for reclamations all required building stones. Prominent among the pre-Second World War buildings are the Supreme Court Building and the ex-Hong Kong and Shanghai Bank Building. Also, the old Bank of China Building and the old Central Government Offices best represent post-Second World War buildings.

Quarrying in Hong Kong is a traditional industry that is well established. Inevitably, the granite reserves closest to the areas of development and sea transport were worked first. In obtaining the rock and aggregates it has often created the space necessary for the expansion of housing for the community and other industries. The sites of the earliest quarries have long

since been obliterated by the encroachment of development, although traces of their workings may be found in the urban area.

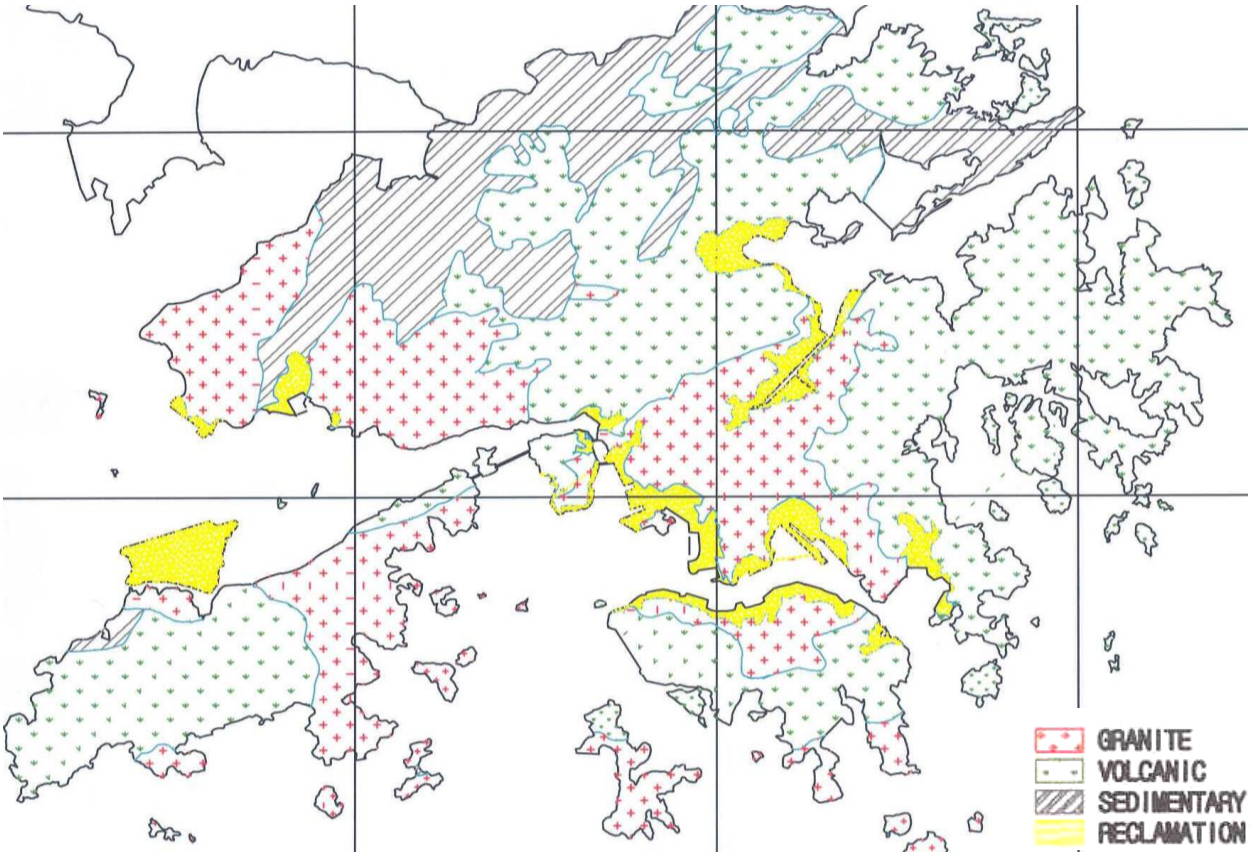


Figure 1 –Geological Map of Hong Kong

2. Three Main Eras of Modern Quarrying Industry in Hong Kong After Second World War

The development of the modern quarrying industry in Hong Kong accelerated after Second World War. With the introduction of modern technology (e.g. blasting, mechanization and automation) and three main eras can be classified as the permit / contract quarries before 1974, contract quarries between 1974 and 1988, and rehabilitation contract quarries after 1988 [1].

(I) Permit/Contract Quarries (before 1974)

Poon and Ma (2012) [2] detailed the Government's administration of Hong Kong quarries between 1840 and 1940. In the mid nineteenth century, most buildings were constructed with stone or red bricks joined by lime mortar, the demand for aggregates was very small. The production of aggregates in almost all small-scale quarries at that time depended on manual labour with slow and primitive methods. With the introduction of concrete in the late nineteenth century, the demand of aggregates for buildings and roads started to grow. In general, modern quarries can produce large sized materials such as armour rock for breakwaters and seawalls construction although most of the materials produced from these quarries are in the form of 'aggregates' (i.e. crushed rock with less than 50mm diameter).

Within six years after the end of Second World War in 1945, the number of new buildings constructed in Hong Kong was about 20,000 blocks and the aggregates required were of the order of several hundred thousand tons. Apart from two government quarries at North Point and Yuen Long, the rest were private quarries which produced quantities in the order of several hundred tons daily.

Up to early 1960s, the quarrying industry in Hong Kong was largely in the hands of small quarry operators who extracted stone at sites under the authority of a permit issued by the Government, similar to the practice adopted in the early twentieth century until Second World War. To open a quarry, an operator had to select a likely area of outcropping rock, applied for a permit and, provided his request did not conflict with other interests in the immediate area, his permit to extract stone was generally authorized. Although quarrying permits were

normally valid for periods of only six or twelve months, in practice permits were continually renewed and the operators could remain on site indefinitely. The number of quarries operating at any one time was dependent upon the demand for rock blocks and aggregates from the construction industry. For obvious economic reasons, permit quarries tended to proliferate in places close to the areas of urbanization and building development or where sea transports were convenient, and in particular where the granite outcrops could be easily worked.

Most of these permit quarries were small and operations were labour intensive, producing only a few hundred tons of aggregate daily. Cutting started at the bottom level with the quarry face advanced upwards. Circular holes were drilled by hand held jackhammers, and explosives were placed manually by men suspending from ropes on the quarry face so as to split the rock into different sizes. Blasted rock blocks were subsequently broken down manually until they were small enough to be fed into the small crushers. In 1960s, the Government quarry at Mount Butler, producing up to 600 tons per day for public use, employed about 200 men solely as stone breakers.

