Republic of the Philippines
Department of Environment and Natural Resources
Visayas Avenue, Diliman, Quezon City
Tel Nos. (632) 929-66-26 to 29 •(632) 929-62-52
929-66-20 to 29 •929-66-33 to 35
929-70-41 to 43

FEB 28 2007

DENR Memorandum Circular
2007-04

SUBJECT : **PROCEDURE IN CAVE CLASSIFICATION**

Pursuant to Republic Act No. 9072, otherwise known as the National Caves and Cave Resources Management and Protection Act of 2001, and Sections 10, 12 and 13 of its Implementing Rules and Regulations, (DAO 2003-29), a Manual on Cave Classification is hereby prescribed and adopted for all caves within public domain and private lands, including those found within protected areas for the guidance of all concerned.

Section 1. **Process in Cave Classification**. The following are the general steps in cave classification.

1. Identification of caves, including their location and general description through available topographic and cave maps and field reconnaissance surveys;

2. Assessment of bio-physical, socio-economic and cultural status of identified caves;

3. Recommendation of classification by the cave assessment team;

4. Review of recommended classification by the Regional Cave Management Committee or the Protected Area Management Board (PAMB), in the case of protected areas; and

5. Approval of classification by the Regional Executive Director.

Section 2. **Cave Assessment Team**

Cave assessment team shall be created in each CENRO by the Regional Executive Director to be composed of the following disciplines: biology, geology, socio-economics, and other relevant fields of expertise. The team shall include representatives from the other sectors concerned.

Section 3. **Cave Classification**

The caves after assessment may be classified as follows:

Class I. Caves with delicate and fragile geological formations, threatened species, archeological and paleontological values, and extremely hazardous conditions. Allowable activities are limited to mapping, photography, educational and scientific purposes.

Class II. Caves with areas or portions which have hazardous conditions and contain sensitive geological, archeological, cultural, historical, and biological values or high quality ecosystem. It may be necessary to close sections of these caves seasonally or permanently. It is open to experienced cavers or guided educational tours/visits.

Class III. Caves generally safe to inexperienced visitors with no known threatened species and archeological, geological, natural history, cultural and historical values. These caves may also be utilized for economic purposes such as guano extraction and edible birds nest collection.

Section 4. **Annual list of classified caves.**

All Regions are required to submit to PAWB their list of classified caves. PAWB shall consolidate and prepare list of classified caves. DENR shall publish a consolidated list of classified caves annually.

Section 5. **Transitory provisions.**

Caves with existing utilization permits such as guano and edible bird's nest, (except water rights permit), ecotourism, and research and development activities, may be temporarily suspended, canceled or terminated, when a cave is recommended for temporary closure, after consultation with local government units (LGUs) and concerned parties.

Section 6. **Repealing Clause.**

All circulars and memoranda which are inconsistent herewith are hereby revoked or amended accordingly.

Section 7. **Effectivity**

This Circular takes effect immediately.

ANGELO T. REYES
Secretary

ANNEX A

BRITISH CAVING RESEARCH ASSOCIATION (BCRA)
GRADINGS FOR A CAVE SURVEY CENTER LINE

Grade 1	A sketch of low accuracy where no measurements have been made
(Grade 2)	May be used if necessary to describe a sketch that is intermediate in accuracy between grade 1 and grade 3 (use only if necessary. See note 7)
Grade 3	A rough magnetic survey. Horizontal and vertical angles measured to +/- 2.5 degrees; Distances measured to +/-50cm; station position error less than +/-50cm
Grade 4	May be used if necessary to describe a sketch that fails to attain all the requirements of a grade 5 but is more accurate than a grade 3 (use only if necessary. See note 7)
Grade 5	A magnetic survey. Horizontal and vertical angles accurate to +/-1 degree; distances accurate to +/-10cm; station position error less than 10cm
Grade 6	A magnetic survey that is more accurate than grade 5 (see note 5)
Grade X	A survey that is based primarily on the use of theodolite instead of a compass (see notes 6 and 10 below)

NOTES:

1	The above table is a summary and intended only as an aide memoire; the definitions of a survey grades given above must be read in conjunction with the comments below.
2	In all cases it is necessary to follow the spirit of the definition and not just the letter
3	STATION POSITION ERROR is the maximum distance between any of the points to which and from which the various measurements were made at that station.
4	ACCURACY means the nearness of a result to the true value; it must not be confused with PRECISION which is the nearness of a number of repeat results to each other, irrespective of their accuracy.
5	To attain grade 3, it is necessary to use a clinometer in passages having an appreciable slope.
6	It is essential for instruments to be properly calibrated to attain grade 5; the methods are described in "Surveying Caves" and in "An Introduction to Cave Surveying."
7	A grade 6 survey requires the compass to be used at the limit of possible accuracy, i.e. accurate to +/-5 degrees; clinometer readings must be to the same accuracy. Distances and station position error must be accurate to at least +/-2.5cm and will require the use of tripods or similar techniques.
8	A grade X survey must include on the drawing notes describing the instruments and techniques used, together with an estimate of the probable accuracy of the survey compared with grde 3, 5 or 6 surveys.
9	Grades 2 and 4 are for use only when, at some stage of the survey, physical conditions have prevented the surveyor from attaining all the requirements for the next higher grade and it is not practical to re-survey.
10	*Caving organizations, etc. are encouraged to reproduce figures 1 and 2 in their own publications;permission is not required from the* British Cave Research Association to do so. However, the tabular summary must not be re-published without these notes.

BRITISH CAVING RESEARCH ASSOCIATION (BCRA)
CLASSIFICATION FOR CAVE SURVEY DETAIL

CLASS A	All passage details based on summary.
CLASS B	Passage details estimated and recorded in the cave.
CLASS C	Measurements of detail made at survey stations only.
CLASS D	Measurements of detail made at survey stations and whenever necessary between stations to show significant changes in passage shape, size, direction, etc.
NOTE:	The accuracy of the detail should be appropriate to the accuracy of the center line. Normally only one of the following combinations should be used: Grade 1A, Grade 3B or 3C, Grade 5C or 5D, Grade 6D, Grade XA, XB, XC, XD.

ANNEX B

CAVE ASSESSMENT FORM

Name of Cave:____
Location:____
Region:____________________________________Province:_____________________
Municipality:_________________________________Barangay:____________________
Sitio:____
Size of the Area:________________________ha (area enclosed by the proposed boundary)
Date of Assessment:____

General Instruction: Attach site level and regional maps. Include cave maps if available.

