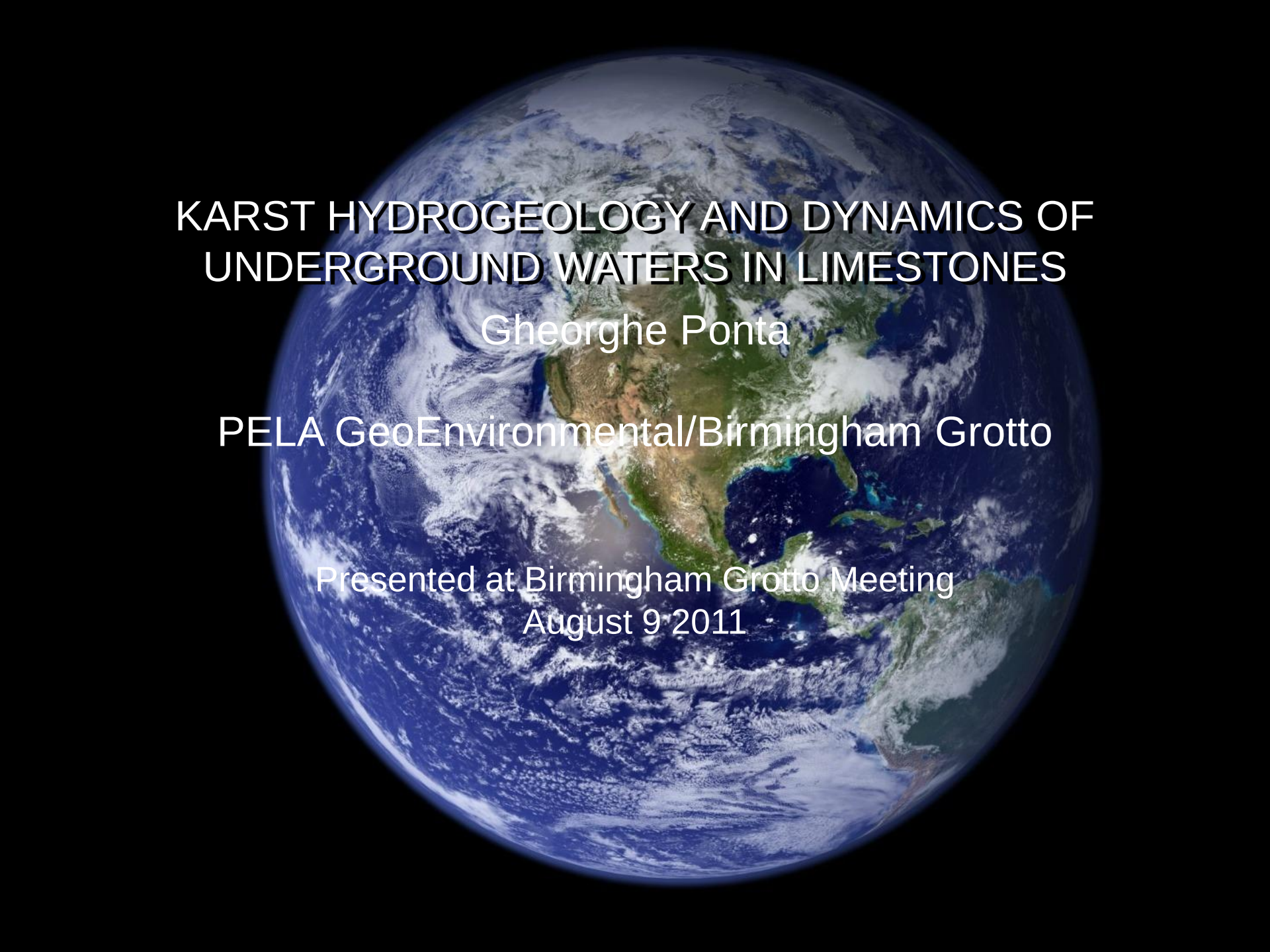


KARST HYDROGEOLOGY AND DYNAMICS OF UNDERGROUND WATERS IN LIMESTONES

Gheorghe Ponta

PELA GeoEnvironmental/Birmingham Grotto

Presented at Birmingham Grotto Meeting
August 9 2011

What is Karst?