Permit quarry fees, in the form of a royalty based on the amount of rock excavated, were assessed by the Government similar to that in the pre-war practice. However, most of the operator's own production records were found to be unreliable and government staff were unable to assess the potential output of processed stone from individual quarries, an empirical formula based on the length of the quarry face was devised to compute that part of the quarry permit fee associated with the production of stone. Under such circumstances and in order to reduce the royalty payment as much as possible, most operators tended to exploit quarries with narrow but high working faces and with minimal overburden cover. The creation of undesirable high near-vertical rock faces as high as 100 metres was not uncommon. The general disfigurement of Hong Kong countryside by these bare quarry scars became one of the legacies of the permit quarry system.

Lye Yue Mun Quarries [3]

In the 1940s to mid-1950s, the government had issued new permits to four quarry companies at Lei Yue Mun, namely Dai Hing Quarry Company (大興石廠), Lei Hing Quarry Company (利興石廠), Tung Fong Quarry Company (東方石廠) and Wong Yin Quarry Company (旺賢石廠). These were the 'second generation' quarries and located at the back of Tin Hau Temple and extended towards east. The 'first generation' quarries at Lei Yue Mun were established in early-19th century and included four companies; Tong Ren Tang (同仁堂), Tong Tai Tang (同泰堂), Tong Fu Tang (同福堂) and Tong Li Tang (同利堂). These companies were located along the Hoi Pong Road (海傍道), or previously Ha Wan (下環) area and extended towards Yau Tong (油塘) or previously Sam Ka Tsuen (三家村). Quarrying works at the 'first generation' sites were carried out mainly by hand whilst the works by the 'second generation' companies were done by machines and explosives until the temporary prohibition of using explosives in 1967. In view of the decreasing demand and strict imposition of blasting requirements after 1967, the 'second generation' quarries were subsequently closed gradually. The remaining rock face of Wong Yin Quarry Company at the far end of the Ma Pui Village and ancillary structures were generally left untouched after 1967-68. Some concrete structures such as pier and storage bins can still be identified easily now. An interview with Mr Stephen Law, son of the operator of Wong Yin Quarry Company, was conducted in 2012. A record of interview is included in Appendix I.1. Another interview with Mr Ip Pak Keung, grandson of the operator of a Quarry Company situated at Lei Yue Mun Survey District No. 3 Lot No. 753 in around 1905, was conducted in 2013 and the record of the interview is included in Appendix I.2.

1966 Government Quarry Study

A major building boom during 1963-64 strained the production of the quarrying industry to its limit. The permit quarries so operated could not meet the sudden increase in demand for aggregates. The severe shortage of aggregates and the associated increase in aggregates selling prices generated considerable speculative interest in short-term investment in the quarrying industry. It was evident that the industry was in need of major reform and the irrational method of assessing permit fees which resulted in reduced revenue was in need of revision. Things did not happen as expected as the sudden decline in the demand for

aggregates following the 1963-64 building boom resulted in ceased operation of a large number of permit quarries. In 1966, there were 70 permit quarries though only 37 were operating. As a result, two Government Quarries at that time supplemented the privately run quarries to ensure adequate aggregates supply even at times of high demand. There were also contract quarries operating at that time (i.e. an operator had a contract with the Government for quarrying for which he paid the royalties) but the number was small in comparison to that of permit quarries. The contracts for these quarries were based on a fixed quantity of rock to be extracted from a proposed landform. A completion date was specified in the contract but in most cases, extension of time were allowed until the specified contract volume was extracted if there were good reasons such as poor market and economic conditions.

The building industry recession after the 1963-64 boom triggered re-examination and revision of the Government quarry policy. In association with the influx of immigrants from China to Hong Kong during early 1960s, the Government made plans for the expansion of new public works in the New Territories, in particular the new town development programme which would require a large demand of aggregates and rock products for the infrastructures. The Government conducted a quarry study in 1966 [4] and the recommendations were as follows :–

(a) to convert permit quarries into contract quarries,
(b) to close the small and non-operating permit quarries, and
(c) to recommend sites for future quarries to ensure continuous supply of aggregates.

The Government then embarked upon a programme of awarding revenue earning quarry contracts through open tender in 1968. Each contract quarry contained a guaranteed minimum tenure of ten years with proven rock reserves. It also became Government Policy that the main sources for production of aggregates within the Territory should be provided by contract quarries, thus giving the incentive to quarry operators to invest heavily in the mechanization of the industry. With this new policy, the number of permit quarries dropped significantly while the number of contract quarries had increased. In 1974 the last permit quarry closed and the Government's strategy of conversion of permit to contract quarrying was completed. The rationalization of the permit quarry system resulted in the phased closure of the vast majority

of the smaller quarries and the development of a limited number of the most promising sites into large scale quarrying operations.

(II) Contract Quarries (Between 1974 and 1988)

Since the mid 1970s, Hong Kong has been provided with aggregates from the following four sources :–

(a) contract quarries and rock crushing sites,
(b) site crushers installed on public works construction sites,
(c) Government direct labour quarries, and
(d) imports from Mainland China in the form of aggregates and natural sands.

There were six contract quarries and two Government owned quarries in 1974. The demand for aggregates and rock products continued to increase in mid-1970s. In order to plan Hong Kong's quarry industry for the next ten to fifteen years, an investigation was carried out in 1974 by the Government. The Government consultant's recommendations below were accepted and subsequent follow up action were taken by the Government [5]:-

(a) to expand the contract quarry system in order to meet future requirements,
(b) to impose strict controls on the production of aggregates at site developments,
(c) to investigate and develop new large quarries including underground mines and a super quarry, and
(d) to award contracts for the manufacture of fine aggregates to supplement marine sand supply.

The demand for aggregates increased as the population continued to grow, and there was a need for proper planning of quarries so as to mitigate the impacts of quarrying on planning and the environment. In 1979, the Government's Land Development Policy Committee (LDPC) approved a future planning strategy for supply of aggregates, and identified and set aside new quarry sites to safeguard future supplies. In addition, the Hong Kong Planning Standards and Guidelines for future fill and aggregates resources was published [6].

(III) Quarry Rehabilitation Contract (After 1988)

About fourteen years after the 1974 quarry study, it was considered timely for carrying out a review of the Government's quarry policy and preparing predictions on future supply of aggregates. The study was completed in 1988 by Civil Engineering Services Department [7] and proposed several options available to the Government for meeting the likely future demand from the construction industry for aggregates and sand, as well as the growing public concern about the effects of quarrying on the environment. Finally, the Government supported the option to convert the existing quarry contracts to site formation contracts with the right to quarry rock. The new contracts would include rehabilitation requirements necessitating additional rock excavation. Rock excavation in the quarry would be carried out to conform with a pre-approved final landform and completion of rehabilitation works within a given period. In 1989, the LDPC endorsed the new Metroplan Landscape Strategy that recommended early rehabilitation using 'revenue earning' quarrying operation to produce the required final landform.

