

CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF HONG KONG

12-18 January 2010

Richard A. Engelhardt, UNESCO Senior Advisor for Culture
Consultant



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PART I TERMS OF REFERENCE AND METHODOLOGY

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CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF HONG KONG

PART I TERMS OF REFERENCE AND METHODOLOGY

This study followed specific terms of reference set out by the Antiquities and Monuments Office in the contract between the Government of Hong Kong SAR and this consultant. These terms of reference included on-site visits to each of the 9 rock carvings and inscriptions which are declared Protected Monuments in Hong Kong SAR.

The purpose of the study undertaken by this consultant was to examine the issues affecting the conservation of the rock carvings and inscriptions of Hong Kong SAR and to recommend management protocols designed with the twin objectives of safeguarding the rock carvings and inscriptions and enhancing their significance as a heritage resource.

1. Terms of Reference

Purpose

To review the conservation methodology and to work out a long-term preservation and management plan for 9 ancient rock carvings in Hong Kong. These rock carvings have been declared as monuments and are protected under the Antiquities and Monuments Ordinance of Hong Kong. They are located at:

- (1) Shek Pik, Lantau;
- (2) Po Toi Island;
- (3) Tung Wan, Cheung Chau;
- (4) Kau Sai Chau, Sai Kung;
- (5) Joss House Bay, Sai Kung;
- (6) Lung Ha Wan, Sai Kung;
- (7) Tung Lung Island, Sai Kung;
- (8) Big Wave Bay, Hong Kong Island; and
- (9) Wong Chuk Hang, Hong Kong Island.

The goal of the long-term preservation plan is to conserve, enhance and communicate the cultural significance of the 9 ancient rock carvings.

Scope of Study

The scope of the study shall include but not limited to the following:

1. To assess the present condition of the rock carvings and identify the potential hazards that will affect the well being of the rock carvings;
2. To review the current preservation and conservation practice;
3. To advise on a practicable preservation strategy for the rock carvings;
4. To examine the display settings and advise on improvement measures;
5. To devise a comprehensive management plan for the rock carvings.

Study Plan

The consultancy study shall be comprised of site inspections of the 9 rock carvings listed above and attendance at work meetings as and when required in seven consecutive days with the dates to be agreed by the Government and the Advisor after signing the Agreements. Thenceforth, the Advisor is required to render a study report on the listed rock carvings covering, but not limited to the aspects as described in the following section for submission to the Government within 1 month after the inspection visits.

Study Report

Based on the background information provided by the Government as well as the findings of the Advisor in the site inspections and meetings, the Advisor shall deliver to the Government a study report in English of not less than 4,500 words for all 9 rock carvings while not less than 500 words for each rock carving within 1 months after the site visits. The report shall address all the 5 aspects stipulated in the scope of study for each of the 9 rock carvings and include but not limited to the following contents:

1. Present situation
 - Context, merits and issues (if any) of the current conservation practice
 - Physical condition of the rock carvings
 - Diagnosis of the preservation problems (if any)
 - Site constraints and environmental settings
2. Proposed solutions/improvements (both interim and long-term)
 - Preservation and/or conservation strategy
 - Requirements for intervention treatment
 - Follow-up evaluation and documentation work
 - Resources implications
3. Risks (if any)
 - Identification and assessment of the risk factors
 - Risk management
4. Conservation plan
 - Priority for intervention treatments
 - Detail implementation plans
 - Suggestion on timeline for conservation work
5. Recommendations on specialist supplies
 - Sources of specialist materials and/or service suppliers
 - Recommendations for outsourcing of site management (if necessary)

2. Schedule of Work

Prior to 11 January 2010	Examination of background information and technical reports provided by the Government of Hong Kong SAR
12 January 2010.	Briefing with officials of Antiquities and Monuments Office and Central Conservation Section, Hong Kong Heritage Museum

12 – 17 January 2010	On-site visits to all 9 sites under analysis
14 January 2010	Meeting with Dr. Roderick Sewell and staff, Hong Kong Geological Services, Civil Engineering and Development Department
18 January 2010	De-briefing with officials of Antiquities and Monuments Office and Central Conservation Section, Hong Kong Heritage Museum

3. Acknowledgements

This consultant would like to acknowledge the exemplary assistance of the staff of the Antiquities and Monuments Office and the Central Conservation Section, Hong Kong Heritage Museum. These professionals generously provided detailed background information and information on past conservation efforts. They also expertly facilitated the site visits during which they discussed conservation issues on-site with the consultant. The staff also took the photographs included in this report. With dedicated professionals such as these in charge of the safeguarding of the rock carvings of Hong Kong, this valuable part of Hong Kong's heritage is in well-informed, competent and caring hands.

4. Persons Consulted

CHAN Sing-wei, Chief Curator (Conservation), Central Conservation Section, Hong Kong Heritage Museum, Leisure and Cultural Services Department, Government of Hong Kong SAR

FONG Wai-yin, Karen, Assistance Curator II (Conservation), Central Conservation Section, Hong Kong Heritage Museum, Leisure and Cultural Services Department, Government of Hong Kong SAR

FUNG Chun-hong, Assistant Curator I (Archaeological Preservation) 3, Antiquities and Monuments Office, Leisure and Cultural Services Department, Government of Hong Kong SAR

LEUNG ST, Eddy, Central Conservation Section, Leisure and Cultural Services Department, Government of Hong Kong SAR

SEWELL, Roderick J. Head, Hong Kong Geological Services, Civil Engineering and Development Department, Government of Hong Kong SAR

YEUNG So, Evita, Curator (Conservation) 3D, Central Conservation Section, Hong Kong Heritage Museum, Leisure and Cultural Services Department, Government of Hong Kong SAR

5. Bibliography

Climatic Data for Po Toi Rock Carving, AMO, August 2008


Lei WF and Carol Tang, *Analysis of the brown stain and translucent white accretion at Po Toi Rock Carving*, AMO Analysis Report, March 2008

Lei WF and Carol Tang, *Analysis of the biogrowth at Po Toi Rock Carving*, AMO Analysis Report, December 2008

Meacham, William, Rock Carvings in Hong Kong, Hong Kong 2009

6. Disclaimer

Although many professionals of the Antiquities and Monuments Office and the Central Conservation Section of the Hong Kong Heritage Museum advised and informed this consultant and engaged in frank and open discussion and professional debate with him, this consultant takes full responsibility for the conclusions and recommendations contained in this report. Any mistaken information or mis-informed analysis are mine and mine alone.

A handwritten signature in black ink, appearing to read 'Richard A Engelhardt', with a stylized, wavy line extending from the end.

Richard A Engelhardt
15 February 2010

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PART II INDIVIDUAL SITE ANALYSIS

SITE 1: ROCK CARVING AT BIG WAVE BAY

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- II.1.1 Map: location and rock composite (provided by AMO)
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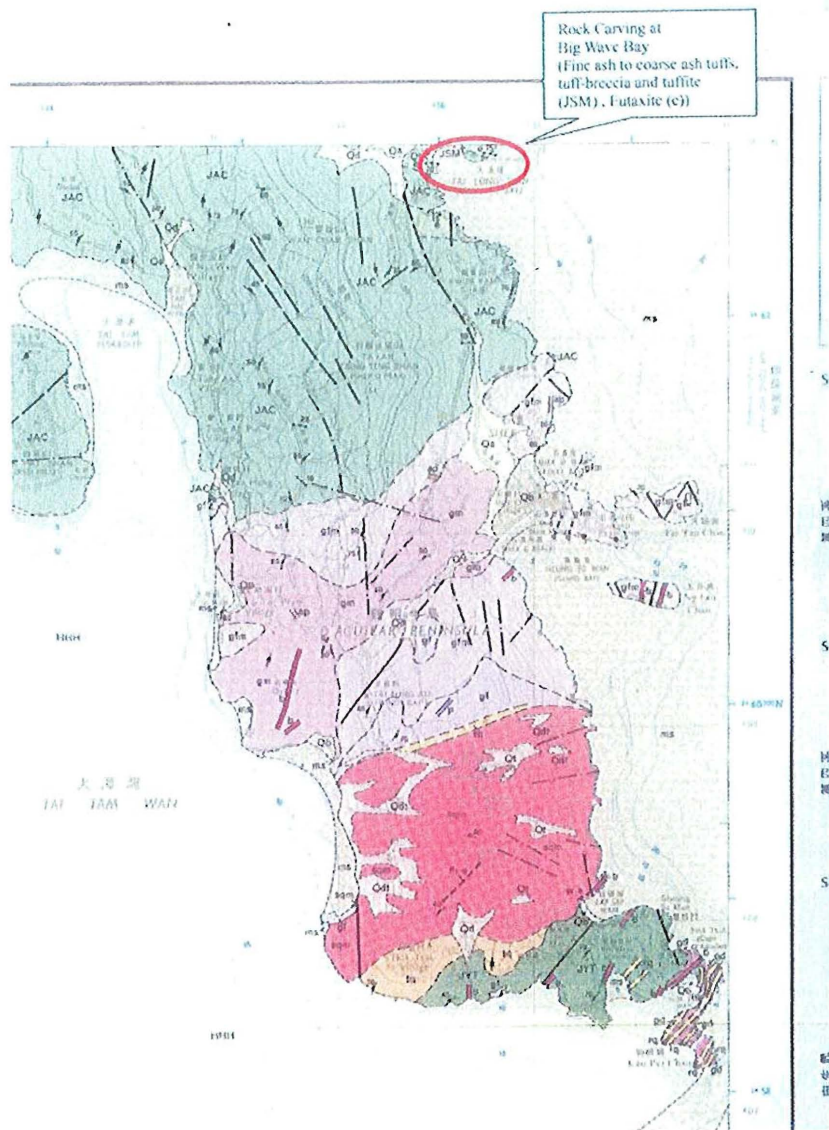


**PART II
INDIVIDUAL SITE ANALYSIS**

SITE 1: ROCK CARVING AT BIG WAVE BAY

1.1.1 Map

Location and Rock Composite of Rock Carving at Big Wave Bay




**PART II
INDIVIDUAL SITE ANALYSIS**

SITE 1: ROCK CARVING AT BIG WAVE BAY

II.1.2 Data Sheet

1. Rock Carving at Big Wave Bay

1. Date of Declaration	<ul style="list-style-type: none"> 13 October 1978
2. History and background information	<ul style="list-style-type: none"> Big Wave Bay Rock Carving was first reported in 1970 by a police officer. The design shows very dynamic geometric and animal patterns with a worked surface measuring 90cm x 180cm. Like most other carvings, apart from those at Shek Pik and Wong Chuk Hang, it is situated on a headland embracing the beautiful bay. There is some evidence that early inhabitants who created these carvings depended on the sea for their livelihood. The carvings might have been intended to propitiate the power of the sea and to protect its sea-faring population.
3. Protective Measures and Visitor's Facilities	<ul style="list-style-type: none"> September 1976: Erection of a wire cage as a temporary protective measure. October 1980: Replacement of the wire cage by a new cage. March 1983: Protection and improvement works which included a concrete footpath, a new protective cage made with stainless steel and tempered glass, a viewing platform in front of the carving, a surface channel at the back of the carving. 1991: Replacement of the stainless steel cage by a new timber pavilion, making good of surface water channel at the back, random rubble paving to the concrete platform, repairing and repainting of the metal railing along the footpath, etc. July 1995: Replacement of the glass screen of the timber pavilion with grilles. April 2009: Erection of a new metal protective shelter for the rock carving as the timber as the old timber pavilion was destroyed by the typhoon in late September 2008.
4. Present Condition and Past Treatment	<p><u>Present Condition</u></p> <ul style="list-style-type: none"> Overall condition of rock carving was stable. <p><u>Past Treatment in 2008</u></p> <ul style="list-style-type: none"> Cleaned with soft bristle brush for removing dust and loose vegetation. The surface was cleaned with biodegradable and non-ionic surfactant (Decon@90) and then rinsed thoroughly with water.
5. Photo Reference	 <ul style="list-style-type: none"> approx. 2.0 m (W) 1.1 m (H)

**PART II
INDIVIDUAL SITE ANALYSIS**

SITE 1: ROCK CARVING AT BIG WAVE BAY

II.1.3 Analysis and Recommendations

BIG WAVE BAY: Analysis and Recommendations

1. Present Situation

1.1 Physical condition of the rock carvings

The rock carving at Big Wave Bay is in stable condition with no evidence of any immediate risk.

There is no evidence of biological growth on the carved rock surface. The black patches which some have identified as evidence of micro-organism contamination are, in fact, mechanical breeches in the orange-brown weathered cortex of the rock, revealing the black un-weathered rock beneath. These mechanical breeches are of uncertain date, some may be decades or centuries old as they appear in early photographs of the carving at Big Wave Bay. The source of these mechanical breeches is most likely due to percussion from small wind-blown particles of rock.

1.2 Diagnosis of preservation problems

There are five possible types of preservation problem which need to be managed at Big Wave Bay:

- The possibility of the growth of micro-organisms on the rock surface, due to contamination from plant growth above the rock carving.
- Damage to the rock surface from wind-born particles of rock (erosion).
- Spalling of the rock face caused by the mechanical action of infiltrated water migrating through the rock to the surface of the carving.
- Staining and defacing of the carved surface due to cement leached from the dams above the carving.
- Vandalism, as this is one of the most easily accessible of the Hong Kong rock carving. Although it should be noted that the site has not suffered from vandalism in the past.

1.3. Site constraints and environmental setting

The rock carving at Big Wave Bay is easily accessible and thus potentially vulnerable to vandalism.

The accessibility of the site, however, also offers opportunities for enhanced visitor interpretation of this site and its linkages with the other rock carving sites in Hong Kong, thus raising the awareness and enhancing the value of the rock carvings as an important part of Hong Kong's archaeological heritage.

The site is also exposed to wind erosion due to its location, although as the carving faces due south it is not exposed to the prevailing winds which typically come into Big Wave Bay from the east.

1.4 Context, merits and issues of the current conservation practice

In 2008, the surface was cleaned with a non-ionic surfactant and then rinsed with water. This treatment appears to have been effective in cleaning the surface of the rock and has had no

negative impact which can be discerned. However, like all treatments, on-site control tests should be maintained in order to monitor the medium-term impact of any and all treatments.

In common with other rock carving sites, the housekeeping and monitoring protocols can be improved. As this site is frequently visited, there are cigarette butts, candy wrappers and other refuse littering the site. This detracts from the value of the site in the public eye.

It should also be noted that while the structure constructed at Big Wave Bay to protect the carving from both the elements and from potential vandalism is performing its first intended function admirably, the shelter has no effect in protecting the carving from vandalism as the carving itself is easily reached by hand through the bars of the shelter. Furthermore the design of the shelter (it has no door) prohibits appropriate maintenance of the site by the staff of AMO. The consequence is that the site is littered with pieces of concrete from previous constructions/shelters at the site. These are unsightly and a source of potential contamination.

During the most recent shelter construction, a second concrete dam was placed on top of the boulder, presumably to prevent water from washing over the surface of the rock. It is evident however that this dam does not perform the job intended, but instead traps water behind it and thus increases the possibility that cement will be leached out and re-deposited on the rock face below. This concrete dam should be removed.

2. Proposed solutions/improvements

2.1 Preservation and conservation strategy

2.1.1 Interim

- Improved supervision of site housekeeping and maintenance.
- Removal of the concrete dam and removal of all other concrete debris from the site.

2.1.2 Long-term

- Monitoring of biological growth on the carving and treatment with isothiazolinon or a similar agent, if required. This should be a part of the routine monitoring protocol for the site, but should be undertaken only if biological contamination is verified.
- Modeling by the Geological and Geo-technical Services of infiltration of water through fractures in the bedding of the rock onto the surface of the carving, followed by implementation of the recommended corrective measures.
- Construction of a better-designed shelter and visitor interpretation kiosk at the site.

2.2 Requirements for intervention treatment

2.2.1 Interim

- Improved supervision of housekeeping and maintenance protocols.
- Removal of concrete from the site.

2.2.2 Long-term

The long-term treatment for the Big Wave Bay rock carving is no different than that for the other rock carvings of Hong Kong. This consists of:

- Frequent periodic monitoring of the condition of the carving, following the establishment of a baseline monitoring data base using laser scanning.
- Application of an appropriate biocide if contamination with micro-organisms is identified.
- Construction of new, better-designed shelter to protect the carving and enhance its value as a public educational resource.
- Geo-technical engineering to divert the flow of water through the fractures in the rock away from the carved surface.

(Please refer to Part III.2 for a thorough discussion of these above points.)

2.3 Follow-up evaluation and documentation work

Required are:

- Laser scanning of the carving to establish a data baseline from which to monitor subsequent changes.
- Periodic monitoring of bio-growth on the rock surface.
- Geo-technical study of water infiltration.

2.4 Resources implications

2.4.1 Interim

- As at all sites, investment will be required in laser scanning to create the required monitoring data base. This should be done as soon as budget resources permit.

2.4.2 Long-term

- As at all sites, the geological modeling and application of geo-technical engineering solutions to the problem of infiltrating water will require budgetary allocation to be implement by Geological Services.
- As at other sites, the construction of an improved shelter will require a budgetary allocation.

3. Risks

3.1 Identification and assessment of the risk factors

- The only ascertained risk affecting Big Wave Bay is the possibility of cement leaching onto the surface of the carving.
- A possible risk is from mechanical damage from small wind-borne rocks hitting the carved surface and pitting the cortex of the rock.
- Another possible risk comes from the mechanical action of infiltrated water.

3.2 Risk Management

Risk management at Big Wave Bay consists of the same actions as at all other rock carving sites:

- Improved housekeeping/maintenance protocols, aimed at both preventing mechanical damage to the site, and at the early identification of bio-growth which can then be halted before it becomes a problem.
- Periodic monitoring based on a laser scan data base of the condition of the carving.
- Geo-technical engineering solutions to the problem of water infiltration.
- The construction of an appropriately-designed structure to protect the rock carving from wind erosion, temperature differentials and the possibility of vandalism.

4. Conservation plan

4.1 Priority for intervention treatments

4.1.1 Immediate Interventions

(i) Removal of the cement contaminating the site.

Followed by the application of the recommended standard medium to long-term conservation protocols applicable to all protected rock carvings in Hong Kong, viz.,

- (ii) Undertake laser scanning of the rock carving to create a baseline for future monitoring.
- (iii) Establish a schedule of frequent periodic monitoring, incorporating improved housekeeping arrangements for site maintenance.
- (iv) Application of biocide if biological contamination is identified.
- (v) With assistance from Geological Services, model geo-technical options for preventing the flow of water through fractures in the rock onto the surface of the carving.
- (vi) Undertake the recommended geo-technical engineering work.
- (vii) Design and construct a new shelter to protect the carving and for the purposes of enhanced visitor interpretation.

4.2 Implementation plans and 4.3 timeline for work

Recommendations (i):	Immediate, within the next 1-2 months
Recommendations (ii), (iii) and (iv):	Immediate incorporation into the routine work plan of AMO
Recommendations (v), (vi) and (vii):	As soon as can be budgeted for under the normal budgetary cycle of the Government.

5. Recommendations on specialist supplies

5.1 Sources of specialist materials and service suppliers

Biocide. There is no call for the application of a biocide at Big Wave Bay until and unless biological contamination is confirmed. If undertaken, it is recommended that an on-site control test be established and maintained at this site and at all sites where a biocide, or any other chemical treatment, is applied.

Shelter. It is recommended that in the construction of new shelters, which are required at all sites, no concrete is used in any location where there would be any danger of dissolved concrete coating the rock surface. Nor should untreated iron be used. Consideration should be given to the use of stainless steel, tempered, shatter-proof glass, wood and stone in the construction of the new shelters. The final choice of materials is a matter for the architecture specialists to decide.

It is worth noting that the existing shelter at Big Wave Bay has a sloping wooden roof. This design and the materials used appear to be very effective in protecting and stabilizing the environment of the carving.

However, the design of the shelter without a door inhibits proper monitoring and maintenance by AMO.

5.2 Recommendations for outsourcing of site management (if necessary)

- As at all sites, there is the need for increased supervision of site housekeeping and maintenance.
- As at the other sites, monitoring arrangements with local community stakeholder interests should be explored.
- The valuation of this site, like the other rock carving sites, can be enhanced through better visitor interpretation/education facilities and programmes which should be undertaken in cooperation with Education Department and Country Parks. This will contribute to the long-term safeguarding of the site.

INDIVIDUAL SITE ANALYSIS

SITE 1: ROCK CARVING AT BIG WAVE BAY

II.1.4 Photographs

Photo 1: Existing protective shelter; cracks/fissures in rock bedding

Photo 2: Moist surface due to migration of water from within the rock onto the surface of the carving

Photo 3: Problems with existing shelter

Photo 4: Close-up of cement contamination from construction of shelter

Big Wave Bay

Photo 1: Existing protective shelter; cracks/fissures in rock bedding

Note: Cracks in the bedding of the rock which allow water to migrate through the rock to the surface of the caving

Note: Prison-like structure of the shelter does not enhance the value of the carving as an important resource



Big Wave Bay

Photo 2: Moist surface due to migration of water from within the rock onto the surface of the carving



Big Wave Bay

Photo 3: Problems with existing shelter

Note: Shelter is too close to carving

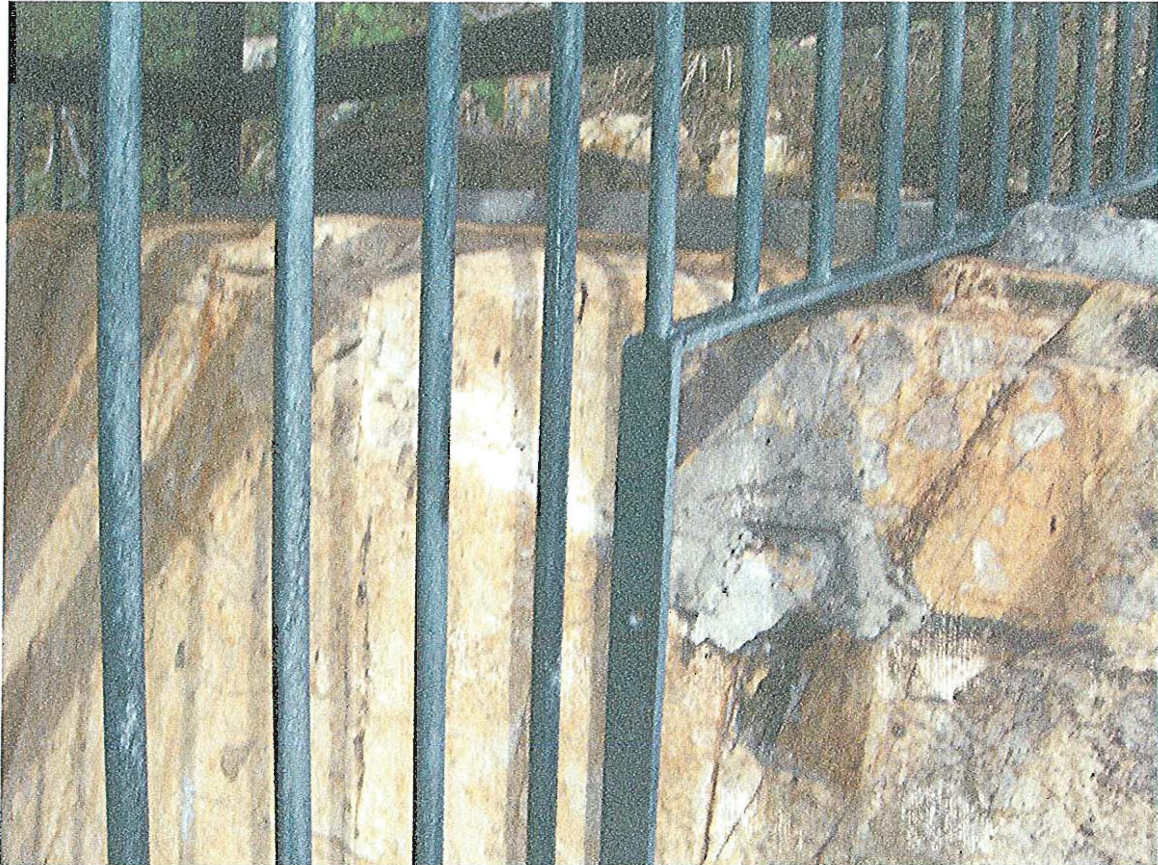
Note: Concrete from the construction of this and/or previous shelters was contaminated the rock so near to the carving as to make leaching of cement onto the carving almost inevitable

Note: Concrete dam above the carving is too near the edge of the rock to be effective in preventing water from seeping down into cracks/fissures in the rock. The dam is also a potential source of cement contamination.