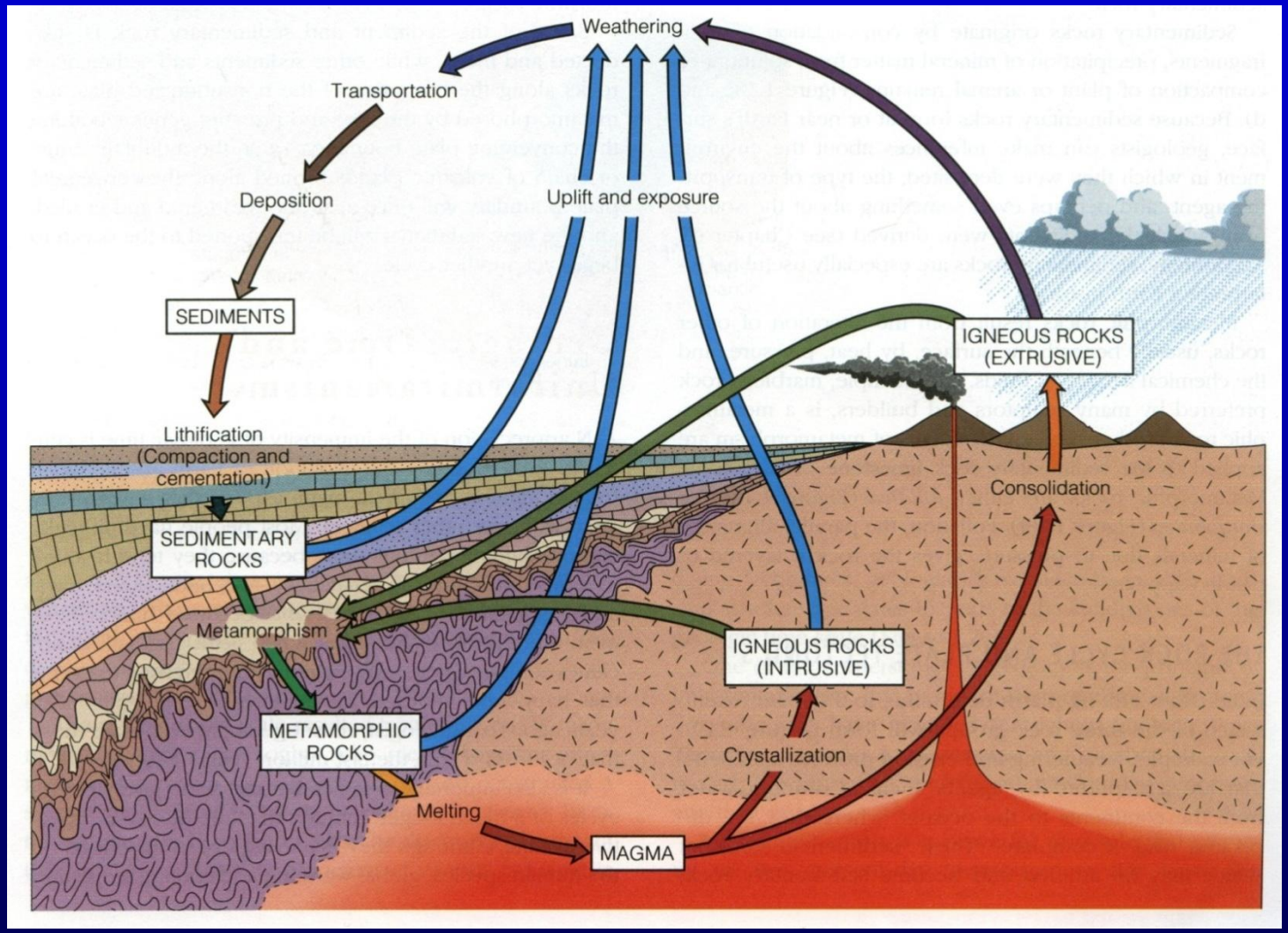
- Karst topography is a landscape shaped by the dissolution of a layer or layers of soluble bedrock, usually carbonate rock such as limestone or dolomite.

- Karst is a kind of landscape, characterized by closed depressions, caves, and underground drainage.
- Karst is formed on rocks that dissolve, rather than being eroded mechanically (rivers, waves, etc.).