In 2001, there were four quarries in operation, namely Shek O, Lamma, Anderson Road and Lam Tei. The first three quarries were operated on quarry rehabilitation contract. Rehabilitation work for Lamma quarry was successfully completed in 2002. Between 2003 and 2011, the three quarry rehabilitation contracts in operation were capable of producing about 50% of the annual demand of aggregates and rock products in Hong Kong.

The aim of the quarry rehabilitation contracts is simply to revert the site back to a natural-looking state or to turn a once bare-looking eyesore into an area covered with trees and vegetation which is in harmony with the natural environment and suitable for future development. The quarrying industry in Hong Kong is facing constantly stiffer opposition and criticism on the grounds of adverse environmental impact and intrusion into nearby social facilities. In many worldwide urban situations this makes quarrying unpopular to the point of prohibition but in Hong Kong, where land is so valuable and a constant supply of reasonably priced high quality aggregates is essential, a compromise has been achieved. To redress lasting environmental damage, imaginative and stimulating schemes worked between the

Government and the quarry operators were developed to transform degraded landscapes into fully rehabilitated and re-vegetated landforms. The new landforms for quarries are designed so that usable land can be created upon completion of rehabilitation of the visible scar of the quarry after 10 to 15 years. Substantial reserves of rock will be extracted as part of the quarrying process in order to achieve the rehabilitation.

Tsing Yi Island Quarry, Cha Kwo Ling Quarry, Anderson Quarry and Lam Tei Quarry

Mr Tang Kau, ex Quarry Manager of the above quarries started his career in quarrying work at Tsing Yi Island Quarry in 1964 and continued to work until retirement on his 74th birthday in 2002. He had witnessed the various stages of modernization of quarrying in Hong Kong. A record of interview is provided in Appendix I.3.

3. Culture and Heritage of the quarrying industry

3.1 Life of Workers in Quarries between 1950s and 1970 [a]

Workers Quarters

As most quarries were located in relatively remote areas, workers normally had to live on site. Temporary quarters made of masonry and wood, one storey of about 15 feet high, were built on site by the operator. The beds were wooden planks supported by wooden framed stools of about two-foot high which had a double function of being seats as well. The number of people sleeping on these beds depended on the total width of the wooden planks. No pillows, blankets and mosquito nets were provided by the operator.

Dining and Food

As strong physique is the prerequisite of quarry workers, a resident cook was on site serving breakfast, lunch and dinner. There were rules for dining in quarries. Each table should not be seated with more than six persons, as in the Chinese custom "seven" (做七) is often avoided because it is specially used for funeral dining arrangement and regarded as unlucky. This rule applied to the number of dishes in a meal as well. Dining table was actually placed on the floor and everyone had to squat while taking the food. When taking food, no one was allowed to take the dishes on the other side of the table. For the first bowl of rice, no one was allowed to take meat; for the second bowl of rice, no one was allowed to take the dressing. Anyone who breached the rule could lead to fighting by all workers.

On the second (初二) and sixteenth (十六) day of each month in lunar calendar, delicious foods and additional dishes were made for quarry workers after worshiping the Gods. This is called "Jo Nga" (造禡).

Greetings

[a] Appendix I. 1, 2, 3 and 4

When quarry workers met, they only called each other “Foh Kei” (伙記) meaning “colleague”. No one was allowed to call each other teacher (師傅) as this meant calling “Lo Ban” (魯班). Quarrying is a dangerous trade as it involves working at height, manual lifting of heavy rock blocks, handling of explosives etc., calling teacher besides not respecting the ancient trade master and would also have the underlying meaning that you were dead.

Afternoon Nap

Between the hot summer months from Dragon Boat Festival (端午節) and Mid-Autumn Festival (中秋節), quarry workers were allowed to take a nap or rest from 3:00 pm to 4:00 pm as the weather would be too hot.

Worship

When quarry workers started work on a new quarry site, they would worship their Gods as shown in the photos attached in this report.

On the second (初二) and sixteenth (十六) day of each month in the Chinese calendar, they would worship their Gods using chicken, pig, fish, wine, tea, fruits and other food. On the 13th of June in the Chinese calendar, quarry workers would have a holiday and they would gather and worship ancient trade master “Lo Ban” (魯班) by arranging an annual dinner paid by the operator.

Leisure Activities

After work, the most common leisure activity enjoyed by quarry workers was gambling within the quarters. There were many types of gambling game largely originated from the Hakka Ng Wah (客家伍華) such as 打六糊 and 牛牌；others included 十五糊、牌九、釣魚、斜釘、擲骰 etc. As the host responsible for setting up the gamble tables and providing the kits for the games normally took 10% charges from the total bets, everybody would become a loser at the end of the day.

3.2 Pre-requisite and work of Stone Breakers in 1950s to 1960s [8]

Asset of stone breakers (揀石工) generally contained two parts [9]. Firstly, they should have a well fit physique and strength capable of moving a large rock block and capable of handling a 12-lb hammer effectively and efficiently; secondly, they need to possess a basic tool-kit costing around HK$50 [b] which consisted of a 12-lb steel hammer, 1½ -lb hand hammer, bamboo baskets, bamboo rods, triangular files and canvas.

These stone breakers were not employed by the quarry operators or construction companies, instead they sold the aggregates to the construction companies at $0.5 per 'dau'. The weight of one 'dau' aggregates was about 140 catties. When the construction company required large volume of concrete for construction, the company would obtain from the quarries several trucks of large rock blocks. The stone breakers would then break up the large rock blocks into aggregates and sell to the construction company. They normally worked 8 hours a day although some worked even 12 hours a day. There were stone breakers who worked 8 hours, rested for 2 hours and worked for another 8 hours during periods of high demand. These stone breakers normally worked as a team of two, normally family members like husband and wife or father and son. The elder member would break up the large rock block using the large 12-lb hammer with flexible rattan handle into smaller rock pieces. The smaller rock pieces would be passed to the female or child for breaking up into aggregates of required sizes (normally 1" and ¾") using small hammers. For those newcomers with insufficient skills, they normally let the 12-lb hammer hit their toes.