Big Wave Bay

Photo 4: Close up of cement contamination from construction of shelter



CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF HONG KONG

PART II INDIVIDUAL SITE ANALYSIS

SITE 2: ROCK CARVING AT WONG CHUK HANG

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- II.2.1 Map: location and rock composite (provided by AMO)
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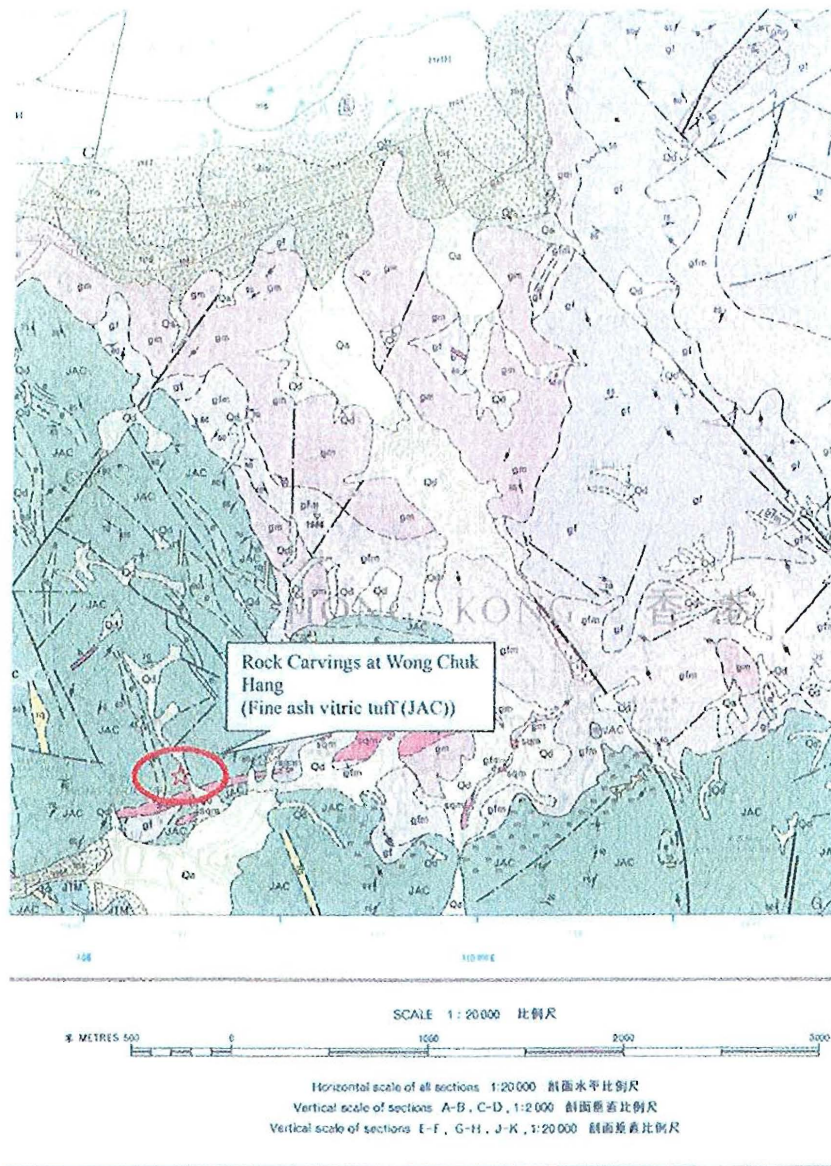


INDIVIDUAL SITE ANALYSIS

SITE 2: ROCK CARVING AT WONG CHUK HANG

II.2.1 Map

Location and Rock Composite of Rock Carvings at Wong Chuk Hang




INDIVIDUAL SITE ANALYSIS

SITE 2: ROCK CARVING AT WONG CHUK HANG

II.2.2 Data Sheet

2. Rock Carvings at Wong Chuk Hang

1. Date of Declaration	<ul style="list-style-type: none"> 15 June 1984
2. History and background information	<ul style="list-style-type: none"> Rock Carvings at Wong Chuk Hang are located beside a stream course at Wong Chuk Hang on Hong Kong Island. Three main groups of carved patterns can be recognised. They consist of meandering and spiral designs suggesting stylised animal eyes. It is most unusual that they stand at least a kilometre from the sea, unlike other rock carvings in Hong Kong, although they still overlook 'a small expanse of water', i.e. the stream running below them.
3. Protective Measures and Visitor's Facilities	<ul style="list-style-type: none"> September 1987: Construction of the footpath, the viewing platform, railing around the viewing platform, protection of slope and minor improvement works to the adjacent area.
4. Present Condition and Past Treatment	<p><u>Present Condition</u></p> <ul style="list-style-type: none"> Overall condition of rock carving was stable <p><u>Past Treatment in 2006</u></p> <ul style="list-style-type: none"> Green moss on the rock carving was removed by soft bristle brush with water. The surface was cleaned with biodegradable and non-ionic surfactant (Decon@90) and then rinsed thoroughly with water. Applied aqueous solution of isothiazolinon (Remmer BFA) to prevent further vegetation growth; Applied siloxane based hydrophobic agent (Remmer SNL) to act as water-repelling layer to avoid air pollutants deposition and pest infestation.
5. Photo Reference	 <ul style="list-style-type: none"> approx. 2 m (W) 3 m (H)

INDIVIDUAL SITE ANALYSIS

SITE 2: ROCK CARVING AT WONG CHUK HANG

II.2.3 Analysis and Recommendations

WONG CHUK HANG: Analysis and Recommendations

1. Present Situation

1.1 Physical condition of the rock carvings

The rock carvings at Wong Chuk Hang are in stable condition with no evidence of any immediate risk. Past identification of the growth of micro-organisms at the site, appears to have been brought under control.

There is evidence however of past damage due to spalling of the rock surface. This damage may be quite old (decades or centuries).

1.2 Diagnosis of preservation problems

There are three possible types of preservation problem which need to be managed at Wong Chuk Hang:

- The recurrence of the growth of micro-organisms on the rock surface.
- Spalling of the rock face caused by the mechanical action of infiltrated water migrating through the rock to the surface of the carving.
- The potential that the rock carvings (especially those lower down) maybe be damaged if hit by loose rocks brought down the stream during a flash flood.

1.3. Site constraints and environmental setting

The Wong Chuk Hang rock carvings are located beside a stream course, in an isolated location.

The isolation of the site, coupled with limited access provided by a gated footpath and viewing platform across the stream course provide protection for the site from potential vandalism or maltreatment by visitors.

The stream course is well-shaded which has the effect of limiting temperature variation during the day and thus protects the rock from thermal fracturing.

However the wooded environment is also the source of micro-biological contamination, which therefore must be carefully monitored at this site.

And the stream course is the source of potential mechanical damage to the carvings if it should happen that loose rocks are brought down the stream during a flash flood, hit and damage the carved surface.

1.4 Context, merits and issues of the current conservation practice

In 2006, the surface was cleaned, isothiazolinon was applied to prevent biological growth, and a hydrophobic agent was applied to repel water.

This treatment appears to have been effective in controlling the biological growth on the surface of the rock carving, when compared with nearby, untreated rock surfaces.

There is some evidence of recurrence of biological growth which needs to be monitored. The presence of insects nesting in a crevice of the rock is evidence that biological growth may be more advanced than was observed by the consultant who visited the site in the dry season.

The most potentially harmful practice affecting the site is caused by careless housekeeping. The contractee responsible for maintaining the site, attended to the site just prior to the visit by the consultant. Branch overhanging the site were cut and thrown down the rock face to lie at the foot of the carving. This practice is unsightly, and may scratch the surface of the carving. Housekeeping at the site needs to be better supervised.

2. Proposed solutions/improvements

2.1 Preservation and conservation strategy

2.1.1 Interim

- Improved supervision of site housekeeping and maintenance.
- Inspection of the concrete dam above the site and removal of the dam if there is any evidence that concrete is leaching down onto the surface of the rock below.

2.1.2 Long-term

- Monitoring of biological growth on the carving and treatment with isothiazolinon or a similar agent, if required. This should be a part of the routine monitoring protocol for the site.
- Modeling by the Geological and Geo-technical Services of two aspects of the site:
 - (i) infiltration of water through fractures in the bedding of the rock onto the surface of the carving;
 - (ii) ways to prevent stray rocks brought down by the stream during a flash flood from hitting the carving.

Followed by implementation of the recommended corrective measures.

2.2 Requirements for intervention treatment

2.2.1 Interim

- Improved supervision of housekeeping and maintenance protocols.

2.2.2 Long-term

The long-term treatment for the Wong Chuk Hang rock carvings is no different than that for the other rock carvings of Hong Kong. This consists of:

- Frequent periodic monitoring of the condition of the carving, following the establishment of a baseline monitoring data base using laser scanning.
- Application of an appropriate biocide if contamination with micro-organisms is identified.
- Construction of new, better-designed shelter to protect the carving and enhance its value as a public educational resource. However, it should be noted that there is no compelling reason for protection purposes that a shelter needs to be constructed at Wong Chuk Hang. The rationale for constructing a shelter at this site would be motivated solely for the purpose of improved site interpretation. (Please refer to the discussion in Part III.2).

- Geo-technical engineering to divert the flow of water through the fractures in the rock away from the carved surface.

(Please refer to Part III.2 for a thorough discussion of these above points.)

2.3 Follow-up evaluation and documentation work

Required are:

- Laser scanning of the carving to establish a data baseline from which to monitor subsequent changes.
- Periodic monitoring of bio-growth on the rock surface.
- Geo-technical study of water infiltration.

2.4 Resources implications

2.4.1 Interim

- As at all sites, investment will be required in laser scanning to create the required monitoring data base. This should be done as soon as budget resources permit.

2.4.2 Long-term

- As at all sites, the geological modeling and application of geo-technical engineering solutions to the problem of infiltrating water will require budgetary allocation to be implemented by Geological Services.
- If the decision is taken to construct a shelter or visitor kiosk at the site, this will require a budgetary allocation.

3. Risks

3.1 Identification and assessment of the risk factors

- The only ascertained risk affecting Wong Chuk Hang comes from careless housekeeping.
- A possible risk is from mechanical damage from rocks hitting the carved surface brought down the stream during a flash flood.
- Another possible risk is that the surface of the rock may crack and spall due to the mechanical action of infiltrated water.

3.2 Risk Management

Risk management at Wong Chuk Hang consists of the same actions as at all other rock carving sites:

- Improved housekeeping/maintenance protocols, aimed at both preventing mechanical damage to the site, and at the early identification of bio-growth which can then be halted before it becomes a problem.
- Periodic monitoring based on a laser scan data base of the condition of the carving.

- Geo-technical engineering solutions to the problem of water infiltration.

4. Conservation plan

4.1 Priority for intervention treatments

Nothing further is required at Wong Chuk Hang beyond the application of the recommended standard medium to long-term conservation protocols applicable to all protected rock carvings in Hong Kong, viz.,

- (i) Undertake laser scanning of the rock carving to create a baseline for future monitoring.
- (ii) Establish a schedule of frequent periodic monitoring, incorporating improved housekeeping arrangements for site maintenance.
- (iii) Application of biocide if biological contamination is identified.
- (iv) With assistance from Geological Services, model geo-technical options for preventing the flow of water through fractures in the rock onto the surface of the carving.
- (v) Undertake the recommended geo-technical engineering work.
- (vi) Design and construct a new shelter to protect the carving, with the caveat that a shelter at Wong Chuk Hang needs to be undertaken only if it is desired for the purposes of enhanced visitor interpretation. There is no compelling need to construct a shelter at Wong Chuk Hang from the conservation protection point of view.

4.2 Implementation plans and 4.3 timeline for work

Recommendations (i), (ii) and (iii):	Immediate incorporation into the routine work plan of AMO
Recommendations (iv), (v) and (vi):	As soon as can be budgeted for under the normal budgetary cycle of the Government.

5. Recommendations on specialist supplies

5.1 Sources of specialist materials and service suppliers

Biocide. Considering that isothiazolinon has proven effective in past applications, its use can be continued. However, it is recommended that an on-site control test be established and maintained at this site and at all sites where a biocide is applied.

Shelter. There is no compelling reason from the point of view of conservation protection that a shelter needs to be constructed at Wong Chuk Hang. The justification for a construction on site would be for enhanced visitor interpretation.

It is worth noting that Wong Chuk Hang is a well-shaded site and like the other well-shaded rock carvings its condition is better than those carving exposed to wind erosion and extreme temperature variations during the day. This is a lesson to be learned and incorporated into the construction of on-site shelters.

It is recommended that in the construction of new shelters, which are required at all sites, no concrete is used in any location where there would be any danger of dissolved concrete coating the rock surface. Nor should untreated iron be used. Consideration should be given to the use of stainless steel, tempered, shatter-proof glass, wood and stone in the construction of the new shelters. The final choice of materials is a matter for the architecture specialists to decide.

5.2 Recommendations for outsourcing of site management (if necessary)

- As at all sites, there is the need for increased supervision of site housekeeping and maintenance.
- As at the other sites, monitoring arrangements with local community stakeholder interests should be explored.
- The valuation of this site, like the other rock carving sites, can be enhanced through better visitor interpretation/education facilities and programmes which should be undertaken in cooperation with Education Department and Country Parks. This will contribute to the long-term safeguarding of the site.

INDIVIDUAL SITE ANALYSIS

SITE 2: ROCK CARVING AT WONG CHUK HANG

II.2.4 Photographs

Photo 1: Refuse from cleaning deposited at foot of carving

Photo 2: Surface cleaned of bio-contamination

Photo 3: Evidence of insect presence, indicative of fungal contamination

Photo 4: Concrete **dam directly above carving**

Wong Chuk Hang

Photo 1: Refuse from cleaning deposited at foot of carving



Wong Chuk Hang

Photo 2: Surface cleaned of bio-contamination



Wong Chuk Hang

Photo 3: Evidence of insect presence, indicative of fungal contamination



Wong Chuk Hang

Photo 4: Concrete dam directly above carving



CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF HONG KONG

PART II INDIVIDUAL SITE ANALYSIS

SITE 3: ROCK INSCRIPTION AT JOSS HOUSE BAY

Contents

- II.3.1 Map: location and rock composite (provided by AMO)
- II.3.2 Data Sheet (provided by AMO)
- II.3.3 Analysis and Recommendations
- II.3.4 Photographs (courtesy Dr. Karen Wai-yin FONG)

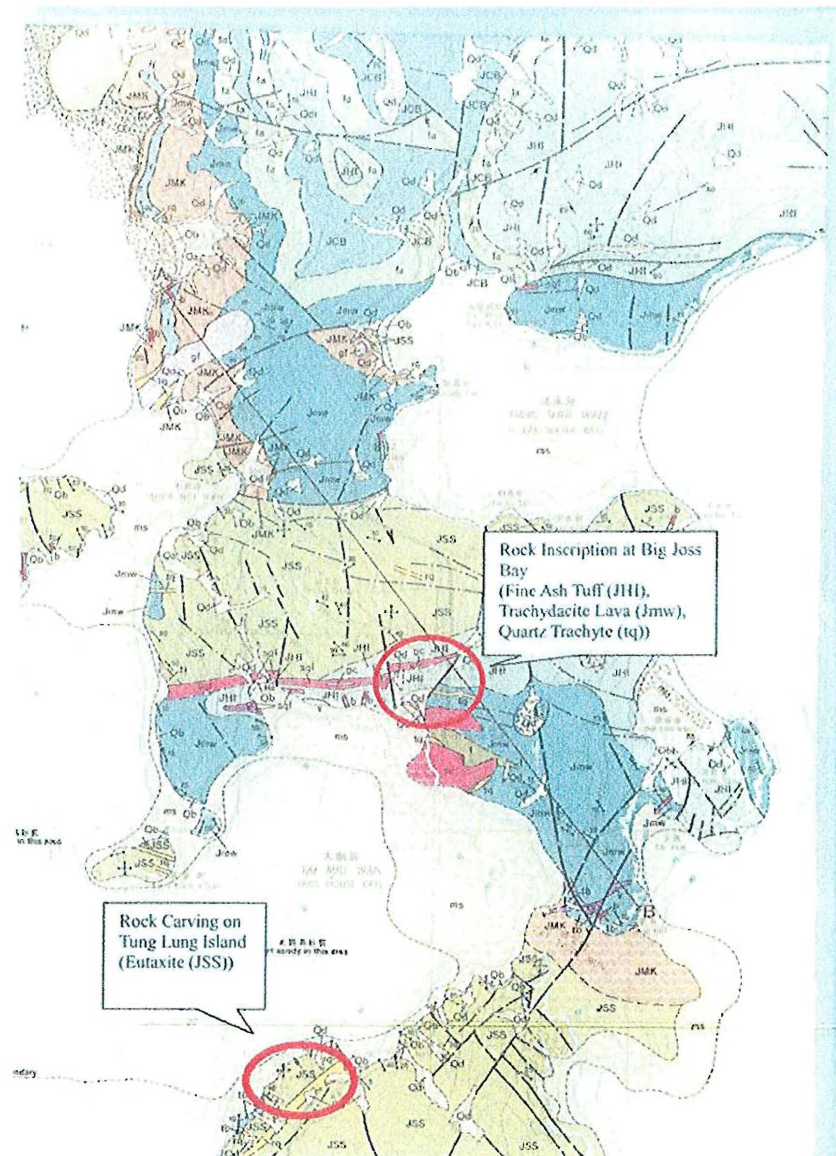


INDIVIDUAL SITE ANALYSIS

SITE 3: ROCK INSCRIPTION AT JOSS HOUSE BAY

II.3.1 Map

Location and Rock Composite of Rock Carving on Tung Lung Island and
Rock Inscription at Big Joss Bay




INDIVIDUAL SITE ANALYSIS

SITE 3: ROCK INSCRIPTION AT JOSS HOUSE BAY

II.3.2 Data Sheet

3. Rock Inscription at Joss House Bay

1. Date of Declaration	<ul style="list-style-type: none"> 26 January 1979
2. History and background information	<ul style="list-style-type: none"> The inscription carved on the rock is dated as the cyclical year jiaxu of the Xianchun reign during the Southern Song Dynasty (i.e. the year 1274) and is the oldest dated inscription known in Hong Kong. It records a visit by a salt administration officer and his friend and gives the history of two temples at the north and south of Fat Tong Mun.
3. Protective Measures and Visitor's Facilities	<ul style="list-style-type: none"> 1983: protective measures and improvement works were completed, including front panel made of iron and perspex screen with concrete base, pathways and staircase, concrete viewing platform
4. Present Condition and Past Treatment	<p><u>Present Condition.</u></p> <ul style="list-style-type: none"> Overall condition of rock carving was stable. <p><u>Past Treatment in 2004</u></p> <ul style="list-style-type: none"> Cleaned with soft bristle brush for removing dust and loose vegetation. <p><u>Past Treatment in 2006</u></p> <ul style="list-style-type: none"> Cleaned with soft bristle brush for removing dust and loose vegetation. The surface was cleaned with biodegradable and non-ionic surfactant (Decon@90) and then rinsed thoroughly with water. Applied aqueous solution of isothiazolinon (Remmer BFA) to prevent further vegetation growth; Applied siloxane based hydrophobic agent (Remmer SNL) to act as water-repelling layer to avoid air pollutants deposition and pest infestation.
5. Photo Reference	 <ul style="list-style-type: none"> approx. 1.5 m (W) x 1.2 m (H)

INDIVIDUAL SITE ANALYSIS

SITE 3: ROCK INSCRIPTION AT JOSS HOUSE BAY

II.3.3 Analysis and Recommendations

JOSS HOUSE BAY: Analysis and Recommendations

1. Present Situation

1.1 Physical condition of the rock carvings

The rock inscription at Joss House Bay is stable condition. Although there is some bio-growth on the adjacent rock face, there is no evidence of any accelerated or immediate risk to the inscription.

1.2 Diagnosis of preservation problems

There are three preservation problems which need to be managed at Shek Pik:

- Bio-contamination of the surface of the rock by micro-organisms.
- Long-term loss of definition of the inscription surface caused by the mechanical action of infiltrated water migrating through the rock to the surface of the carving.
- Potential vandalism of the site, due to the large number of visitors who pass by the site on the way to the annual Tin Hau Festival at Tei Tong Tsui.

1.3. Site constraints and environmental setting

The site of the Joss House Bay inscription is still within its original context above the Tin Hau temple, the foundation of which presumably predates the inscription and was (again, presumably) the object of the visit to the site by the Southern Song administrator who had the inscription carved in 1274.

The authenticity of the setting of the inscription is therefore very high.

Its location is also well-protected and shaded affording the inscription protection from the elements and from daily temperature differentials which may contribute to damaging the inscription.

The constraint of the location of the inscription is that it is located along the path to the Tin Hau Temple and at festival times many people pass pay the inscription, without necessarily have an interest in it or stake in its safeguarding.

1.4 Context, merits and issues of the current conservation practice

In 2006, the surface was cleaned and a biocide applied (Decon@90). A solution of isothiazolinon was also applied to control the bio-growth. This appears to have controlled the growth of micro-organisms on the surface of the carving, although some new growth was observed by this consultant. The source of the biological contamination is the wooded hill slope behind the rock carving. This could be better cut back and pruned. Renewed treatment with a biocide is also called for.

During the 2006 intervention a siloxane based hydrophobic agent was also applied to act as a water repellent. There is no evidence that this has had any beneficial effect and indeed it is a treatment of a effect without addressing the underlying cause, which is the infiltrated water in the rock – a problem common to all of the rock carvings and inscriptions in Hong Kong and due to the bedding structure of Hong Kong rock. There is no compelling reason to repeat this treatment and if it undertaken, must be accompanied by a rigorous on-site control. Rather geological modeling of the rock should be undertaken with a view to geo-technical intervention to divert the flow of water through the rock to the surface of the inscription.

The main problem contributing to the bio-growth on the rock, however, is the protective screen installed a few centimeters from the surface of the inscription. This has created a heat and humidity trap on the surface of the inscribed rock. Evidence for this is to be found in the degraded state of the Perspex of which the shelter itself is constructed – it has been attacked by the very same agents affecting the rock surface

2. Proposed solutions/improvements

2.1 Preservation and conservation strategy

2.1.1 Interim

There are three interim actions which need to be taken to improve the condition of the Joss House Bay inscription:

- Remove the Perspex screen, to increase the ventilation of the rock surface.
- Clean and re-apply the biocide to the rock surface.
- Improve the housekeeping and maintenance of the site, which involves pruning back the surrounding vegetation.

