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Cave Management Classification in Thailand: Modification of the Australian Scheme

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ABSTRACT

A new cave management classification scheme for use in Thailand is proposed being a modified version of the Australian Cave Classification for Management scheme. The new scheme retains the simplicity of use in the original, adds two new classes and improves on the level of comprehension of the terms used. Incorporation of the scheme into the new database for the caves of Thailand, currently under preparation, will help with data referencing and retrieval. The scheme is also intended to aid management decisions and has important implications in fund allocation. All individuals and agencies with responsibility for the management of caves and karst in Thailand will find the scheme useful. Extensive testing in the field has already proven the ease of use by non-specialists and applicability of the scheme.

Keywords: natural resources management, classification, cave, karst, Thailand.

Background

Caves are widely distributed throughout Thailand, in rocks of virtually every age and type. The majority of presently known caves (c. 4,000 sites) occur in limestone of Permian and Ordovician age, outcropping from northern Thailand down through the mountains of the West and the central plains to the South. The longest, largest and deepest caves in Thailand are also found here, i.e. Tham Phra Wang Daeng, Phitsanulok Province = 13.1 km long (SMART, in prep.), Tham Nam Lang and Tham Pha Puek, both Mae Hong Son Province = 2,000,000 m^3+ in volume and 276 m deep, respectively (DUNKLEY, 1986; KIERNAN, 1990). Many small sandstone caves and rockshelters occur in the Northeast. Exploration, survey, and study of caves in Thailand is ongoing and basic information for most of the c. 20,000 caves thought to exist (DUNKLEY, 1995) is currently being collected. Data gained from past, present and future research is to be stored in a computerised, global database currently under preparation as part of the Thungyai Naresuan Cave Survey Project. This database will cover all aspects of caves and karst throughout Thailand and aims to become the focal point of future research and management. Access to the data will be via the Internet.

Caves in Thailand are significant for many reasons. There are 73 endemic species restricted to hypogean habitats (SMART *ET AL.*, unpublished). Preservation of archaeological and historical material is often excellent and the value of Thai caves for palaeo-environmental reconstruction is being realised. Through historical and current exploitation, caves have played a major role in shaping Thai culture. Caves used for temples and other places of worship and ritual are very common. Swift nest and guano extraction has occurred for

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hundreds of years and several million tourists visit caves annually. The suitability and sustainability of cave use in Thailand varies. A few sites are used appropriately and provide few worries. However, the vast majority of caves in Thailand are subjected to inappropriate use and a great deal of damage is being caused. A system for easily identifying the current management policy or use of a site for comparison with its values within a global database would therefore be very useful. This can be achieved through classification.

Classifying caves is a useful technique that easily and readily describes a site as to its character and contents. Many different classification schemes exist and the one to be used depends on the desired outcome of the exercise. For example, caves may be classified in terms of their mode of genesis (FORD & WILLIAMS, 1989, p. 248), hydrological aspects (WHITE, 1969), interior deposit types (FORD & WILLIAMS, 1989, p. 317; GILLIESON, 1996, p. 144), biological habitats (HOWARTH, 1983), etc.

The scheme being proposed here is for use in cave management. The intention is to create a system whereby information can be logically referenced, stored and easily retrieved when required. The scheme assists with policy and development decisions. Most importantly, it helps to ensure that scarce funds and resources are spent on the caves that need it most (HAMILTON-SMITH, 1991).

Cave management in Australia has been progressing steadily in both quality and quantity for a long time. Speleologists and governmental agencies there realised at a very early stage that the natural, scientific, and cultural heritage contained in caves is indeed very significant. They also had the foresight to see that this heritage was being wasted and lost through inadequate management practices and policies. Today, Australia, together with the USA, represent the forerunners of cave and karst management.

Whilst not suggesting that Thailand should copy these practices and policies in their entirety, there are certainly lessons to be learnt. One of these lessons is the Australian cave classification for management scheme.

This scheme evolved gradually between 1973 and 1977 with six proposed schemes. At a cave management conference in 1979, a committee was appointed to review these and develop a national system. The resulting report proposed the scheme shown in Table 1.

Table 1. The original Australian Cave Classification for Management scheme.[1]

Category 1:	**Public Access Caves**
	1.1 Adventure caves
	1.2 Show caves
Category 2:	**Special Purpose Sites**
	2.1 Reference sites
	2.2 Outstanding natural value
	2.3 Dangerous sites
Category 3:	**Wild (& unclassified)**
	3.1 Caves classified as wild
	3.2 All unclassified caves

[1]DAVEY, WORBOYS & STIFF (1982).