3.3 Quarry Workers Unions [c]

According to the interviews with the quarry workers and operators, workers unions after Second World War differed very much from that of the 19th century and pre-war times. Only two unions were registered in 1948 and 1949, namely, the Hong Kong and Kowloon Building and Stone Masons Workers Union (Shing Yee) (港九勝義建築結石工會) and the Hong Kong and Kowloon Masons General Union (港九石行總工會), with members of 36 and 33 respectively in 2005. In 1958, the Hong Kong and Kowloon Masonry and Building Workers

[b] 2 workers working 8 hours a day produced 10 'dau' aggregates cost $5

[c] Appendix I.1, 2 and 3

Union (港九打石建造業職工會) was registered and in 2005 they had 157 members. In the mid 1960s, Mr. Law Wong of Wong Yin Quarry Company at Lye Yue Mun was one of the Advisors of the Hong Kong and Kowloon Masons General Union. Based on the information obtained from interviews of quarries practitioners, some quarry workers did not join these unions as they thought that the union could not provide assistance to solve their problems. They would prefer to seek assistance from Urban Council Members such as Madam Elsie Hume Elliot Tu (葉錫恩) when in troubles. The closed-shop linkage in the 19th and early 20th century appeared to have broken down in the post Second World War between quarry workers and mason unions.

3.4 Contract Quarries Association (CQA) [d]

The Association was founded in April 1972 and consisted of companies which operated the Government's contract quarries in Hong Kong. The objectives of the Association are :

1. To promote and protect the lawful business of the holders of government contract quarries in Hong Kong;
2. To secure for members all the advantages of unity of action change;
3. To collage, distribute and supply to members useful statistics, data, information and advice.

The members held regular meetings with the Employer's Representative of the contract, i.e. currently Chief Geotechnical Engineer / Mines Section of Civil Engineering and Development Department.

In 2000, the Association had four members:

1. Asia Stone Co Ltd which operated Lam Tei Quarry in Tuen Mun.
2. K. Wah Quarry Co Ltd which operated the Anderson Road Quarry jointly with Pioneer Quarries (HK) Ltd in Sau Mau Ping.
3. Lamma Rock Products Ltd (member of Shui On Construction and Materials Ltd) which operated the quarry on Lamma Island.

[d] Appendix I.5

4. Pioneer Quarries (HK) Ltd (member of Hanson Group) which operated the Shek O quarry on H K Island.

In 2013, although the two existing quarries at Lam Tei and Anderson Road were operated under quarry rehabilitation contract system instead of contract quarry system, the name of the Association remained the same. The three current members are Asia Stone Co Ltd, K Wah Quarry Co Ltd and Pioneer Quarries (HK) Ltd.

3.5 Institute of Quarrying – Hong Kong Branch [e]

The Institute of Quarrying is an international professional body for quarrying, construction materials and the related extractive and processing industries. The Institute was founded in the United Kingdom in 1917. The Institute's Hong Kong Branch which was founded in 1973 is one of the five overseas affiliated members and has about 100 members in 2013. Each year, the Hong Kong Branch arranges lunch talks and site visits to promote progressive improvements in all aspects of operational performance for members. It also arranges international quarrying conference at about every six years.

[e] Appendix I.5

4. Legislation related to quarrying industry

4.1 Legislation related to quarrying [10]

Before 1970, quarrying was not controlled under the mining regulations. Since 1954 specific safety regulations has been in force in respect of mining operations and until 1964 controlling over the use of explosives in quarries was followed by virtue of the Dangerous Goods (General) Regulations. The control of safety, health & welfare for quarry workers as well as quarry machinery was mainly controlled under the Factories and Workshops Ordinance adopted since the pre-war era and its subsequent amended law – the Factories and Industrial Undertakings Ordinance since 1955. Safety awareness among quarry operators and workers was low before the 1970s and the accident rate in quarries was high. Between 1965 and 1967, there were 16 deaths and 257 accidents in the quarrying industry. In 1968, the Government became concerned that the serious hazards to workers in the quarries needed to be dealt with. Statutory safety requirements were considered necessary and the Quarries (Safety) Regulations were made under the Factories and Industrial Undertaking Ordinance (Hong Kong Laws Chapter 59) to govern those specific aspects of quarry operations in order to ensure the safety of persons working in quarries. The regulations required a quarry proprietor (i.e. operator) to employ suitably trained personnel as quarry supervisors to carry out regular inspection of the working face, overburden, mechanical plant and safety equipment.

4.2 Legislation related to explosives

Statutory control of explosives in Hong Kong can be dated back to the 19th century. Dangerous Goods Ordinance became effective in 1873 and explosives belong to Category 1 Dangerous Goods. In 1875, the United Kingdom passed the Explosives Act, and Hong Kong appeared to have adopted this legislation in the same year. In 1901, Gun Powder and Fire Works Ordinance regulated the manufacture, sale and transportation of such materials. The above two legislations were replaced by the new Dangerous Goods Ordinance enacted in 1940. The Dangerous Goods Ordinance (Hong Kong Laws Chapter 295) was amended continuously as appropriate and the major amendments were completed in 1966. Currently, the Dangerous Goods Ordinance contains several subsidiary Regulations, namely Dangerous Goods

(Application and Exemption) Regulations, Dangerous Goods (General) Regulations, Dangerous Goods (Government Explosives Depot) Regulations. Since 1998 the current Ordinance, which contains both Chinese and English version, has become effective.

Administration of Explosives

After the Second World War, the authorities responsible for the control of use of explosives largely come under the Police Department and Fire Services Department. A summary of the responsible authority of control of use of explosives specified in the Dangerous Goods Ordinance is shown below:

Period	Responsible Authority of control of use of explosives
• 1949-1959	Commissioner of Police & Director of Fire Services
• 1959	Commissioner of Police
• 1962	Director of Fire Services
• 1963	Commissioner of Mines (taken up by Commissioner for Labour)
• 1991	Commissioner of Mines (taken up by Director of Civil Engineering Services)

The control of use of commercial explosives is currently vested in the Commissioner of Mines (taken up by the Director of Civil Engineering and Development). The daily administrative works are handled by the Mines Division of the Department. Police Department, Fire Services Department and Marine Department etc. will provide assistance as appropriate. One of the major differences in the mode of control of explosives compared with other countries is that Hong Kong Government is directly involved in the storage and transport of explosives, whereas other countries will normally allow the explosives users to store and transport explosives.

4.3 Safety in Quarries & Quarry (Safety) Regulations

In 1969, regulations concerning safety in quarries were introduced as Quarries (Safety) Regulations (Hong Kong Laws Chapter 59) to govern those aspects of quarry operations that were outside the control of the other regulations. The regulations came into effect with an aim of ensuring the safety of persons in the quarries by requiring operators to employ suitably trained personnel as supervisors to adopt safe quarrying practices. These regulations had proved generally satisfactory, and by their enforcement, safety standards in quarries had been raised considerably. However, between the enactment of the original regulations in 1969 and 1973, 10 of the 14 fatal accidents recorded in quarries were resulted from falls; and in 7 cases the workers were not secured by safety ropes. In another case the safety rope broke. Such accidents were unacceptable and thus amendments to the regulations were introduced to afford greater safety to persons working at height on the face or on the top of quarries. The amended Regulations in 1973 required a proprietor to provide his quarry workers with a safety harness which must be worn, and a safety rope of which one end must be securely attached to the safety harness and the other to an anchorage. The Regulations also imposed a duty on a quarry supervisor to inspect anchorages, safety harness, ropes and helmets and mechanical equipment, and if they are not in order, to prohibit their use until they have been put into a safe and efficient order or condition. The introduction into Hong Kong of the face and bench method of quarrying systematically in levels from the top down was also included in the Regulations. With the enactment of the Regulations, the adoption of improved quarrying methods and standards, and the co-operation of the quarrying industry, the number of injuries in quarries has been reduced greatly from the record high of 190 in 1962 to 2 in 2003.

