

Hongs of southeast Asia.

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Abstract: Hongs are dolines invaded by the sea within fengcong karst, and are commonly accessible only through caves within the tidal zone. The best of them are in the limestone islands of Phang Nga and Ha Long Bays, in Thailand and Vietnam. Isolated within rugged and forested terrains, hong lagoons can be very beautiful sites. The sea-level caves that lead into them either pre-date the hongs or developed as a result of their presence.

Keywords: hong, doline, marine karst, tidal cave, Thailand, Vietnam, Malaysia.

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INTRODUCTION

Southeast Asia has some magnificent karst landscapes, including some along the coasts that have been flooded by relative rises in sea level. This has left karst towers and hills that rise dramatically from the sea, with sheer cliffs that drop right down into the water, while the karst plains between are fully submerged. The most famous areas are at Phang Nga Bay on the west coasts of Thailand, and Ha Long Bay in Vietnam, with other smaller sites scattered along the Andaman coast of Myanmar, Thailand and Malaysia, and also on the Gulf coasts of the Thai peninsula (Fig.1). All of these regions are in relatively narrow belts of folded Carboniferous and Permian limestones. The outcrops are crossed by faults, many of which

separate isolated outcrops that become single clusters of fengcong karst. Along the coasts these become individual islands, whose steep and rugged profiles are a distinctive feature of these very beautiful marine karst terrains (Fig.2).

The island hills of limestone are distinguished by their widespread marine notches, cut by both dissolution and wave action, and development of these contributes to cliff undercutting that steepens the hill profiles and turns them into spectacular towers. Some small islands are individual single towers, but most are clusters of steep-sided hills in the style of fengcong karst; their hills are not vertical-sided towers but are just very steep cones, though many of the outer cliffs have been undercut by marine erosion so that they now include many vertical profiles. Many of the limestone walls are scored by higher dissolution notches, representing former sea levels. Numerous open entrances in the cliffs are truncations across older caves; these include early phreatic passages and old sea-level caves, and there are also drowned caves that now lie beneath sea level.

A distinctive feature of these islands is the hongs, named after a Thai word meaning room. Essentially, hongs are large, partially drowned dolines within the fengcong karst that now contain inland, open-air, tidal lagoons surrounded by sheer limestone cliffs. The hongs can reach more than 300m in diameter, and many are very beautiful enclaves of solitude isolated within the forested karst. They all have hydrological connection to the sea, and in most cases this is



Figure 1. Southeast Asia, showing locations of hongs and hong caves.



Figure 2. Undercut limestone tower that is now an island in Phang Nga Bay, just off the Phra Nang peninsula.





Figure 3. A typical hong, with its lagoon surrounded by fengcong karst, in Cong Do Island within Ha Long Bay.

through accessible caves that penetrate right into the islands within the tidal range. For a typical hong, the only way in and out is through its tidal cave, as any route over the steep limestone rims is rarely an attractive option. Most of the hong caves have deep water throughout their lengths, but many have low roofs close to high tide level. Through the latter, the route through may only be open for an hour or so around each low tide. Once the tide is high, all or part of the cave may be totally underwater.

The typical hong is a deep doline, open-roofed but with steep or vertical perimeter walls (Fig.3). Because sunlight reaches in, flora and fauna abound. Large mangroves are common inside the hong. Other plants are able to grasp a foothold and grow on the sheer walls. Cycads grow high up on the walls; as the oldest group of seed-bearing plants, these have undergone relatively little change over the last three hundred million years, earning them the appellation of “living fossils”. There may be endemic species of palms and figs. The fruiting trees, such as figs, provide seasonal food inside the hong for many species of birds and primates. Long-tailed macaques feed on fruit and insects, as well as crabs and crustaceans at water level. Dusky langurs, or leaf monkeys, are vegetarian and can survive on the plants inside the hong. Even gibbons may be found on the larger karst islands where there is continuous forest cover enough to support their dietary needs. At water level, monitor lizards, snakes and other reptiles dwell, and birds are common inhabitants.