For karst landscape to be formed we have to have:

1. Lithologic Condition (rocks that dissolves)
2. Hydrogeologic Condition (surface, groundwater and precipitations)
3. Tectonic Conditions

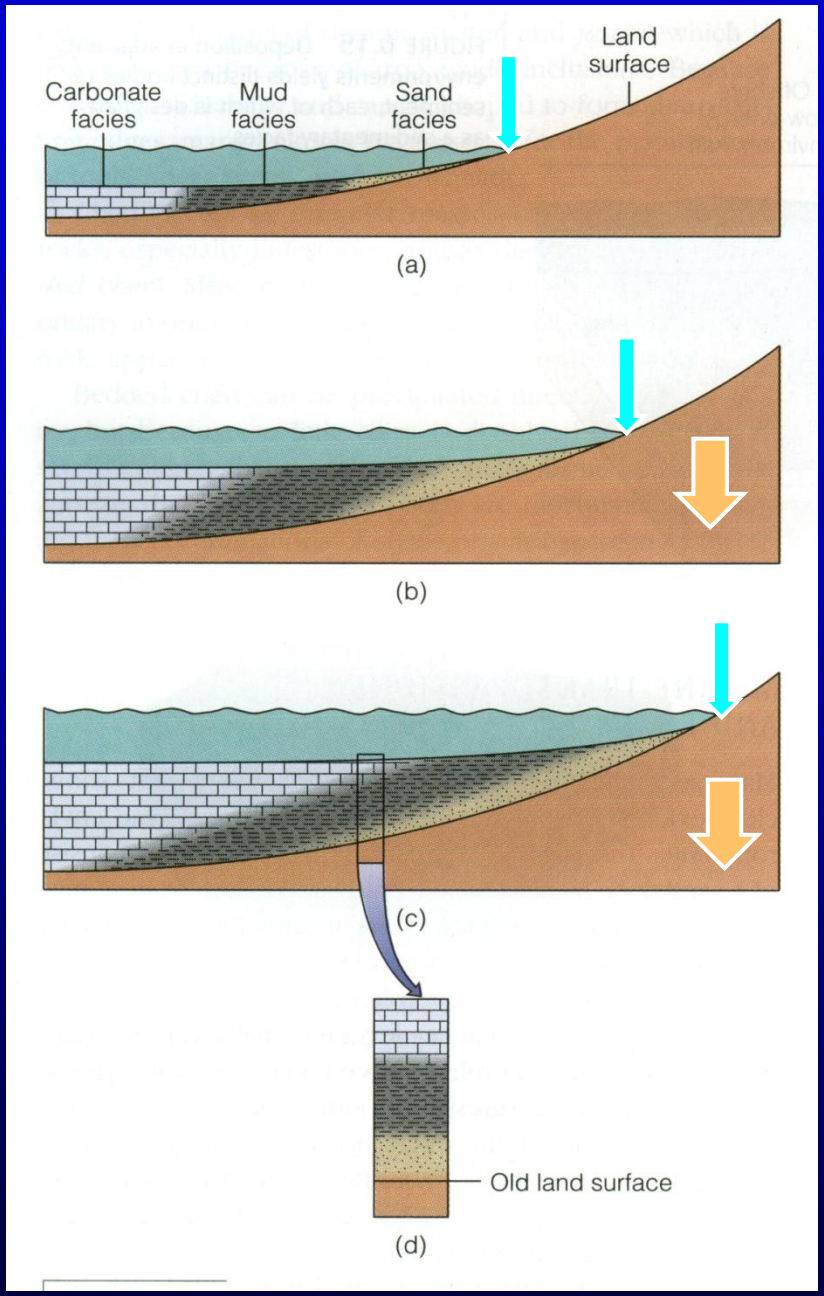
1. Lithologic Condition



The rock cycle showing the interrelationship between Earth's internal and external processes and how each of the three major rock groups is related to the others

(source: Monroe and Wicander 1997)

