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Exploration on the Existing Silvermine Cave and Study for Its Re-opening

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Historical Background

The historical value of Silvermine Cave (銀礦洞) is significant in terms of its mining activity that began in the 1860s, during the Ching Dynasty (清皇朝) at time of Emperor Tong Zhi (同治皇帝). The mine tunnels are believed to have been excavated primarily by means of hand tools for both lead and silver. The mine in fact produced more lead than silver but the silver was of much higher value than lead. Therefore, the mine economy was mainly driven by the silver production. By virtue of the mining activity, the area was eventually developed into a village called Pak Ngan Heung (白銀鄉), literally translated as “Silver Village” in English. After more than three decades of operation, the mine ceased in 1896 following the drops of silver grade in the ore as well as of the market price for silver in the 1890s. The population in the area declined after the mine closure, but some people stayed to earn their living as fishermen around the nearby waters. The area was then developed into one of the fishing villages in in a centennial period with the new

name of the place as Mui Wo Township (Refer to Fig.1). For safety reasons, in 2004 the Island District Office of the Government erected a concrete wall with steel barriers at a distance of 10 m from the main entrance of the Upper Tunnel.

Some of the old villagers revealed that there were in total four entrances for the tunnels. The existing main entrance of the Upper Tunnel (Upper Adit) is called Silvermine Cave (i.e. the Portal No.P3 as shown in Appendix A), and second entrance is believed to be located at the Lower Tunnel (the Lower Drive). The other two entrances are missing, and are believed to have been buried by earth for many years. The Lower Level is also revealingly very spacious internally with almost 4m in width. Besides, there is also a 40m long water stream with depth of water of 1.2m.

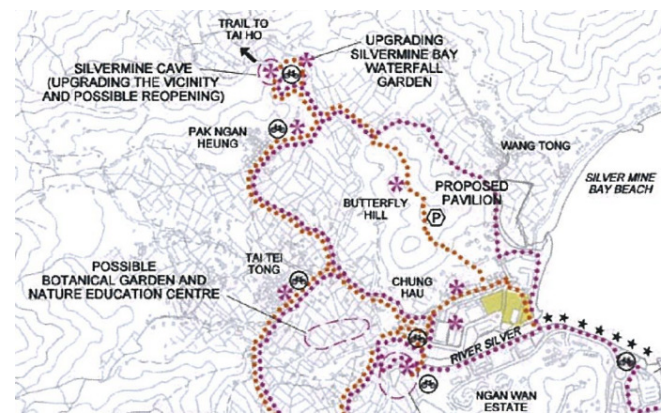


Fig 1. Map showing the location for the Silvermine Cave in Mui Wo Township.

Site Reconnaissance

Meinhardt Consultants Ltd was commissioned by the HKSAR Government to carry out a preliminary feasibility study for the future improvement works for upgrading the facelift of the whole area of the Mui Wo Township in 2007. A team of working staff

including, the author who is an experienced executive engineer, embarked to carry out the topographical and geological survey.

Exploration of Silvermine Cave and Tunnels

Although the feasibility study stipulated under the contract did not cover the investigation of the mine tunnels, a working committee was established, led by the village representative, Mr. Teng Ka Hung, to put forward the reopening of the mine tunnels in order to attract tourism and various public attraction. The author was invited to participate in the working group to explore the mine tunnels and to provide his professional geological opinions.

The first visit to the Lower Tunnel was conducted by Mr. Teng accompanied by the author in 2007 (Fig 2). As the entrances for the tunnels had been missing for many years, most of the features of the entrances of the tunnels had not been shown on the topographical maps from the Government. At the beginning of the investigation, the working group and the author had to look for the entrances carefully along the hillsides of Pak Ngan Heung and the existing stream course. The working group eventually found one of the entrances (i.e. Portal No.P3) that connected to the middle of the Lower Tunnel. Inside the Lower Tunnel, the working group also found one of the ventilation shafts, and examined and checked thoroughly the length, conditions and alignment of the mine tunnels. There are bats living inside the mine. Following the land survey works for the mine tunnels, the invert levels of the Lower Tunnel was found to range between +32.71mPD and +47.41mPD. The mine tunnels were fully excavated in sound rocks.