Figure 4. Truncated fragment of an old phreatic passage, draped with stalactites, that now forms a sea-level tunnel through an island in Phang Nga Bay.



Figure 5. Sea cliffs that fringe the splendid karst of Ko Hong in Phang Nga Bay.

Some of the caves opening into the hong, other than the tidally submerged entrance caves, contain colonies of bats and swiftlets. Local people have known about these sites for a long time, and have long collected birds’ nests from within the caves. Fisherman also visit some hong on a regular basis. But for many hong today, the largest numbers of visitors are tourists who are drawn to the unusual beauty of the “hidden” hong lakes, often with the added excitement of reaching them in a kayak or by a long swim.

Hong are not restricted to Southeast Asia, though this region does appear to contain the best of them. They could occur in any coastal region of well developed cone karst. Hong have been reported in some of the Philippine islands. A hong is known as a wang in Malaysia, but this term also includes inland karst basins and deep poljes that are accessible through caves.

HONGS OF PHANG NGA BAY

The sheltered waters of Phang Nga Bay are justly famous for their beautiful limestone islands, and have become a major visitor destination, mainly reached from the tourist centres of Phuket and Krabi, on either side of the bay (Dunkley, 1995). Much of the area is now part of a National Marine Park and there are strict controls on access by tour groups. Recreational diving is a major industry, and sea canoeing is also very popular, with flotillas of canoes and kayaks going around the islands and their hong. The Thai word for an island is *ko*, and for a cave is *tham*. Some of the sea-level caves are half-drowned remnants of spacious phreatic passage (Fig.4), but others are the characteristic low tunnels within the tidal range.

Ko Hong (or Hong Island) is one of the most visited islands, as it lies in the Phuket sector of the bay (Fig.5). There is a classic hong lagoon in the centre of the island. Its access cave has a low entrance from the sea, but the cave roof soon rises and is decorated with stalactites, and also with stalagmites on its dry banks. Then the roof suddenly lowers and the walls close in, to leave a gap not much larger than a kayak; the canoeists have to lie flat to get through. This tunnel leads out into the hong. Its sheer limestone walls rise more than 100m, and are capped with lush green vegetation. The grey and white cliff faces are streaked with red, orange and black striations, created by algae and lichens. Green pandanus and other palms and shrubs cling to the precipitous walls, and there are mangroves at water level.

Ko Panak is another, much larger island, also off the Phuket coast, that has at least nine hong lakes within its northern end (Fig.6), four of which are each well over 100m across and are regularly visited by tourists in kayaks. From the eastern coast, Tham Pa Chai Len (Mangrove Cave) reaches through darkness into a large hong with mangroves that is also visited by local fishermen (Fig.7). Tham Phet (Diamond Cave) is named after a fine bank of flowstone inside the dark cave that is 70m long; it leads to one hong, from which an arch passes through to another. On the west side of the island, Tham Khang Khao (Bat Cave) is 150m long, housing colonies of insectivorous bats that seem to be oblivious to passing tourists in kayaks; it leads into a hong 120m across, which is known for its resident troops of crab-eating long-tailed macaques. Oyster Cave (Tham Hoy Naang Rom) is 50m long through a high ridge into another small hong.