Since the scheme's introduction, problems have been perceived and dealt with. The original definition of class 2.2—'outstanding natural value'—has been replaced by the deliberately broader definition of 'sites of special natural and/or cultural value' (DAVEY & WHITE, 1986). Users of the scheme commonly misunderstood the terms 'adventure', 'show' and, in particular, 'reference' as pointed out by DAVEY (1995). By providing better explanations of these terms, misclassification has been reduced.

Another uncertainty has been pointed out by LARKIN (1993), who believed that the scheme did not pay enough attention to vulnerability and significance, and was therefore lacking in conservation value. This is a valid and important point, though lacking somewhat in viability. The option of introducing greater emphasis on vulnerability and significance increases subjectiveness and decreases usability. The issues of vulnerability and significance are in fact dealt with by the scheme and are discussed later. Larkin also suggested that cave management needed to do more than simply classify caves. This is also true, although cave management uses many tools and techniques, classification being just one. This issue had been raised earlier by HAMILTON-SMITH (1991), who placed classification in a wide planning context and argued for a clear, narrow definition of its role as a tool for resources allocation. He also pointed out that the scheme is not so much a classification of caves, but rather a classification of management strategies.

Modifying the Scheme for Use in Thailand

A modification of the Australian scheme has already been proposed for and applied to caves in southern China (WHITE, 1993). This scheme added a fourth category of Human Industry Sites to the basic three-category outline. Within this category seven separate classes were identified: 4.1 Agricultural sites, 4.2 Manufacturing/Industrial sites, 4.3 Residential sites, 4.4 Storage sites, 4.5 Speleotherapy sites, 4.6 Military/Strategic sites and 4.7 Other.

It is obvious that the Australian scheme in itself is not applicable to Thailand without some modification. For example, temple caves are abundant in Thailand and lack a classification under the basic scheme. The Southern China modification also lacks such classifications and the division of human industry sites into seven separate classes under a special category is cumbersome.

A new modification is needed for caves in Thailand that utilises the ease of application of the original Australian scheme, improves understanding of the terms (especially with translation into Thai in mind) and contains all the necessary classifications. The scheme proposed here was first conceived in 1996 by the author. Extensive field application and testing of peoples' understanding of the terminology have refined the scheme to its present state. It is outlined in Table 2.

Application and Use

The scheme is intended for use by anyone with responsibility for the management of a cave or caves in Thailand. This includes, but is certainly not restricted to: the Royal Forest Department, the Mineral Resources Department, the Department of Religious Affairs, the Tourism Authority of Thailand, local government at provincial, district and borough level, and private enterprises.

Table 2. Proposed cave management classification scheme for use in Thailand.

Category 1:	**Public Access Caves**
	1.1 Eco-tourism caves
	1.2 Tourism caves
	1.3 Temple caves
Category 2:	**Special Purpose Sites**
	2.1 Comparison sites
	2.2 Sites of special natural and/or cultural value
	2.3 Dangerous sites
	2.4 Human industry sites
Category 3:	**Wild (& unclassified)**
	3.1 Caves classified as wild
	3.2 Unclassified caves

Simplicity is the key to a good classification system. Removing as much subjectiveness as possible enables non-specialists to apply the scheme accurately. Differentiating between categories must be made as obvious as possible. The scheme proposed here largely fulfills these requirements and assumes just a basic level of understanding of caves in the user. Minor overlaps do exist and an explanation of each class is needed. It must be stressed that the management of the cave is being classified rather than the cave itself.

Category 1: Public Access Caves

1.1 Eco-tourism Caves (originally 'Adventure Caves')

Caves that are used by adventure tourists, eco-tourists and other groups of people for organised, recreational activities. Development of these caves is minimal and management aims to retain natural aspects. The cave is protected through control of visiting groups, i.e. the use of guides, and good interpretation. Examples include Tham Nok Nang En, Kanchanaburi (1.1) and Long Snake Cave, Mae Hong Son (1.1).

1.2 Tourism Caves (originally 'Show Caves')

Highly developed caves designed for tourists. In-cave development might include walking trails, lighting systems, interpretation signs, etc. Outside development may include car parking areas, restaurants, visitor centre, souvenir shops, etc. Management centres on protecting the cave from visitors, protecting visitors from the cave and presenting the cave in an aesthetic, informative way. Some overlap between classes 1.1 and 1.2 exists although in most cases the division should be obvious. Examples of tourism caves are Tham Khao Bin, Ratburi (1.2), Tham Lot, Mae Hong Son (1.2) and Tham Phraya Nakhon, Prachuab Khiri Khan (1.2).