I. General Information

1. Evolution of the Cave (include cave's origin, solution, tectonic movement, etc.)

2. Geographic location and Description

   Coordinates_________________________ Elevation_____________________
   Physiography____

3. Land Status (please check)

   ____A & D　　　　____Unclassified public forest
   ____Timberland　　　　____Private
   ____Others (specify)_______________________________

4. Accessibility (State how the cave can be reached from the nearest barangay; indicate distance, means of transportation)

5. Climatological data (rainfall pattern, climate type)

6. Existing land-use patterns in area adjacent to the cave.

LISTING BY TYPE	AREA (ha)
Reforestation area	
Reservation	
Logging	
Grazing/Pasture	
Settlements	
Mineral Extraction	
Others	

7. Demographic information (secondary data gathered from the municipality; indicate)

NAME OF BARANGAY	NUMBER OF HOUSEHOLD	BARANGAY POPULATION	MEANS OF LIVELIHOOD

8. Current Uses/Human Activities
Identify the current activities inside the cave.

Type of Activity	Duration	Area Covered	Implementing Agencies/Orgs	Remarks
Scientific				
Educational				
Resource Extraction				
Tourism/Recreation				
Archaeology				
Others				

9. Physical features

a. Cave Map (Describe the size of the cave; length, height and width, its mouth, floor and ceiling)- available cave map should conform to British Cave Research Association standard of Grade 3C or higher.

b. Status of the Cave

b.1 ( )Pristine Cave (virgin or newly discovered cave; immensely decorated)
b.2 ( ) Intact (State what probable factors could have worked for their protection)
___difficult access
___within protected area
___inside private property
b.3 ( ) Vandalized (State extent, location of vandalism; describe vandalism)
b.4 ( ) Exploited (State cause and extent of exploitation)
b.5 ( ) Claimant (State name)
b.6 ( ) Others (specify)

II. NATURAL FEATURES

1. Vegetative Cover (Surface; inside cave; enumerate plant species)

1.1 Flora outside the cave

Local/Common Name	Scientific Name	Uses	Importance/Value

1.2 Flora inside the cave

Local/Common Name	Scientific Name	Uses	Importance/Value

2. Fauna

2.1 Enumerate species of fauna found inside the cave

Instructions: Tick ( ) the cell before the type of organism you observed in the cave. Estimate its number and indicate accordingly in the Number column after each organism. Whenever possible, tick the colum of the corresponding cave zone where the organism was observed. Write additional observations under Remarks (For bats, note if nursing mothers or baby bats are present; for birds, note if nests, eggs or hatchlings are present). Attach additional sheets if necessary.

Organism	Local Name	Scientific Name	Common Name	Number	Cave Zone		Threatened Specie	Conservation Status	Remarks
					Twilight	Dark			
Bats									
Rats									
Birds									
Geckos									
Snakes									
Frogs									
Fish									
Crabs									
Shrimps									
Snails									
Moths									
Beetles									
Cockroach									
Crickets									
Earwigs									
Springtails									
Centipedes									
Millipedes									
Spiders									
Pseudoscorpions									
Whipscorpions									
Others									

2.2 Enumerate species of fauna found outside the Cave (attach additional sheets if necessary)

Local/Common Name	Scientific Name	Conservation Status*	Distribution			Remarks
			Resident	Endemic	Migratory	

* Based on DAO 48, S. 1990

3. GEOLOGY

3.1 Fill details for speleothems found inside the cave.

Speleothem		Approximate Number	Zone		Remarks
			Twilight	Dark	
Dripstone and Flowstone Forms (gravity controlled)					
	Stalactites				
	Stalagmites				
	Draperies				
	Flowstone Sheets				
	Columns				
	Others				
Erratic Forms (crystal growth controlled)					
	Shields				
	Helictites				
	Botryoidal forms (popcorns, grape, etc.)				
	Anthodites				
	Oulopholites (gyspsum flowers)				
	Moonmilk				
	Others				
Sub-aqueous Forms					
	Rimstone dams (gour pools)				
	Concretions of various kinds (limestone concretions e.g. cave pearls, iron, basalt)				
	Pool deposits				
	Crystal Linings				
	Others				

3.2 Enumerate mineral deposits inside the cave

Common Mineral Found Inside the Cave	
Aragonite	
Calcite	
Dolomite	
Huntite	
Hydromagnesite	
Magnesite	
Others	

3.2 What are the other geological features inside the cave?

Geologic Features Inside the Cave	Location
Faults	
Joints	
Cracks	
Fossils (paleontological feature)	
Others	

4. HYDROLOGY

4.1 What are the hydrological features inside the cave?

Features	Perennial	Intermittent	Natural	Manmade	Size/Volume	Remarks
Rivers						
Falls						
Sumps						
Pools						
Others (Specify)						

*for rivers, indicate direction of flow relative to the entrance. Indicate location and reference points.

4.2 What are the hydrological features outside the cave?

Features	Number	Perennial	Intermittent	Natural	Manmade	Remarks
Pools/sumps						
Rivers						
Falls						
Others (Specify)						

5. Cave Hazards/Safety-Please indicate if any of the following are present. Pls. indicate location inside the cave.

Cave Hazards	Location Inside Cave	Remarks
bad air (from guano, poor air circulation, low supply of oxygen)		
presence of swiftly running underground river system		
deep sumps or pools		
flooding indications		
vertical pitches/entrances		
tight crawlways/squeezes		
presence of rockfall		
presence of breakdown		
deep mud		
unstable flooring		
Sharp rocks		
Extremely cold temperatures		

III. ANTHROPOLOGICAL FEATURES- Are there indigenous peoples (IP's) or settlers living within the general location? If yes, then specify the name of the IP and other information listed below

IP	Approximate Population	Livelihood Activities	Traditional Uses/ Cultural Activities

IV. ARCHAEOLOGICAL FEATURES

1. Are there artifacts and ecofacts on the present floor area of the cave, rock shelter or overhang?
___Yes ___No

2. What are the artifacts present?
___stone tools (flaked)
___stone tools (polished)
___shell tools
___tradeware ceramics (porcelain)
___pottery (earthenware)
___pottery (earthenware with designs)
___metal implements
___wooden coffins

3. What are the ecofacts present?
___human bones
___animal bones
___wood
___shells (land)
___shells (freshwater)
___shells (marine)

4. Are there artworks on the wall?
___charcoal drawings
___hematite paintings
___engraved artwork

V. THREATS, PROBLEMS AND POSSIBLE SOLUTIONS

Identify and describe the actual and/or potential threats, conflicts (man-made or natural) and other forms of disturbances that would affect the integrity of the cave.

Problems	Current	Potential
Deforestation		
Agriculture		
Urbanization and Industry		
Tourism and Recreation		
Chemical Waste		
Water Exploitation (dams, groundwater pumping, inundation)		
Others		

VI. POTENTIAL USES OF THE CAVE

Potential Uses of the Cave	
Scientific Research	
Tourism and Recreation	
Exploration	
Others	

VII. Recommendations

Prepared by:
Concurred by:
For regional: (PAWMS)
For field personnel (CENRO/PENRO)
For composite team (PAWMS, CENRO, PENRO)

ANNEX C

Excerpted from "Caves, Carbon Dioxide and You." For detailed information on carbon dioxide concentration and reduced oxygen concentrations in caves, please refer to the complete article.

By Garry K. Smith © 1997

Member of the Newcastle & Hunter Valley Speleological Society - NSW Australia. and the Australian Speleological Federation.

Condensed from a comprehensive paper by Garry, presented at the 21st biennial Australian Speleological Federation conference 1997 (published in the proceedings) and an article published in the 1993 Australian Caver No. 133, Pages 20-23. For more detailed information refer to these papers.