Farther north in Phang Nga Bay, Tham Lod is one of the larger tunnel caves that have numerous small tourist boats passing completely through small islands. Nearby, Ko Thalu has many sea caves popular with visitors in kayaks, but no known hong. Farther

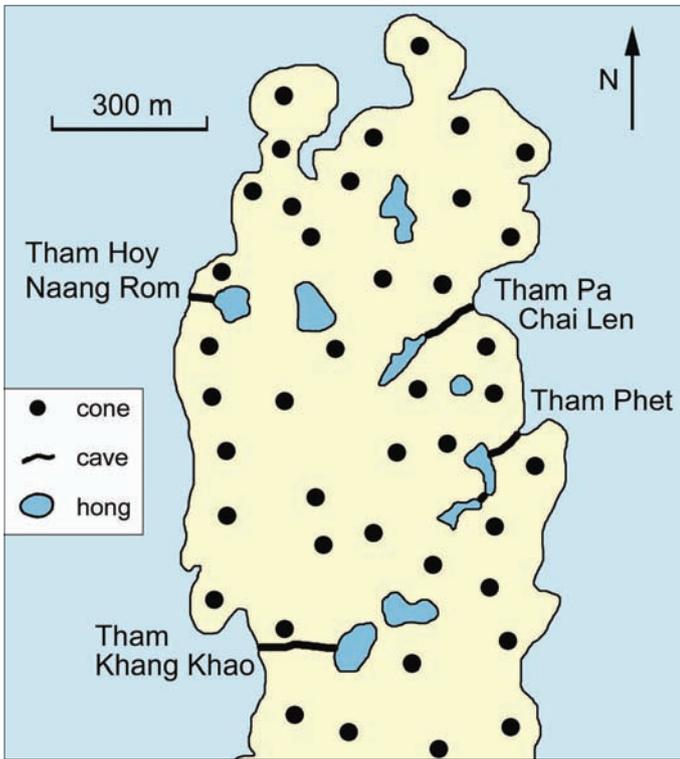


Figure 6. Outline map of the karst hills, hongs and caves in the northern half of Ko Panak, in Phang Nga Bay.

east, Ko Kudu Yai has three small hongs just in from its east coast, but it is not known if there is access to them though sea level caves. There are many more sea-level caves that have been searched out by local kayak companies taking tourists out from Phuket and Krabi, and many of these lead to hongs, but none is known to be more than about 50m across.

Near Ao Luk, about 40km north of Krabi, the Than Bokkhorani National Park is best known for its waterfalls and flora, but also has caves within some splendid areas of karst. Downstream of the Bo Tho Pier, Tham Lot Nua (or Lot Tai) is a water-level tunnel cave 90m long through a small hill. Its southern entrance is 30m wide and the northern is 15m, while the roof is about 8m high, adorned with stalactites. Daylight penetrates the whole cave, and dusky langurs are common around it. Just upstream from Tham Lot Nua, and only accessible by boat, Tham Phi Hua To (or Hua Kalok) is a high-level cave with three entrances into two large chambers that are noted for their ancient petroglyphs and wall paintings. Upstream from Bo Tho Pier, another Tham Lod is again a water cave (Fig.8), which passes through a darkness zone round bends that prevent daylight penetrating (Fig.9). It emerges in a beautiful hong, with a circular lagoon surrounded by high cliffs. Cycads cling to the sheer cliffs,



Figure 7. Kayakers among the mangroves in the hong reached through Tham Pa Chai Len in Ko Panak.



Figure 8. The view out from Tham Lod within the Than Bokkhorani karst, east of Phang Nga Bay.

and oyster shells are attached to the lower walls. Various other sea-level caves are known in the area, but these lead through limestone ridges and not into hongs.

Just west of Krabi town, Ao Nang has the beaches, hotels and resorts of Railay on the Phra Nang peninsula, all only accessible by boat from Ao Nang beach. The peninsula is a series of limestone hills fringed by isolated beaches where the undercut cliffs have created a mecca for rock climbers. Beyond a sand spit, the outer cluster of limestone peaks has in its centre a single hong lagoon, locally known as Sa Phra Nang, reached by a rough path over its very steep marginal ridge; there is no known cave access.

Tham Phaya Nak (Viking Cave) lies in the steep eastern cliffs of Ko Phi Phi Le, with a wide entrance at high tide level. It opens into a partly day-lit chamber more than 50m across and over 30m high, which is famous for its acrobatic birds' nest collectors, but there is no hong.