4.4 Dust Control in Quarries

After the Second World War, the economy of Hong Kong gradually recovered, construction material demand for brick, steel bars and cement, etc. was in need as the population increased rapidly. In 1951, the population exceeded two million that was more than double as it was before the War.

The Mines Department headed by the Superintendent of Mines was established in 1951. Initially, the Department was housed under the Labour Department and was responsible for

handling illegal mining, issuing mining and prospecting licences as well as overseeing the health, the safety and the working conditions in the mining industry. The tungsten mine, the iron mine, the lead and the silver mine were engaged with thousands of work force. At that time, there was one large registered quarry with 91 workers and six stone crushing plants on the registration list. The legal requirement for registration of companies or workshops was when they employed more than 20 workers, and thus it is believed that there were many small quarries legally or illegally. However, some smaller ones even not registered could be entered into a record among the list of dangerous workplaces because of frequent accidents.

The numbers of quarries and quarry workers were increasing towards the end of the 1950s. By 1958, there were 51 quarries with 2,051 workers. Needless to say, most of these quarries were small in size but they might have employed causal workers because the processing of the stone fine materials was mainly done by manual male and female workers (stone breakers 掾石工). From early 1950s onward, more and more quarries were gradually modernized by installing the powerful crushing and grinding machines. Though fewer workers were employed as a result of modernization, the dust exposure level of quarry workers had increased due to a lack of proper protective measures.

Lawrie's report and Lai Sau Shue's report

Occupational diseases arising from quarrying and construction work have been widely studied and silicosis was found to be one of the main concern. It was known to be incurable disease because the symptoms of fibrosis are progressive in nature and unfortunately the injury cannot be recovered. The early official reporting by the registered company or workshop on the disease to the Labour Department started from 1956, and at the beginning, it was on voluntarily basis. In those days, the reported silicosis cases were mainly from the quarrying industry. The Industrial Health Unit of Labour Department was responsible for handling the dust hazard in workplaces and monitoring of workplaces for dustiness was initiated by them. In the 1964 Lawrie's report [11], the Government's consultant from the United Kingdom identified granite quarrying, iron mining, quartz mining and milling, refractory material manufacturing and foundries were among the dusty trades. Construction activities involving rock breaking, drilling, stone dressing, sand blasting were dusty operations. The main risk

came from the dust arising from work on granite and quartz, which are rich in local rock material. It therefore recommended urgent attention under the requirements of the Clean Air Ordinance No.19 of 1959 (to be operated by the Labour Department during that time). During Lowrie's visit to Hong Kong from October 1963 till early December 1963, he worked with government officers and staff from the University of Hong Kong. Mr. Lawrie pointed out that the situation of workers' health was critical because many of the disease cases had an incubation period of one to three years instead of the normally expected one to fifteen years. To prevent deterioration of workers' health, immediate remedial action should be taken and he recommended important measures for dust exposure assessment, the control of dust in quarries including stone crushing and grinding plants. As the wet control methods were not practical for remote sites and during the dry period of an arid year, the application of proper ventilation control as well as the personal respiratory protection for workers was introduced. The Government's Mount Butler Quarry was identified as one of the high risk quarries and the management was recommended to adopt the measures, including the installation of the local exhaust system, as a good example to the private quarries.

The report from Dr. Lai Sau Shue of Labour Department [12] was a special follow up study on the development of dust control in quarrying industries during the 1960s to early 1970s. The number of reported silicosis was on the rise in the period and the majority of the reports were mainly from quarry workers. As regards to the implementation programme for measures recommended in Lawrie's report, it took several years. For example, in Mount Butler Quarry, the installation of the dust control facilities was only completed by the end of 1960s. However, the improved measure for dust control was effective and the result was quite significant. According to a comparison study in Lai's report, the dust levels between 1968 and 1970 recorded at the primary crusher and secondary crusher at Mount Butler Quarry were significantly reduced by 3 folds and 10 folds respectively. Moreover, construction workers in the later years picked up the trend and more reported cases were coming from construction workers because new duty processes appeared when new machinery or work methods were introduced (e.g. application of hand dug caisson technique from 1970s onward). Hand dug caisson became the major concern later and their use was restricted by the construction

industry in 1995. According to the statistics of 1982, the peak of the confirmed new silicosis cases was 510 cases after the new compensation ordinance was enacted.

The compensation cases for quarry workers have been decreased for the last two decades because of the change of technology and the closing down of some quarries leading to a reduction in the number of quarry workers. At present, the total number of quarry workers in the existing two quarries is less than 100 but the disease among construction workers will remain the key issue. Moreover, the working conditions have been improved. The statistics for the year 2012 and 2013 had only 44 and 51 new cases respectively though most of them were related to construction workers because of the larger construction workforce and dusty work environment.

4.5 Pneumoconiosis and other issues

At the first international conference on pneumoconiosis (a restrictive lung disease caused by inhalation of dust) organized by the International Labour Organisation (ILO) held at Johannesburg of South Africa in 1930 [13], it had been pointed out that silicosis was common among the quarry workers. Hong Kong adopted the concept in diagnosis of the diseases with X-ray (ILO's classification of radiographs of pneumoconiosis) by 1950s. Although the Workmen's Compensation Ordinance came into effective as early as in 1953 and the occupational diseases (compulsory) notification in Compensation Ordinance in 1964, there was a difficulty in the inclusion of pneumoconiosis among the occupational diseases for compensation purpose. After several reviews in almost two decades, the compensation issue was resolved by the establishment of a central compensation fund board with funding from the levy contributed by the dusty trades including the quarries and construction companies. The current Pneumoconiosis and Mesothelioma (Compensation) Ordinance (Hong Kong Laws Chapter 360) was at first promulgated in 1980. The Pneumoconiosis Compensation Fund Board (PCFB) was empowered to take care of the affair of compensation to those workers with incapacity in lungs or even death due to the occupational disease caused by inhalation of dust including asbestos and silica dust. In the subsequent years, the functions of PCFB were expanded to provide rehabilitation care to the patients for enhancing their physical condition,

and developing and implementing preventive measures for striving to minimize the occurrence of these diseases among the workforce in the construction and quarry industries.