Carbon Dioxide (CO_2) is the body's regulator of the breathing function. It is normally present in the air at a concentration of 0.03% by volume. Any increase above this level will cause accelerated breathing and heart rate. A concentration of 10% can cause respiratory paralysis and death within a few minutes. In industry the maximum safe working level recommended for an 8 hour working day is 0.5% .

Caves often contain elevated levels of Carbon Dioxide (CO_2), consequently cavers may be putting themselves at risk without really knowing the full potential danger.

A cave atmospheres containing greater than 1% Carbon Dioxide (CO_2) is called **Foul Air.** This is the most likely hazard to be encountered in deep limestone caves with relatively still atmospheres. Having said that, one must be aware that there are many caving areas around Australia, where Foul Air is not a significant problem.

To the novice caver the first encounter with foul air is often a frightening experience. Typically there is no smell or visual sign associated with foul air and the first signs are increased pulse and breathing rates. Higher concentrations of CO_2 lead to clumsiness, severe headaches, dizziness and even death. Experienced foul air cavers can notice a dry acidic taste in their mouth, however the average caver may not notice this effect.

Because an elevated CO_2 concentration in caves, corresponds to a depletion in O_2, cavers have for many years used the naked flame test to determine whether the cave atmosphere contained an elevated level of CO_2. The naked flame test involves lighting a match or cigarette lighter in the cave air, or carrying a burning candle into a suspected foul air area of the cave and the flame would extinguish when a particular concentration was reached. This test has in the past been widely accepted by the caving fraternity as a fairly accurate indications of percentage concentrations. During January 1997, I undertook extensive testing in controlled atmospheres which revealed that **the Naked Flame Test is not a reliable test of CO_2 concentrations**, other than to indicate that the cave atmosphere is most likely dangerous to human life. In fact the naked flame is only measuring the O_2 concentration and the CO_2 has such a small influence over combustion that it can be ignored within the concentration range found in caves. For example a 1% increase in CO_2 concentration will raise the O_2 concentration required to support combustion of a given fuel by less than 0.05% O_2.

Without sophisticated measuring instruments a caver cannot determine the CO_2 concentration as the flame test only measures a lack of oxygen. To make things really complicated, it is not the lack of Oxygen which is the real danger in the majority of cave atmospheres, but the elevated CO_2 concentration.

EFFECTS OF CO_2 ON HUMANS

As each persons body has a slightly different reaction and tolerance to stressful situations the following symptoms are general, however nobody is immune to the dangers of CO_2.

Generally accepted physiological effects of CO_2 at various concentrations by volume.

Concentration	Comments
0.03%	Nothing happens as this is the normal carbon dioxide concentration in air.
0.5%	Lung ventilation increases by 5 percent. This is the maximum safe working level recommended for an 8 hour working day in industry (Australian Standard).
1.0%	Symptoms may begin to occur, such as feeling hot and clammy, lack of attention to details, fatigue, anxiety, clumsiness and loss of energy, which is commonly first noticed as a weakness in the knees (jelly legs).
2.0%	Lung ventilation increases by 50 percent, headache after several hours exposure. Accumulation of carbon dioxide in the body after prolonged breathing of air containing around 2% or greater will disturb body function by causing the tissue fluids to become too acidic. This will result in loss of energy and feeling run-down even after leaving the cave. It may take the person up to several days in a good environment for the body metabolism to return to normal.
3.0%	Lung ventilation increases by 100 percent, panting after exertion, Symptoms may include:- headaches, dizziness and possible vision disturbance such as speckled stars.
5 - 10%	Violent panting and fatigue to the point of exhaustion merely from respiration & severe headache. Prolonged exposure at 5% could result in irreversible effects to health. Prolonged exposure at > 6% could result in unconsciousness and death.
10 - 15%	Intolerable panting, severe headaches and rapid exhaustion. Exposure for a few minutes will result in unconsciousness and suffocation without warning.
25% to 30%	Extremely high concentrations will cause coma and convulsions within one minute of exposure. Certain Death.

Effects of O_2 deficiency on Humans

If we consider an atmosphere consisting of just N_2 and O_2, where the O_2 is at a lower concentration than the normal atmosphere, the human body would be affected in the following manner.

Generally accepted physiological effects of reduced O_2 concentrations.

O_2% by volume.	Symptoms
reduced from 21 to 14%	First perceptible signs with increased rate and volume of breathing, accelerated pulse rate and diminished ability to maintain attention.
between 14 to 10%	Consciousness continues, but judgment becomes faulty. Rapid fatigue following exertion. Emotions effected, in particularly ill temper is easily aroused.
10 to 6%	Can cause nausea and vomiting. Loss of ability to perform any vigorous movement or even move at all. Often the victim may not be aware that anything is wrong until collapsing and being unable to walk or crawl. Even if resuscitation is possible, there may be permanent brain damage.
below 6%	Gasping breath. Convulsive movements may occur. Breathing stops, but heart may continue beating for a few minutes - ultimately death.

WHAT TO DO WHEN ENCOUNTERING CO_2.

A test should be made as soon as foul air is suspected and if a naked flame test fails, then all members of the party should immediately exit the cave in an orderly manner without panicking. Inexperienced cavers in the group should be especially watched and guided to the entrance.

When undertaking vertical pitches in caves suspected of foul air the first person down should make thorough checks for CO_2. Besides carrying ascenders, a safety belay is a wise option in the event that the first person down may be overcome when suddenly descending into an area of high concentration.

A safety belay should be mandatory with all pitches where a ladder is more than just a hand-hold.

Cavers should only enter areas of foul air during special circumstances, such as search and rescue operations, exploration and scientific work. Under these circumstances special precautions should be taken to ensure the safety of the group. For more information regarding safety precautions refer to ASF Cave Guidelines.

CONCLUSION

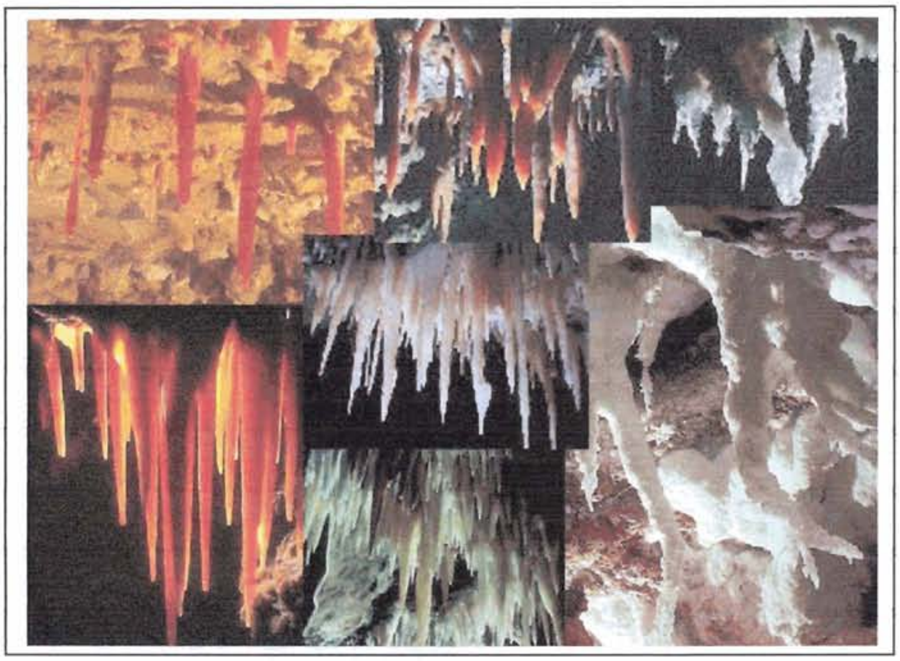
If sophisticated measuring equipment is not available, the best advice is to carry out a "Naked Flame Test" when you or a member of your group experiences the first signs of labored breathing, headaches, clumsiness, loss of energy or any of the other signs associated with elevated concentrations of CO_2. Ideally cavers should use a cigarette lighter flame. This will reduce the amount of unpleasant fumes emitted from matches burnt by people experimenting in the confines of a cave. The best advice is, "If in doubt, get out", in an orderly manner.