1. Lithologic Condition

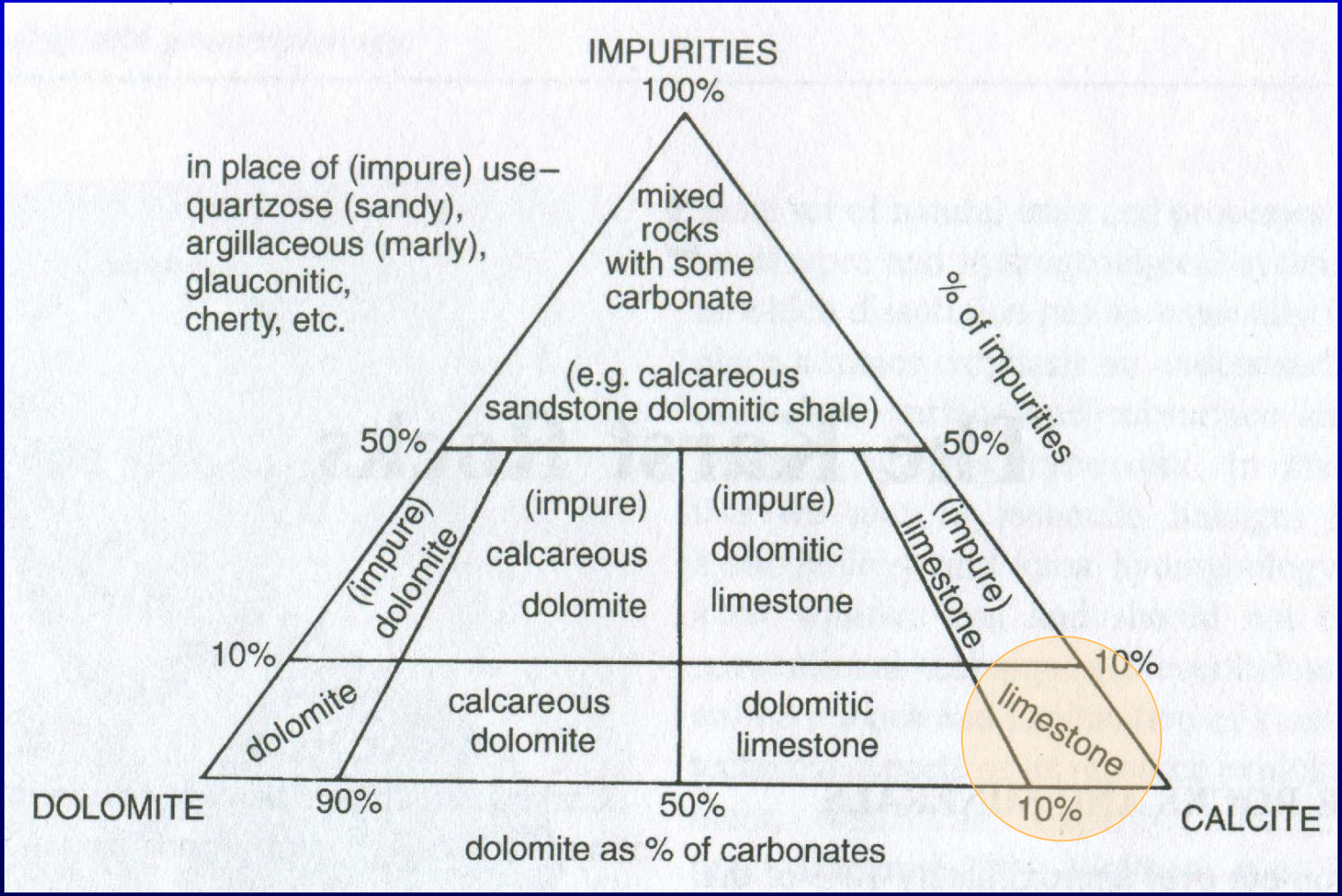


(a), (b), and (c) Three stages of a marine transgression.

(d) Diagrammatic representation of the vertical sequence resulting from the transgression