On 28 October 1987, the Legco passed a new law to increase the protection of workers against pneumoconiosis, the lung disease caused by the inhalation of dust, such as silica and asbestos [14]. The Pneumoconiosis (Compensation) (Amendment) Bill sought to allow the PCFB to use the funds to boost preventive measures. In 2012, about $14.7 million was paid to new and old cases of pneumoconiosis within the year alone [15]. The board's authority has hence extended from compensating those workers who have contracted the disease to cover medical examination and training for workers, research studies, and promotion and publicity in prevention and control of dust aspects.

An interview with members of the Pneumoconiosis Mutual Aid Association was conducted and the report is attached in Appendix I.1.

5. Recommendations on possible exhibits for quarry museum in Hong Kong

As the quarrying industry is significantly diminishing and may be approaching its end in Hong Kong, there is an immediate need to keep and maintain all available records in a tidy and orderly manner. We would suggest setting up a Hong Kong Quarry Museum and gathering all available records together for future reference. A preliminary list of the types of collection is suggested below:-

- Documents, newspapers, photos, files, reports etc. from Hong Kong Government Departments, the Public Records Office, and various Hong Kong LCSD Museums.
- Documents, photos and equipment / tools collected by private bodies or individuals (e.g. descendants of ex quarry workers; old and current quarry companies, contractors etc.).
- Old films / documentaries from the Hong Kong Film Archive and Radio Television Hong Kong which show previous quarry activities in Hong Kong.

6. Conclusions

The reconstruction of Hong Kong after Second World War and the various building boom and recession contributed to the policy change of quarrying industry. The small private quarries were knocked out by the modern large scale quarries. Manual labours were replaced by modern mechanical plants. Legislations were rationalized to include up-to-date safety and health, blasting, dust, environmental and pneumoconiosis issues.

The contract quarries in 1980s and 1990s (Lamma, Shek O, Anderson Road and Lam Tei) which had gradually turned into rehabilitation quarry contract would be gradually completed and the quarry platforms would be used for various development. In 2013, only Anderson Road and Lam Tei quarries remain operation. By 2014, Anderson Road quarry will cease the normal quarry operation and Lam Tei quarry will be the only active quarry in Hong Kong with production probably until 2020 (pending on new contract approval).

It can be seen that since 1965, apart from exploring ways to extract the available granite reserves within the operating contract quarries, no green field sites above ground in urban areas have been established specifically for quarrying. At this stage, with the intended infrastructure and mass transit railway projects to be carried out in the next 10 years, there is an imminent need to review the quarrying industry. Although the public would fully aware that economic development which requires building materials including aggregates is desirable, they would object having a new quarry in their neighbourhood. Environmental concerns over the impact of quarrying activities are more critical nowadays. To the government and quarry operators, preparation of tender documents and public consultations are time consuming and may take years, whilst to the public this has often manifested into demands to stop quarrying to remove the destructive evil.

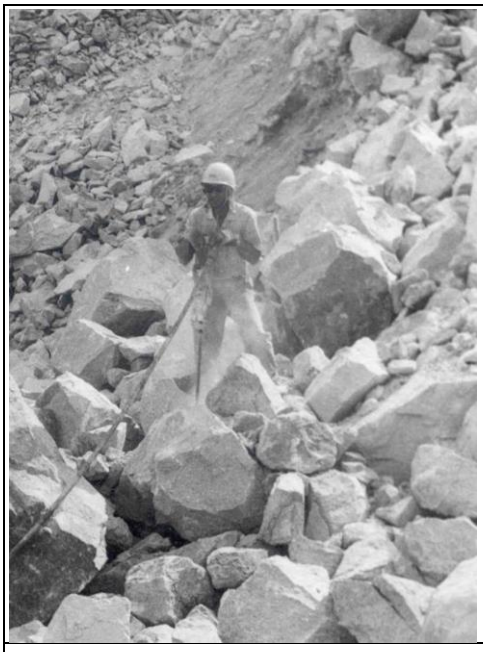
In October 2011, Civil Engineering and Development Department engaged consultants to carry out a comprehensive review and study to assess the long-term demand and strategy for supply of crushed rock products in Hong Kong, identify potential new quarry sites in Hong Kong, carry out preliminary studies for three selected sites and devise a Quarry Development Master Plan.

Hong Kong is now at the cross road of whether to open new quarry sites or rely on importing rock products for construction. No matter what is the outcome, the history of quarrying in Hong Kong should be recorded down as it is one of the very few old industries that still survives today.

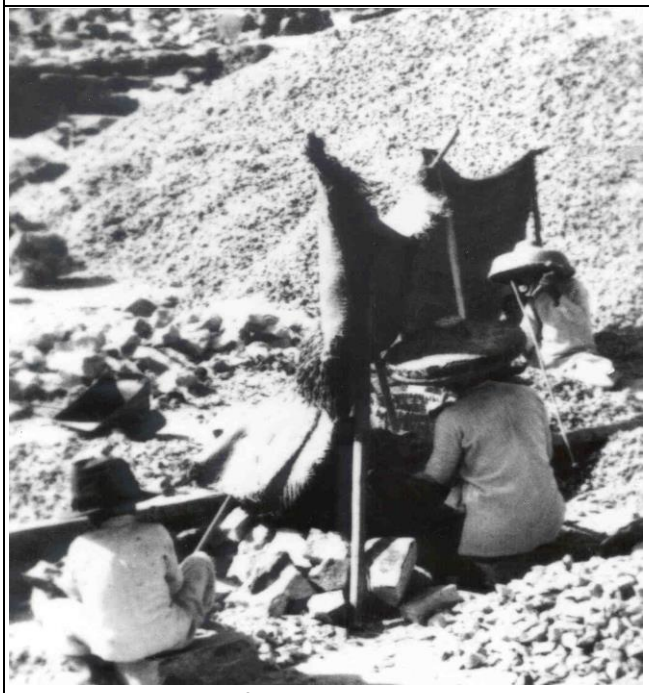
7. Acknowledgement

The funding received from Lord Wilson Heritage Trust in carrying out this project is gratefully acknowledged.