HONGS OF THE ANDAMAN COAST

The limestone outcrops of Phang Nga Bay have sporadic extensions further south, as far as the Kedah coast of Malaysia. They also appear in isolated fault-bounded outcrops farther north in the Mergui Archipelago of Myanmar.

Ko Muk is an island offshore from Trang, south of Phang Nga Bay. It contains the cave of Tham Morakhot, which goes under the name of Emerald Cave for the benefit of its many foreign visitors. A classic hong lies just in from the sea cliffs on the western side of the island (Fig.10). The linking cave is 80m long and curves enough to leave a short middle section in almost total darkness. It is large enough to take a small boat at low tide, but this is discouraged, so tourists swim through after leaping into the sea from their boats moored to buoys outside. The entire cave is in deep water and the gentle swell from external waves creates dramatic sound effects in



Figure 9. Heading in to Tham Lod.



Figure 10. The western coast of Ko Muk at low tide, with the entrance to Tham Morakhot in the dark shadow of the marine notch, directly beneath the saddle over to the hong.

the darkness, as water is trapped and freed from marginal air pockets. The hong is spectacularly beautiful, with a clean, white sand beach beside a lagoon about 50m across; lush vegetation backs the beach, and the site is surrounded by limestone cliffs 30m or more high (Fig.11). The popularity of the site meant that tourists were there on the December morning when the 2004 tsunami arrived. Two swimmers were caught within the cave, where the rapid rise of water meant that they were drowned against the roof. Another 80 tourists were safe on the beach inside the hong, but were trapped for some hours because they had no idea what was happening and were unwilling to risk a swim back to the open sea when they thought that further high waves could arrive.

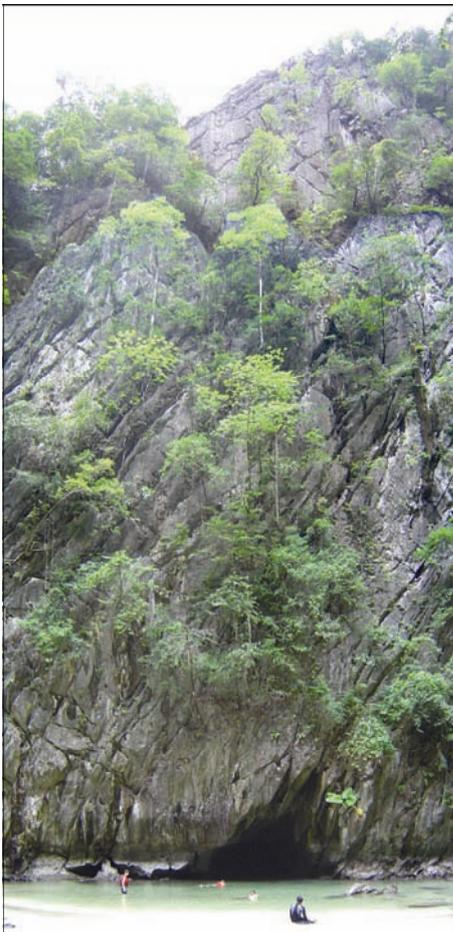


Figure 11. The steep perimeter cliffs inside the Ko Muk hong, looking across the lagoon to the hong entrance of Tham Morakhot.



Figure 12. The southern end of Hinget Thaik Taung, in the Mergui Archipelago; left of centre, the low rocky saddle leads over to the large hong lagoon, and the tidal cave into the lagoon lies in the shadowed notch beneath the centre of the hill just right of the saddle.