Laboratory tests have proven that combustion of a match, candle or butane cigarette lighter will cease at about 14.5% to 15% concentration of oxygen. Twenty one percent (21%) being the oxygen concentration in normal atmosphere. Bearing in mind that humans on average breath out air containing 15% oxygen and this is enough to revive a person using mouth to mouth resuscitation. In fact humans can survive in an atmosphere containing 10% oxygen, so when the flame test just fails it is still measuring an atmosphere containing enough oxygen to survive.

The real danger is the carbon dioxide concentration which is the main trigger for the human body to increase the breathing rate. Prolonged exposure to a concentration of just 5 or 6% may be enough to cause suffocation. In the majority of cases, if a person has any of the symptoms of elevated carbon dioxide levels, a simple naked flame test will fail to ignite. This is a sure sign of foul air and it is time to get out.

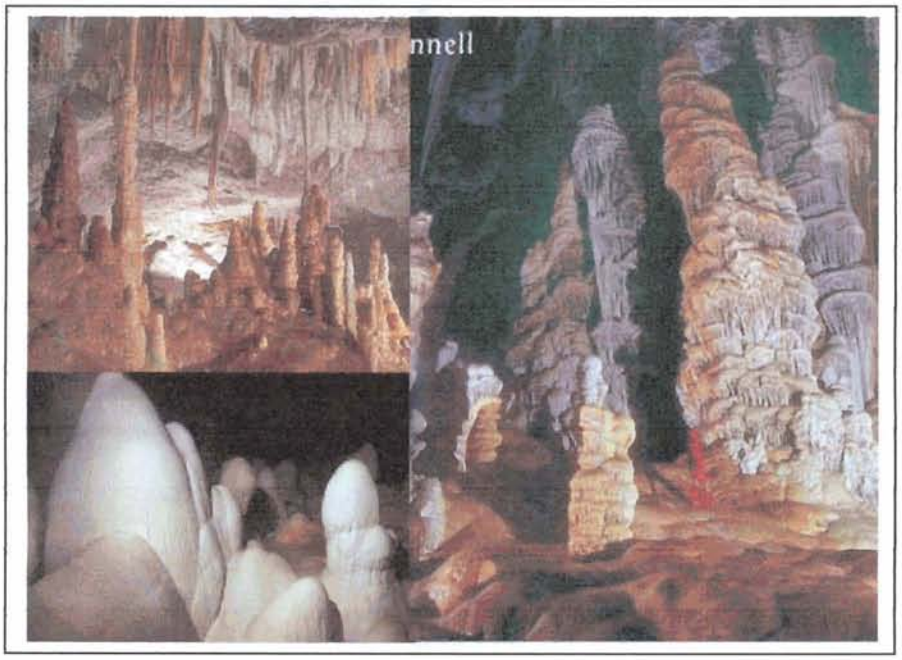
ANNEX D

GENERAL DESCRIPTION OF SPELEOTHEM AND SPELEOGENS (FIELD IDENTIFICATION GUIDE FOR DENR FIELD PERSONNEL AND OTHER CAVE USERS)



STALACTITES

- icicle-shaped precipitates of $CaCO_3$ hanging from the ceiling

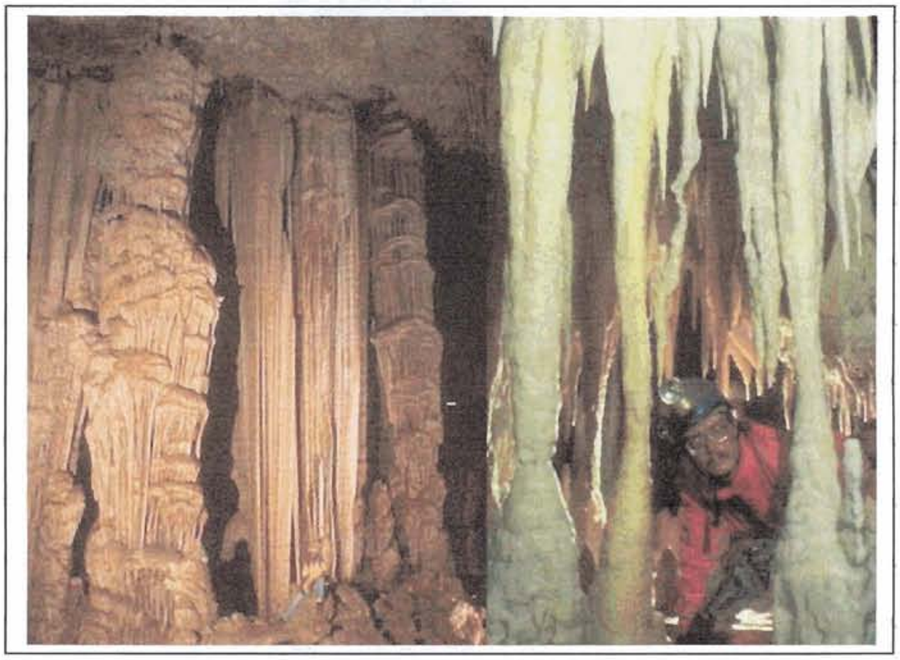


STALAGMITES

- precipitates of $CaCO_3$ that grow upward from the floor as a result of water dripping from overhanging stalactites

HELICTITES

- twisted or spiraling cylinders or needles apparently developed when water seeps through the ceiling slowly that slight chemical or physical changes can cause reorientation of the crystal structure of calcite or gypsum