Fig.2 The first visit for the Silvermine Cave by Mr. Rocky Tan (The Executive Engineer from Meinhardt Consultant Ltd), and Mr. Teng Ka Hung (The Village Representatives) in the Lower Tunnel in 2007.

The mine tunnels comprise three horizontal levels, namely, the Upper, the Lower, and the Buried Tunnels. The existence of Buried Tunnel is inferred, as no verification shaft was found during this investigation. The Upper Tunnel appears to be an adit, the Lower and Buried Levels are believed to be drifts that connected by various transportation and ventilation shafts. The average elevations for the Upper and Lower Tunnels are at +50mPD and +25mPD respectively, and the Buried Tunnel is inferred to be at +15mPD. It is also believed that the sections of the three Tunnels are in the same vertical plane in the area around the Portal No.3. If a vertical hole was drilled from ground surface above the Portal No.3, it might penetrate the Upper, Lower and probably the Buried Tunnels.

The Upper Tunnel

The main entrance located at the Upper Tunnel has already been blocked by a concrete wall with steel barriers (Fig.3), and therefore, on-site inspection was not possible. During the site reconnaissance in January 2008, a horizontal corehole was drilled through the wall, and it

revealed that the wall is made of concrete with a thickness of 220 mm. A drawing showing the sections and outline layouts of the mine tunnels are deduced based on field mapping and field observations (Refer to Appendix A).



Fig.3 The Silvermine Cave was sealed by a concrete wall and steel barriers for safety reasons.

The existing main entrance of the Silvermine Cave is located at the eastern end of the Upper Tunnel. During the inspection inside the Lower Tunnel, Shaft No. 4 was found on the soil slope that was covered by vegetation 5m higher than the existing footpath. The shaft was laid with a concrete slab with open strips. The distance between the main entrance and the shaft is about 120m. After checking, the depth of shaft is over 15m. The shaft appeared to be dry without fresh air blowing out. In view of field observations, a collapsed hole close to the footpath was inferred to be the location for Shaft No. 6. It was eventually verified after digging up of the filled materials. Taking into account the geological structure and existing features on site, attempts were made to locate Shaft No.5 but did so in vain. In order to investigate the location for Shaft No 4, reconnaissance search in the forest was made twice but failed to locate the shaft. The working group, however, found a big slump of rock fragments on the top of the hill. It was likely that

they were excavated quartz veins that were stockpiled for processing. The existence of the stockpile suggests that the shaft should be in the vicinity of this area. The working group further believed that the shaft should be connected to the Upper Tunnel.

The Lower Tunnel

The Lower Tunnel can be accessed through Portal No.P2. The portal is just behind a 2m high brick wall that is next to the public toilet in the Waterfall Garden.

By means of going into the Portal No. 2 of the Lower Tunnel, it was found that the eastern section of the tunnel from the portal is 250m in length, and half of this section was filled with water at depth of 0.3m to 1.2m, and another half was almost dry. The western section of the portal is found to be about 50m to 60m in length, and it was fully filled with water at depth of 1.2m to 1.4m. The dimension of the drift measures around 3m by 3m, and locally 4.5m by 4.5m. During inspection of the Lower Tunnel, a stick was used to check the floor levels. It was found that the floor of the drift was uneven, and contained a few deeper trenches. The drift is nearly straight and along a general direction of N70E to N080E, except a few locally and slightly curved sections. It was found that tunnel rock is moderately to slightly decomposed granite. No significant sight of silver mineralization or large crystal of galena could be traced on the drift walls. However, some cubical tiny voids on some of the rock faces were observed through enlarged photographs. It is believed that these voids were originally galena crystals.

Along the drift, several junctions or portals were observed. The northern wall dipped at 70 degrees towards the north-northwest, and showed a large rock plane toppling slightly towards the inside of the drift. The southern wall appeared to be more

irregular but it clearly showed the dominant sets of joints: 70/340N. No collapsed debris was observed at the toe of the two walls. The roof of the drift was very irregular, albeit apparently stable as it did not show any of the significant loose blocks. The roof and walls were almost dry, and no sheared zone or fractured seam was observed. It might be that water flowed from the toe of the walls, and therefore flooded the mine workings. The water was almost clean and in absence of air bubbles. The roof and the shoulder of the drift were difficult to investigate without distributing the bats.