2.1.2 Long-term

There are also a number of medium to long-term actions which are recommended:

- Modeling by the Geological and Geo-technical Services of infiltration of water through fractures in the bedding of the rock onto the surface of the carving, followed by implementation of the recommended corrective measures.
- Monitoring of the effects of the application of biocide to the site, through on-site monitoring test patches.
- Construction of a better-designed protective shelter and visitor interpretation facilities at the site.

2.2 Requirements for intervention treatment

The long-term treatment for the Joss House Bay rock inscription is no different than that for the other rock carvings of Hong Kong. This consists of:

- Frequent periodic monitoring of the condition of the carving, following the establishment of a baseline monitoring data base using laser scanning.
- Geo-technical engineering to divert the flow of water through the fractures in the rock away from the carved surface.
- Application of an appropriate biocide if contamination with micro-organisms is identified.
- Construction of new, better-designed shelter to protect the carving and enhance its value as a public educational resource.

(Please refer to Part III.2 for a thorough discussion of these above points.)

2.3 Follow-up evaluation and documentation work

Required are:

- Laser scanning of the carving to establish a data baseline from which to monitor subsequent changes.
- Geo-technical study of water infiltration.

2.4 Resources implications

2.4.1 Interim

- As at all sites, investment will be required in laser scanning to create the required monitoring data base. This should be done as soon as budget resources permit.

2.4.2 Long-term

- As at all sites, the geological modeling and application of geo-technical engineering solutions to the problem of infiltrating water will require budgetary allocation to be implement by Geological Services.
- As at other sites, the construction of an improved shelter and a visitor information kiosk will require a budgetary allocation.

3. Risks

3.1 Identification and assessment of the risk factors

There are two ascertained risks to the rock inscription at Joss House Bay:

- Contamination of the site by micro-organisms.
- Possible vandalism at the site, due to the heavy traffic through the site during the Tin Hau Festival.

3.2 Risk Management

Risk management at Joss House Bay consists, in large part, of the same as the actions required at all other rock carving sites:

- Improved housekeeping/maintenance protocols, aimed at both preventing mechanical damage to the site, and at the early identification of bio-growth which can then be halted before it becomes a problem.
- Periodic monitoring based on a laser scan data base of the condition of the inscription.
- Geo-technical engineering solutions to the problems of water infiltration.
- The construction of an appropriately-designed structure to protect the inscription from mechanical damage, erosion, temperature differentials and the possibility of vandalism.

4. Conservation plan

4.1 Priority for intervention treatments

The priorities for intervention at Joss House Bay are application of the recommended medium to long-term conservation protocols applicable to all protected rock carvings in Hong Kong, viz.,

- (i) Undertake laser scanning of the rock inscription to create a baseline for future monitoring.
- (ii) Establish a schedule of frequent periodic monitoring, incorporating improved housekeeping arrangements for site maintenance.
- (iii) Application of biocide if biological contamination is identified.
- (iv) With assistance from Geological Services, model geo-technical options for preventing the flow of water through fractures in the rock onto the surface of the carving.
- (v) Undertake the recommended geo-technical engineering work.
- (vi) Design and construct a new shelter to protect the carving and for the purposes of enhanced visitor interpretation.

4.2 Implementation plans and 4.3 timeline for work

Recommendations (i), (ii) and (iii): Immediate incorporation into the routine work plan of AMO

Recommendations (iv), (v) and (vi): As soon as can be budgeted for under the normal budgetary cycle of the Government.

5. Recommendations on specialist supplies

5.1 Sources of specialist materials and service suppliers

Water Repellant. There is no compelling evidence that the application of a water repellant to the Joss House Bay inscription has any benefit, considering that the source of the water is from within the rock itself. If it is decided to continue this practice, it should be undertaken only after a rigorous on-site test has proven its efficacy.

Biocide. Application of a biocide at Joss House Bay should follow previously successful protocols, with the caveat that an on-site control test be established and maintained at this site and at all sites where a biocide, or any other chemical treatment, is applied. It might be sufficient to apply Decon@90 only without the subsequent application of isothiazolinon.

Shelter. It is recommended that in the construction of new shelters, which are required at all sites, no concrete is used in any location where there would be any danger of dissolved concrete coating the rock surface. Nor should untreated iron be used. Consideration should be given to the use of stainless steel, tempered, shatter-proof glass, wood and stone in the construction of the new shelters. The final choice of materials is a matter for the architecture specialists to decide.

Dam. As at many other rock carving sites, there is a small concrete dam which has been constructed above the Joss House Bay inscription. This dam should be carefully inspected during the rainy season and if it is not doing its job to divert water from the inscription, it should be

removed. It should be borne in mind that water flowing over the surface of the inscription is not harmful; in fact, it washes dust and other contaminants from the rock surface. What is damaging is the infiltration of water into the fractures within the structure of the rock which then percolates out through the rock and deposits minerals on the surface of the rock, disfiguring the inscription. If the dam above the inscription traps water and thereby encourages the water to seep into the rock fractures, the dam does more harm than good. Another negative effect of a concrete dam placed above an inscription or carved surface is that it can serve as the source of dissolved concrete leached onto the surface of the inscription.

5.2 Recommendations for outsourcing of site management (if necessary)

- As at all sites, there is the need for increased supervision of site housekeeping and maintenance. This is particularly so at Joss House Bay during the Tin Hau Festival season.
- As at the other sites, monitoring arrangements with local community stakeholder interests should be explored. In the case of the Joss House Bay inscription, the Tin Hau temple management committee should be interested in the maintenance of this site which is an integral part of the temple's history.
- The valuation of this site, like the other rock carving sites, can be enhanced through better visitor interpretation/education facilities and programmes which should be undertaken in cooperation with Education Department and Country Parks. This will contribute to the long-term safeguarding of the site.

INDIVIDUAL SITE ANALYSIS

SITE 3: ROCK INSCRIPTION AT JOSS HOUSE BAY

II.3.2 Photographs

Photo 1: Protective screen

Photo 2: The interface between the cleaned and uncleaned surface

Joss House Bay

Photo 1: The protective screen

Note: That the screen makes it very difficult to read the inscription. It also traps condensation behind the screen, keeping the surface of the inscription moist and warm – an environment conducive to bio-growth



Joss House Bay

Photo 1: Interface between cleaned and uncleaned surface



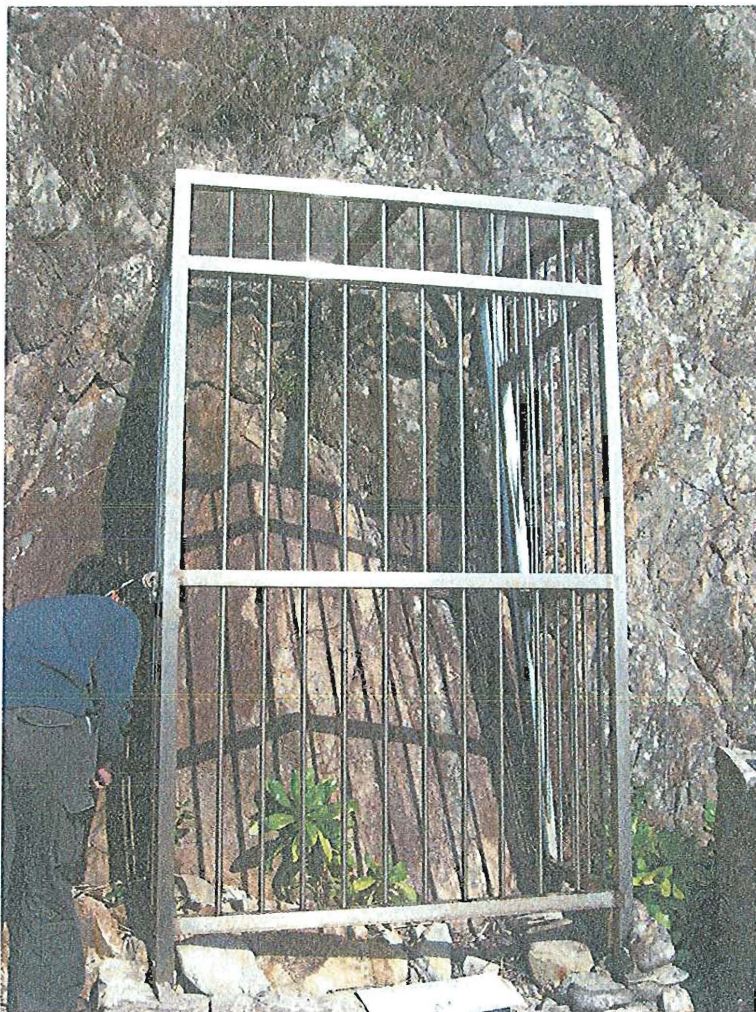
CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF HONG KONG

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SITE 4: ROCK CARVING AT KAU SAI CHAU

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- II.4.3 Analysis and Recommendations
- II.4.4 Photographs

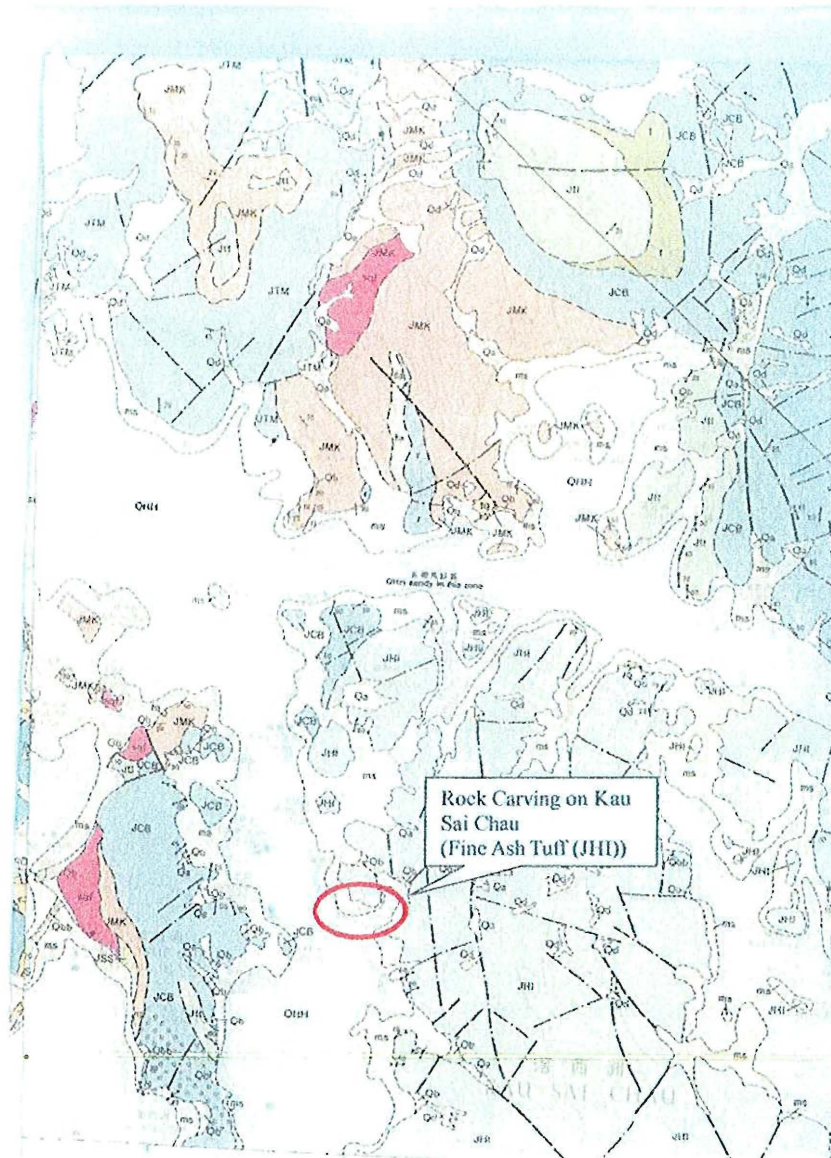


INDIVIDUAL SITE ANALYSIS

SITE 4: ROCK CARVING AT KAU SAI CHAU

II.4.1 Map

Location and Rock Composite of Rock Carving on Kau Sai Chau




INDIVIDUAL SITE ANALYSIS

SITE 4: ROCK CARVING AT KAU SAI CHAU

II.4.2 Data Sheet

4. Rock Carving at Kau Sai Chau

1. Date of Declaration	<ul style="list-style-type: none"> • 26 January 1979
2. History and background information	<ul style="list-style-type: none"> • Kau Sai Chau Rock Carving was discovered in 1976. It is located at the north-western coast of Kau Sai Island where accessibility by land is extremely poor. • The design itself is badly weathered, especially on its lower half. However, a zoomorphic motif is still visible when examined closely and carefully. The worked surface is approximately 2m above the highest water mark, which is a rather low position compared to similar rock carvings.
3. Protective Measures and Visitor's Facilities	<ul style="list-style-type: none"> • December 1978: Erection of a wire cage as temporary protection. • 1979: Erection of a monument plaque. • September 1986: Construction of a stainless steel cage, a channel above the carving, a concrete viewing platform and a monument plaque stand.
4. Present Condition and Past Treatment	<p><u>Present Condition.</u></p> <ul style="list-style-type: none"> • Overall condition of rock carving was stable. • Prosperous plant growth was found in front of protect cover.
5. Photo Reference	 <ul style="list-style-type: none"> • approx. 80 cm (W) x 100 cm (H)

INDIVIDUAL SITE ANALYSIS

SITE 4: ROCK CARVING AT KAU SAI CHAU

II.4.3 Analysis and Recommendations

KAU SAI CHAU: Analysis and Recommendations

1. Present Situation

1.1 Physical condition of the rock carvings

The rock carving at Kau Sai Chau is in poor, but stable, condition. The carving cannot be seen by the naked eye except at sunset with the right conditions. This is its found condition when discovered in 1976. There is no evidence any change since then, nor of any immediate risk.

1.2 Diagnosis of preservation problems

There are four possible preservation problems which need to be managed at Kau Sai Chau:

- The possibility of the growth of micro-organisms on the rock surface, due to contamination from plant growth above the rock carving.
- Damage to the rock surface from wind and water erosion. The carving is located just above the high tide line and thus subject to wave erosion during storms.
- Spalling of the rock face caused by the mechanical action of infiltrated water migrating through the rock to the surface of the carving.
- Damaging to the carving from falling rock, as the rock face above the carved surface is unstable.

1.3. Site constraints and environmental setting

The rock carving at Kau Sai Chau is not accessible to the public. There is no footpath and there is no boat landing near the carving. This inaccessibility protects the site from possible vandalism.

However, as mentioned above in section 1.2, the carving is in a vulnerable location because it is near to the high tide line which exposes it to wave erosion and salt contamination. Furthermore, the rock face above the carving is unstable and the carving could possibly be damaged by falling rock.

1.4 Context, merits and issues of the current conservation practice

There has been no conservation intervention at the site with the exception of the removal of plant growth in the immediate vicinity of the carving.

No surface treatment has been carried out and no is required.

However, stabilization of the rock face above the carving should be considered and/or the carving protected from falling rock by a roofed shelter.

2. Proposed solutions/improvements

2.1 Preservation and conservation strategy

- Monitoring of biological growth on the carving and treatment with isothiazolinon or a similar agent, if required. This should be a part of the routine monitoring protocol for the site, but should be undertaken if biological contamination is verified.

- Stabilization of the rock face above the carving done with the assistance of Geo-technical Services.
- Modeling by the Geological and Geo-technical Services of infiltration of water through fractures in the bedding of the rock onto the surface of the carving, followed by implementation of the recommended corrective measures.
- Construction of a better-designed shelter and visitor interpretation kiosk at the site.

2.2 Requirements for intervention treatment

The intervention treatment protocol for the Kau Sai Chau rock carving is no different than that for the other rock carvings of Hong Kong. This consists of:

- Frequent periodic monitoring of the condition of the carving, following the establishment of a baseline monitoring data base using laser scanning.
- Application of an appropriate biocide if contamination with micro-organisms is identified.
- Construction of new, better-designed shelter to protect the carving and enhance its value as a public educational resource.
- Geo-technical engineering to divert the flow of water through the fractures in the rock away from the carved surface.

(Please refer to Part III.2 for a thorough discussion of these above points.)

2.3 Follow-up evaluation and documentation work

Required are:

- Laser scanning of the carving to establish a data baseline from which to monitor subsequent changes.
- Periodic monitoring of bio-growth on the rock surface.
- Geo-technical study of water infiltration and its effect on slope stability.

2.4 Resources implications

2.4.1 Interim

- As at all sites, investment will be required in laser scanning to create the required monitoring data base. This should be done as soon as budget resources permit.

2.4.2 Long-term

- As at all sites, the geological modeling and application of geo-technical engineering solutions to the problem of infiltrating water will require budgetary allocation to be implement by Geological Services.
- In addition, at Kau Sai Chau the assistance of Geo-technical Services in stabilizing the slope above the carving will require budgetary support.

- As at other sites, the construction of an improved shelter and on-site visitor information will require a budgetary allocation. It may be considered necessary to construct a hiking trail to the Kau Sai Chau carving, which otherwise is inaccessible to the public. Country Parks should be consulted on this matter.

3. Risks

3.1 Identification and assessment of the risk factors

- The only ascertained risk affecting the Kau Sai Chau rock carving is from falling rock from the unstable slope above.
- As at all sites, another possible risk comes from the mechanical action of infiltrated water.
- A third risk at Kau Sai Chau comes from the poorly designed existing shelter which does not protect the carving from any of the ascertained risks to the site, but rather calls attention to the site in a negative way inviting abuse.

3.2 Risk Management

Risk management at Kau Sai Chau consists of the same basic package of actions as at all other rock carving sites:

- More frequent site visits and improved housekeeping/maintenance protocols, aimed at both preventing mechanical damage to the site, and at the early identification of bio-growth which can then be halted before it becomes a problem.
- Periodic monitoring based on a laser scan data base of the condition of the carving.
- Geo-technical engineering solutions to the problems of water infiltration and slope stability.
- The construction of an appropriately-designed structure to protect the rock carving from wind erosion, temperature differentials, falling rock and the possibility of vandalism.

4. Conservation plan

4.1 Priority for intervention treatments

Application of the recommended standard medium to long-term conservation protocols applicable to all protected rock carvings in Hong Kong, viz.,

- (i) Undertake laser scanning of the rock carving to create a baseline for future monitoring.
- (ii) Establish a schedule of frequent periodic monitoring, incorporating improved housekeeping arrangements for site maintenance.
- (iii) Application of biocide if biological contamination is identified.
- (iv) With assistance from Geological Services, model geo-technical options for preventing the flow of water through fractures in the rock onto the surface of the carving, and to insure slope stability.
- (v) Undertake the recommended geo-technical engineering work.

- (vi) Design and construct a new shelter to protect the carving and for the purposes of enhanced visitor interpretation. If no new shelter is to be constructed at Kau Sai Chau, the existing shelter should be removed. (See section 5.1 below.)

4.2 Implementation plans and 4.3 timeline for work

Recommendations (i), (ii) and (iii): Immediate incorporation into the routine work plan of AMO

Recommendations (iv), (v) and (vi): As soon as can be budgeted for under the normal budgetary cycle of the Government.

5. Recommendations on specialist supplies

5.1 Sources of specialist materials and service suppliers

Biocide. There is no call for the application of a biocide at Big Wave Bay until and unless biological contamination is confirmed. If undertaken, it is recommended that an on-site control test be established and maintained at this site and at all sites where a biocide, or any other chemical treatment, is applied.

A simple routine maintenance involving the removal of vegetation from the immediate vicinity of the carving should suffice.

Shelter. It is recommended that in the construction of new shelters, which are required at all sites, no concrete is used in any location where there would be any danger of dissolved concrete coating the rock surface. Nor should untreated iron be used. Consideration should be given to the use of stainless steel, tempered, shatter-proof glass, wood and stone in the construction of the new shelters. The final choice of materials is a matter for the architecture specialists to decide.

It should be noted that the existing shelter at Kau Sai Chau is particularly ineffective in protecting the carving from wave erosion, fallen rock or vandalism. It only serves to "imprison" the carving and thus devalue it – perhaps even inviting abuse to the carving. This shelter should be removed, even if no other shelter is built.

5.2 Recommendations for outsourcing of site management (if necessary)

- As at all sites, there is the need for increased supervision of site housekeeping and maintenance.
- As at the other sites, monitoring arrangements with local community stakeholder interests should be explored. In particular, Country Parks should be encouraged to take an interest in this site, as an expansion of its system of walking trails on Kau Sai Chau island.
- The valuation of this site, like the other rock carving sites, can be enhanced through better visitor interpretation/education facilities and programmes which should be undertaken in cooperation with Education Department and Country Parks. This will contribute to the long-term safeguarding of the site.