Photos



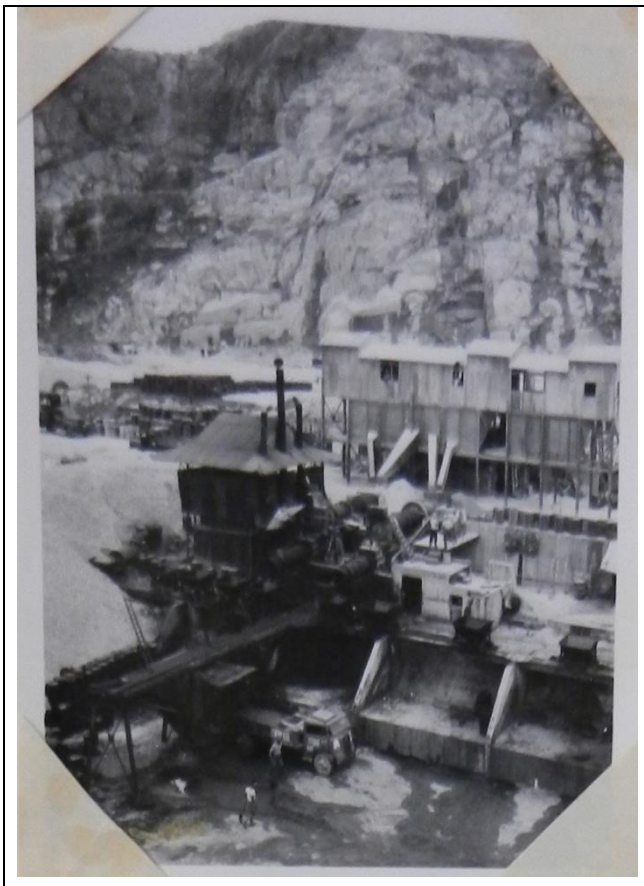
Drilling hole in large block by jackhammer ca 1960s