Langkawi is the largest of a group of 104 islands just into Malaysia. Its northern peninsula near Tanjung Rhu has various sea-level caves that are reached only by boat. Gua Teluk Dedap lies at beach level, and its straight, sand-floored passage can be walked through at low tide for 70m, to a hong lagoon 80m across. Its perimeter cliffs only rise 20–30m, and mangroves fill part of the lagoon. Just south of Langkawi, the lake of Dayang Bunting is more than 500m across in a deep depression in the limestone island of the same name. It is 14m deep and is separated from the sea by a thin wall of limestone; its brackish water suggests that it has limited underground connection with the sea, so it may also be described as a hong. A karst lake over 200m across appears to be another hong lagoon in the middle of the small island of Pulau Langgun, just east of Langkawi.

The Mergui Islands along the southern Andaman coast of Myanmar (Burma) include only a few that are of limestone (Waltham and Eavis, 2004). The small island of Hinget Thaik Taung contains a single hong lagoon 300m across (larger than shown on the 2004 map) that is reached through a classic tidal cave 100m long (Fig.12). The next island to the north has a lagoon of similar size, with a similar tidal cave into it, but the opposite side has been breached by marine erosion and is now open to the sea.

HONGS OF ANG THONG PARK

The Ang Thong National Marine Park lies between the east coast of the Thai peninsula and the holiday island of Ko Samui. The park includes about forty islands, many of which are limestone, that rise dramatically from the sea, some to heights of 400m.

Ko Mae Ko (Mother Island) is famed for Ang Thong (Golden Bowl), a green lagoon that gave its name to the entire archipelago. Also known as Thale Nai, this is a classic hong with a shallow tidal lagoon about 250m across. It is regularly visited, and the visitors have to climb a steep path from the seashore to the hong rim, as there is no known accessible route through any sea-level cave.

Many of the other Park islands have caves and lagoons, but the other dolines of Ko Mae Ko are no longer hongs as they have been breached by the sea to create spectacularly enclosed bays.

HONGS OF HA LONG BAY

The northern coastline of Vietnam is famous for the spectacular scenery of Ha Long Bay. This is a superb seascape of limestone islands that represents an extensive drowned karst. Small rock islands are undercut fenglin towers, whereas larger islands are clusters of fengcong peaks containing many short segments of large and decorated cave passage. There are 775 islands in Ha Long bay, with many more along the coast to the east (Waltham, 2005). Wave-cut notches are a feature of the Bay's islands; some reach back into caves within the tidal range, and some of these reach through to hong lagoons.

A well-known feature in Ha Long Bay is the Ho Ba Ham group of hongs and their connecting caves in Dau Be Island (Fig.13). From

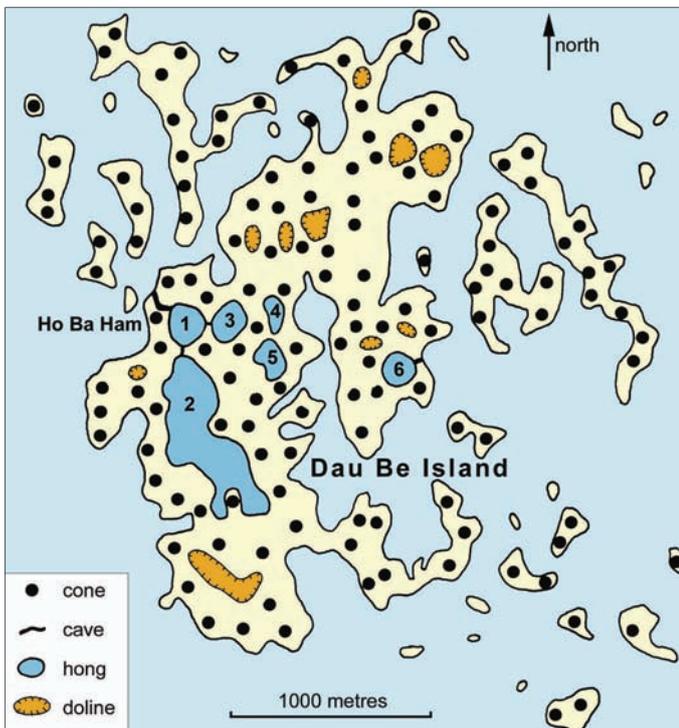


Figure 13. Outline map of the karst hills, hongs and caves in Dau Be Island, in Ha Long Bay.