INDIVIDUAL SITE ANALYSIS

SITE 4: ROCK CARVING AT KAU SAI CHAU

II.4.4 Photographs

Photo 1: Cliff with loose rocks above the carving

Photo 2: Close of protective structure interface with rock surface

Kau Sai Chau

Photo 1: Cliff with loose rocks above the carving



Kau Sai Chau

Photo 2: Close of protective structure interface with rock surface

Note: Poor construction of the structure damages the rock



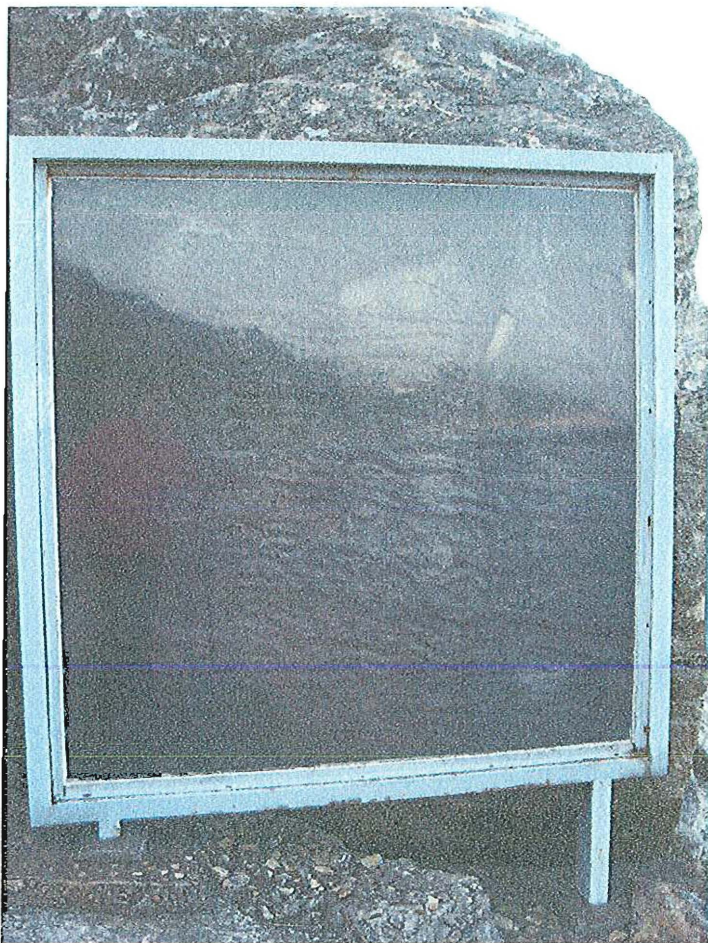
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PART II INDIVIDUAL SITE ANALYSIS

SITE 5: ROCK CARVING AT LUNG HA WAN

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- II.5.2 Data Sheet (provided by AMO)
- II.5.3 Analysis and Recommendations
- II.5.4 Photographs (courtesy Dr. Karen Wai-yin FONG)



INDIVIDUAL SITE ANALYSIS

SITE 5: ROCK CARVING AT LUNG HA WAN


II.5.1 Map

INDIVIDUAL SITE ANALYSIS

SITE 5: ROCK CARVING AT LUNG HA WAN

II.5.2 Data Sheet

5. Rock Carving at Lung Ha Wan

1. Date of Declaration	<ul style="list-style-type: none"> 4 March 1983
2. History and background information	<ul style="list-style-type: none"> Discovered in 1978 by a group of hikers, the Lung Ha Wan Rock Carving is located on a vertical face of a badly weathered boulder facing east. The design shows geometric patterns, some may resemble stylised animals or bird forms. There is though another school of thought suggesting that it is purely the work of nature. While this academic discussion still continues, the rock carving, or pattern, has been protected under the Antiquities & Monuments Ordinance. This would allow the opportunity for it to be further studied.
3. Protective Measures and Visitor's Facilitie	<ul style="list-style-type: none"> December 1981: Erection of a protective screen. October 1984: Construction of a new protective glass screen, a monument plaque, a concrete path and a direction sign board. May 1990: Construction of a new stainless steel frame, directional signage and railing along the steps of the concrete path.
4. Present Condition and Past Treatment	<p><u>Present Condition.</u></p> <ul style="list-style-type: none"> Overall condition of rock carving was stable. <p><u>Past Treatment in 2006</u></p> <ul style="list-style-type: none"> Cleaned with soft bristle brush for removing dust and loose vegetation. Applied silicic acid ethyl ester based stone strengthener (Remmer 300) to consolidate the rock carving. Applied siloxane based hydrophobic agent (Remmer SNL) to act as water-repelling layer to avoid air pollutants deposition and pest infestation.
5. Photo Reference	 <ul style="list-style-type: none"> approx. 1.4 m (W) x 1.4 m (H)

INDIVIDUAL SITE ANALYSIS

SITE 5: ROCK CARVING AT LUNG HA WAN

II.5.3 Analysis and Recommendations

LUNG HA WAN: Analysis and Recommendations

1. Present Situation

1.1 Physical condition of the rock carvings

The rock carving at Lung Ha Wan is in poor, but stable condition. It is highly eroded, but this is the cumulative of centuries of exposure. There is no evidence of any accelerated or immediate risk to the site.

1.2 Diagnosis of preservation problems

There are two preservation problems which need to be managed at Lung Ha Wan:

- Damage to the rock surface from wind erosion.
- Loss of rock caused by the mechanical action of infiltrated water migrating through the rock to the surface of the carving.

1.3. Site constraints and environmental setting

The site of Lung Ha Wan is very exposed to wind erosion to the point that it is still a matter of debate among experts whether this is a genuine archaeological artifact, or if what appears to be carving is only the result of centuries of wind erosion of the nature rock surface, which, like most of the rocks of Hong Kong is riddled with small bedding fractures and mineral inclusions. These variations in the structure of the rock result in differential weather, whether or not the surface has been purposefully carved by humans.

1.4 Context, merits and issues of the current conservation practice

In 2006, the surface was cleaned and consolidated with Remmer 300, a silicic acid ethyl ester-based stone strengthener. While treatment appears to have done no damage to the carving, its beneficial effects are also negligible. In treating a cause with a history of many centuries of graduate progress, it is doubtful that chemical surface intervention can be effective unless it too can be applied continually over a matter of centuries.

Furthermore, there is the issue of accumulated inert materials in the crevasses in the rock surface which will most certainly interfere with the ability of the surface to “breathe” that is to say, for water within the rock (a common problem in Hong Kong) to evaporate when it reaches the surface of the rock. Water trapped behind an inert barrier will be subject to increased pressure as the water builds up behind it and as the daily thermal differentials expand and contract the trapped water, the resultant mechanical action will fracture off small parts of the rock surface, contributing to the overall deterioration of the surface.

2. Proposed solutions/improvements

2.1 Preservation and conservation strategy

There is no immediate action which must be taken to protect the Lung Ha Wan rock carving. There are, however, a number of medium to long-term actions which are recommended:

- Modeling by the Geological and Geo-technical Services of infiltration of water through fractures in the bedding of the rock onto the surface of the carving, followed by implementation of the recommended corrective measures.
- Monitoring of the effects of the application of Remmer 300 to the surface, through on-site monitoring test patches.
- Monitoring of biological growth on the carving and treatment with a biocide, if required. This should be a part of the routine monitoring protocol for the site, but should be undertaken only if biological contamination is verified.
- Construction of a better-designed shelter and visitor interpretation kiosk at the site. The present protective shelter at Lung Ha Wan is ineffective in protecting the carving from wind erosion and probably increases the velocity of the wind flowing across the carved surface.
- Improvement of the pathway and handrail down to the site, which are not up to prevailing safety standards.

2.2 Requirements for intervention treatment

The long-term treatment for the Lung Ha Wan rock carving is no different than that for the other rock carvings of Hong Kong. This consists of:

- Frequent periodic monitoring of the condition of the carving, following the establishment of a baseline monitoring data base using laser scanning.
- Geo-technical engineering to divert the flow of water through the fractures in the rock away from the carved surface.
- Application of an appropriate biocide if contamination with micro-organisms is identified.
- Construction of new, better-designed shelter to protect the carving and enhance its value as a public educational resource.

(Please refer to Part III.2 for a thorough discussion of these above points.)

2.3 Follow-up evaluation and documentation work

Required are:

- Laser scanning of the carving to establish a data baseline from which to monitor subsequent changes.
- Geo-technical study of water infiltration.
- Geological study to determine the authenticity of the presumed carving. The credibility of the AMO is at stake if it protects as a cultural monument something which is not; conversely if it does not adequately protect an archaeological relic which is authentic.

2.4 Resources implications

2.4.1 Interim

- As at all sites, investment will be required in laser scanning to create the required monitoring data base. This should be done as soon as budget resources permit.

2.4.2 Long-term

- As at all sites, the geological modeling and application of geo-technical engineering solutions to the problem of infiltrating water will require budgetary allocation to be implemented by Geological Services.
- As at other sites, the construction of an improved shelter and a visitor information kiosk will require a budgetary allocation.
- At Lung Ha Wan, investment is also required for upgrading the pathway down to the site to required safety standards.

3. Risks

3.1 Identification and assessment of the risk factors

- The one ascertained risk at Lung Ha Wan comes from the long-term effects of wind erosion. The protective shelter must be redesigned with this in mind.
- Another possible risk comes from the mechanical action of infiltrated water affecting the vulnerability of the carved surface to enhanced effects of erosion.

3.2 Risk Management

Risk management at Lung Ha Wan consists of the same actions as at all other rock carving sites:

- Improved housekeeping/maintenance protocols, aimed at both preventing mechanical damage to the site, and at the early identification of bio-growth which can then be halted before it becomes a problem.
- Periodic monitoring based on a laser scan data base of the condition of the carving.
- Geo-technical engineering solutions to the problems of water infiltration.
- The construction of an appropriately-designed structure to protect the rock carving from wind erosion, temperature differentials and the possibility of vandalism.
- Furthermore, at Lung Ha Wan, improved visitor access is required for the purposes of public safety and security.

4. Conservation plan

4.1 Priority for intervention treatments

Application of the recommended standard medium to long-term conservation protocols applicable to all protected rock carvings in Hong Kong, viz.,

- (i) Undertake laser scanning of the rock carving to create a baseline for future monitoring.
- (ii) Establish a schedule of frequent periodic monitoring, incorporating improved housekeeping arrangements for site maintenance.

- (iii) Application of biocide if biological contamination is identified.
- (iv) With assistance from Geological Services, model geo-technical options for preventing the flow of water through fractures in the rock onto the surface of the carving.
- (v) Undertake the recommended geo-technical engineering work.
- (vi) Design and construct a new shelter to protect the carving and for the purposes of enhanced visitor interpretation. At Lung Ha Wan, attention must be paid to the providing appropriate, safe public access to the site.

4.2 Implementation plans and 4.3 timeline for work

- | | |
|--------------------------------------|--|
| Recommendations (i), (ii) and (iii): | Immediate incorporation into the routine work plan of AMO |
| Recommendations (iv), (v) and (vi): | As soon as can be budgeted for under the normal budgetary cycle of the Government. |

5. Recommendations on specialist supplies

5.1 Sources of specialist materials and service suppliers

Consolidant. The application of a stone strengthener (consolidant) should be discontinued until such time as controlled on-site experiment demonstrates that it is effective in the long-term. To continue to apply an unproven chemical treatment to the stone is potentially damaging to the long-term condition of the carving; at best it is an unproven, and therefore unjustifiable use of public resources.

Biocide. Application of a biocide at Lung Ha Wan should be done only if biological contamination is confirmed. If undertaken, it is recommended that an on-site control test be established and maintained at this site and at all sites where a biocide, or any other chemical treatment, is applied.

Shelter. It is recommended that in the construction of new shelters, which are required at all sites, no concrete is used in any location where there would be any danger of dissolved concrete coating the rock surface. Nor should untreated iron be used. Consideration should be given to the use of stainless steel, tempered, shatter-proof glass, wood and stone in the construction of the new shelters. The final choice of materials is a matter for the architecture specialists to decide.

It is worth noting that at Lung Ha Wan, the shelter to protect the carving from wind erosion must be so designed so as not to increase the wind velocity across the surface of the carving.

5.2 Recommendations for outsourcing of site management (if necessary)

- As at all sites, there is the need for increased supervision of site housekeeping and maintenance. In Lung Ha Wan, this pertains especially to the public access route to the site, the jurisdiction of which is unclear.
- As at the other sites, monitoring arrangements with local community stakeholder interests should be explored. In the case of Lung Ha Wan, Country Parks should be interested in the maintenance of this site which is situated along a hiking trail.
- The valuation of this site, like the other rock carving sites, can be enhanced through better visitor interpretation/education facilities and programmes which should be undertaken in

cooperation with Education Department and Country Parks. This will contribute to the long-term safeguarding of the site.

INDIVIDUAL SITE ANALYSIS

SITE 5: ROCK CARVING AT LUNG HA WAN

II.5.4 Photographs

Photo 1: Protective screen

Photo 2: Close up of results of wind erosion

Lung Ha Wan

Photo 1: Protective screen



Lung Ha Wan

Photo 2: Close up of results of wind erosion



CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF HONG KONG

PART II INDIVIDUAL SITE ANALYSIS

SITE 6: ROCK CARVING AT TUNG LUNG ISLAND

Contents

- II.6.1 Map: location and rock composite (provided by AMO)
- II.6.2 Data Sheet (provided by AMO)
- II.6.3 Analysis and Recommendations
- II.6.4 Photographs (courtesy Dr. Karen Wai-yin FONG)

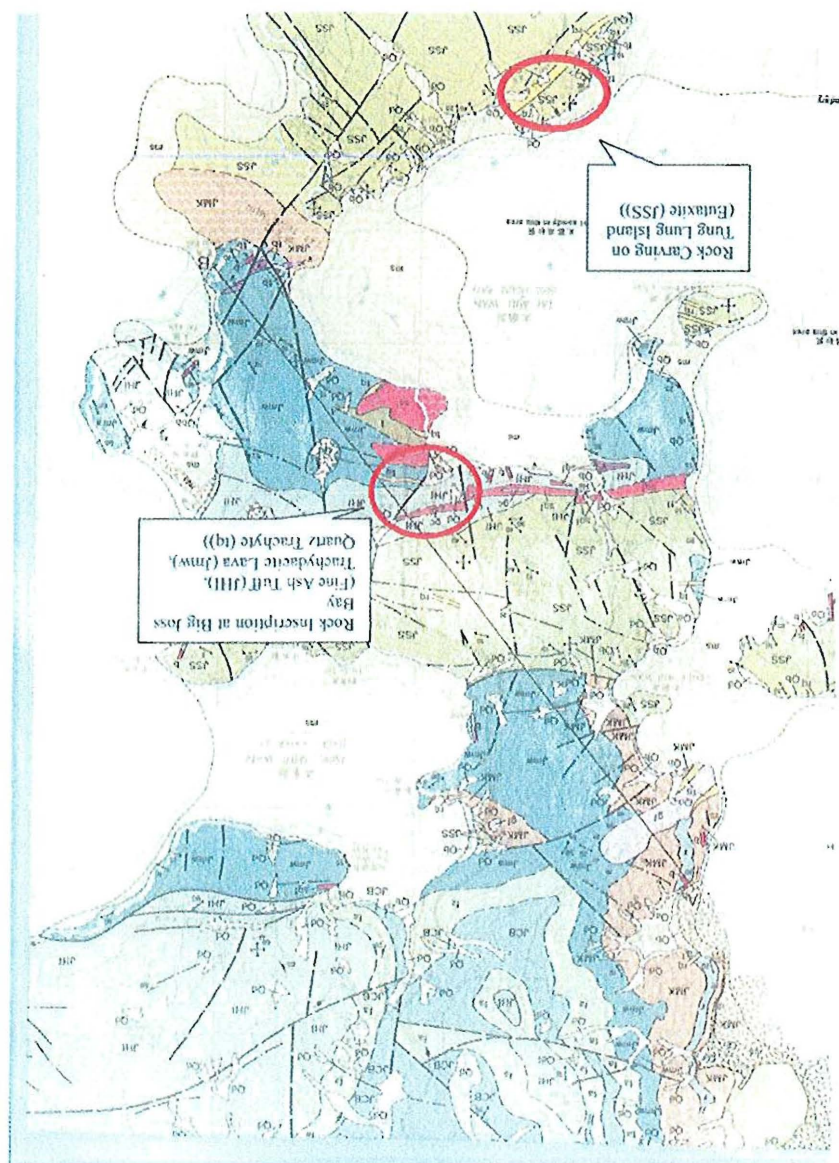


PART II
INDIVIDUAL SITE ANALYSIS

SITE 6: ROCK CARVING AT TUNG LUNG ISLAND

II.6.1 Map

Location and Rock Composite of Rock Carving on Tung Lung Island and
Rock Inscription at Big Joss Bay




**PART II
INDIVIDUAL SITE ANALYSIS**

SITE 6: ROCK CARVING AT TUNG LUNG ISLAND

II.6.2 Data Sheet

6. Rock Carving at Tung Lung Island

1. Date of Declaration	<ul style="list-style-type: none"> • 26 January 1979
2. History and background information	<ul style="list-style-type: none"> • This is the earliest recorded in-situ rock carving in the territory. There was an entry in the 1819 Xinan Gazetteer, compiled by Wang Chong Xi, stating that the impression depicts the image of a dragon. It is also the largest carving ever found in Hong Kong, measuring 1.8m by 2.4m.
3. Protective Measures and Visitor's Facilities	<ul style="list-style-type: none"> • March 1983: A protective shelter with four-panel polycarbonate sheets and protective screens and metal bars was built. • 1993: A landslide resulted in the closure of the footpath from the ferry pier leading to the carving and a temporary alternative footpath was built. • 1995: A landslide led to the closure of the footpath to the carving and a new footpath from the ferry pier to the lookout located at the top of the rock carving was built. • 2005: A new access road from the lookout located at the top of the rock carving to the rock carving was completed.
4. Present Condition and Past Treatment	<p><u>Present Condition.</u></p> <ul style="list-style-type: none"> • Overall condition of rock carving was stable. <p><u>Past Treatment in 2006</u></p> <ul style="list-style-type: none"> • Cleaned with soft bristle brush for removing dust and loose vegetation. • The surface was cleaned with biodegradable and non-ionic surfactant (Decon@90) and then rinsed thoroughly with water.
5. Photo Reference	 <ul style="list-style-type: none"> • approx. 3 m (W) x 2 m (H)

PART II
INDIVIDUAL SITE ANALYSIS

SITE 6: ROCK CARVING AT TUNG LUNG ISLAND

II.6.3 Analysis and Recommendations

TUNG LUNG: Analysis and Recommendations

1. Present Situation

1.1 Physical condition of the rock carvings

The rock carving at Tung Lung is in stable condition with no evidence of any immediate risk.

In 2006, the surface was cleaned and treated with a biocide (Decon@90). This appears to have been effective in controlling the growth of micro-organisms on the carving.

1.2 Diagnosis of preservation problems

There are six possible types of preservation problem which need to be managed at Tung Lung:

- The stability of the rock itself, as it is undermined by wave action and is at present supported on a concrete plinth. The hill slope behind the carving is unstable, having suffered several landslips over the past two decades.
- The possibility of the growth of micro-organisms on the rock surface, due to contamination from plant growth above the rock carving.
- Damage to the rock surface from wind erosion.
- Spalling of the rock face caused by the mechanical action of infiltrated water migrating through the rock to the surface of the carving.
- Deterioration of the supporting concrete plinth. Although this is a long-term issue, failure of the supporting concrete plinth would cause the carving to crack away from the parent rock and fall into the sea. There is, however, no immediate danger of this happening.
- Vandalism, as this is the only site where there perhaps has been some purposeful vandalism – not to carving itself, but to the protective shelter. This incident occurred two years ago.

1.3. Site constraints and environmental setting

The site is very exposed to undermining wave action, thus the need for a supporting concrete plinth.

Furthermore, the carving is located next to a large fracture in the parent rock, filled with a loose clay matrix. This increases the instability of the slope in the carving.

The carving is exposed to wind erosion facing WNW into the channel.

1.4 Context, merits and issues of the current conservation practice

In 2006, the surface was cleaned with a non-ionic surfactant and then rinsed with water. This treatment appears to have been effective in cleaning the surface of the rock and in controlling biological growth. The treatment has had no negative impact which can be discerned. However, like all treatments, on-site control tests should be maintained in order to monitor the medium-term impact of any and all treatments.

In common with other rock carving sites, the housekeeping and monitoring protocols can be improved. Vegetation is growing near and shelter, which is to say, very near to the carving itself. This should be removed.

Common to many other rock carving sites, attempts have been made to control the flow of water onto the surface of the carving through the construction of concrete dams above the carvings. Most of these appear to be ineffective. However, the dams at Tung Lung are constructed far above the carvings and well inland. They do appear to function to limit the amount of water which is able to infiltrate into the rock behind the carvings and percolate out through the fissures in the rock onto the carved surface.

2. Proposed solutions/improvements

2.1 Preservation and conservation strategy

2.1.1 Interim

There are no immediate emergency actions which need to be taken to safeguard the rock carving at Tung Lung.

2.1.2 Long-term

There are, however, a number of medium to long-term actions which are recommended:

- Modeling by the Geological and Geo-technical Services of slope stability and that of the supporting concrete plinth, followed by corrective measures, if any are recommended.
- Modeling by the Geological and Geo-technical Services of infiltration of water through fractures in the bedding of the rock onto the surface of the carving, followed by implementation of the recommended corrective measures.
- Monitoring of biological growth on the carving and treatment with a biocide, if required. This should be a part of the routine monitoring protocol for the site, but should be undertaken only if biological contamination is verified.
- Construction of a better-designed shelter and visitor interpretation kiosk at the site.
- Monitoring of the condition of the concrete supporting plinth.

2.2 Requirements for intervention treatment

The long-term treatment for the Tung Lung rock carving is no different than that for the other rock carvings of Hong Kong. This consists of:

- Frequent periodic monitoring of the condition of the carving, following the establishment of a baseline monitoring data base using laser scanning.
- Geo-technical engineering to divert the flow of water through the fractures in the rock away from the carved surface, and to ensure slope stability.
- Application of an appropriate biocide if contamination with micro-organisms is identified.
- Construction of new, better-designed shelter to protect the carving and enhance its value as a public educational resource.

- In addition, at Tung Lung, attention must be paid to the condition of the concrete supporting plinth, which will deteriorate over time and will need to be repaired or replaced.

(Please refer to Part III.2 for a thorough discussion of these above points.)

2.3 Follow-up evaluation and documentation work

Required are:

- Laser scanning of the carving to establish a data baseline from which to monitor subsequent changes.
- Periodic monitoring of bio-growth on the rock surface.
- Geo-technical study of water infiltration and slope stability.
- Condition assessment of the condition of the supporting concrete plinth.

2.4 Resources implications

2.4.1 Interim

- As at all sites, investment will be required in laser scanning to create the required monitoring data base. This should be done as soon as budget resources permit.

2.4.2 Long-term

- As at all sites, the geological modeling and application of geo-technical engineering solutions to the problem of infiltrating water and slope stability will require budgetary allocation to be implement by Geological Services.
- As at other sites, the construction of an improved shelter will require a budgetary allocation.

3. Risks

3.1 Identification and assessment of the risk factors

- One ascertained risk at Tung Lung is vandalism. The protective shelter must be redesigned with this in mind.
- Another possible risk comes from the mechanical action of infiltrated water affecting both the stability of the slope and the vulnerability of the carved surface to enhanced effects of erosion.
- A third, longer-term, risk comes from the gradual deterioration of the concrete supporting plinth.

3.2 Risk Management

Risk management at Tung Lung consists of the same actions as at all other rock carving sites:

- Improved housekeeping/maintenance protocols, aimed at both preventing mechanical damage to the site, and at the early identification of bio-growth which can then be halted before it becomes a problem.

- Periodic monitoring based on a laser scan data base of the condition of the carving.
- Geo-technical engineering solutions to the problems of water infiltration and slope stability.
- The construction of an appropriately-designed structure to protect the rock carving from wind erosion, temperature differentials and the possibility of vandalism.

4. Conservation plan

4.1 Priority for intervention treatments

Application of the recommended standard medium to long-term conservation protocols applicable to all protected rock carvings in Hong Kong, viz.,

- (i) Undertake laser scanning of the rock carving to create a baseline for future monitoring.
- (ii) Establish a schedule of frequent periodic monitoring, incorporating improved housekeeping arrangements for site maintenance.
- (iii) Application of biocide if biological contamination is identified.
- (iv) With assistance from Geological Services, model geo-technical options for preventing the flow of water through fractures in the rock onto the surface of the carving and for ensuring slope stability.
- (v) Undertake the recommended geo-technical engineering work.
- (vi) Design and construct a new shelter to protect the carving and for the purposes of enhanced visitor interpretation. At Tung Lung, attention must be paid to the possibility of vandalism.

4.2 Implementation plans and 4.3 timeline for work

Recommendations (i), (ii) and (iii):	Immediate incorporation into the routine work plan of AMO
Recommendations (iv), (v) and (vi):	As soon as can be budgeted for under the normal budgetary cycle of the Government.

5. Recommendations on specialist supplies

5.1 Sources of specialist materials and service suppliers

Biocide. Application of a biocide at Tung Lung should be done only if biological contamination is confirmed. If undertaken, it is recommended that an on-site control test be established and maintained at this site and at all sites where a biocide, or any other chemical treatment, is applied.

Shelter. It is recommended that in the construction of new shelters, which are required at all sites, no concrete is used in any location where there would be any danger of dissolved concrete coating the rock surface. Nor should untreated iron be used. Consideration should be given to the use of stainless steel, tempered, shatter-proof glass, wood and stone in the construction of the new shelters. The final choice of materials is a matter for the architecture specialists to decide.

It is worth noting that the new shelter at Tung Lung should be vandal-proof.