Manual breaking of rock blocks into aggregates 1950s to 1960s

North Point Seawall 1951

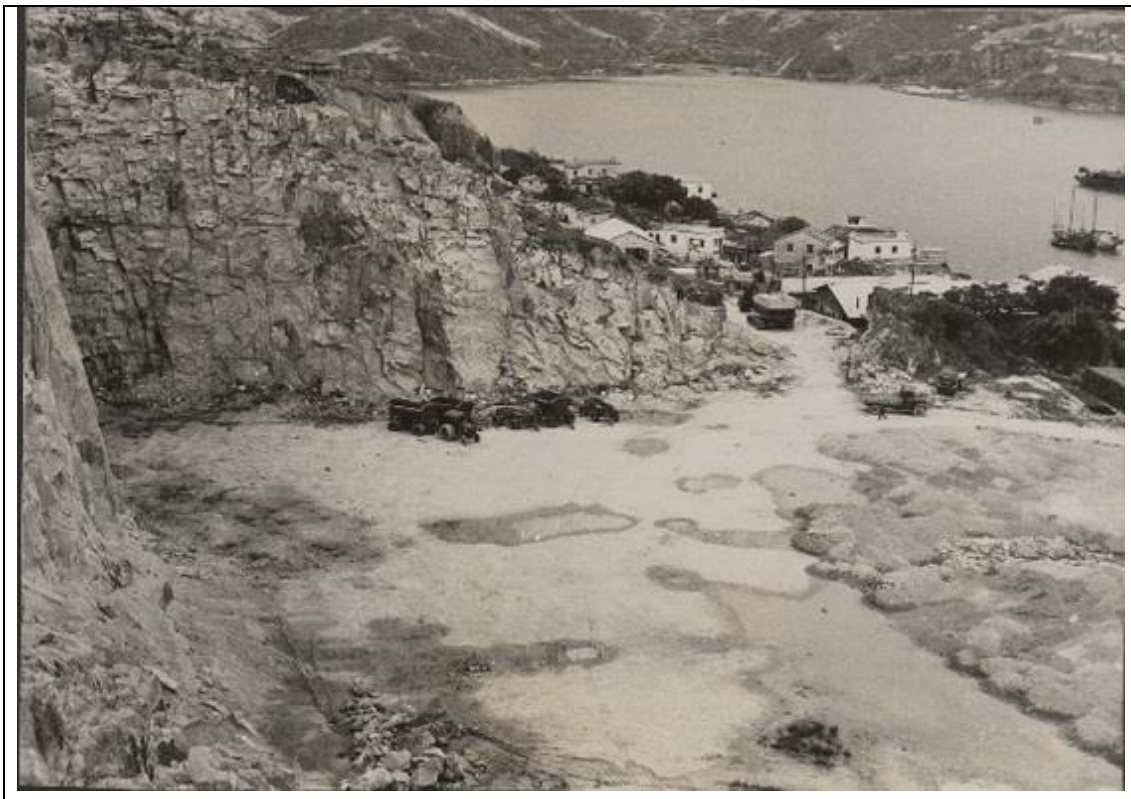
North Point Reclamation 1950



Hok Un Quarry 1951

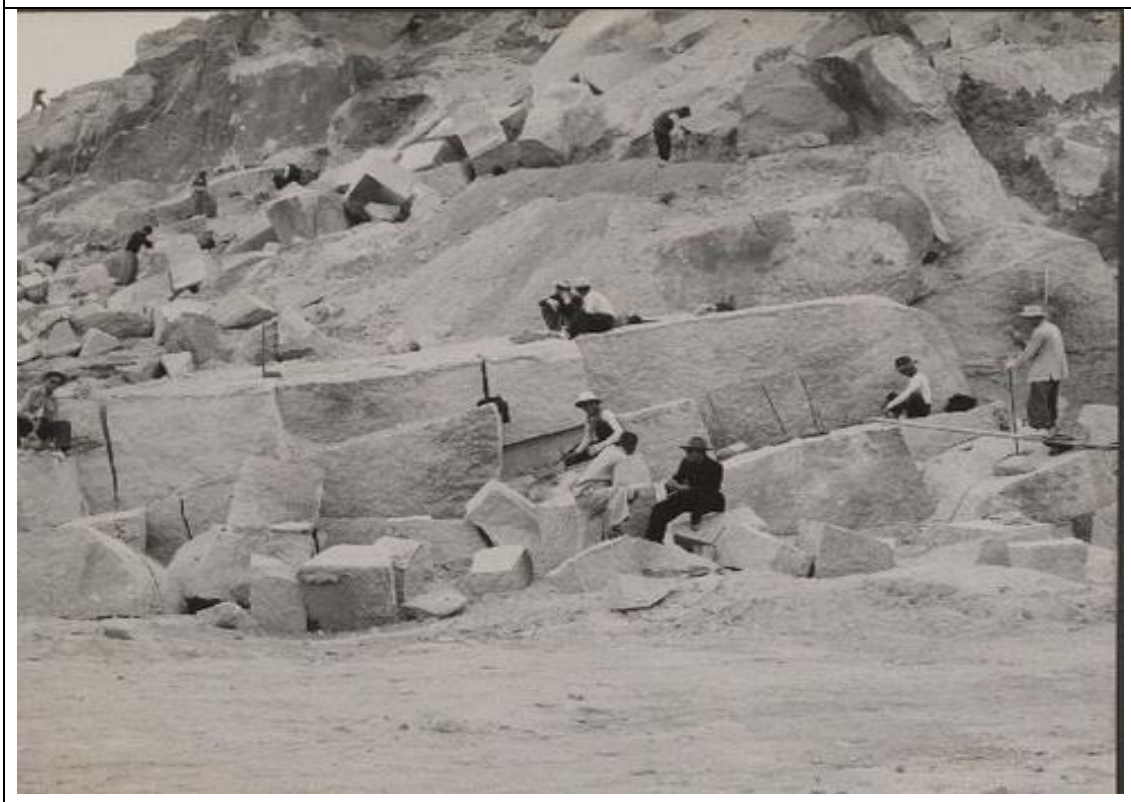
Tai Lam Chung Reservoir Site 1954

Governor visited Tai Lam Chung Reservoir in 1955



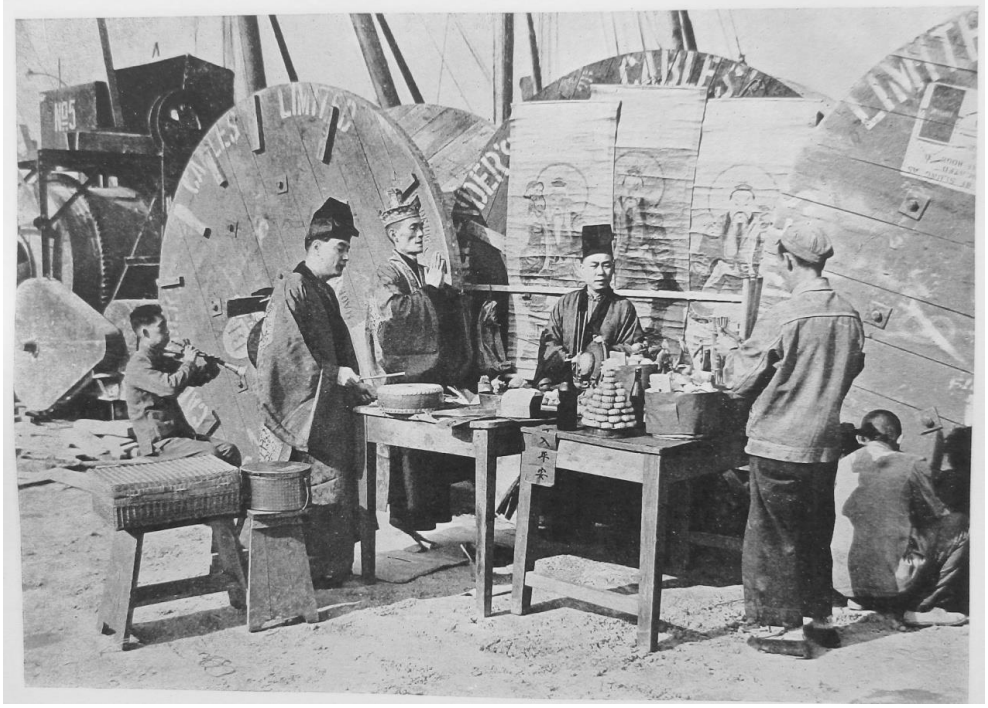
Kwun Tong Quarry 1956

Blasting in Kwun Tong Quarry 1956

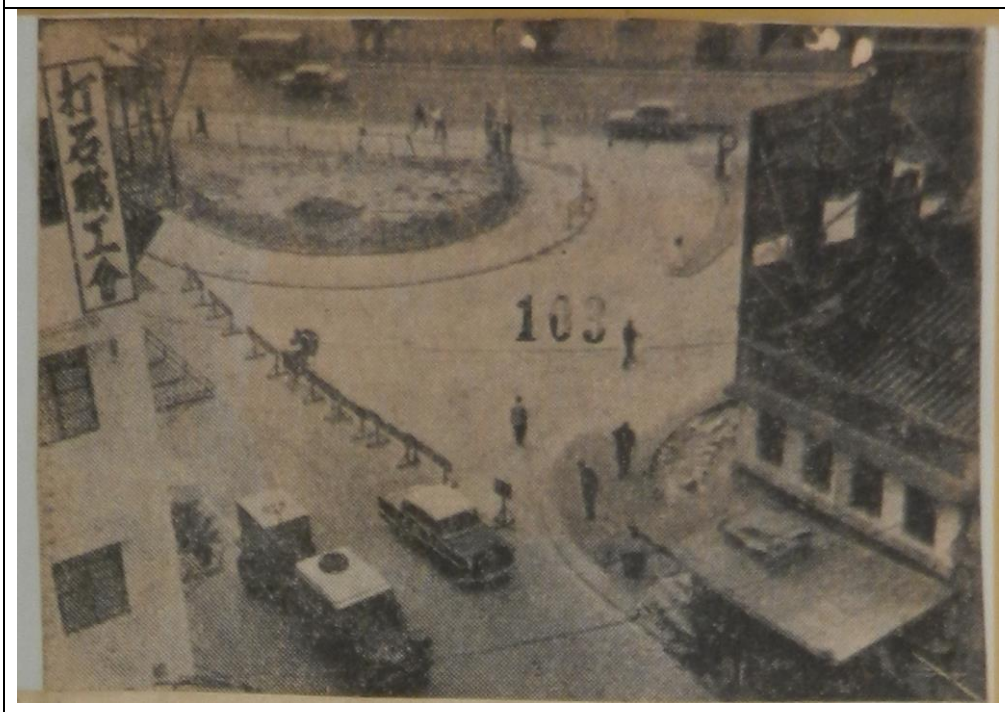


Rock breaking in Sung Hill Kowloon City 1956

Worship custom on site



Worship custom on site



Stone mason union office ca 1950s

Anderson Road Quarry 2002

Lam Tei Quarry 2002

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List of Appendix

A. Record of Interviews (in Chinese)

1. Son of Operator of Permit Quarry Wong Yin Quarry Company (旺賢石廠) at Lye Yue Mun – Mr Stephen Law
2. Grandson of Operator of a 1905 Permit Quarry Company at Lye Yue Mun – Mr Ip Pak Keung
3. Members of The Pneumoconiosis Mutual Aid Association – Mr Lee Ming Kwan, Mr Tsui Yun Cheung and two others workers
4. Retired Quarry Manager of Ex – Tsing Yi Island Quarry, Cha Kwo Ling Quarry, Anderson Quarry, Asia Stone Quarry and Lam Tei Quarry - Mr Tang Kau
5. Representative of Contract Quarries Association and Institute of Quarrying (Hong Kong Branch) – Mr Chan Hon Man

B. Presentations at Seminars and Conferences

1. "The four brick wells at Tai Tam Harbour". S W Poon, K Y Ma, K F Man, T W Tsin & Y Deng. Publication in Hong Kong Engineer Journal, pp 22-23. Feb 2013
2. HKU Knowledge Exchange Seminar on 13 July 2013
3. "Development of Dust Hazard Control in Quarrying' – Paper presented by Mr T W Tsin in 11th Conference of Mainland China, Taiwan, Hong Kong and Macau on Occupational Safety and Health, Nov 2013, Hong Kong.

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