COLUMNS

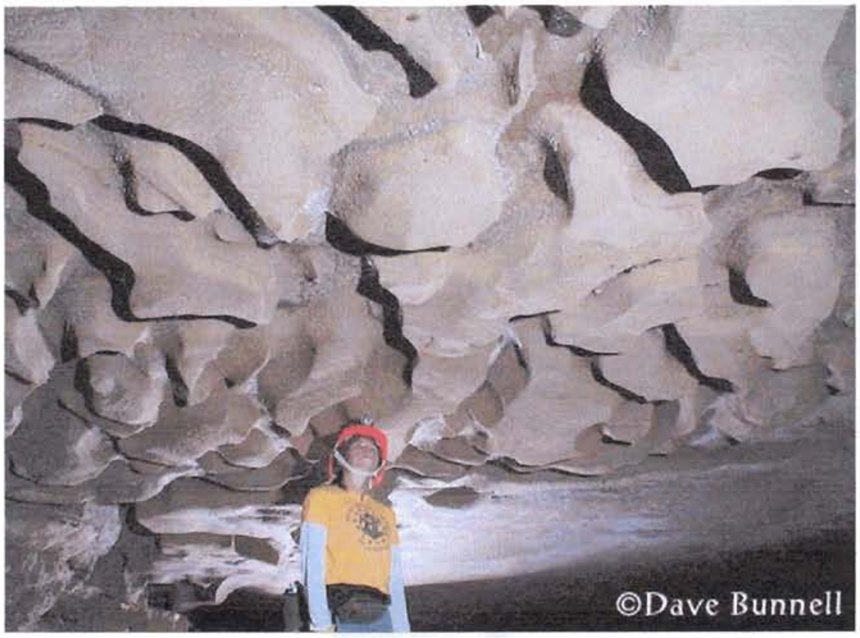
- stalactites and stalagmites that have eventually met and joined together

SHIELDS

- form as calcite-rich seep water under hydrostatic pressure is forced from tiny cracks in a cave wall, ceiling, or floor; as this seep water loses CO_2 to the cave air, calcite is deposited as parallel extensions to the crack walls

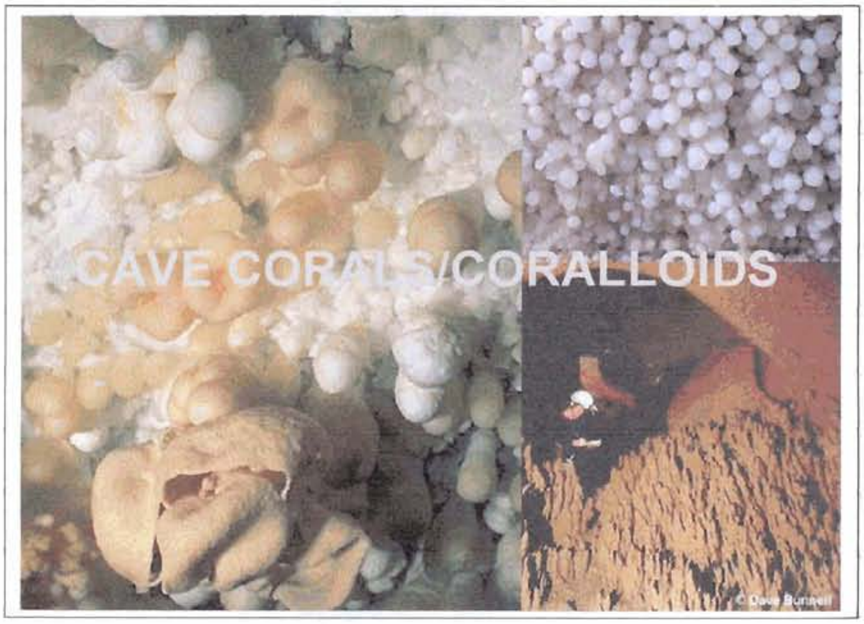
RIMSTONE DAMS

- raised fence-like deposits of calcite on the cave floor that form around pools of water



SPELEOGENS

- are not mineral or crystal deposits; rather, they are part of the bedrock the cave is formed in that has been sculpted by erosion or dissolved into distinct interesting shapes



CAVE CORALS / CORALLOIDS

- small clusters of individual knobs formed by slowly sleeping water

ANNEX E

GENERAL DESCRIPTION OF CAVE FLORA AND FAUNA

Cave organisms are classified into the following: (delete) appendix

a. troglobites - True cave dwellers. They are obliged to live in the deep zone and show significant eye and pigment reduction. These creatures are relatively rare and are unable to survive outside the cave environment. The often-bizarre cave beetles with absent or residual non-functional eyes and long antennae provide one example of true cave dwellers. Troglobites are mostly endemic species thus require special care and be left undisturbed.

b. troglophiles - species that use the deep cave environment but show little eye and pigment reduction are facultative cave dwellers. They live and breed inside the cave, but on the basis of their morphology it is assumed that they can live on the surface as well, usually in similar dark, humid microhabitats such as the undersides of fallen logs. Many cave crickets, spiders, and millipedes fall into this group. Some of these species have not been identified thus are considered unique.

c. trogloxenes - species often found in caves for refuge that leave to feed. Some other species wander into caves accidentally but cannot survive there. Bats and swiftlets are good examples of this group. There are bat species that are endangered while others are in maternity roost thus should not be disturbed.

For aquatic organisms there is a parallel classification:

a. stygobites – those highly specialized animals living entirely in the groundwater environment, and absent in surface waters
b. stygophiles - found in both surface and underground waters without adaptation to subterranean life
c. stygoxenes - organisms that appear rarely, and almost randomly, in underground waters but are essentially surface dwellers

ANNEX F

"Cave sites have been one of the major geologic features, which contains in site archaelogical as well as paleontological materials. The nature of semi-close structures of caves make the deposition or burial of archaeological materials pristine. Some of the oldest homonid fossils were found in caves or even in sinkholes. In Sterkfontein cave system in Africa, the fossil remains of *A. africanus* was found dating to 4.4 mya. Another famous cave in Africa is the Klassies River mouth cave system where the oldest fossil of an archaic *Homo sapien* dating 120,000 years ago was found. In Europe, cave sites depicting Mousterian to solutrean stone technology were found. Caves were also used by early humans not only for habitation but also in ritualistic activities as represented by cave art such as those in Altamira, Spain. In the Philippines, caves were used by early humans as early as 50,000 years ago as the new dating for Tabon Caves (Palawan) would signify. In the Callao limestone formation (Cagayan), transition from a huntering-gathering subsistence strategy to horticulture can be studied through the cave depositions. Clearly, our past was recorded in the buried deposits in caves. And in order to understand our past, then the preservation of cave sites is important. To preserve these rich archaeological resources, excavation should not be conducted without the supervision or direction of an archaeologist. All caves, both wet and dry, would have the potential to have archaeological deposits. Some caves could have them on the surface, while some are buried and would require test excavation for verification. The public as well as people who use caves for recreation could help in the identification of archaeological use of caves. Surface finds in cave sites can easily be identified. Some of the common surface finds are stone tools such as flakes and core tools, earthenware sherds, human skeletal remains, and animal bones. Flake stones are intentionally detached piece from a core through percussion, and can be utilized for cutting and scraping. Core tools on the other hand are pebble-size stones where at least three flakes were detached on one edge-face to produce a sharp edge. This can be used for chopping purposes. Earthenwares are made from clay and fired to produce a container. They can be used for utilitarian purposes such as serving or cooking pots, as burial jars, and in ritual activities. When they break in to pieces, they are called sherds. The public can then be informed to identifying them and reporting to the National Museum by disseminating brochures on archaeological use of caves. Recreational cavers as well as government officials involved in cave protection could undergo seminars on surface identification of archaeological materials and use the brochure as a field guide."