5.2 Recommendations for outsourcing of site management (if necessary)

- As at all sites, there is the need for increased supervision of site housekeeping and maintenance.
- As at the other sites, monitoring arrangements with local community stakeholder interests should be explored. In the case of Tung Lung, Country Parks should be interested in the maintenance of this site which is situated along a hiking trail.
- The valuation of this site, like the other rock carving sites, can be enhanced through better visitor interpretation/education facilities and programmes which should be undertaken in cooperation with Education Department and Country Parks. This will contribute to the long-term safeguarding of the site. As the Tung Lung rock carving has been known since its report in the Xinan Gazetteer of 1819, the interpretation of this rock carving may hold the key to the interpretation of the corpus of rock carvings in Hong Kong.

PART II INDIVIDUAL SITE ANALYSIS

SITE 6: ROCK CARVING AT TUNG LUNG ISLAND

II.6.4 Photographs

Photo 1: Cracks in bedding of the rock through which water migrates to surface, deposits dissolved mineral stain on surface, and creates a moist environment conducive to the growth of micro-organisms

Photo 2: The concrete plinth underpinning the boulder on which the Tung Lung carving is located. The failure of this concrete plinth is a long-term risk for the safeguarding of the site.

Tung Lung

Photo 1: Cracks in bedding of the rock through which water migrates to surface, deposits dissolved mineral stain on surface, and creates a moist environment conducive to the growth of micro-organisms



Tung Lung

Photo 2: The concrete plinth underpinning the boulder on which the Tung Lung carving is located. The failure of this concrete plinth is a long-term risk for the safeguarding of the site.



CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF HONG KONG

PART II INDIVIDUAL SITE ANALYSIS

SITE 7: ROCK CARVING AT CHEUNG CHAU

Contents

- II.7.1 Map: location and rock composite (provided by AMO)**
- II.7.2 Data Sheet (provided by AMO)**
- II.7.3 Analysis and Recommendations**
- II.7.4 Photographs (there are no photographs of Cheung Chau available from the Consultant's mission, as the photo disk prepared by AMO is blank)**

PART II
INDIVIDUAL SITE ANALYSIS

SITE 7: ROCK CARVING AT CHEUNG CHAU


II.7.1 Map

PART II
INDIVIDUAL SITE ANALYSIS

SITE 7: ROCK CARVING AT CHEUNG CHAU

II.7.2 Data Sheet

7. Rock Carvings at Cheung Chau

1. Date of Declaration	<ul style="list-style-type: none"> 22 January 1982
2. History and background information	<ul style="list-style-type: none"> Cheung Chau Rock Carvings were reported by a geologist in 1970, the same year when Big Wave Bay Rock Carving was discovered. They are situated at the south-eastern end of the tombolo forming the island, immediately below the Warwick Hotel. They consist of two groups of similar design with several carved lines surrounding small depressions. The second group was not completely exposed when found and could only be fully revealed after removal of soil.
3. Protective Measures and Visitor's Facilities	<ul style="list-style-type: none"> December 1978: Erection of a wire cage as temporary protection. 1983: Construction of cement steps to the Rock Carving. September 1986: Construction of protective cage with glass.
4. Present Condition and Past Treatment	<p><u>Present Condition.</u></p> <ul style="list-style-type: none"> Overall condition of rock carving was stable. Stains of microbiological growth were found on the surface.
5. Photo Reference	 <ul style="list-style-type: none"> approx. 0.3m (W) x 0.4m (H);

**PART II
INDIVIDUAL SITE ANALYSIS**

SITE 7: ROCK CARVING AT CHEUNG CHAU

II.7.3 Analysis and Recommendations

CHEUNG CHAU: Analysis and Recommendations

1. Present Situation

1.1 Physical condition of the rock carvings

Of all the rock carvings examined by this consultant only the Cheung Chau rock carving showed evidence of on-going and accelerating deterioration. Decomposition of the rock is evidenced by quantities of rock dust at the base of the upper-most carving. This deterioration is probably due to the presence of active micro-organism growth, although this must be confirmed by a specialist botanist.

This is a condition of urgency, which must be addressed and corrected immediately.

1.2 Diagnosis of preservation problems

The growth of micro-organism on the Cheung Chau carving (if confirmed) can be attributed to two linked factors:

- (i) Addition of water to the rock immediately above the carving, caused by frequent watering by hotel staff of flowers planted in a small bed on the top of the rock directly above the carving. This daily watering introduces a constant supply of water into the parent boulder. Because of the fractures in the natural bedding of the stone, this water percolates out onto the surface of the carving providing a moist environment conducive to the growth of micro-organisms. The water also carries dissolved nutrients from the soil above (and perhaps even added fertilizers, although the consultant could not check if this were or were not the case.) These dissolved nutrients feed the micro-organisms growth.
- (ii) The problem is most severe on the upper-most carving because the water which reaches the surface of the rock cannot readily evaporate due to the fact that the shape of the boulder shelters the carved surface from prevailing breezes. Furthermore – and most importantly -- the glass roof of the shelter is very near the affected carved surface, focusing sunlight on the area and creating a heat and humidity trap. The micro-environment so created is conducive to the growth of micro-organisms by ensuring that the relative humidity remains above 64% -- the threshold for the optimum growth of micro-organisms.

1.3. Site constraints and environmental setting

The Cheung Chau rock carving is unique among the Hong Kong rock carvings as it is located on privately-held land. Although the owners of the land cannot be identified having been deceased without heirs, it is nonetheless necessary for the staff of the AMO to seek and receive the permission of the Chief Executive each time they wish to do conservation work at the site. As a consequence of this cumbersome administrative requirement, the site does not receive conservation attention with the same regularity as other sites. This relative neglect has resulted in the poor condition of the carving.

1.4 Context, merits and issues of the current conservation practice

Because of the situation explained in 1.3 above, there is no history of conservation treatment for the Cheung Chau rock carving.

Furthermore, the protective glass shelter which dates from 1986, while more attractive than many other shelters constructed at other rock carving sites, is a major contributor to the on-going deterioration of the carving because of the micro-environment created by this shelter which encourages the growth of micro-organisms.

2. Proposed solutions/improvements

2.1 Preservation and conservation strategy

2.1.1 Interim

- Permission should be sought from the Chief Executive for AMO to undertake the necessary emergency diagnosis and conservation treatment.
- Dialogue should be engaged with the owners of the hotel with the aim to stop the practice of watering the flower bed above the rock carving and to remove the flowers and soil. As this affects only three small plants in an area not visible to the hotel's clientele, this should not be a difficult objective to achieve.

2.1.2 Long-term

- A standing executive order should be sought from the Chief Executive giving AMO unconditional access to the Cheung Chau carving and permission to undertake the conservation work it deems necessary, whenever necessary, without having to seek a separate permission for each work.
- The protective shelter should be re-built to a design which does not create micro-environments inappropriate for the conservation and preservation requirements of the carving. (Please refer to Part III.2.1 for a more thorough discussion of the need for and design of new shelters at all rock carving sites.)

2.2 Requirements for intervention treatment

2.2.1 Interim

- Watering of the flower bed above the rock carving should stop.
- The glass panel above the affected rock carving should be removed to allow for better ventilation of the rock surface.
- A sample of the micro-organism should be taken and analyzed by expert botanists. Their advice as to the appropriate fungicide should be sought.
- The affected surface should be mechanically cleaned with a soft brush and ph-neutral water, removing the rock dust and any the micro-botanical remains that come away easily.
- The surface should be treated with an appropriate fungicide, at the appropriate time in the life-cycle of the micro-organism, as recommended by the expert botanists.
- Follow-up cleaning and, if there is still evidence of continued growth of the micro-organism, repeated treatment with the fungicide should take place until the micro-organism affecting the rock carving is killed.

2.2.2 Long-term

The long-term treatment for the Cheung Chau rock carving is no different than that for the other rock carvings of Hong Kong. This consists of:

- Frequent periodic monitoring of the condition of the carving, following the establishment of a baseline monitoring data base using laser scanning.
- Application of an appropriate biocide if contamination with micro-organisms is identified.
- Construction of new, better-designed shelter to protect the carving and enhance its value as a public educational resource.
- Geo-technical engineering to divert the flow of water through the fractures in the rock away from the carved surface.

(Please refer to Part III.2 for a thorough discussion of these above points.)

2.3 Follow-up evaluation and documentation work

As explained above in section 2.2, required are:

- Frequent periodic monitoring of the condition of the carving at Cheung Chau. This should be done on a monthly basis, until it can be confirmed that the micro-organism affecting the carving has been killed and the deterioration halted. After that, monitoring of the Cheung Chau caving can enter into the regular schedule of site monitoring by AMO staff which would ideally be twice a year.
- Laser scanning of the carving to establish a data baseline from which to monitor subsequent changes.

2.4 Resources implications

2.4.1 Interim

- As at all sites, investment will be required in laser scanning to create the required monitoring data base. This should be done as soon as budget resources permit.

2.4.2 Long-term

- As at all sites, investment will be required in the design and construction of a new, improved shelter.
- As at all sites, the geological modeling and application of geo-technical engineering solutions to the problem of infiltrating water will require budgetary allocation to be implement by Geological Services.
- Because of the uncertain ownership issues of the Cheung Chau rock caving, it may eventually be necessary for the Government to acquire this land in order to ensure that adequate long-term protection is afforded the carving.

3. Risks

3.1 Identification and assessment of the risk factors

The risks affecting the Cheung Chau rock carving are described above in section 1.2. Both of the risks are attributable to human agency and can be removed by:

- Stopping the watering of the flower beds above the carving.
- Improving the design of the shelter.

3.2 Risk Management

It is worth noting that only the Cheung Chau rock carving is in immediate danger. This is probably due to the anomalous management situation of the carving, whereby AMO is not the custodian of the site. To remove this risk and provide long-term protection for the Cheung Chau rock carving, the site should be brought under direct AMO management, as are all the other protected rock carving sites in Hong Kong.

4. Conservation plan

4.1 Priority for intervention treatments

4.1.1 The induced, rapid decomposition of the upper rock carving must be halted immediately. Required are the following steps:

- (i) Negotiate with the hotel to stop watering and to remove the 2-3 flowers planted directly above the carving. This daily addition of water, which carries nutrients from the soil above and may well carry chemicals from fertilizers applied to the flowers, assures that the conditions for the growth of micro-organisms is maintained.
- (ii) Remove the glass roof panel from immediately above the carving, in order to eliminate the existing thermal heat and humidity trap. This should be done immediately, before any new structure is designed, budgeted and built which may take some time.
- (iii) Collect the samples of the micro-organism and have them analyzed as to genus/species.
- (iv) In consultation with the specialist botanist, apply an appropriate fungicide to kill the micro-organism, at the appropriate place in its fruiting cycle.
- (v) Clean the dead micro-organisms and any rock dust from the carving.

4.1.2 After the condition of the carving is stabilized, its conservation can be incorporated into the recommended routine strategy of the AMO, applicable to all protected rock carvings in Hong Kong, viz.,

- (vi) Undertake laser scanning of the rock carving to create a baseline for future monitoring.
- (vii) Establish a schedule of frequent periodic monitoring, incorporating improved housekeeping arrangements for site maintenance.
- (viii) With assistance from Geological Services, model geo-technical options for preventing the flow of water through fractures in the rock onto the surface of the carving.
- (ix) Undertake the recommended geo-technical engineering work.

- (x) Design and construct a new shelter to protect the carving.

4.2 Implementation plans and 4.3 timeline for work

Recommendations (i) and (ii):	Immediate action, within the next 1-2 months.
Recommendations (iii), (iv) and (v):	Within the next 2-4 months.
Recommendations (vi) and (vii):	Within the next 6-12 months.
Recommendations (viii), (ix) and (x):	Within the next budgetary cycle of the Government.

5. Recommendations on specialist supplies

5.1 Sources of specialist materials and service suppliers

Fungicide. Because the active growth of micro-organisms is a problem only at Cheung Chau and because it may be exacerbated by the introduction of artificial fertilizers from the hotel's flower bed, the precise type of micro-organism should be identified by expert botanists and a specific fungicide applied at the appropriate time in the fruiting cycle. This will result in longer-lasting results and minimize the need for frequent re-applications.

Shelter. It is recommended that in the construction of new shelters, which are required at all sites, no concrete is used in any location where there would be any danger of dissolved concrete coating the rock surface. Nor should untreated iron be used. Consideration should be given to the use of stainless steel, tempered, shatter-proof glass, wood and stone in the construction of the new shelters. The final choice of materials is a matter for the architecture specialists to decide.

It is however worth to note that the existing shelter at Cheung Chau with its glass roof has proven very problematic and is a major factor negatively affecting the state of conservation of the carving there. Glass roofs should be avoided in the design of the new shelters.

5.2 Recommendations for outsourcing of site management (if necessary)

Changes in the administrative management of the Cheung Chau rock carving site are required.

- The carving needs to be brought under direct AMO conservation management, as explained above in section 1.3.
- The management of the nearby hotel must be engaged and instructed not to endanger the carving through the watering of its flower beds.

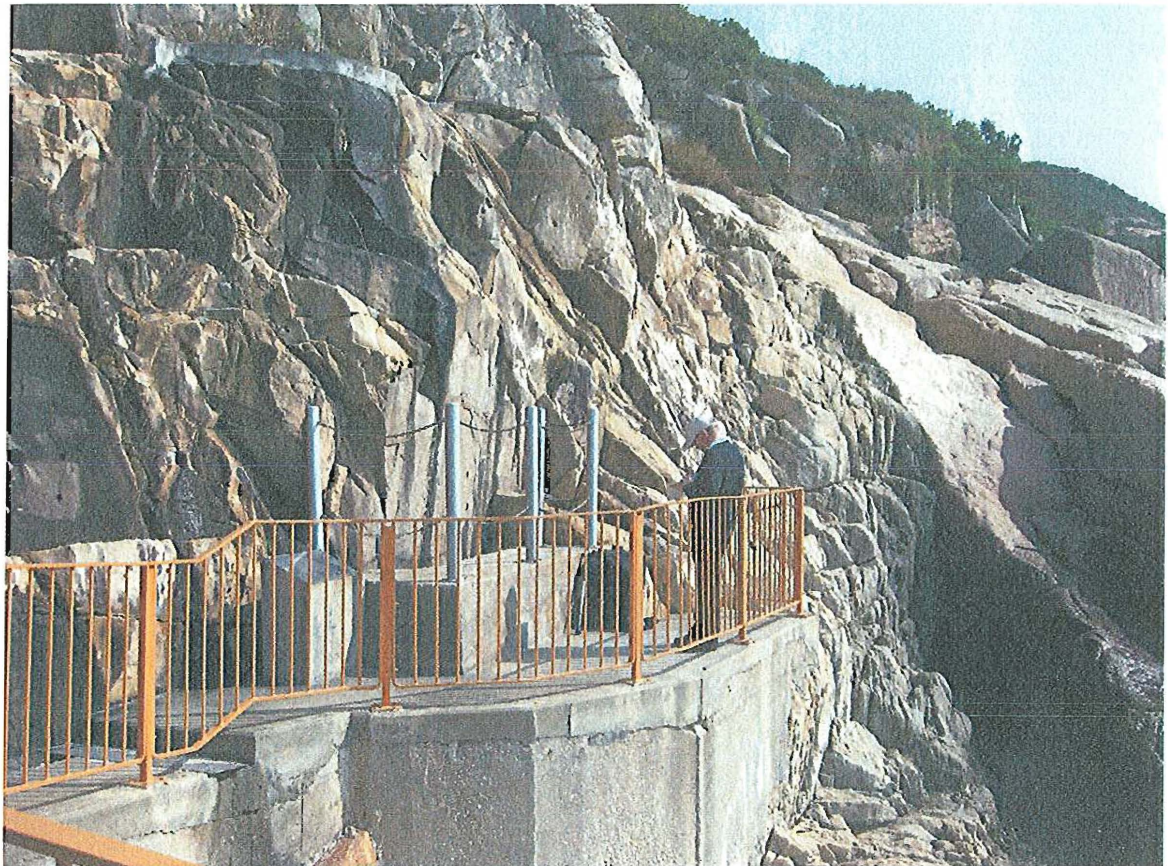
CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF HONG KONG

PART II INDIVIDUAL SITE ANALYSIS

SITE 8: ROCK CARVING AT PO TOI ISLAND

Contents

- II.8.1 Map: location and rock composite (provided by AMO)
- II.8.2 Data Sheet (provided by AMO)
- II.8.3 Analysis and Recommendations
- II.8.4 Photographs (courtesy Dr. Karen Wai-yin FONG)

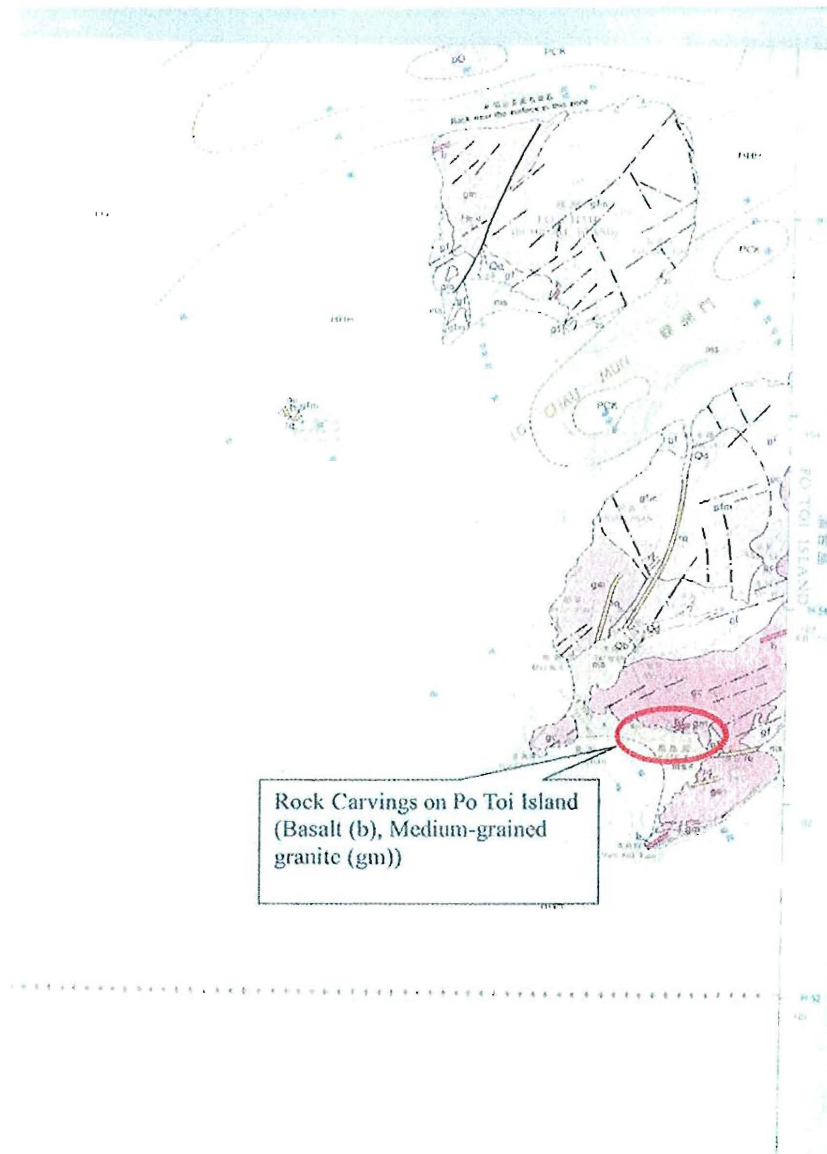


PART II
INDIVIDUAL SITE ANALYSIS

SITE 8: ROCK CARVING AT PO TOI ISLAND

II.8.1 Map

Location and Rock Composite of Rock Carvings on Po Toi Island



**PART II
INDIVIDUAL SITE ANALYSIS**

SITE 8: ROCK CARVING AT PO TOI ISLAND

II.8.2 Data Sheet

8. Rock Carvings at Po Toi Island

1. Date of Declaration	<ul style="list-style-type: none"> 27 April 1979
2. History and background information	<ul style="list-style-type: none"> There had long been a local legend among the fisherfolk of the existence of several rock carvings on Po Toi Island. Finally, groups of carvings were found at the southern part of Po Toi in the 1960's. They are of different motifs and separated by a rock fracture 70cm wide. One group on the left consists of lines resembling stylized animal and fish patterns, while the other on the right is composed of spirals in an inter-locking arrangement.
3. Protective Measures and Visitor's Facilities	<ul style="list-style-type: none"> November 1977: Erection of wire cages for temporary protection. 1984: Installation of protective cages made of metal frame and laminated unbreakable glass screen. August 2002: Improvement works for the footpath (Reconstruction of stairs and replacement of railing near the rock carving. January 2009: Repair of the protective shelter (left) being damaged by the typhoon in late September 2008. Replacement of the protective shelter (right) being destroyed by the typhoon by a set of railings surrounding the rock carving.
4. Present Condition and Past Treatment	<p><u>Present Condition.</u></p> <ul style="list-style-type: none"> Overall condition of rock carvings were stable. The right carving was guarded by railing. The left carving was protected by Perspex sheet. <p><u>Past Treatment in 2004</u></p> <ul style="list-style-type: none"> Cleaned with soft bristle brush for removing dust and loose vegetation. The surface was cleaned with biodegradable and non-ionic surfactant (<u>Decon@90</u>) and then rinsed thoroughly with water. <p><u>Past Treatment in 2007</u></p> <ul style="list-style-type: none"> Cleaned with soft bristle brush for removing dust and loose vegetation. The surface was cleaned with biodegradable and non-ionic surfactant (<u>Decon@90</u>) and then rinsed thoroughly with water. Applied aqueous solution of isothiazolinon (Remmer BFA) to prevent further vegetation growth; Applied siloxane based hydrophobic agent (Remmer SNL) to act as water-repelling layer to avoid air pollutants deposition and pest infestation. <p><u>Past Treatment in 2008</u></p> <ul style="list-style-type: none"> Applied dilute acetic acid to dissolve the cement staining. Cleaned with soft bristle brush for removing dissolved cement staining. The surface was cleaned with biodegradable and non-ionic surfactant (<u>Decon@90</u>) and then rinsed thoroughly with water. In view of the consultancy study ahead, the siloxane based coating was not applied, though it might have been washed away by the treatment this time.

**PART II
INDIVIDUAL SITE ANALYSIS**

SITE 8: ROCK CARVING AT PO TOI ISLAND

II.8.3 Analysis and Recommendations

PO TOI: Analysis and Recommendations

1. Present Situation

1.1 Physical condition of the rock carvings

The rock carvings at Po Toi demand the second most urgent attention, after those at Cheung Chau.

The urgency at Po Toi does not arise from any on-going or accelerating process of decomposition, or because of any new and immediate threat to the site, rather the urgency to act is compelled because of the failure of the interventions in site management, which now expose the Po Toi carvings to more severe damage in the immediate future. The two management interventions which have failed are:

- The protective shelters have been destroyed and/or compromised during a recent typhoon.
- One of the concrete dams above the carvings is not serving the purpose of diverting water from the carving, but rather is trapping water, allowing it to infiltrate into the fractures in the rock behind the carving. There is also evidence of cement leaching from the dam onto the surface of the rock.

Correction, or at least interim arrangements, to address these two issues are required before the next typhoon season.