1.3 Temple Caves (new class)

Any cave used and managed for worship, meditation or other religious purposes. Development includes installation of Buddha (or other) images, meditation cells, floored areas for kneeling, walking trails, etc. Examples are Tham Khao Luang, Phetchaburi (1.3) and parts of Tham Chiang Dao, Chiang Mai (1.3).

Many temple caves are promoted for and used by tourists. Confusion with class 1.2 could arise although the primary development and management plan should be obvious.

Category 2: Special Purpose Sites

2.1 Comparison Sites (originally 'Reference Sites')

Perhaps the least well comprehended class. The original term 'reference' was so misunderstood that a change became essential. The class of comparison caves is not intended for caves of special value (although they may be), which are dealt with next.

These caves are the most highly protected. Comparison sites are kept in as natural a state as possible (i.e. no casual visitation, strictly limited pollution, etc.) and used as baselines or controls for comparison with other sites of a similar aspect that are developed, managed or vulnerable. For example, the tourist cave Tham Lot, Mae Hong Son (1.2), contains several wooden coffins dated to 1,400 years old (Peter Graves, pers. com.). To gauge the impacts of visitors on these coffins, another similar site with coffins is selected for comparison over time. Around 90 such sites are known in the district (John Spies, pers. com.) providing opportunity for useful baselines. Visitors to the comparison cave are strictly limited to one or two monitoring trips per year. Through minimising human impacts at the comparison cave in this way, any deterioration in the coffins at Tham Lot will be highlighted. A comparison site for Tham Lot has yet to be designated.

Another example is a cave containing the troglobitic fish *Schistura oedipus*—Tham Nong Pha Cham, Mae Hong Son (3.1). The catchment area contains fields and houses belonging to the local people. The fish colony in the cave may be subject to pesticides, fertiliser, increased siltation, sewage pollution and general garbage. The nearby cave Tham Hud contains the same species of fish (GERY, 1987) but is not subject to as many potential sources of impact. Tham Hud could be designated as the comparison site for Tham Nong Pha Cham and used to monitor the fish population there.

To clarify, comparison sites are managed so as not to experience significant changes as a result of human intrusion. They act as a baseline for monitoring other similar caves that are developed, managed or vulnerable. Natural environmental changes out of our control may cause change within a comparison site. In this case, comparison sites may provide a measure of the extent of natural change over time.

2.2 Sites of Special Natural and/or Cultural Value

This class requires that the user has sufficient knowledge and experience to make a subjective decision. Is the site in question truly of special value enough to warrant the extra protection afforded to these sites?

Placing a cave in this class depends on two main factors: significance and vulnerability. A cave with high significance located in a remote area will have few visitors and a low

vulnerability. It may be better not to interfere with these sites, by 'managing' them. Nature can work for us. An example of this kind of site is Tham Yongtahmoo, Kanchanaburi (3.1), containing a large sequence of layered sediments and speleothems but located high in the mountains (SMART, 1995). The low vulnerability of this very significant site allows management to be based on the wild cave strategy (3.1).

Many caves of high significance are under severe threat though and the caves of Khao Ngu, Ratburi (2.2: 1,300-year-old Dvaravati art) are no exception (see MUNIER, 1998, pp. 189, 197–208). Access to the caves is very easy and protective management is required to prevent vandalism. This comes in the form of locked gates on two of the caves: Tham Reussi and Tham Chin. Unfortunately, the other two caves containing Dvaravati art, Tham Fa Tho and Tham Cham, have yet to receive such treatment. Other examples include Tham Lumphini Suan Hin, Saraburi (2.2: type locality of the spider *Liphistius tham*), Tham

Table 3. Grounds for site evaluation as representative and/or outstanding.[1] These grounds are unranked as to importance.

Whether the site:

1) has contributed substantially to development of explanations about a wider class of sites
2) is the location of important research investigations
3) contains evidence with potential for understanding the past (e.g. speleothems, sediments, palaeontological or archaeological deposits, cultural relics)
4) has important associations with prehistoric or historic human activities, especially if connected with important events, personalities or the developments in the history of the region or of cave science
5) contains especially clear examples which are of educational value
6) is the type locality for any species
7) is the habitat of an endemic species
8) is the habitat for any troglobitic species
9) is the breeding locality (maternity site) for any species, or is important to any species for acclimatisation, overwintering, staging or roosting
10) is the habitat for a species which is endangered, rare, restricted, or near the limits of its range
11) is aesthetically impressive or of high visual or other sensory quality
12) contains unusual recreational opportunities
13) has potential for non-destructive use which will contribute to the local and regional economy and employment
14) is one of the few remaining or best preserved of its class
15) is part of a related compilation of sites which collectively meet one or more of the other criteria above.