-*"Archaeological Use of Caves"* by Armand Salvador B. Mijares - Head, Terrestrial Archaeology Section National Museum,

ANNEX G

ANNEX G

ECOTOURISM SITE SELECTION FORM

Evaluation Form for the Selection of Key Ecotourism Sites

Instruction: Assess the site by marking or encircling the number that corresponds to the following criteria (1-low,2-below moderate,3-above moderate,3-high)

Score

I.	Accessibility (12%)	
	a. Proximity to a major gateway/hubs	
	b. Proximity to tourist service centers/spokes	
	c. Transportation connectivity	
	(min score of 1 and max score of 4 for each criterion; sum=12%)	
II.	Accessibility Natural and Cultural Features (20%)	
	a. Uniqueness of features/diversity of product	
	b. Presence of biodiversity/significance of richness	
	c. Current physical condition	
	d. Appeal to international markets	
	e. Appeal to national/domestic markets	
III.	Market Demand (12%)	
	a. Presence of international markets	
	b. Presence of local visitors from outside the region	
	c. Presence of local visitors from within the region	
IV.	Availability of Ecotourism products in the market (4%)	
	(Potential - 2, Emerging - 3, Existing - 4)	
	Enumerate the product/s available________________________	
V.	Visitor services (12%)	
	a. Availability & quality of accommodation & other facilities	
	b. Availability & quality of support services and amenities	
	c. Availability %& quality of support infrastructure	
VI.	Social/Political Support (24%)	
	a. Community involvement/participation	
	b. Government support/cooperation	
	c. Private sector support/partnership	
	d. Non-governmental organizations support	
	e. Established linkages among sectors	
	f. Benefits to the local communities	
VII.	Tolerance to Impacts (12%)	
	a. Social	
	b. Cultural	
	c. Natural Environment	
VIII.	Security - safety/peace & order (4%)	

Total Point Score.. [ ]

Remarks:____

____

Evaluated by: ____________________ Date: ____________________

GLOSSARY

ANTHRODITE	radiating clumps of crystalline aragonite. Tufts of crystals radiate from a common center resulting in a spiky appearance.
ARAGONITE	a less common crystalline form of calcium carbonate than calcite, denser and orthorhombic
ARTHROPODS	the most common group of animals inhabiting caves, including insects, crustaceans, spiders, millipedes, etc. They have jointed limbs and external skeletons.
ARCHAEOLOGY	refers to the scientific study of material remains (such as fossils, relics, artifacts, ecofacts, features and monuments of post-human life and activities;remains of the culture of a people.
BAD AIR	(see Foul Air) A cave atmospheres containing greater than 1% Carbon Dioxide (CO_2); often characterized by increased pulse and breathing rates; leads to Higher concentrations of CO_2 lead to clumsiness, severe headaches, dizziness and even death.
BIOSPELEOLOGY	the scientific study of organisms living in caves
BOTRYOID	small bead or knob-like projections from cave walls. They are usually of calcite.
BREAKDOWN	fall of rock from the roof or wall of a cave
CALCITE	the chief mineral in limestone, which is composed of the chemical called calcium carbonate.
CAVE	any naturally occurring void, cavity, recess or system of interconnected passages beneath the surface of the earth or within a cliff or ledge and which is large enough to permit an individual to enter, whether or not the entrance, located either in private or public land, is naturally formed or man-made. It shall include any natural pit, sinkhole or other feature, which is an extension of the entrance.
CAVE PEARLS	a small round calcite concretion that has formed in a shallow cave pool or floor depression.
CAVE RESOURCES	includes any material or substance occuriring naturally in caves, such as animal life, plant life, including paleontological and archaeological deposits, cultural artifacts or products of human activities, sediments, minerals, and speleothems.
CAVERN	a very large chamber within a cave.
CAVE SYSTEM	a collection of caves interconnected by enterable passages or linked hydrologically or a cave with an extensive complex of chambers and passages.
CULTURAL RESOURCES	refer to prehistoric and historic sites, any material recovered from these sites, or places or areas of historic or religious significance. These include archaeological and ethnographic materials, such as artifacts, ecofacts, hidden deposits, features, monuments, and human fossil remains.
COLUMN	a speleothem from floor to ceiling, formed by the growth and joining of a stalactite and a stalagmite, or the growth of either to meet bedrock.
DEAD CAVE	A cave without streams or drips of water.
DARK ZONE	the part of the cave which daylight never reaches.
ETHNOGRAPHY	study of a race, people, or cultural group.
EXPLORATION	the discovery and examination of caves, often entailing digging, climbing, and diving.
FAUNA	the animals found in or peculiar to a certain region
FLORA	the whole vegetation of a country or geological period.
FLOWSTONE	a deposit formed from thin films or trickles of water over floors or walls, usually of calcite.
FOUL AIR	A cave atmosphere containing greater than 1% Carbon Dioxide (CO_2)
GEOLOGY	the science that deals with the composition and structures of the earth and changes , which it has undergone or is undergoing including the study of the evolution of life and the environment that has existed as recorded in the different rock sequences
GUANO	large accumulations of bat and bird dung, often partly mineralized, including rock fragments, animal skeletal material and products of reactions between excretions and rock.
GYPSUM FLOWER	an elongated and curving deposit of gypsum on a cave surface.
HELICTITE	a smooth-surface stalactitic form that grows in curved paths instead of hanging vertically.
HYDROLOGY	the scientific study of the nature, distribution, and behavior of water.
KARST	an irregular limestone region with sinks, underground streams, and caverns.
MARBLE	limestone re-crystallized and hardened by pressure and heat.
MINERALS	naturally occurring chemical composition and crystal structure.
MOONMILK	a soft, white plastic speleothem consisting of calcite, hydrocalcite, hydromagnesite or huntite.
PALEONTOLOGY	the science dealing with the life of post-geological periods as known from fossil remains.

PASSAGE	a cavity that is much longer than it is wide or high and may join larger cavities.
RIMSTONE	deposit formed by precipitation from water flowing over the rim of a pool.
SEDIMENT	material recently deposited by water, ice or wind, or precipitated from water.
SHIELDS	a massive plate or slab of travertine that juts out from the cave wall at an angle apparently determined by the arrangement of joints.
SHOW CAVE	a cave open to the general public on commercial basis.
SPELEOLOGY	scientific study or exploration of caves
SPELEOGEN	a cave feature produced by the removal of bedrock such as ceiling pockets or scallops.
SPELEOTHEM	any natural mineral formation or deposit occurring in a cave or lava tube, including but not limited to any stalactite, stalagmite, helictite, cave flower, concretion, drapery, rim stone or formation of clay or mud. Synonym, cave formation.
SQUEEZE	an opening in a cave passable only with effort because of its small dimensions.
STALACTITE	a speleothem hanging downwards from a roof or wall.
STALAGMITE	a speleothem projecting upward from the floor that is formed by precipitation from drips.
SUMP	a point in a cave passage when the water meets the roof.
TROGLOBITE	a cave organism that is unable to live outside the cave environment.
TROGLOPHILE	a cave organism that frequently spends most of its life inside a cave but is not confined to the cave environment.
TROGLOXENE	a cave organism that spends only part of its life cycle inside the cave but frequents the surface for food.
TWILIGHT ZONE	the part of a cave which daylight penetrates.

LIST OF REFERENCES

Code of Ethics, Australian Speleological Federation Inc. , 1995.