1.2 Diagnosis of preservation problems

Although there is need for urgent remedial action at Po Toi, It needs to be stressed that the preservation problems at Po Toi are not different in character than at any of the other rock carvings sites. Nor is it clear that the preservation problems are more severe at Po Toi than at some of the other sites. The problems at Po Toi have been more thoroughly analyzed by AMO and are therefore better understood than at the other sites. Thus there is a more compelling argument for intervention.

There are six preservation problems which need to be managed at Po Toi:

- The growth of micro-organisms on the rock surface, due to contamination from plant growth above the rock carving, which is exacerbated by the fact that the surface of the right-hand carving (when viewed facing the carvings) is continually moistened by water seeping out onto the surface of the rock from internal fractures within the rock.
- Destabilization and possible spalling of the rock face caused by the mechanical action of infiltrated water migrating through the rock to the surface of the carving.
- Mineral staining of the rock face due to dissolved minerals brought to the surface from within the rock, by the process described above.
- Staining and defacing of the carved surface due to cement leached from the dams above the carving.
- Damage to the rock surface from wind erosion.
- Possible vandalism.

It should be noted that the first four of the above problems are linked and due to the same geological processes.

1.3. Site constraints and environmental setting

The rock carvings at Po Toi are relatively easily accessible to the public along a well maintained footpath. The viewing platform in front of the carvings is, however, very narrow (due to the fact that the carvings are on a cliff face above the sea). This is a potential problem as it brings the visit in very close contact with the carvings.

As noted above, the Po Toi carvings are on a cliff face with the sea directly below, located near the mouth of the Po Toi harbour. They are thus exposed to wind erosion, which is exacerbated by the fact that the wind is heavily laden with salt. The carvings are also exposed to direct sunlight and this means that the daily temperature differentials on the face of the rock are considerable.

Po Toi harbour has today a well-known typhoon shelter along the South China Sea coast, and no doubt has so served since the time the carvings were made. This is an indication of the severity of the exposure of the harbour mouth to storms, and is an indication that wind/water erosion of the carvings is an issue to be monitored.

1.4 Context, merits and issues of the current conservation practice

There have been various interventions made on the Po Toi carvings in the past, particularly in the years 2004-2008 when public attention to the condition of the Po Toi carvings prompted the AMO to respond.

Control of Bio-growth. Like other rock carvings sites in Hong Kong, the surface of the carvings has been cleaned with a non-ionic surfactant and then rinsed with water, after which the biocide isothiazolinon has been applied. This standard treatment appears to have been largely effective (but not completely) in controlling the growth of micro-organisms on the rock surface. The treatment has proven only partially successful on those rock surfaces which are maintained continually moist due to the seepage of water from within the fractures of the rock. A control test patch has been set up on site at Po Toi (which is an excellent practice which should be repeated at all sites where chemical treatment has been applied or is considered.) This test indicates that unless the surface of the rock is kept dry, the effectiveness of chemical treatment in controlling the growth of micro-organisms is limited to a single fruiting cycle of the micro-organism and must, therefore be repeated annually. This has implications for site maintenance protocols. It also argues for the need to solve the underlying problem, which is that of the migration of internally-trapped water through the rock to the surface of the carvings, if the carvings are to be preserved for the really long-term (i.e. hundreds of years more).

Application of Water Repellant. In 2006 a siloxane-based hydrophobic agent was applied. There is no evidence that this has had any long-term beneficial effect. There is also no evidence that it has had any harmful effect. The agent is most likely quickly washed off the surface of the rock by rain. The treatment was not repeated in 2008. If it is foreseen to repeat this treatment in the future, a rigorous on-site control test needs to be undertaken to demonstrate that it is, indeed, effective. The issue is that the infiltrated water damage is affecting the entire face of the rock, not just the carvings themselves. If consolidation of the surface is justified, then it is the entire rock face that needs to be consolidated, not just the small surface of the carvings. It is observable the past cracking and spalling of the rock surface has affected areas beyond the carved surfaces. The carvings have been incidentally affected. Although this damage is likely to be decades or even centuries old, it is an indication that surface treatment of the carvings themselves will be ineffective in the long run and that the solution to the problem will be the diversion of the trapped water so that it flows away from the carved surfaces and exits elsewhere.

Protective Shelters. In order to address the possible damage from wind erosion, protective shelters have been built. These shelters have failed and so obviously were deficient in design. They also may have created heat and humidity traps exacerbating the problems on the surface of the carvings. It needs to be remembered that the carvings have reached equilibrium with the environment over the centuries and their weathered cortex is the best protection against further damage. Any disruption to this equilibrium -- such as may be caused by a poorly-designed shelter, case, or screen -- will result in accelerated deterioration of the surface of the rock until a renewed equilibrium to the new environment is established.

Housekeeping/Maintenance. In common with other rock carving sites, the housekeeping and monitoring protocols at Po Toi can be improved. There is considerable growth of vegetation and soil accumulation directly above the carvings which is a source of bio-contamination. This should be cleared.

2. Proposed solutions/improvements

2.1 Preservation and conservation strategy

2.1.1 Interim

- Remove or repair concrete dams that do not function properly.
- Clean vegetation and soil from above the carvings.

2.1.2 Medium-term

- Control test for the effectiveness of the application of water-repellants and surface consolidants.
- Modeling by the Geological and Geo-technical Services of infiltration of water through fractures in the bedding of the rock onto the surface of the carving, followed by implementation of the recommended corrective measures. The Po Toi modeling exercise should serve as the pilot for the methodology to be followed at all rock carving sites in Hong Kong.
- Replace the damaged wind shelters with a new, better-designed shelter and visitor interpretation facilities.

2.1.3 Long-term

- Extend the visitors' platform to provide greater separation of visitors from the carvings. This may best be undertaken with the re-design of the shelter and recommended above.

2.2 Requirements for intervention treatment

2.2.3 Interim

- Improved supervision of housekeeping and maintenance protocols, including removal of vegetation and soil.
- Removal of ineffective concrete dam(s).
- Repeat treatment to kill micro-organisms growing on surface of the carving, and on adjacent rock surfaces.

2.2.4 Long-term

The long-term treatment for the Po Toi rock carvings is no different than that for the other rock carvings of Hong Kong. This consists of:

- Frequent periodic monitoring of the condition of the carving, following the establishment of a baseline monitoring data base using laser scanning.
- Application of an appropriate biocide if contamination with micro-organisms is identified.
- Construction of new, better-designed shelter to protect the carving and enhance its value as a public educational resource.
- Geo-technical engineering to divert the flow of water through the fractures in the rock away from the carved surface.

(Please refer to Part III.2 for a thorough discussion of these above points.)

2.3 Follow-up evaluation and documentation work

Required are:

- Laser scanning of the carving to establish a data baseline from which to monitor subsequent changes.
- Periodic monitoring of bio-growth on the rock surface.
- Geo-technical study of water infiltration.

2.4 Resources implications

2.4.3 Interim

- As at all sites, investment will be required in laser scanning to create the required monitoring data base. This should be done as soon as budget resources permit.

2.4.4 Long-term

- As at all sites, the geological modeling and application of geo-technical engineering solutions to the problem of infiltrating water will require budgetary allocation to be implemented by Geological Services.
- As at other sites, the construction of an improved shelter will require a budgetary allocation. At Po Toi the visitors' platform in front of the site should be extended or redesigned to provide better separation of the visitor from the carving. Perhaps the design could be that of a walkway, gallery or viewing platform akin to what exists now at Wong Chuk Hang.

3. Risks

3.1 Identification and assessment of the risk factors

- The major risk to the Poi Toi rock carvings comes from the mechanical action of infiltrated water, as explained above.

3.2 Risk Management

Risk management at Po Toi consists of the same actions as at all other rock carving sites:

- Improved housekeeping/maintenance protocols, aimed at both preventing mechanical damage to the site, and at the early identification of bio-growth which can then be halted before it becomes a problem.
- Periodic monitoring based on a laser scan data base of the condition of the carving.
- Geo-technical engineering solutions to the problem of water infiltration.
- The construction of an appropriately-designed structure to protect the rock carving from wind erosion, temperature differentials and the possibility of vandalism.

4. Conservation plan

4.1 Priority for intervention treatments

- (i) Improved housekeeping and maintenance of the site, removing vegetation and soil above the carvings.
- (ii) Removal or repair of cement dams which hold, rather than divert, water above the rock carvings.
- (iii) Repeat the protocol for killing micro-organism growth on the rock surface where this has been identified.
- (iv) Replace the destroyed shelter with a better-designed shelter. Perhaps it will be necessary to provide for an interim solution consisting of a roof and wire cage, until a new permanent shelter can be designed, funded and built.

Followed by the application of the recommended standard medium to long-term conservation protocols applicable to all protected rock carvings in Hong Kong, viz.,

- (v) Undertake laser scanning of the rock carving to create a baseline for future monitoring. If this has already been done at Po Toi, it should be repeated in order to have a comparable data base with all other carvings.
- (vi) Establish a schedule of frequent periodic monitoring, incorporating improved housekeeping arrangements for site maintenance.
- (vii) Application of biocide when biological contamination is identified.
- (viii) Control test on-site for the application of water-repellants and surface consolidants.
- (ix) With assistance from Geological Services, model geo-technical options for preventing the flow of water through fractures in the rock onto the surface of the carving.
- (x) Undertake the recommended geo-technical engineering work.
- (xi) Design and construct an improved shelter and visitor facilities incorporating an extension to the visitors' platform to protect the carving and for the purposes of enhanced visitor interpretation.

4.2 Implementation plans and 4.3 timeline for work

Recommendations (i), (ii), and (iii):	Immediate, within the next 2-4 months
Recommendations (iv):	If budgetary provision allows, within this budget year.
Recommendations (v), (vi), (vii), (viii):	Immediate incorporation into the regular annual site monitoring and maintenance protocols of the AMO
Recommendations (ix), (x) and (xi):	As soon as can be budgeted for under the normal budgetary cycle of the Government.

5. Recommendations on specialist supplies

5.1 Sources of specialist materials and service suppliers

Biocides and other chemical surface treatments. All chemical treatments applied at Po Toi and at all other sites, should first be proven effective and non-harmful through the establishment of on-site control tests. As all rocks are different and as the conditions at all sites vary, it is necessary to establish control tests at all sites with regard to all chemical applications. This is an essential feature of responsible site conservation management.

Shelter. It is recommended that in the construction of new shelters, which are required at all sites, no concrete is used in any location where there would be any danger of dissolved concrete coating the rock surface. Nor should untreated iron be used. Consideration should be given to the use of stainless steel, tempered, shatter-proof glass, wood and stone in the construction of the new shelters. The final choice of materials is a matter for the architecture specialists to decide.

It is worth noting that the previous shelters provided at Po Toi proved entirely inadequate. New larger, better ventilated shelters are required, with sloping, opaque roofs. It will probably prove desirable to redesign the visitors' platform as well to provide a physical separation of visitors from the carvings.

5.2 Recommendations for outsourcing of site management (if necessary)

- As at all sites, there is the need for increased supervision of site housekeeping and maintenance.
- As at the other sites, monitoring arrangements with local community stakeholder interests should be explored.
- The geological and geo-technical modeling which is required at Po Toi should be undertaken in cooperation with the Geological Services of the Government.
- The valuation of this site, like the other rock carving sites, can be enhanced through better visitor interpretation/education facilities and programmes which should be undertaken in cooperation with Education Department and Country Parks. This will contribute to the long-term safeguarding of the site.

PART II INDIVIDUAL SITE ANALYSIS

SITE 8: PO TOI

II.8.4 Photographs

Photo 1: Rock bedding showing cracks through which infiltrated water migrates to surface of carvings

Photo 2: Spalling (cracking off) of carved surface, due to action of infiltrated water

Photo 3: Concrete dam above carvings

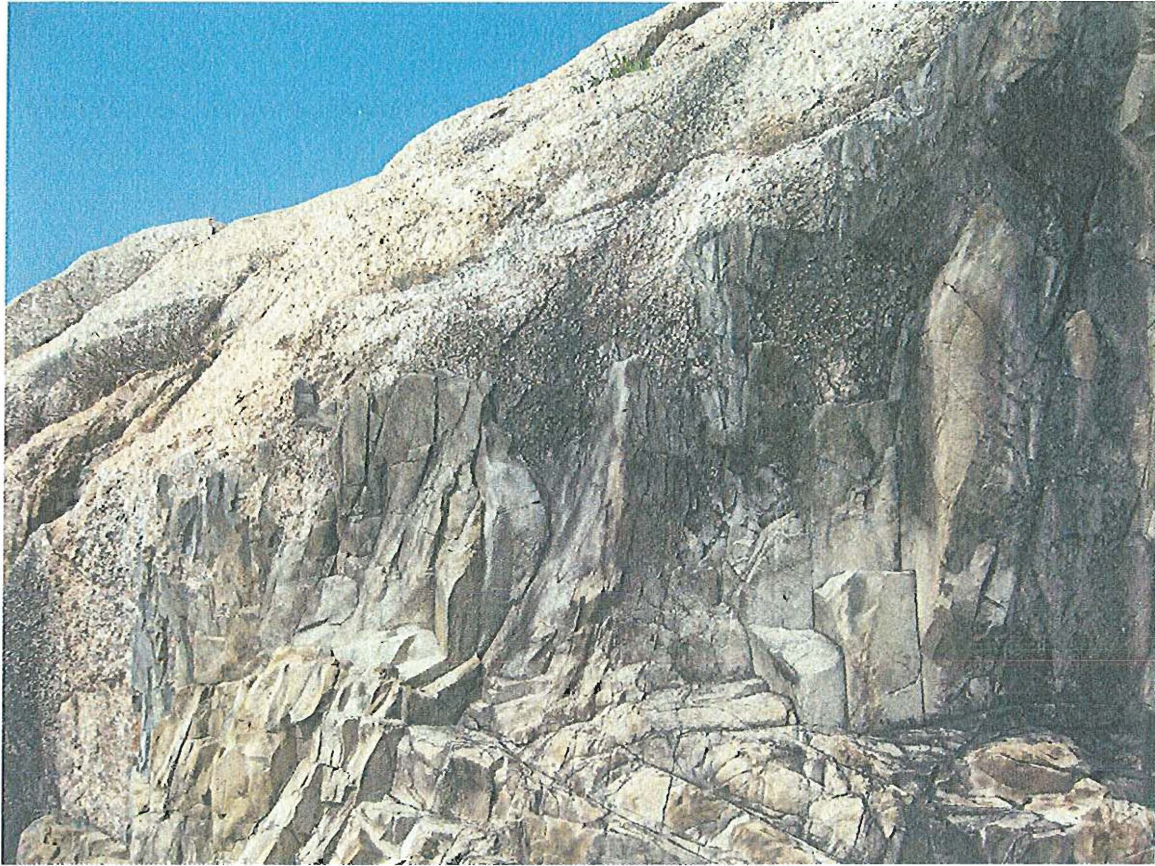
Photo 4: Concrete dam acting to trap water on top of rock which promotes the infiltration of surface water into the crack in the rock

Photo 5: Protective shelter

Photo 6: Walkway brings visitors too close to the carvings

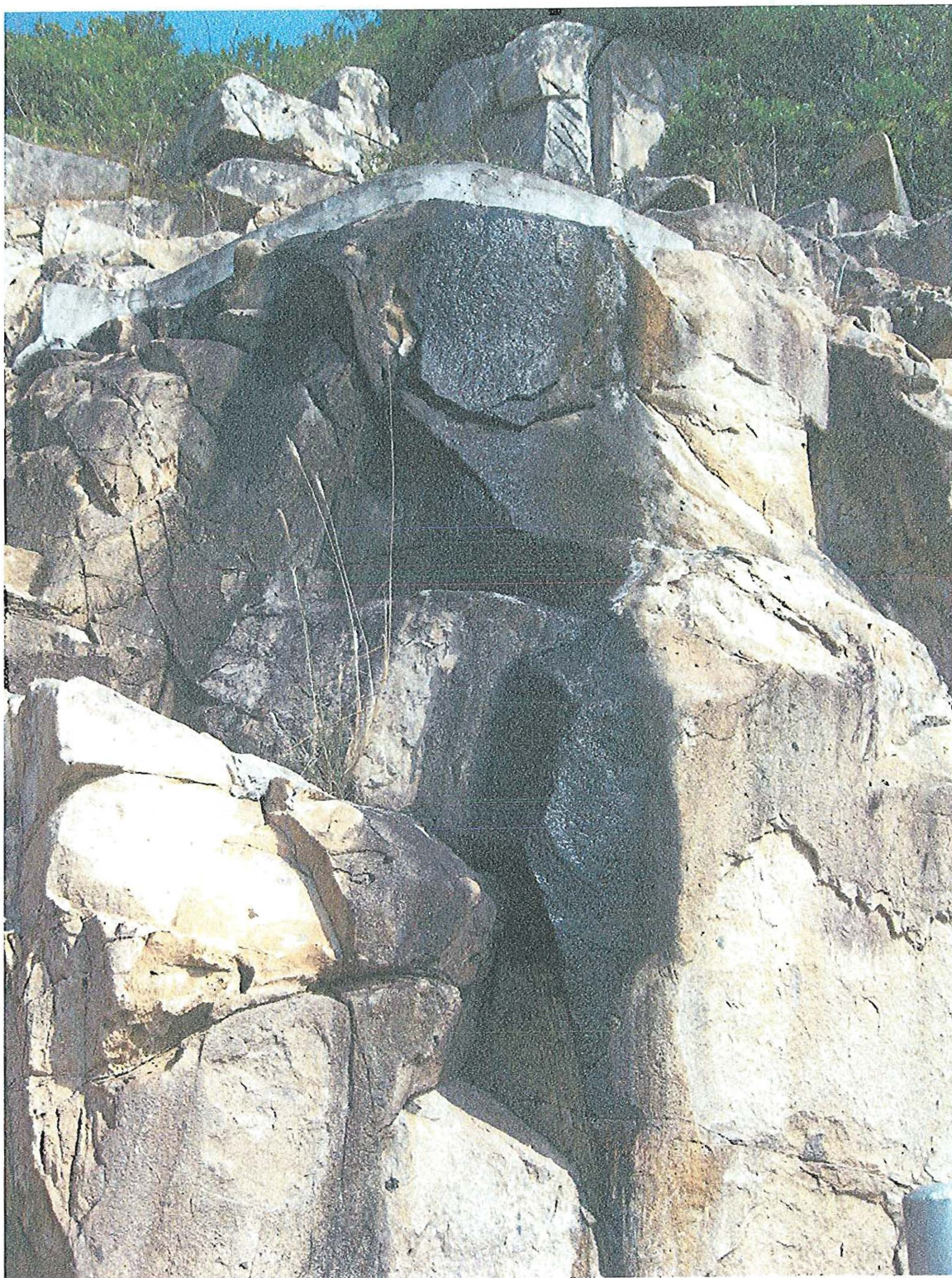
PO TOI

Photo 1: Rock bedding showing cracks through which infiltrated water migrates to surface of carvings



PO TOI

Photo 2: Spalling (cracking off) of carved surface, due to action of infiltrated water



PO TOI

Photo 3: Concrete dam above carvings



PO TOI

Photo 4: Concrete dam acting to trap water on top of rock which promotes the infiltration of surface water into the crack in the rock



PO TOI

Photo 5: Protective shelter

Note: Shelter creates a heat and humidity trap encouraging the growth of micro-organisms

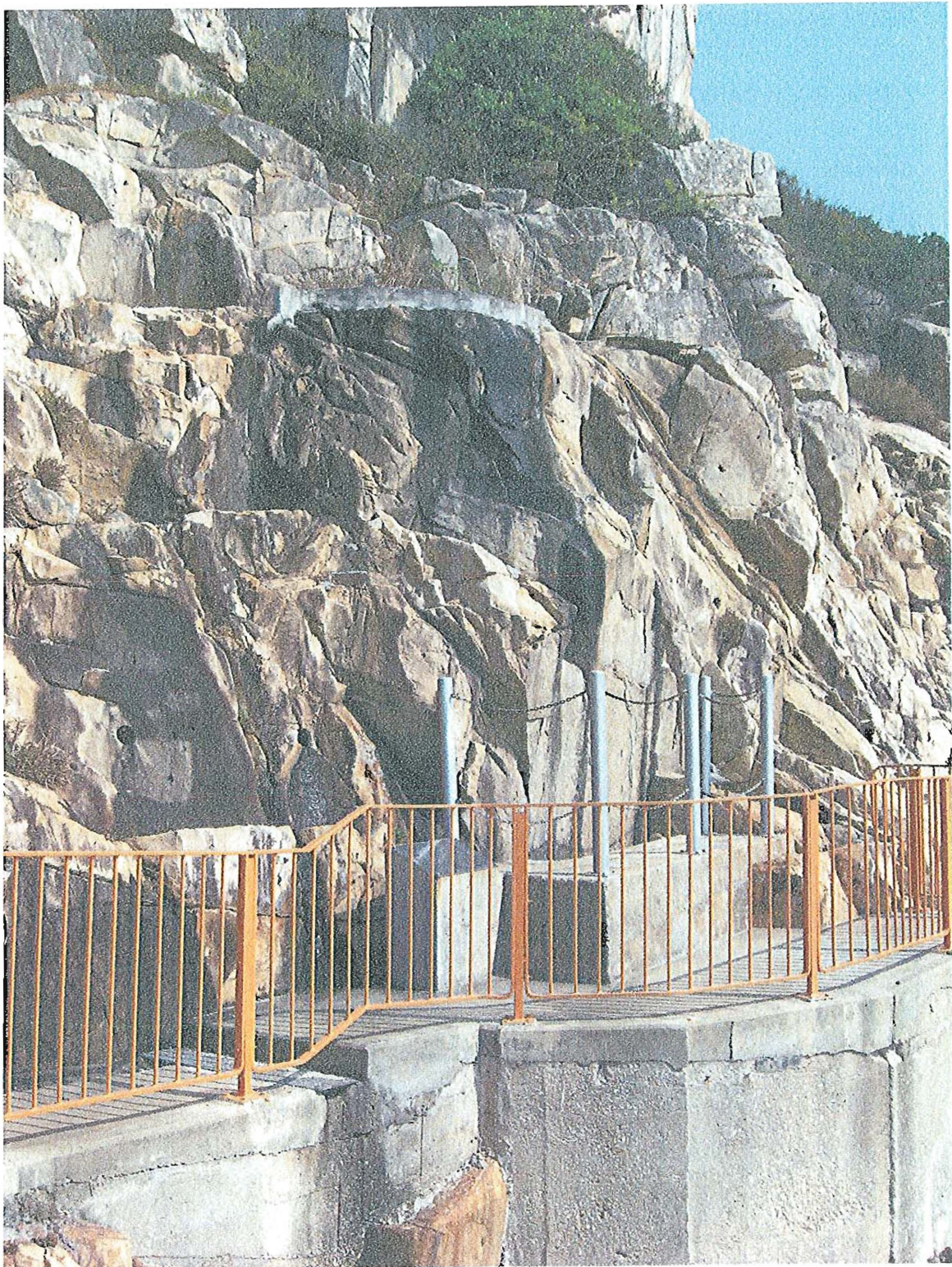
Note: Shelter does not protect from wind, as shelter has been damaged by typhoons