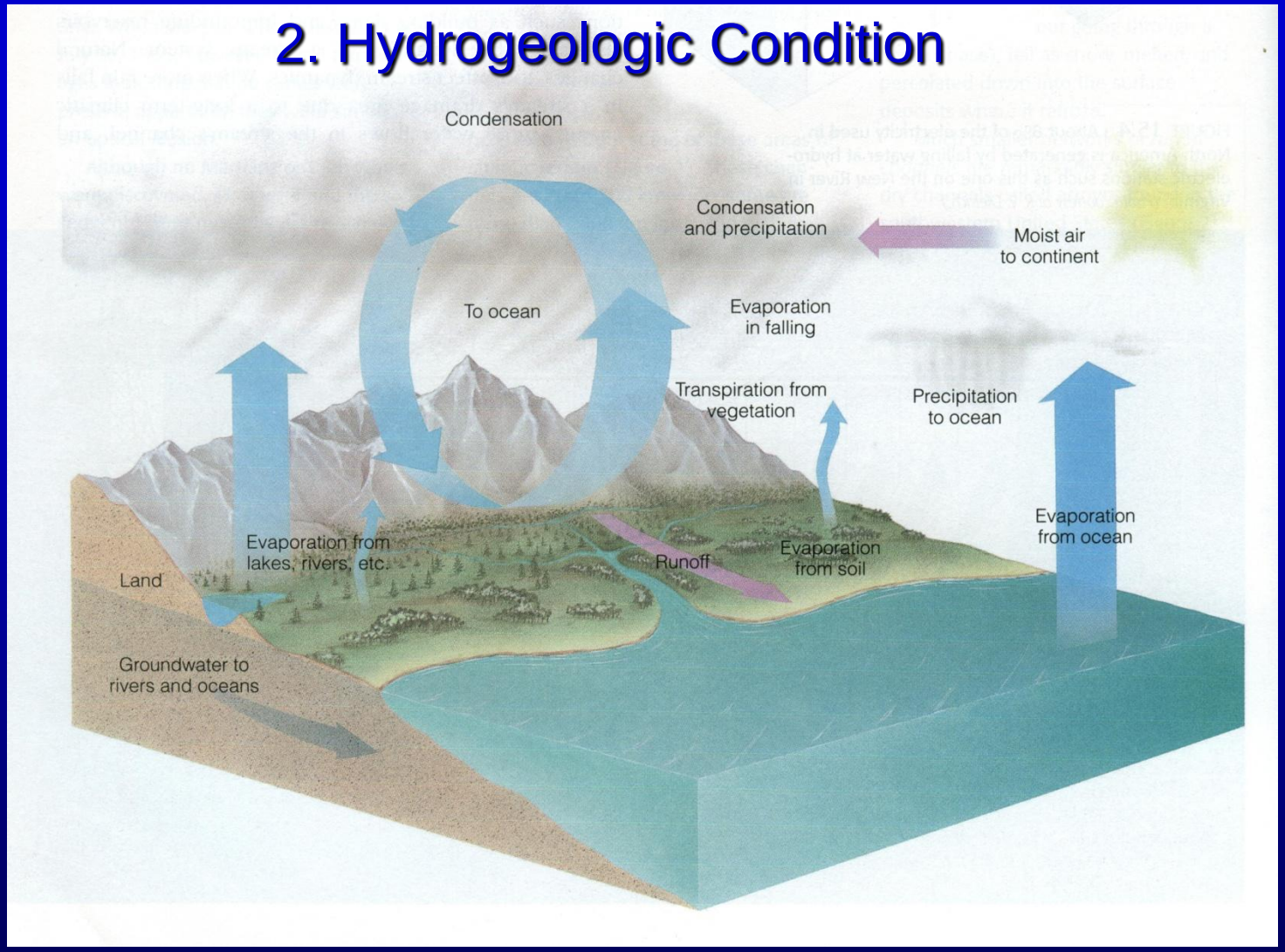
(source: Monroe and Wicander 1997)

1. Lithologic Condition



From Leighton, M.W. and Pendexter C. (1962) A Bulk compositional classification of carbonate rocks, Carbonate Rock Types, mem. 1, page 33 – 61, 1962 American Association of Petroleum Geologists