the island's perimeter cliff, a cave extends about 150m to Hong #1; the passage is 10m wide at water level, and curves so that the centre is almost dark and requires some care when passing through in a boat. At low tide there is a minimum of 1.5m of airspace, over water that is at least 2m deep. A second cave is of similar cross section but only about 60m long, and leads through to Hong #2, with a lagoon that is 800m long. These two caves were the sole means of access to a floating fish farm that was operated by Chinese on the lagoon in Hong #2 up until the mid-1990s (Fig.14), though all trace of it has since been removed. A cave through to Hong #3 is smaller, and may only be traversed by a canoe; any links to Hongs #4 and #5 have not been checked. Hong #6 is reached by a separate cave about 50m long from the cliffs on the east coast of the island. Some of the other deep dolines among the karst of Dau Be may once have been active hongs, but their floors are now largely above high-tide level. In the two larger caves, in and out of Hong #1, most of the ceiling profile is a perfectly flat corrosion surface. Bulbous stalactites up to 1m in diameter hang from the cave roofs, and largely postdate the ceiling planation.

There are at least 15 more hong lagoons in Ha Long Bay, besides the six in Dau Be Island and at least four more in limestone islands east of the bay. Nearly all are less than 250m across, and all are tidal. Sea-level caves are only known reaching through to some of these hongs, but more caves probably await exploration and documentation. Hang Luon (Fig.15) is one of the largest caves in



Figure 14. The fish farm that once existed in the inner hong lagoon of Ho Ba Ham, in Ha Long Bay.



Figure 15. The sea-level cave of Hang Luon, which reaches through into the large hong lagoon in Bo Hon Island, Ha Long Bay.

cross section and extends 50m through to a large hong lagoon in Bo Hon Island. A cave into the eastern tip of Cong Do Island carries sea water in and out of a hong lake; its passage is over 3m high and wide, and it is a very fine stream cave in clean rock, unusual only in that its flow reverses with the ebb and flow of the tide; whether it is completely traversable at low tide is unknown to the authors. There are many more marine notch caves that reach through headlands (Fig.16) and not into hongs, notably linking adjacent bays on the west side of Vung Ha Island and again on the south side of Bo Hung Island.

West of Halong Bay, and south of Hanoi, Tam Coc is a small inland area of spectacular tower karst that is often known as "Ha Long among the rice paddies". The Ngo Dong River winds across poljes within the karst and passes through three intervening caves each 50–150m long that are cut in behind major dissolutional notches that fringe the alluvial flats. Flotillas of rowing boats carry visitors through the caves, which are more than 10m wide with headroom of about 2m over deep water (Fig.17). With their access through caves, the poljes are similar to hongs except that their lagoons are now cultivated as rice paddies.

HONG GEOMORPHOLOGY

A hong may be dismissed as no more than a drowned doline, but it does constitute a singularly attractive landform that characterizes some of the karst terrains in Thailand, Vietnam and elsewhere. The hongs lie within the coastal fengcong karst – the spectacular topography of limestone hills clustered into small groups that stand above wider areas of karst plain. The clustered peaks define this as fengcong karst in the Chinese style, which is broadly equivalent to cone karst in Western nomenclature (though with cones commonly much steeper than in the classic cone karsts of Java and Jamaica). The precipitous hills in both the Phang Nga and Ha Long bays commonly earn the appellation of tower karst, though true towers are isolated hills (known in China as fenglin karst), and internal dolines cannot occur within unclustered towers.



Figure 16. The arched roof of a sea-level cave linking adjacent bays between the karst hills of Vung Ha Island, Ha Long Bay.



Figure 17. A water-level cave through a karst tower at Tam Coc, in mainland Vietnam.