[1]DAVEY & WHITE (1986).

Table 4. Level of significance criteria (not ranked as to relative importance).[1]

1) rarity, in a total (worldwide) sense
2) scarcity or abundance, in a spatial distribution sense
3) scale and extent
4) clarity of expression or exposure ("display")
5) state of preservation
6) juxtaposition against or combination with other features
7) extent to which the site has contributed to understanding of natural or cultural events with implications elsewhere
8) proximity to or separation from other features and/or concentrations of people
9) image, or distinctive character, because of the particular natural setting and/or cultural context
10) potential for providing further research insights
11) universality, whereby the site provides crucial insights into environmental problems
12) comparability with other known examples

[1]DAVEY & WHITE (1986).

Calcite, Mae Hong Son (2.2: speleothems and mineralogy) and Tham Ongbah, Kanchanaburi (2.2: archaeology).

Note that in addition to a classification of 2.2, a note of justification is required for each site. For a review of quantifying cave significance, see Tables 3 and 4 and also DAVEY (1984).

2.3 Dangerous Sites

A cave deemed to be too dangerous for general public usage. The danger may be due to fast flowing water, severe and rapid flooding, loose boulders, carbon dioxide gas, open shafts in the floor, slippery rocks, etc. Obviously, these sites should not be developed and management takes the form of discouraging visitors or at least posting clear warnings. Examples are the further reaches of Tham Pha Thai, Lampang (2.3: carbon dioxide gas) and Tham Sao Hin, Kanchanaburi (2.3: deep and fast flowing water).

2.4 Human Industry Sites (new class)

People utilise the resources of caves in many ways in order to make or supplement a living. Bat guano and swift–nest collecting is obvious. Less obvious may be the use of caves for water supply, shelter, wine cellars, mushroom farms, cheese factories, bronchial clinics or as safe houses, either for people or valuables. Management of an industry site aims to ensure sustainability of the usage by altering the environment and nature of the cave as little as possible. Examples include Tham Khao Chong Phran, Ratburi (2.4: bat guano) and Tham Phaya Nak, Krabi (2.4: swift nests), Tham Nam Tok, Phangnga (2.4: water supply).

Category 3: Wild (& Unclassified)

3.1 Caves Classified as Wild

Wild caves are where nature is relied upon to do the management for us and people interfere minimally or not at all. Any cave eligible for classification (see category 3.2: unclassified caves) that does not fit into one of the other classes may be regarded as wild. These caves may be visited in an informal way, but as no management plans are in place to protect the cave, other methods should be sought. In Australia, cave explorers are required to have a certificate of competence before permission to enter wild caves is granted (POTTS, 1997). As this would entail a further increase in bureaucracy, this approach may be unsuitable in Thailand. Also, there are very few people in Thailand with sufficient knowledge and experience with caves to be able to assess the competence of others. Educating potential explorers in cave conservation ethics and keeping certain sites secret are better approaches to the problem. Many caves in Thailand are regarded as wild, such as: Tham Nam Tok, Kanchanaburi (3.1); Nam Bor Phi, Mae Hong Son (3.1); Tham Lam Chi, Chaiyaphum (3.1); and Tham Than Lot, Tak (3.1).

The difference between wild caves, 3.1, and eco-tourism caves, 1.1, is in the level of active promotion of the site and the organised, regular usage of the latter.

3.2 Unclassified Caves

Classifying a cave requires information concerning the site. In the absence of information, classification is impossible. The absolute minimum information needed is an accurate survey and a brief description on all aspects of the cave, including geology, geomorphology, hydrology, sediments and speleothems, biology, palaeontology, archaeology, cultural history, current management, etc. Caves of this classification may include sites that have been heard about but not yet visited. For example, a large open pit called Haeo Narok has been reported in the highlands of Tak Province (authors own data). If verified, classification would be Haeo Narok (3.2). After exploration and survey, the cave would be reclassified.

All caves placed in this class should be assumed to be under severe threat and immediate action should be taken to find out whether protective management is desirable.

Sufficient information exists to be able to classify around 500 of the c. 4,000 'known' caves in Thailand. The 'unknown' caves, are estimated at between 10,000 and 20,000 sites by DUNKLEY (1995, p.27).