Note: Shelter detracts from the visitor experience of the site



PO TOI

Photo 6: Walkway brings visitors too close to the carvings



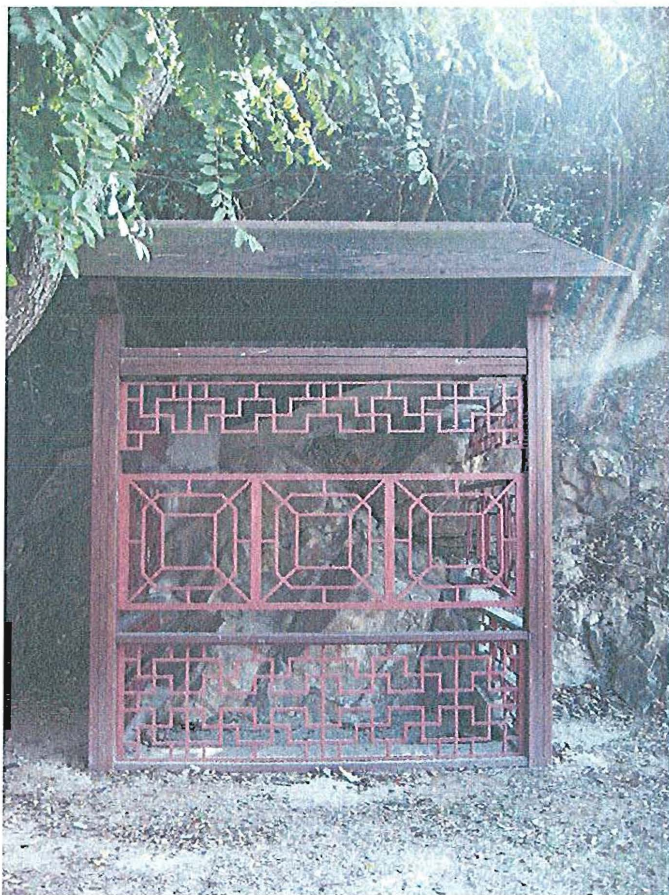
CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF HONG KONG

PART II INDIVIDUAL SITE ANALYSIS

SITE 9: ROCK CARVING AT SHEK PIK

Contents

- II.9.1 Map: location and rock composite (provided by AMO)
- II.9.2 Data Sheet (provided by AMO)
- II.9.3 Analysis and Recommendations
- II.9.4 Photographs (courtesy Dr. Karen Wai-yin FONG)

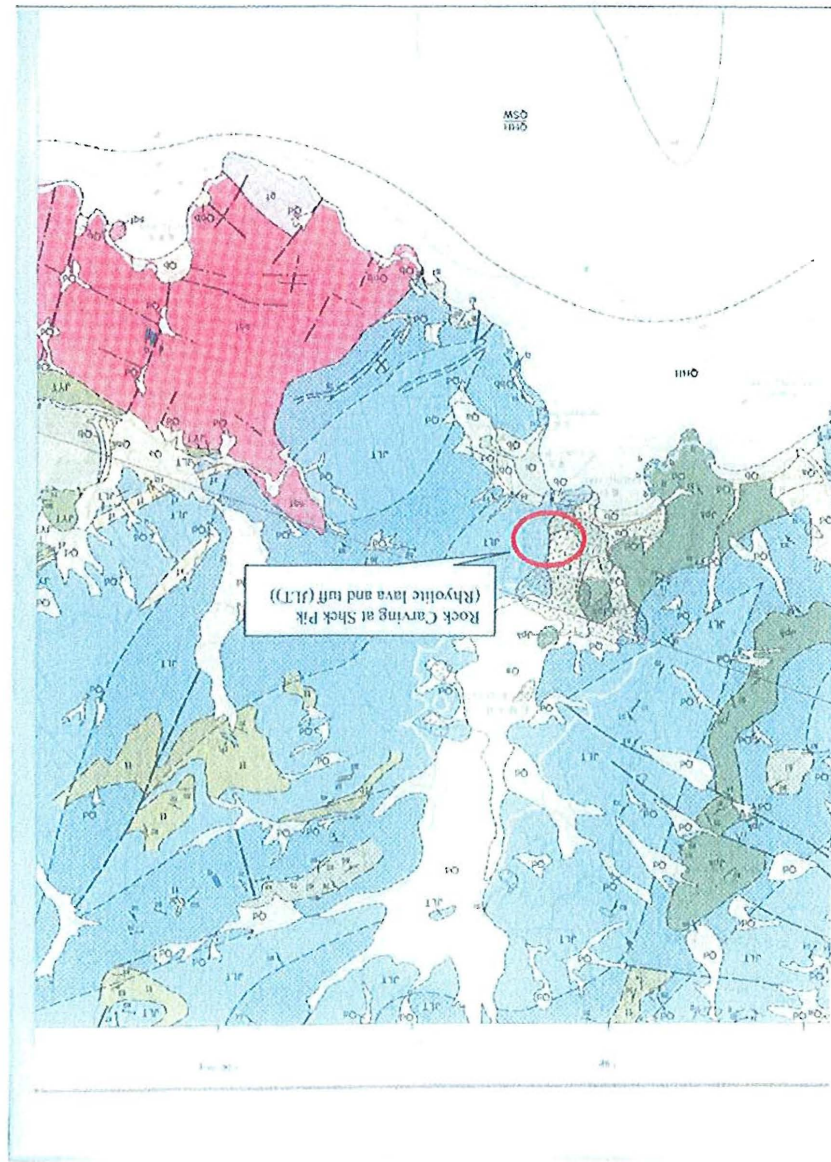


PART II
INDIVIDUAL SITE ANALYSIS

SITE 9: ROCK CARVING AT SHEK PIK

II.9.1 Map

Location and Rock Composite of Rock Carving at Shek Pik




PART II
INDIVIDUAL SITE ANALYSIS

SITE 9: ROCK CARVING AT SHEK PIK

II.9.2 Data Sheet

9. Rock Carving at Shek Pik

1. Date of Declaration	<ul style="list-style-type: none"> 27 April 1979
2. History and background information	<ul style="list-style-type: none"> Rock carvings from the neolithic age were found by Chen Kung-chiek in Shek Pik in 1939. Most of the ancient rock carvings in the territory overlook the sea, but Shek Pik Rock Carving is about 300m from the coastline. However, it is believed that in the past, the sea inlet might have extended up to this point. The design shows geometric patterns composed of spiral squares and circles which closely resemble those on Bronze Age artefacts. It is thus quite safe to deduce that they were carved by early inhabitants of this area in the local Bronze Age some 3,000 years ago.
3. Protective Measures and Visitor's Facilities	<ul style="list-style-type: none"> December 1978: Erection of a wire cage for temporary protection. July 1985: Erection of a stainless steel protective cage with polycarbonate sheets and a monument plaque. Early 1988: Construction of a viewing platform, a footpath and four directional signages. August 1992: Replacement of the protective cage of the rock carving by a pavilion structure, and the improvement of the access pathway and the environment of the rock carving. May 2000: Improvement work for direction signages and erection of three extra direction signages. September 2005: Replacement of the protective cage by the present one.
4. Present Condition and Past Treatment	<p><u>Present Condition</u></p> <ul style="list-style-type: none"> Overall condition of rock carving was stable. <p><u>Past Treatment in 2005</u></p> <ul style="list-style-type: none"> Cleaned with soft bristle brush for removing dust and loose vegetation. The surface was cleaned with biodegradable and non-ionic surfactant (<u>Decon@90</u>) and then rinsed thoroughly with water.
5. Photo Reference	 <ul style="list-style-type: none"> approx. 0.3 m (W) x 0.8 m (H)

PART II
INDIVIDUAL SITE ANALYSIS

SITE 9: ROCK CARVING AT SHEK PIK

II.9.3 Analysis and Recommendations

SHEK PIK: Analysis and Recommendations

1. Present Situation

1.1 Physical condition of the rock carvings

The rock carving at Shek Pik stable condition. There is no evidence of any accelerated or immediate risk to the site.

1.2 Diagnosis of preservation problems

There are three preservation problems which need to be managed at Shek Pik:

- Bio-contamination of the surface of the rock by micro-organisms.
- Loss of definition of the carved rock surface caused by the mechanical action of infiltrated water migrating through the rock to the surface of the carving.
- Potential vandalism of the site, due to its devaluing location – behind the incinerator and within the rubbish dump of the Shek Pik Correctional Institution.

1.3. Site constraints and environmental setting

The site of the Shek Pik rock carving, once thought to be on the coast like other rock carvings in Hong Kong, is now located some 300 meters inland, separated from the coast by the massive construction of the Shek Pik Correctional Institution. While this location affords the rock carving protect from the elements, and some degree of police surveillance due to its proximity to a high-security prison, the present environmental context of the site is problematic. The site is located right behind the prison's garbage disposal area and is, in fact, within an outside perimeter of the prison's rubbish dump.

This location devalues the rock carving as community rubbish. A visit to the site is unpleasant and communicates to the public that this part of Hong Kong's heritage has no value.

The prison authorities appear to have neither knowledge of the value of the carving nor any concern for the protection of the site. Indeed, they appear to regard visitors to the site as a threat to the prison's own security protocols. Indeed, while this consultant visited the site, prisoners on garboard detail were also present on site.

There are, in fact, two access routes to the Shek Pik rock carving site. The road access route leads through the prison's garbage disposal area. There is however an alternative hiking route which does not entail going through the catchment of the prison's territory.

1.4 Context, merits and issues of the current conservation practice

In 2005, the surface was cleaned and a biocide applied (Decon@90). This appears to have controlled the growth of micro-organisms on the surface of the carving, although some new growth was observed by this consultant. Renewed treatment is called for.

The source of the contamination is the hill slope behind the rock carving which is infested with termites. No doubt the proximity to the prison's garbage disposal area contributes nutrients to support the populations of insects, fungi and other micro-organisms found at the rock carving site.

There is a protective shelter consisting of metal bars and a roof, the purpose of which seems to be to mark off the carving as something to be protected and to provide a measure of protection against potential vandalism. The shelter also prevents heavy vehicles from the prison from damaging the site; and to a degree it segregates the site from the creeping expansion of the prison's garbage dump.

2. Proposed solutions/improvements

2.1 Preservation and conservation strategy

2.1.1 Interim

There are two actions which need to be taken to improve the condition of the Shek Pik rock carving:

- Clean and re-apply the biocide to the rock surface.
- Improve the housekeeping and maintenance of the site, which involves cutting the surrounding vegetation, eliminating the termite nest, and removing encroaching garbage and other debris from the site.

2.1.2 Long-term

There are also a number of medium to long-term actions which are recommended:

- Modeling by the Geological and Geo-technical Services of infiltration of water through fractures in the bedding of the rock onto the surface of the carving, followed by implementation of the recommended corrective measures.
- Monitoring of the effects of the application of biocide to the site, through on-site monitoring test patches.
- Construction of a better-designed shelter and visitor interpretation kiosk at the site.
- Change in the access to the site in favour of the footpath and the construction of a physical barrier separating the Shek Pik rock carvings from the prison compound.

2.2 Requirements for intervention treatment

The long-term treatment for the Shek Pik rock carving is no different than that for the other rock carvings of Hong Kong. This consists of:

- Frequent periodic monitoring of the condition of the carving, following the establishment of a baseline monitoring data base using laser scanning.
- Geo-technical engineering to divert the flow of water through the fractures in the rock away from the carved surface.
- Application of an appropriate biocide if contamination with micro-organisms is identified.
- Construction of new, better-designed shelter to protect the carving and enhance its value as a public educational resource.

- And, in the case of Shek Pik, the change of access to the site avoiding the prison's garbage dump.

(Please refer to Part III.2 for a thorough discussion of these above points.)

2.3 Follow-up evaluation and documentation work

Required are:

- Laser scanning of the carving to establish a data baseline from which to monitor subsequent changes.
- Geo-technical study of water infiltration.

2.4 Resources implications

2.4.1 Interim

- As at all sites, investment will be required in laser scanning to create the required monitoring data base. This should be done as soon as budget resources permit.

2.4.2 Long-term

- As at all sites, the geological modeling and application of geo-technical engineering solutions to the problem of infiltrating water will require budgetary allocation to be implement by Geological Services.
- As at other sites, the construction of an improved shelter and a visitor information kiosk will require a budgetary allocation.
- At Shek Pik, investment is also required for upgrading the alternate pathway down to the site and in the construction of a fence or other barrier separating the rock carving site from the prison compound.

3. Risks

3.1 Identification and assessment of the risk factors

There are two ascertained risks at Shek Pik:

- Contamination of the site by micro-organisms.
- Location of the site within the prison's garbage dump, thus devaluing the heritage to the equivalent of garbage.
- The one ascertained risk at Lung Ha Wan comes from the long-term effects of wind erosion. The protective shelter must be redesigned with this in mind.

3.2 Risk Management

Risk management at Shek Pik consists, in the first instance,

- in isolating the rock carving from the prison's garbage dump.

Thereafter, the risk management actions are the same as the actions required at all other rock carving sites:

- Improved housekeeping/maintenance protocols, aimed at both preventing mechanical damage to the site, and at the early identification of bio-growth which can then be halted before it becomes a problem.
- Periodic monitoring based on a laser scan data base of the condition of the carving.
- Geo-technical engineering solutions to the problems of water infiltration.
- The construction of an appropriately-designed structure to protect the rock carving from wind erosion, temperature differentials and the possibility of vandalism.
- Furthermore, at Shek Pik, the changes to and improvement of visitor access is required.

4. Conservation plan

4.1 Priority for intervention treatments

The first priority is to:

- (i) Isolate the Shek Pik rock carving from the prison compound, by changing the access route and constructing a barrier separating the rock carving from the prison compound.

Thereafter, application of the recommended standard medium to long-term conservation protocols applicable to all protected rock carvings in Hong Kong, viz.,

- (ii) Undertake laser scanning of the rock carving to create a baseline for future monitoring.
- (iii) Establish a schedule of frequent periodic monitoring, incorporating improved housekeeping arrangements for site maintenance.
- (iv) Application of biocide if biological contamination is identified.
- (v) With assistance from Geological Services, model geo-technical options for preventing the flow of water through fractures in the rock onto the surface of the carving.
- (vi) Undertake the recommended geo-technical engineering work.
- (vii) Design and construct a new shelter to protect the carving and for the purposes of enhanced visitor interpretation.

4.2 Implementation plans and 4.3 timeline for work

Recommendation (i):	Negotiations should begin immediate and the work should be completed within the next budgetary cycle.
Recommendations (ii), (iii) and (iv):	Immediate incorporation into the routine work plan of AMO
Recommendations (v), (vi) and (vii):	As soon as can be budgeted for under the normal budgetary cycle of the Government.

5. Recommendations on specialist supplies

5.1 Sources of specialist materials and service suppliers

Biocide. Application of a biocide at Shek Pik should follow previously successful protocols, with the caveat that an on-site control test be established and maintained at this site and at all sites where a biocide, or any other chemical treatment, is applied.

Shelter. It is recommended that in the construction of new shelters, which are required at all sites, no concrete is used in any location where there would be any danger of dissolved concrete coating the rock surface. Nor should untreated iron be used. Consideration should be given to the use of stainless steel, tempered, shatter-proof glass, wood and stone in the construction of the new shelters. The final choice of materials is a matter for the architecture specialists to decide.

It is worth noting that at Shek Pik, considering that the rock carvings are out of their original environmental context, provision of much improved visitor interpretation is required to explain the original context of the rock carving to the visitor.

5.2 Recommendations for outsourcing of site management (if necessary)

- As at all sites, there is the need for increased supervision of site housekeeping and maintenance. This is particularly so at Shek Pik because of the location of the site adjacent to the prison's garbage dump.
- As at the other sites, monitoring arrangements with local community stakeholder interests should be explored. In the case of Shek Pik, Country Parks should be interested in the maintenance of this site which is situated along a hiking trail.
- However it is not recommended that the daily management of the Shek Pik rock carving site be left to the Shek Pik Correctional Institute as appears to be the *de facto* case today. This is an unsustainable arrangement which is not in the interest of either the AMO of the Prison Authority, and therefore not in the public's best interest.
- The valuation of this site, like the other rock carving sites, can be enhanced through better visitor interpretation/education facilities and programmes which should be undertaken in cooperation with Education Department and Country Parks. This will contribute to the long-term safeguarding of the site.

PART II
INDIVIDUAL SITE ANALYSIS

SITE 9: ROCK CARVING AT SHEK PIK

II.9.4 Photographs

Photo 1: Showing how the nearness of the shelter to the carving diminishes the value of the carving in the eye of the public

Photo 2: Showing insect infestation

Shek Pik

Photo 1: Showing how the nearness of the shelter to the carving diminishes the value of the carving in the eye of the public



Shek Pik

Photo 2: Showing insect infestation



**CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF
HONG KONG**

12-18 January 2010

Richard A. Engelhardt, UNESCO Senior Advisor for Culture
Consultant

**PART III
SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS**

CONSULTANCY STUDY ON THE PRESERVATION OF ANCIENT ROCK CARVINGS OF HONG KONG

PART III

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

This section should be read following and with reference to Part II, which comprises a discussion of the issues and recommendations for each site.

1. Present Situation

1.1 Physical condition of the rock carvings

With the single exception of the Cheung Chau Rock Carving (which is dealt with separately in Part II.7 and in Part III.4.1.1 below), there is no accelerating deterioration in the condition of any of the rock carving in Hong Kong which can be ascribed to human factors, intentional or otherwise, on the part of the AMO or the general public; or to a recent sudden change in the environmental or other circumstances affecting the condition of the carvings.

The rock carvings, to be sure, are all affected by the long-term effects of wind and water erosion, which is exacerbated by the high level of salt in the air due to the proximity of the sea. This is, however, the "natural" or "original" or "authentic" environmental context in which the rock carvings were created. In the intervening hundreds or thousands of years, the carved rock faces have adjusted to and reached a homeostasis with this environment. This homeostasis represents the lowest level of deterioration which can be expected of an *in situ* archaeological site or artifact. This is the normal condition of archaeological materials *in situ*, and represents the optimum condition for the long-term survival of the artifact. All archaeological materials deteriorate after their creation/deposition. This deterioration is in fact part of the body of information that scientists observe and study in order to understand the significance of the artifact. Conservation management aims to maximize the lifespan of the artifact (and therefore of the knowledge encoded therein), through minimizing artificially induced change to the artifact and its context.

Any act which abruptly interferes with this homeostasis and changes the evolved equilibrium which the site/artifact has achieved with its environment will, more likely than not, disturb this equilibrium and result in an accelerated rate of deterioration, until a new equilibrium can be achieved. Therefore, any act of physical or chemical intervention which disturbs the achieved equilibrium of a rock carving is to be avoided, unless there is compelling evidence that an external factor has already disturbed this equilibrium and has induced, or poses an immediate threat of causing, accelerated deterioration. With the single exception of the Cheung Chau Rock Carving, no rock carving in Hong Kong is experiencing or is immediately endangered with such a traumatic, compelling situation. Therefore, with the single exception of Cheung Chau, no heroic intervention is called for at any of the sites.

1.2 Diagnosis of preservation problems

There are two aspects of the environmental contexts of the rock carvings of Hong Kong which contribute to their long-term deterioration over time and it is these two aspects over which we can seek to gain some control, in an effort to slow down the long-term deterioration of the rock carvings and maintain their value as a resource within the community. These two aspects are both mechanical in nature and are related to the environmental context of the rock carvings. They are:

- (i) wind, and wind-borne salt water, erosion

- (ii) water percolation through naturally-occurring bedding fractures in the structural body (not the surface) of the parent rock. The seepage of water through these fractures introduces a number of medium to long-term problems potentially affecting the rock carvings. These problems include:
- transmigration of dissolved minerals to the rock surface where they are deposited, staining the surface and making the carving difficult to read;
 - thermal induction of surface cracking (through mechanical process involved with evaporation) resulting in cracking and potential spalling of the carved surface, which has been rendered already somewhat unstable by the act of carving into weathered cortex of the rock surface;
 - humidification of the rock surface providing a moist environment conducive to the growth of micro-organisms which can erode the carving by literally dissolving some of the minerals in the rock matrix as part of their metabolic processes.

Of these two problems, the first (wind erosion) is more easily understood and counter-acted by physical means, such as the construction of shelters, as will be discussed below in Part III.2.1.

The second problem (water seepage through fractures in the rock) is by far the more serious problem at most of the rock carving sites in Hong Kong and is responsible for most of the physical damage which is apparent to the eye, such as at Po Toi. This issue is discussed individually for each site in Part II and in Part III.2.2 below.

1.3. Site constraints and environmental setting

It is important to understand that this second problem (water infiltration), and to some degree also the first (erosion), are geological in nature. The solutions to these problems are not to be found in the cosmetic, chemical treatment of rock surfaces. Although such treatments may temporarily improve the appearance of the carving and its immediate readability, the need for their repeated application will, in the medium to long-term, result in accelerated deterioration of the carvings. It is the conclusion of this consultant that past attention to surface treatments, while not evidently harmful to the carvings, have had no discernable positive impact either and have diverted attention away from dealing with the more serious underlying issues, especially that of water infiltration through the parent rock.

The solution of this problem of water seepage through the rock, however, is outside the scope of most conservation archaeologists, and lies with experts training in the geological sciences and geo-technical engineering. For this reason, this consultant recommends close collaboration between AMO and the other relevant technical services of Government in the long-term preservation of the rock carvings of Hong Kong.

2. Proposed solutions/improvements

Before going on to describe the strategies to address these two medium to long-term threats to the rock carvings of Hong Kong, it is important, firstly, to understand that these two problems are not new problems caused by some recently changed circumstance. These problems have existed since the carvings were created and are inherent in the geological and environmental contexts of the carvings. Secondly, there is no evidence that the damage caused by either of these two "problems" has accelerated in recent years. In fact, photographic and anecdotal evidence from 19th century travelers suggest that it has not (for example, at Tung Lung.) Therefore the "solutions" to these two "problems" lie in long-term strategies to protect and manage change at the sites, not in one-off, quick-fix solutions.

2.1 Preservation and conservation strategy

WIND BORNE EROSION

To address the first problem, that of erosion, physical barriers to wind and wind-borne salt water are the best solution, as has been recognized by the AMO and is the main reason given for a number of protective shelters being built at the sites.

It should be noted that the other reason given for the construction of these structures is to protect the sites against vandalism. However, there is no history of attempted vandalism at any of the sites, so this threat is more theoretical than real. In any case, the shelters at most accessible sites, such as the one at Big Wave Bay, are easily breached as the consultant observed first hand when a young visitor reached inside the protective shelter and touched the carved surface. If the purpose of the shelters is to protect the sites against the possibility of vandalism, the shelters need a radically different design.

In point of fact, these shelters have been built to a variety of designs and obviously with a minimum budget allocation, with the results that the shelters do not do the protective job intended. They do not adequately protect the rock carvings from wind, and in fact in some cases (Lung Ha Wan) the shelter actually funnels the wind across the surface of the carving with accelerated speed. In other cases, (Cheung Chau) the shelters create heat and humidity micro-climates on the surface of the rock and thus encourage the growth of micro-organisms on the carved surfaces. At other sites, (Po Toi) the shelters have failed when exposed to typhoon winds. At most sites, the shelters are built with materials the quality of which is not up to the protection demands of the site, and with minimum attention to design so they do little to aid in the interpretation and valuation of the sites to the public as an interesting and valuable community resource to be cherished, protected and preserved.¹

What is needed is a much higher degree of design input into the construction of shelters at all of the sites. The shelters need to provide adequate protection from the wind, rain and sun while allowing natural ventilation to be maintained, without the creation of artificial heat and humidity traps. The design needs to be robust enough to withstand the rigours of the typhoon environment and the perceived potential threat of vandals, yet attractive enough to communicate the value of the carvings as a community resource.