Davis, Donald G. " The Carbide Lamp." *Caving Basics:A Comprehensive Guide for Beginners*. Rea, Thomas G.,ed. Alabama: National Speleological Society, 1992. pp. 10-11

Ellis, Bryan, "An Introduction to Cave Surveying." Cave Studies Series No.2. British Cave Research Assocation, 1988.

Gillieson, David. *Caves: Processes, Management and Development*. Oxford: Blackwell Publishers Ltd., 1996.

Jackson, Donald Dale. Underground Worlds. Time-Life Books Inc. 1982.

Judson, David.,ed. *Caving Practice and Equipment*, UK:British Cave Research Association and Cordee, 1991.

Lowe D. and Waltham T., *A Dictionary of Karst & Caves*. Bridgewater, UK:British Cave Research Association, 1995. p.35

Mijares, Armand Salvador B. "Archaeological Use of Caves", Terrestrial Archaeology Section National Museum, Manila, November 2002.

Minimal Impact Caving Code, Australian Speleological Federation Inc. ,1995.

Proclamation No. 996. Declaring the Tabon Cave Complex and all of Lipunan Point in Quezon, Palawan as a Site Museum Reservation,April 11, 1972.

PD 1492. Amending PD 260 To Include the Petroglyps in the Cave at the Tau't-Batu Area in Barangay Ransang, Quezon, Palawan, June 11,1978.

Watson, John et.al., ed. Guidelines for Cave and Karst Protection, IUCN, Gland, Switzerland and Cambridge, UK. 1997.

MANUAL ON CAVE CLASSIFICATION

I. Introduction

Cave classification pertains to the entire process of assessing and determining appropriate sustainable use of caves with due consideration to: biodiversity, archeological, historical, cultural and potential socio-economic values. This Manual is intended to serve as a guide to DENR field implementers, cave coordinating agencies, and other concerned sectors in classifying caves in the country.

II. Why conduct cave classification?

- To ascertain the values of cave in terms of ecological, archeological, historical, cultural and other socio-economic values.

- To determine the appropriate sustainable use of caves with due consideration to the aforementioned values.

- To determine the appropriate management strategies for the conservation and use of caves in relation to identified values, surrounding karst and limestone areas, and other local, regional and global initiative for cave research, management and protection.

III. What are the PROCEDURE FOR CAVE CLASSIFICATION?

Cave classification entails the following major steps. These are as follows:

Cave Identification – Existing or known caves must be identified. Identified caves shall be supported by providing information such as the local name, if available; general description (elevation, accessibility, etc.) and location using topographic maps and available cave maps which conforms to the British Caving Research Association (BCRA) minimum standard of grade 3C (Annex A).

All DENR field offices are responsible for identifying caves within their administrative jurisdiction.

Cave Assessment – All identified caves must undergo an assessment process using the Cave Assessment Form (Annex B). The cave assessment is a comprehensive data gathering and inventory of cave resources and shall be accomplished at the site level.

A cave assessment team shall be created by the Regional Executive Director in each CENRO to be composed of the following disciplines: biology, geology, socio-economics, and other relevant fields of expertise. The team shall include representatives from the other sectors concerned. The main qualification for members who will constitute the assessment team is that he/she should have had previous training on cave assessment. The Protected Area Superintendent (PASu) shall automatically be part of the team if the cave is within a protected area. The representatives of the cave coordinating agencies (National Museum, National Historical Institute, Department of Tourism) accredited caving organizations and other stakeholders concerned may actively participate in the identification and assessment of caves.

The assessment team is required to use the Cave Assessment Form in assessing identified caves within their jurisdiction. For those caves where the old detailed cave assessment form was used, there is a need to fill up other information required under the new cave assessment form.

Review, Recommendation and Approval – After the cave assessment, the assessment team shall submit its recommendation to the CENRO whether to open or temporarily close a cave for further studies. Those recommended as open caves by the assessment team shall be reviewed and affirmed by the CENRO who shall in turn assign initial classification and general management prescriptions.

The CENRO/PASu in case of caves within protected areas, then transmits recommendations to the Regional Cave Management Committee (RCMC) chaired by the RTD for PAWCZMS or the PAMB. The RCMC or PAMB shall conduct the final evaluation and necessary consultations with stakeholders concerned on the recommendation of the CENRO/PASu and shall in turn endorse to the DENR Regional Executive Director the recommended classification for approval.

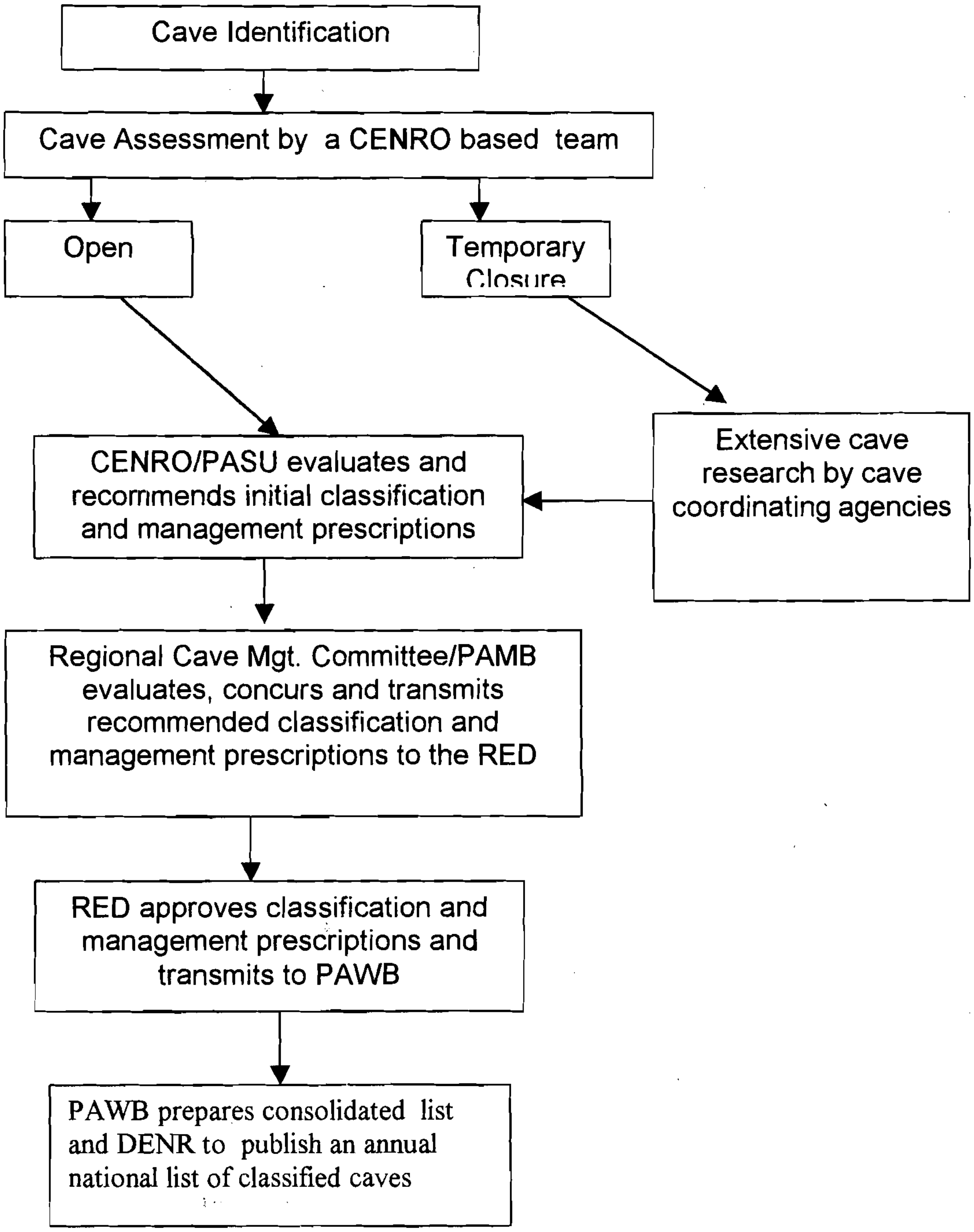
The Regional Office shall submit the approved classified caves to PAWB. PAWB shall prepare the consolidated list and DENR Secretary shall publish an annual list of classified caves.