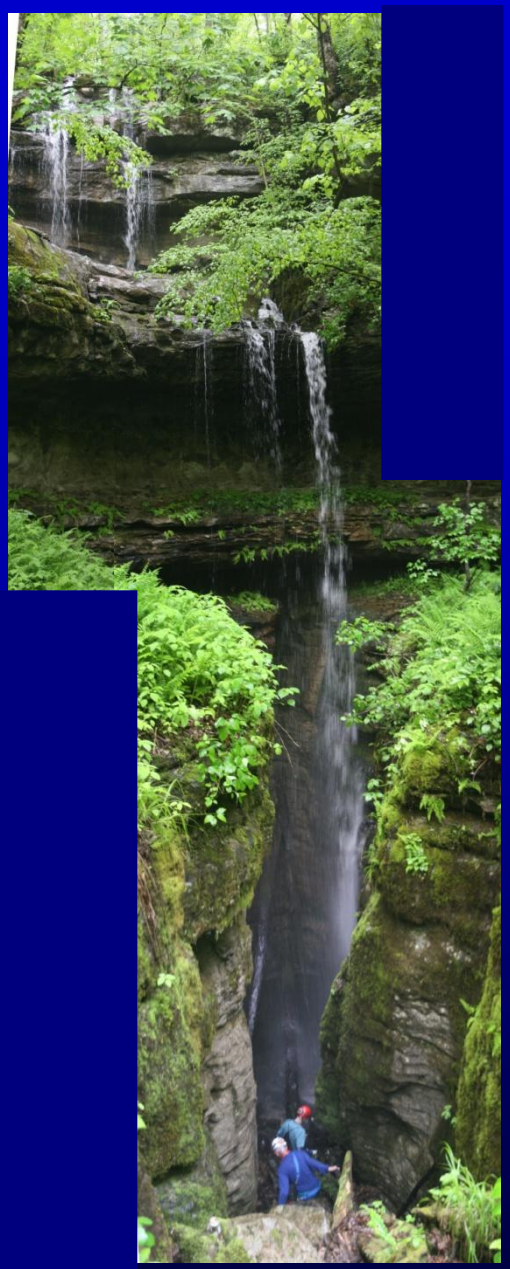
2. Hydrogeologic Condition



During the hydrologic cycle, water evaporates from the oceans and rises as water vapor to form clouds that release their precipitation over oceans or over land. Much of the precipitation falling on land returns to the oceans by surface runoff, thus completing the cycle

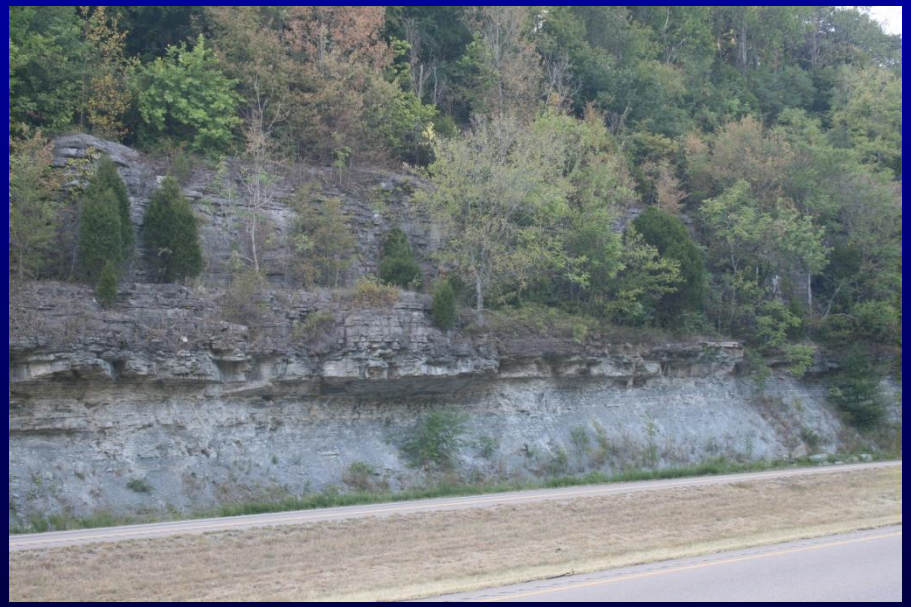
(source: Monroe and Wicander 1997)