Bats were found at the western and eastern ends of the tunnel, and there were around 50 to 80 and 100 to 150 bats respectively at the two ends. As the inspectors approached quietly, the strong and larger bats flew and escaped through the portal which is located behind the toilet. At the eastern end of tunnel, the Shaft No. S1 was covered with a concrete pad that formed a ceiling inside the tunnel. At time of inspection, there were around 70 bat pups hanging from a concrete pad (Fig. 4). Their common characteristics are short muzzle; tawny brown pelage; ear and wing bone are edged in white; with forearms about 70mm long. The bats are identified to be the *Cynopterus Sphinx-Short nosed Fruit Bat* (短吻果蝠), according to the Identification Keys produced by Mr. Shek Chung Tong of AFCD, a bat and mammal expert in Hong Kong. Most of the bats in Silvermine Cave have been identified to be one of the **commonly local** biological species in Hong Kong. Besides, a few 3-4 inch white fishes were observed in the flood water in the drift, but no photograph was taken.

The Buried Tunnel

Four small hand-dug pits were found on the floor of the Lower Tunnel at +25mPD. The spacing of the pits was roughly at 50m to 150m intervals

respectively. These pits were flooded with water of an unknown depth. It is believed that they were the vertical shafts that extended from the Lower Tunnel to the Buried Tunnel. If water could be pumped out of the Lower Tunnel, the pits might be exposed to show the features of the shafts, and further excavation could be conducted to reach the Buried Tunnel. This is supported by the discovery of Shaft No.3 (i.e. #3) which connected the Upper Tunnel and the Lower Tunnel. Albeit unexposed and no entrance found, the Buried Tunnel is inferred to exist at the level of +15mPD.



Fig. 4 *Cynopterus Sphinx-Short-nosed Fruit Bat*, having its forearm of 64 to 79mm

Recommendation

As the Upper Tunnel is located at a higher level, it is dry and more stable. In addition, there is no bat inhabited inside the adit, it is therefore considered to be worthwhile for re-opening as one of the scenic spots for visitors.

For the potential re-opening of the Lower Tunnel, the improvement works include the improvement of the seepage and drainage of water due to influx of groundwater from the adjacent catchment area and the existing stream course should be done. Stabilization of the drift walls and crowns and flattening of the drift floors is also likely to be

required. The eastern portal could be re-opened, and Shaft No.4 and drifts are required to check for the alignment again. The stability of rock walls, roofs and floors of the drifts should be conducted with surveying and geological mapping.

Visitors entering the cave would not only interfere the bat ecosystem but also their health may be endangered by the viruses and bacteria carried by bats. As the species of bats in the Lower Tunnel are protected under the Wild Animals Protection Ordinance, it is mandatory that any improvement affecting their normal habitation shall be approved by the Agricultural and Fishery Department of HKSAR. The most difficult task however is how to isolate parts of the tunnel for the normal habitation for the bats and the other parts for tourism. All of these issues need to have an overall feasibility study. As the unique habitat, the bats, are already living inside the cave, it is reasonable to believe that there will be strong objection from some of the citizens, and the Governmental Departments are more undesirable for the re-opening proposal. Therefore, we should

put more effort for promoting the re-opening of the Upper Tunnel instead.

Since the Buried Tunnel is only inferred to have existed, more investigation is essential before any improvement works are initiated. It appears that it is still far from our vision for any works in comparison with the Upper and Lower Tunnels.

Apart from the re-opening of the mine tunnels, beautification and upgrading works for amenities outside the cave and nearby area should also be planned. The scenic spots, waterfront promenade and rain shelters around the whole area should be considered in parallel with the reopening of the mine tunnels.

Reference

AFCD: Hong Kong Biodiversity, Issue No. 7, August 2004. Chung-tong Shek. Mammal Working Group. "Bats of Hong Kong: An Introduction of Hong Kong Bats with an Illustrative Identification Key".

Appendix A: The Indicative Layout Drawing for the Alignment of the Silvermine Tunnels