The dolines that become hong are of either collapse or dissolutional origins. The characteristic large-scale hong have internal lagoons that are 100m or more across, are partly alluviated, and are surrounded by steep limestone slopes covered in lush green vegetation (Fig.18). These are drowned versions of the normal, steep-sided dolines within mature fengcong karst. They are formed largely by dissolution within karst during periods of declining base level, and any concept of widespread collapse origins would rely on extension of the concepts of more extensive cave un-roofing and tiankeng collapse within the fengcong (Klimchouk, 2005).

However, some of the small-scale hong, particularly some of those found by the kayakers in the north of Phang Nga Bay, have steep or overhanging marginal walls that drop straight into lagoons, some of which are only 30m across. These appear to have developed, largely or entirely, by roof collapse of cave chambers of modest dimensions.

The drowning of the hong, both large and small, is attributed largely to the worldwide rise in sea-level as the Pleistocene ice sheets retreated. The large dolines within fengcong karst can only develop down to altitudes close to local base level, as subsequent dissolutional activity is directed towards lateral planation and the undercutting of the conical hills; the lagoon within a hong is therefore created only by sea-level rise. Smaller cave chambers, which then collapse to form the smaller hong, can develop at any level, and the presence of their hong lagoons is therefore down to current water level that is coincidentally above their floors.

The caves that provide the sea-level access to the hong are also of two separate origins. Some are simply old passages that have been invaded by the sea so that they now happen to be half-full of water. These include the larger tunnels (that can be traversed by tourist boats), with perhaps many metres of open airspace, commonly adorned with stalactites; their passages may have been modified by dissolutional enlargement of wall notches at their water level. Other old phreatic caves opening into the hong are now dry, as they lie well above sea level; yet more lie entirely below water level, unseen, but belying their presence by the tidal fluctuations of the hong lagoons.



Figure 18. The prominent tide zone notch round the perimeter of the large hong lagoon in Bo Hon Island, Ha Long Bay, with its entry cave of Hang Luon passing under the tower on the left.



Figure 19. The flat roof at the level of the top of the tidal zone notch in the cave through into the first of the Ho Ba Ham hong lagoons in Ha Long Bay.

More significant are the hong caves that lie entirely within the tidal range and have developed in conjunction with the hong lagoons. These are distinguished by flat ceilings that lie very close to the level of high tide, and may be up to 20m wide (Fig.19). These caves are extensions into the back walls of the marine notches that are ubiquitous around the limestone islands of both Phang Nga and Ha Long Bay, formed by dissolution but enhanced to some extent by wave action on the more exposed aspects. The marine hong caves are versions of the foot caves that are common in hills bordering onto karst plains, but there are fewer than might be expected in these areas of very mature karst. This suggests that mixing corrosion may be critical to their development, where only the larger islands gather enough freshwater from direct rainfall to promote significant mixing with the salt water. On the small tower islands, notches (and cliff retreat) develop faster than foot caves.

The presence of a hong may be partly responsible for forming its own cave from the sea where the tidal surges in and out of the hong lagoon focus flows through the limestone fissures. It is noticeable that the positions of the hong caves do not relate to the karst topography; many of them pass directly beneath the higher parts of the conical hills, while others lie beneath the saddles between the hills.

As a variation, some hong caves have flat ceilings at levels metres above present high-water level (Fig.20), and many of these are interrupted by phreatic roof domes or are draped with stalactites. Their ceilings relate to old erosion surfaces, created largely by dissolution in times past when sea levels were higher during the Pleistocene. Also, parts of many hong caves are actively breaking upwards within fractured limestone to create low, stable-arch profiles. They will eventually evolve to become just another suite of cave passages, but currently they are integral features of the rather delightful hong within these very mature karst terrains.

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Figure 20. Kayakers entering the sea-level cave of Tham Lod through to a large hong in Ko Panak, Phang Nga Bay, with an old marine notch cut into the cliff above.