A new bespoke design for the shelters is needed, with expert architectural input. The vocabulary of shelter construction should be in keeping with Country Parks design standards, and thus to provide for public recognition of the value of the carvings as a community resource of interest. In addition, the special conservation needs of the rock carvings need to be taken into consideration.

While the design of the new shelters should be drawn up by a professional architect with expertise and experience in the construction of this type of outdoor protective structures,² the consultant would like to recommend some guidelines for the new shelters:

Size: The size of the newly-designed shelters should be large enough to allow no possible physical access to the carvings by visitors, in order to protect against intentional vandalism, graffiti, and unintentional damage caused by repeated touching of the carved surface. The walls and roof of the structures should be far enough away from the surface of the carving, so as not to affect the ventilation and natural thermal conditions of the rock. All shelters which have been built to date are far too small with walls and roofs much too near the carved surfaces. Larger enclosures will also allow for visitors to observe the carvings in a more authentic setting of the rock face, and

¹ Although at some sites, notably Big Wave Bay, the new interpretation plaques do a much improved job of providing informative, interesting, bi-lingual interpretive material about the carvings and their historical context.

² Names of such qualified architects can be obtained from ICOMOS.

ameliorate the feeling at many sites that the rock carvings are "in prison" behind the bars and walls of their shelters. "Imprisoning" the carvings in this way sends the wrong message to the public and indicates that these artifacts are of little interest and not much value to the public as a community resource.

Roof: The shelters need to have sloping roof to provide water drainage; as well as protection from direct sunlight at the hottest times of the day when danger thermal differentials in the rock surface are the greatest. The consultant has observed that the best carvings in the best condition are those that are both well-ventilated and well-shaded (Joss House Bay, Shek Pik, Wong Chuk Hang.) The roof should not be made of glass or other transparent or translucent light-conducting materials. These focus light and create pockets of high temperature and humidity inside the shelter (as is the case with the Cheung Chau shelter, which otherwise is perhaps the most attractive of the existing shelter designs built to date.)

Materials: While the final choice of materials should be left to the qualified architect, consideration should be given to the use of stainless steel (which is inert and easily maintained); tempered, shatter-proof glass; stone; and wood for the roof. To be avoided are (i) concrete, which will eventually dissolve, leaching cement to coat the rock surface, permanently damaging the carving; and (ii) exposed, untreated iron, which will react chemically with the rock it touches, discolouring it. Both of these materials (concrete and untreated iron) will introduce into a site, additional conservation problems, and should be avoided.

Ventilation: Ventilation is all important. It is impractical (and also undesirable) to isolate the carvings from all exposure to water. Water washes the surface dirt from the carvings and keeps them clean. This inhibits the growth of fungi and other micro-organisms. But water must not be allowed to remain for long on the rock surface. Therefore, the shelters must be so constructed as to insure that there is proper drainage of water and sufficient ventilation to allow for evaporation of moisture at the "natural" rate which will dry the surface of the rock as quickly as possible without the radical thermal expansions and contracts which can be caused by direct sunlight. (This optimum ventilation design can best be modeled by the architect in cooperation with geo-technical engineers, but in simple terms it can be easily described as "airy, well-ventilated, and shady".

Cost: One of the issues in the construction of protective shelters at the sites to date is that insufficient investment has been made by AMO in the design and construction of structures of sufficiently high quality to perform the tasks intended. This is an area where added budgetary inputs are required to solve the problem.

To Build or Not to Build. There is an argument that not all sites need shelters for protective purposes. For example at Wong Chuk Hang, where access is carefully controlled by a walkway on the other side of the small river valley, does not need a shelter for protective purposes. Other sites, such as Po Toi, quite obviously will benefit from protection again wind and water erosion, the effects of which are visible. It has been argued that other sites, in particular Kau Sai Chau, do not need a shelter due to their inaccessibility, but this consultant in consultation with experts of the Hong Kong Geological Services Department has been advised that a shelter is needed in order to protect the carving from water and falling debris, brought down by water, from the rock face above the carving.

There are three inter-linked considerations in constructing shelters at the rock carving sites:

- (i) To protect the site from wind erosion and water
- (ii) To protect the site from vandalism
- (iii) To provide information and give added value to the site as a community education resource

The first of these considerations (erosion) should be ascertained by competent experts from the Government's Geological Services. The question to be asked of and answered by experts from

Geological Services is "Will a structure protect the carved surface from wind erosion and water damage or not?"

The second of these considerations (vandalism) is a political decision based on past experience, accessibility of the site, and frequency of visitation. This consultant does not have sufficient information to make a fully-informed judgment in this regard. As no site has experienced vandalism in the past, there seems to be an argument that protection for this purpose is not needed within the Hong Kong context. However, as past experience at heritage sites elsewhere has shown, the more well-known and frequently visited a heritage site is, the more likely there is that someone will vandalise it – at least with graffiti. Although no records of visitation at the sites is kept by AMO, this consultant has the impression that the most frequently visited sites are Big Wave Bay, Joss House Bay, Cheng Chau, Poi Toi and, to a lesser degree, Tung Lung. While the least frequently visited are Wong Chuk Hang, Lung Ha Wan, and Kau Sai Chau. Shek Pik is an anomaly as its location near a prison's garbage dump invites abuse and vandalism.

The last of these three arguments above suggests that all sites should have bespoke structures of some sort or another, for the purposes of interpretation and giving added value to the site as an place of importance in the community.

2.2 Requirements for intervention treatment

INFILTRATION OF WATER THROUGH FRACTURES IN THE ROCK

The second problem is that of the infiltration of water through natural bedding fractures in the rock that allow water to seep out through the rock and onto the surface of the carving. To address this issue, AMO needs to form an alliance with the Geological Services of the Hong Kong Government, a department which has already shown its ability and willingness to address this issue in a most constructive way. This problem cannot be adequately addressed within the AMO; it is an issue which outside the scope and expert capacity of the AMO, as it would be of most any archaeological service of any country in the world.

This consultant has had discussions on how to address this issue with experts in the Geological Services and what they advise needs to be accomplished is threefold:

- (i) Firstly, there is the need to map the cracks and fissures in the parent rock of each carving which allow water to seep through the rock to the surface of the carving;
- (ii) Secondly, following this mapping it will be possible to model this flow of water and the options of how it may be diverted from the carving surface;
- (iii) Thirdly, it will then be necessary to implement the geo-technical engineering solutions to this problem, on a site-by-site basis.

This is a straightforward approach to the problem and has much to recommend it. It will of course require the cooperation of both the Geological and Geo-Technical Services of the Hong Kong Government. It will also require a budgetary allocation, which these services are in the best position to estimate.

2.3 Follow-up evaluation and documentation work

From the above discussion of the issues affecting the conservation of the rock carving, an important question arises: "If the means to address these two most serious medium to long-term aspects of site conservation management are outside the scope and capacity of the AMO, what then is the role of the AMO in safeguarding the rock carving of Hong Kong?"

The answer to that is clear and straightforward. Like the goal of any government heritage protection agency, the roles of the AMO are (i) to be vigilant in monitoring of the condition of the rock carvings as a public resource of great value; (ii) to mobilize the necessary resources, both human and financial, to deal with any ascertained problem identified during the monitoring, including that of routine maintenance; and (iii) to interpret the significance and value of this resource to the Hong Kong public.

MONITORING

Systematic monitoring protocols must be put into place and implemented with sufficient frequency to be able to inform the AMO of developing conservation problems and management concerns at the rock carving sites. Reactive monitoring, or monitoring which takes place only after a member of the public has reported a problem, is insufficient and ineffective.

For the purposes of best-practice monitoring, AMO needs to have access to a digital data base giving the condition of each rock carving at a specific point in time. This is the baseline against which changes (if any) in the condition of the carving can be measured. The best available tools for capturing and storing this information is through laser scanning. This consultant highly recommends that laser scans be conducted at all rock carving sites as soon as possible. This will require inter-departmental cooperation and a budget allocation.

Photographic records are also useful, especially as these can be compared with previous photographs. Photographs can also sometimes capture a very faint image, given the right lighting conditions (such as at Kau Sai Chau, where the carving is usually not visible to the naked eye.) Photographs can also colour changes which might be indicative of mineral staining or of seasonal growth of micro-organisms.

In the past, (plaster? or plasticine?) moulds were taken of the rock carvings. This practice should not be repeated as the process mechanically affects the surface of the carving.

2.4 Resources implications

MOBILIZING HUMAN AND FINANCIAL RESOURCES THROUGH PARTNERSHIPS WITH OTHER TECHNICAL SERVICES

When systematic, periodic monitoring identifies a potential problem at a site, AMO needs to mobilize the appropriate human and financial resources to deal with the correction of the problem at its cause – and not to wait until it must be dealt with as an already negative effect. For this, it may often be necessary for AMO to look beyond the expertise available within its own staff and to develop partnerships with other technical services of the Government. It has been discussed above that partnerships with Geology and Geo-Technical Services, with Architectural Services, and with Country Parks will be necessary.

It should be pointed out in this respect, that rock carvings represent a special kind of *in situ* archaeological resource that is comparatively rare and the conservation issues of which are especially complex. Most archaeological services do not have on staff the expertise required to deal with all issues pertaining to the conservation of rock carvings and it is very common that outsourcing this expertise from other government services is necessary. This is not a problem unique to Hong Kong.

3. Risks

INTERPRETATION OF SIGNIFICANCE AND VALUE

An archaeological resource which has been declared a protected monument is an asset of great value to the Hong Kong community. The AMO's role needs to be to build upon that asset value by providing informative, interesting interpretation of the rock carvings to the community at large. This is something which can be done in many way with the AMO's own expertise in museum and site presentation; and can be augmented in partnership with Educational Services and Country Parks.

Ultimately, the best protection long-term protection which can be provided for the rock carving is to ensure that the community values them and protects them.

3.1 Identification and assessment of the risk factors

Much more can be done than has been done to date in the interpretation of the significance and value of the rock carvings to the Hong Kong public. The proposed new design of the protective shelters can be a tool to facilitate enhanced interpretation.

- Something which has already been started, with the design of new information plaques, is the linkage of the sites to one another, encouraging those interested to visit more than one site.
- The presentation of comparative material in the interpretation of the meaning of the rock carvings (such as the geometric pottery design) is also an excellent innovation.

However, more can be done. For example:

- The interpretation of the carvings is still that of something remote, mysterious (and therefore probably religious or ritualistic). This is old-school archaeological interpretation. More recent trends in interpretation make linkages between the archaeological artifacts (the rock carvings), their environmental settings, and living cultural practices. In this way, members of the lay community, especially elders in the community, can be brought into the interpretation process.
- Another trend in the interpretation of archaeological sites emphasizes the conservation issues of a site, and how contemporary practices endanger the ancient knowledge encoded therein. Conservation groups within society (such as the Boy Scouts, as one example) can be mobilized for community-based site monitoring activities.
- Archaeological sites also raise interesting scientific issues. The use of laser scanning and the modeling of water migration through the bedding fractures of Hong Kong rocks are just two examples of scientific issues of interest which can be studied using the rock carvings.

These are just some suggestions on how the interpretation of the rock carvings of Hong Kong can be enhanced and the carvings given added value to the community.

3.2 Risk Management

AUTHENTICITY OF SETTING

Much of the value of the rock carvings and inscriptions of Hong Kong derives from the fact that they are in their original location and, with the exception of Shek Pik, this *environmental* setting has presumably remained largely unchanged since the time the carvings were made. Management practices therefore need to pay attention to the preservation of the authenticity of this setting and the sensitive presentation of this setting to the public through the use of non-intrusive naturally-occurring materials in the construction of shelters, access ways, landscaping, etc.

That being said, it is also worth remembering that the rock carvings are no longer in their original *functional* setting. They do not function as originally intended, whatever that may have been.

The contemporary function of the rock carvings is as an important part of the archaeological heritage of Hong Kong, to be understood and appreciated by the Hong Kong public as part of the history of the place where they live.

The implication of these observations is that visitor access to and interpretation of the rock carvings is an essential feature of their good conservation management. It is not an add-on to technical conservation actions to preserve the rock carvings – it is the end goal of all preservation strategies. If the rock carvings have no meaning, no significance and no function in the life of the community of Hong Kong today, there is no justification to utilize public funds for their safeguarding.

It has been argued in some quarters that we need to work to return the environmental setting of the rock carvings to precisely the way it was thousands of years ago, in the attempt to render that setting easily understandable to the general public. There may be some things that can be done in this regard, especially as pertain to the non-introduction of modern materials onto the site and the protection of the views from the carvings to the sea from encroachment by new constructions. However, as the sea levels today are approximately 2 meters lower than they were 5000 years ago, actions to this end will always remain largely a case of site presentation rather than of actual authenticity.

4. Conservation plan

4.1 Priority for intervention treatments

4.1.1 Cheung Chau. The priority for intervention is a Cheung Chau. The induced, rapid deterioration of the upper rock carving must be halted immediately. What is required are the following steps:

- (i) Negotiate with the hotel to stop watering and to remove the 2-3 flowers planted directly above the carving. This daily addition of water, which may well carry chemicals from fertilizers applied to the flowers, assures that the conditions for the growth of micro-organisms is maintained.
- (ii) Remove the glass roof panel from immediately above the carving, in order to eliminate the existing thermal heat and humidity trap. This should be done immediately, before any structure is designed, budgeted and built which may take some time.
- (iii) Collect the stone powder at the foot of the carving and have it analyzed to determine if it is the result of the action of micro-organisms.
- (iv) Apply an appropriate fungicide to kill the micro-organism, at the appropriate place in its fruiting cycle. (The application protocols should be determined in consultation with a biological specialist)
- (v) Clean the dead micro-organisms and any rock dust from the carving.

4.1.2 Po Toi. After Cheung Chau, Po Toi requires attention in order to stop the migration of infiltrated water through to the surface of the carving. As explained in Part II.8 and above in Part III 2.2, this will require collaboration with Geological and Geo-Technical Services of the Government.

4.1.3 Shek Pik. Shek Pik also requires immediate attention in order to isolate the site from the garbage dump of the Shek Pik Correctional Institution. Please refer to Part II.9.

4.2 Implementation plans and 4.3 Timeline for work

4.2.1 Cheung Chau, remedial treatment

Immediate action is required.

4.2.2 Improved housekeeping/maintenance at all sites.

Immediate action can be taken, without budgetary implications.

4.2.3 Laser scanning

As soon as budget allocation can be made available, laser scans should be made of all carvings in order to provide a data baseline for future monitoring.

4.2.4 Geological modeling of water infiltration and migration

This should be foreseen within the next budgetary cycle of Government.

4.2.5 New shelters at all sites

The design of these shelters and their implementation should be undertaken, in collaboration with Country Parks, as soon as budgetary allocation can be obtained. Phased execution can be considered.

4.2.5 Interpretation plans

Improved site interpretation should be incorporated into the construction of new shelters.

5. Recommendations on specialist supplies

5.1 Sources of specialist materials and service suppliers

The consultant does not recommend any particular chemicals and suppliers. What can be recommended with regard to materials are the following:

The **inert cleaning agents** which have previously been applied to clear the carving are appropriate.

The broad spectrum **anti-fungals** which have been used by the AMO to treat the growth of micro-organisms are generally appropriate, but as fungal growth is not a widespread or immediately serious problem (except at Cheung Chau, and potentially at Po Toi), the precise type of micro-organism should be identified in partnership with the universities' biology departments, and a specific fungicide applied at the appropriate time in the fruiting cycle. This will result in longer-lasting results and minimize the need for frequent re-applications.

While there is no evidence that the **water-proofing treatments** given to some of the carvings has done any damage to the carving; there is also no evidence that it has done any good. At Lung Ha Wan, the weathering of the applied chemical itself is noticeable and uneven due to the uneven surface of the rock. Therefore frequent reapplication would be required IF this treatment were to have its desired effect. However, the frequent reapplication of such a material to the surface of the rock will result in build-ups which will differentially affect the rock surface's natural transpiration. So it is recommended that this treatment be discontinued.

It is recommended that in the **construction of new shelters**, which are required at all sites, no concrete is used in any location where there would be any danger of dissolved concrete leaching out to coat the rock surface. Nor should untreated iron be used. Consideration should be given to the use of stainless steel, tempered shatterproof glass, wood and stone in the construction of the new shelters. However, the final choice of materials is a matter for the architecture specialists to decide.

In general, it is not the type of (chemical) product or its source which needs to be of concern to the AMO. What should be of concern is to mobilize the proper expertise within sister government agencies or from universities in order to answer the problems facing the conservation of the rock carving with the proper expertise.

If there has been a problem with the conservation of the rock carvings in the past, it is to be found in the assumption that chemical treatment of the surface will solve the problems. This is at best a cosmetic solution with little medium or long-term impact. Long-term impact will come through partnering with sister departments/agencies with the appropriate expertise.

5.2 Recommendations for outsourcing of site management (if necessary)

This consultant does not see the need, or the desirability to "outsource" management of the rock carving. In fact, the AMO should not (and probably cannot) delegate its responsibility to monitor and assure the safeguarding of declared monuments.

5.2.1 Recommended changes

That being said, some changes in the current management structure is needed:

5.2.1.1 Cheung Chau. The only site which is under immediate risk is the only site not under AMO direct management. This anomaly needs to be rectified by an order of the Chief Executive giving the AMO access to and management rights over the site.

5.2.1.2 Shek Pik. This site is located, if not within, then literally directly adjacent to the garbage refuse area of the correctional institute. While the daily refuse of the institute is dealt with in an appropriate fashion, there is nonetheless a lot of discarded rubbish in the vicinity of the rock carving. Access to the rock carving is through a garbage disposal area; and the rock carving itself sits literally within a garbage dump. While the immediate vicinity of the carving (approximate 1 meter) is free of garbage, the impression is nonetheless of the carving being in a garbage dump. This is certainly no way to value the carving to the public as a community resource; and it will eventually lead to direct conservation problems, as garbage has a way of creeping ever outward. It is recommended that access to these carving be changed to come from the hikers' trail above the site and that the site itself be physically isolated from the prison's garbage area.

5.2.2 Establishing partnerships.

5.2.2.1 Country Parks. While the AMO has the primary responsibility for monitoring the condition of the carvings, it does not have the responsibility for managing public access to the sites. This is a matter for Country Parks. Especially considering that housekeeping has been identified as an issue of some concern at all sites, there should be an inter-departmental protocol established for monitoring and maintenance of the site environs, including the shelters.

5.2.2.2 Geological Services. Given that the most serious issue of the conservation of the rock carvings involves the water migration through fractures in the body of the rock, regular on-site monitoring should be carried out together with an expert from Geological Services.

5.2.2.3 Education Department: As a community education resources the rock carvings are under-valued and therefore under-used.

5.2.3 Inter-department coordination mechanism

Given the need for inter-departmental collaboration to assure the protection of Hong Kong's rock carvings, it would seem appropriate that a rock carvings safeguarding task force be established, convened and chaired by AMO, and with membership from, at a minimum:

• AMO

- Country Parks
- Geological Services
- Education Department
- Others could be co-opted onto the task force on an *ad hoc* basis, as required by the issue at hand.

This arrangement would provide AMO with the extra-departmental expertise it requires for best-practice management of the rock carvings. It would also increase the value of the rock carvings as a heritage resource for the community by raising their profile within Government and with the public. An inter-department task force would also serve the purposes of increased public transparency in the management of this resource.

6. Concluding observations

6.1 With the exception of Cheung Chau, where immediate action is required to halt the accelerated deterioration of the surface of the rock carving due to human agency (added water and a constructed heat/humidity trip), there is no ascertained immediate or medium-term risk to the rock carvings.

6.2 The long-term risks, involving (i) wind/water erosion and (ii) water migration through fractures in the rock, are inherent in the environment in which the Hong Kong rock carving were created. Over the centuries, the carvings have evolved an equilibrium with these environmental factors. This equilibrium should not be disrupted by abrupt physical and chemical interventions. This is not necessary and the disruption caused by the intervention will, in most situations, accelerate deterioration, at least until a new environmental equilibrium can be established.

6.3 The natural long-term process of deterioration may, perhaps, be slowed somewhat with two interventions:

- (i) well designed purpose-built shelters
- (ii) diversion of water seepage within the rock

Both of these interventions require expertise that needs to be sourced outside the AMO.

6.4 It needs to be understood that the effects of these interventions on long-term processes of deterioration may, in fact, be negligible when measured over the relevant long-term time scale. It is difficult to interrupt, or even to slow, the processes of geological and climate change. The shelters, in particular, may serve a more important role in the interpretation, valuation and promotion of the rock carvings, than they do in the actual physical conservation of the stone surface. This should be kept in mind in the design of the shelters.

6.5 AMO's role in safeguarding the rock carvings is in their conservation management. It is important to understand that objective of conservation management is not to stop all change. Change is part of archaeology and history. Change is, in fact, what the scientists of these disciplines study. The objective of conservation management is to monitor and manage the rate of that change, and if the rate accelerates to determine why it has accelerated and to intervene on the causes of that acceleration.

6.6 AMP priorities

6.6.1 The first priority of AMO is to stop the deterioration at Cheung Chau.

6.6.2 The second priority should be to set in place monitoring protocols and to implement them in a systematic way. This will include, first of all, the establishment of baseline information on the exact state of the rock carvings using non-invasive laser scanning.

6.6.3 This will then need to be followed through on with enhanced housekeeping arrangements at all sites, as a third priority.

6.6.4 The fourth priority of the AMO should be to add value to the rock carvings as they are understood as a heritage resource for the Hong Kong community, through improved interpretation, visitor facilities and information.

6.6.5 The fifth priority is to mobilize the relevant sister services of Government to address the two identified issues of (a) migration of infiltrated water; and (b) protective shelters.

6.6.6 These priorities will also require that some changes in the structure of site management takes place, particularly with regard to Cheung Chau and Shek Pik where the AMO needs to assume more direct management of the sites and their immediate vicinity. This is the sixth priority.

6.6.7 As all of these actions will require that the AMO action in cooperation with other responsible departments of the government, the seventh priority is to establish an inter-departmental coordination mechanism for the safeguarding of Hong Kong's rock carvings.

6.7 Budgetary requirements

Budgetary provisions will need to be made for the recommended improvements in the conservation and management of the rock carvings sites. In particular the following need budget allocations:

- Laser scanning
- Geological modeling and geo-technical interventions
- Design and construction of new shelters

These budget provisions may not all be appropriately allocated within the budget of AMO, but may be more appropriate within the budgets of the Geological and Geo-Technical Services and the Country Parks Department, for example.

6.8 Communications strategy

It is important to remember (and to communicate to the interested public) that good conservation practice always addresses underlying causes; it is not merely cosmetic. This is especially true of the *in situ* conservation of archaeological relics, as the safeguarding and preservation of the context of the relic is part and parcel of the safeguarding of the relic's overall value. Conservation interventions which are aimed at reversing the effects of an underlying problem are an indication, perhaps not of failure, but of less-than-perfect management of the archaeological resource.

Museum objects often require drastic conservation measures precisely because they have been taken out of the archaeological context in which they have achieved environment equilibrium over time, without the proper safeguards to ensure that their environmental equilibrium is maintained.

If the short-term risks to Hong Kong's rock carving are negligible and the long-term dangers are inherent in their environmental context, the medium-term threats perhaps deserve the most attention from AMO. All of the medium-term threats identified involve the lack of value the rock carving are given within the Hong Kong community, as evidenced particularly by the Shek Pik carvings relegated to the prison garbage tip. More systematic monitoring, better housekeeping, on-site facilities improvements and more pro-active interpretation are the appropriate management responses to these medium-term threats.