Alabama/TAG Caves



Limestones are dipping between 0 and 20 degrees

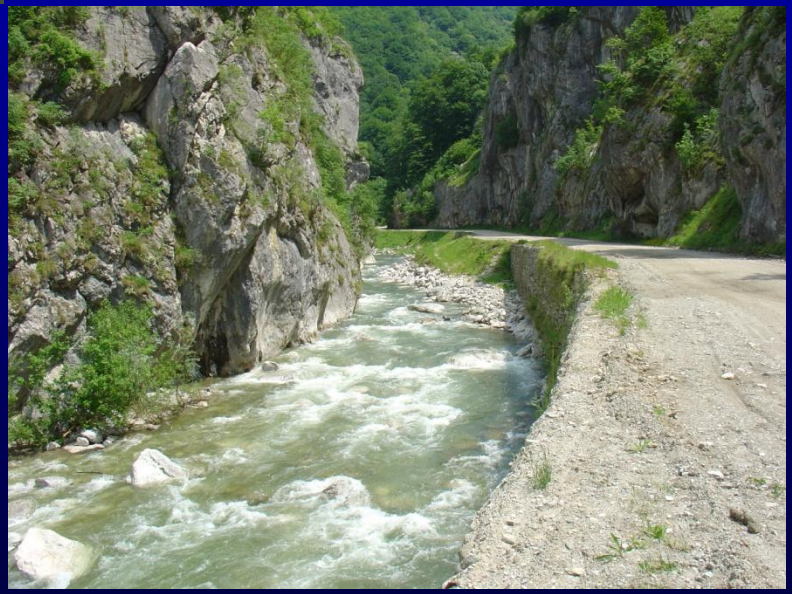
Average precipitation per year is about 49 inches /1,244.6 mm



Romanian Caves

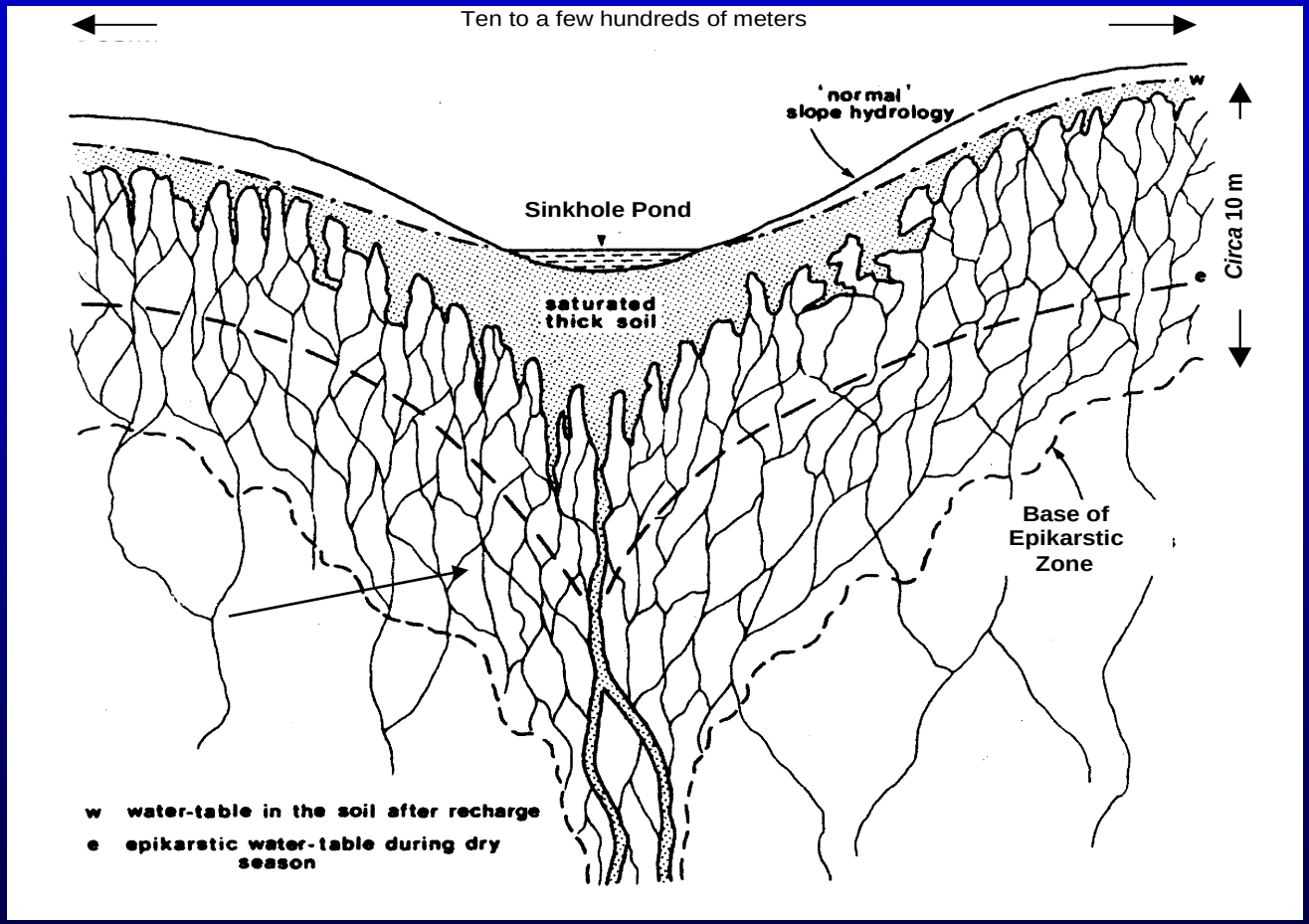
Limestones are dipping between 25 and 60 degrees