What will happen to caves recommended for closure?

Caves recommended for closure will be subjected first initially to extensive cave research by the cave coordinating agencies concerned.

The procedural flow for the entire cave classification process is presented in Figure 1.

Figure 1. FLOWCHART OF PROCEDURE ON CAVE CLASSIFICATION



IV. Classification of Caves and Factors to be considered in classification.

This section presents the classification of caves and the major consideration for such classification. Caves are classified based on protection of geological, biological, cultural and paleontological features and to provide safe recreational educational, scientific and other resource based utilization opportunities. The following shall be the classes of caves.

Class I. Caves with delicate and fragile geological formations, threatened species, archeological and paleontological values, and extremely hazardous conditions. Allowable use may include mapping, photography, educational and scientific purposes.

Class II. Caves with areas or portions which have sections that have hazardous conditions and contain sensitive geological, biological, archeological, cultural, historical, and biological values or high quality ecosystem. It may be necessary to close sections of these caves seasonally or permanently. It shall be opened to experienced cavers or guided educational tours and visits.

Class III. Caves generally safe to inexperienced visitor with no known threatened species, archeological, geological, natural history, cultural and historical values. These caves may also be utilized for economic purposes such as guano extraction and edible birds nest collection

FACTORS TO BE CONSIDERED IN CLOSING PORTIONS OF CAVES

Portions of a cave may be closed due to the existence of any of these attributes: extremely hazardous passages, extremely fragile and unique geological features, unique or endangered species; archaeological, historic ethnographic information, resource values.

1. **Extremely Hazardous Passages**

   a. Bad air

   Bad air refers to the condition of air in caves characterized by low levels of oxygen, high levels of carbon dioxide and other hazardous gases such as methane. Low levels of oxygen and high levels of carbon dioxide in caves or certain cave passages pose dangers to the human body. Bad air is indicated by hyperventilation, increased heart rate, dizziness, dry acidic taste in the mouth, increased pulse rate, labored breathing and headache among humans. Annex C provides general information on the relationship between caves and levels of

CO_2 and O_2. Indicators of low oxygen level that can be dangerous to human life may include difficulty in maintaining open flame as in candles or a flame from a carbide lamp.

b. Difficult Access

Difficult access is characterized by caves or cave passages with any of the following factors: vertical entrances and passages which require the use of rope and rigging techniques for ascending and descending, unstable substrate, squeezes, difficult rigging slope, loose rock formation and wet/slippery conditions. For safety purposes, these areas should be closed to the general public. However, accredited experienced cavers and collectors of birds nest may be allowed entry in these areas.

c. Water-logged and Flood-Prone Caves or Cave Passages

Flooding indications on cave walls, large volume of swiftly running water and deep sumps and pools characterize water-logged cave or cave passages.

2. Decorated Caves

Caves with speleothems and speleogens (Annex D-Guide to Cave Formations) prone to destruction by visitor entry must be closed to the general public until a proper management prescription is in place. Examples of such caves are Heaven Cave in Capisaan, Nueva Vizcaya and Crystal Cave in Sagada, Mt. Province.

Below is a list of speleothems and speleogens found in caves:

SPELEOTHEMS

A. Dripstone and Flowstone Forms (gravity controlled)
- Stalactites
- Stalagmites
- Draperies
- Flowstones

B. Erratic Forms (crystal growth controlled)
- Shields
- Helictites
- Botryoidal forms (popcorns, grape, etc.)
- Anthodites

- Oulopholites (gyspsum flowers)
- Moonmilk
- Sub-aqueous Forms
- Rimstone dams (gour pools)
- Concretions of various kinds such as cave pearls
- Pool deposits
- Crystal Linings

SPELEOGENS

- Scallops
- Meander Niches
- Petromorphs
- Rock Pendants

Caves with above features already being used for ecotourism purposes may continue to be used for such purposes provided, necessary protective measures and interpretation facilities are installed.

3. Rare, Endangered and Endemic Species

Organisms found in caves have special characteristics and features to survive in such an environment. Most troglobites and troglophiles are rare while some trogloxenes are endangered (Annex E). Any visitor entry would have irreversible effect or damage on the cave environment.

4. Paleontological, Archeological, Historical and Ethnographical Value

a. Presence of artifacts with archaeological and historical value.

The presence of artifacts and ecofacts indicate the archeological value of the cave. Artifacts may be in the form of stone tools, shell tools, pottery, metal implements, tradeware ceramics, wooden coffins, among others while ecofacts include human bones, animal bones, wood and shells. Artworks on walls may be in the form of charcoal drawings, hematite paintings, and engraved artwork. All of the above provide an invaluable window to our past. Therefore, such discoveries necessitate immediate closing of the cave for further studies (Annex F).

b. Paleontological Value

Fossils, which are the preserved remains of prehistoric plants or animal, tell us nearly all we know about the history of life on Earth. Most fossils are formed on the seabed and are most commonly embedded in limestone caves.

c. Historical Value

Caves can be declared of historical value if they fulfill the following criteria: 1) Caves that are strongly associated with important historical events or personages and with other illustrious Filipinos who have achieved an enduring contribution toward the enrichment of Filipino cultural heritage (ex. Pamitinan Cave "First Cry of Independence" as historian TM Kalaw proclaimed); 2) those that depict local aesthetic values and those related to a significant cultural-historic experience of Filipinos (ex. Ransang Petroglyps); 3) those that bear strong foreign influences and those with strong evidences of an active political, social, economic, and cultural relations with neighboring countries.

d. Anthropological/Ethnographic Value

Caves with anthropological or ethnographic value include those with burial grounds, habitation sites or ancestral domain, ancestral land, and sites for traditional and religious practices and rituals.

The Cave Coordinating Agencies shall determine whether caves closed for biological, geological, archeological, paleontological and historical research and exploration may be opened to the general public. The Tao't Bato cave in Palawan is an example of a cave that has been opened for ecotourism purposes after the archeological exploration and studies were completed by the National Museum.

Special Consideration:

Caves may be developed and converted into show caves based on the Department of Tourism's (DOT) evaluation for ecotourism sites (Annex G).