Discussion

Any cave, or cave system, may be placed in more than one class. Separate areas within a single cave may be managed in different ways. For example, the dry upper levels of Tham Wang Badan, Kanchanaburi, are used by tourists and classified as 1.2. The lower stream passage is home to two species of troglobitic fish, one being endemic (KOTTELAT & GERY, 1989; NG & KOTTELAT, 1998). This area is designated 2.2: troglobitic fish (threat of visitors disturbing the fish and pollution from the catchment area; management strategy is barring tourists from the stream passage and limiting pollution). The same stream passage also contains a dangerously high level of carbon dioxide that prevents full exploration

(BOURDY, 1993). Beyond 250 m from the access point, in both the up and down stream directions, the cave is classified as 2.3 (carbon dioxide) and access is strictly limited to experienced and fully equipped people.

Tham Phra Wang Daeng, Phitsanulok, is a long river cave. The biology of the cave is highly significant as it contains many new and unique troglobitic species, such as two species of fish, two species of crab, a shrimp, and several other arthropods (SMART, 1998). This rich biodiversity is under threat from potential development for tourism and quarrying. The river passages are given 2.2: endemic species, ecosystem. The entrance area is already being used as a temple cave (1.3) and is subject to uncontrolled visitors, littering, and inappropriate development.

The management classification assigned to a cave may change with time. For example, in the mountains of Kanchanaburi, near the Burmese border, is Tham Chet Mit (3.1). This wild cave is home to an undescribed new species of aquatic isopod (SMART, 1995; SMART, 1996a). Vulnerability was low due to the inaccessibility of the site, but recently a new road was constructed virtually to the cave entrance as part of the Yadana gas pipeline project. The cave needs reclassifying as 2.2: type locality of endemic aquatic isopod. Appropriate management action needs to be taken to protect the site from anticipated increased visitation. Tham Chao Ram, Sukothai, used to be mined for bat guano and assigned to class 2.4. The Royal Forest Department now regards the natural value of this huge bat colony as more important and has stopped extraction (SMART, 1996b). Classification changes to 2.2: huge colony of bats (*Tadarida plicata*). Similarly, caves already classified as wild (3.1) may become developed for tourism or as a meditation site for monks. Also, further research may reveal increased special value of a site that requires protective measures to be taken, and the classification will need to be changed accordingly.

A minor drawback of using this scheme is that many caves managed for public access (Category 1) are also of special natural and cultural value. In these cases classification is according to the main management plan, whilst being aware of the reason for special value. Appropriate management strategies, continual monitoring and the use of a comparison site (2.1), are applied to lessen impacts as much as possible and to ensure adequate protection. An example here would be Tham Pha Taem, Ubon Ratchathani (1.2). This site is managed for tourists to come and view its fine, prehistoric rock art (SENANARONG, 1988, describes the paintings). Damage is lessened through erection of a fence that allows for visual inspection while keeping the paintings out of reach of visitors. Within the data description of the site, the rationale for significance is prominently displayed. A comparison site has yet to be designated.

Another problem is the fact that some Thai caves are highly significant and under severe threat, but without any protective management strategy. Tham Mae Lana, Mae Hong Son, is one such site; containing fine displays of speleothems (SPIES, 1994) and two species of troglobitic fish (KOTTELAT, 1988, provides a description of both species albeit from different localities). Uncontrolled visitors and disturbances to the catchment area threaten to impact the cave. At present, no management plans exist to avert these potential problems and the cave would normally be classified as a wild cave, 3.1. In this case, however, a classification of special value (2.2) is applied in anticipation of improvement of the situation and to help highlight the cave's significance. Tham Mae Lana is thus classified 2.2: speleothems and troglobitic fish.

Conclusion

Classification is a useful management tool. A classification scheme for the management of caves in Thailand has been created, being a modified version of the Australian Cave Classification for Management Scheme. Modifications include the addition of two new classes, and the renaming of three others within the same basic three-category framework.

Extensive field trials and testing of peoples' understanding of the terminology have enhanced the scheme further. Minimal subjectivity is retained and explanations of the different classes improved. The result is a classification scheme that is simple and easy to apply by non-specialists.

The new scheme provides a convenient method for filing, storing and retrieving information. Decisions regarding management strategy will be aided and, most importantly, the scheme will ensure that funds and resources are allocated to the caves that require it the most.

Many 'known' caves in Thailand remain unclassified and even more 'unknown' caves require exploring. Remedying this situation must be regarded as a major priority.

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