Average precipitation per year is about 36 inches /914.4 mm



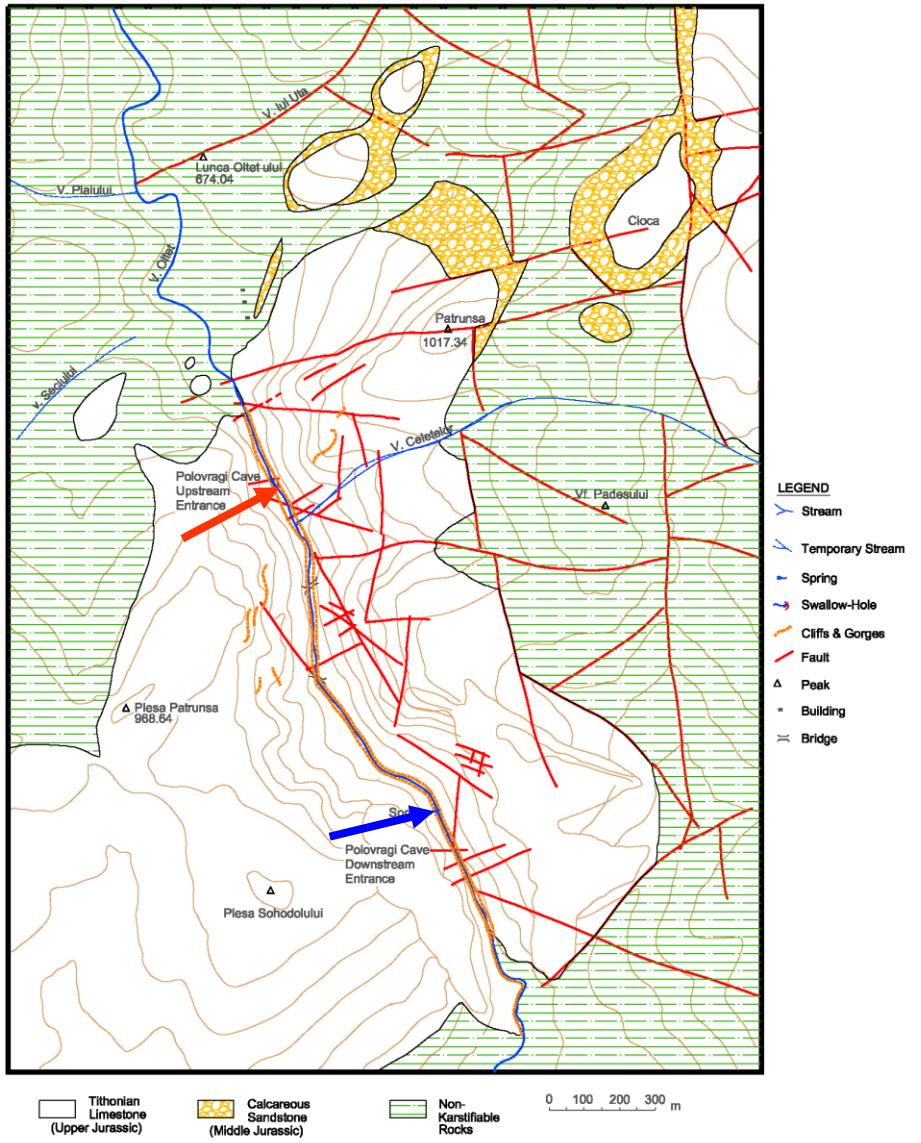
3. Tectonic Condition

Infiltrating Water and Limestone Dissolution Converge on the Intersections of Major Fractures.

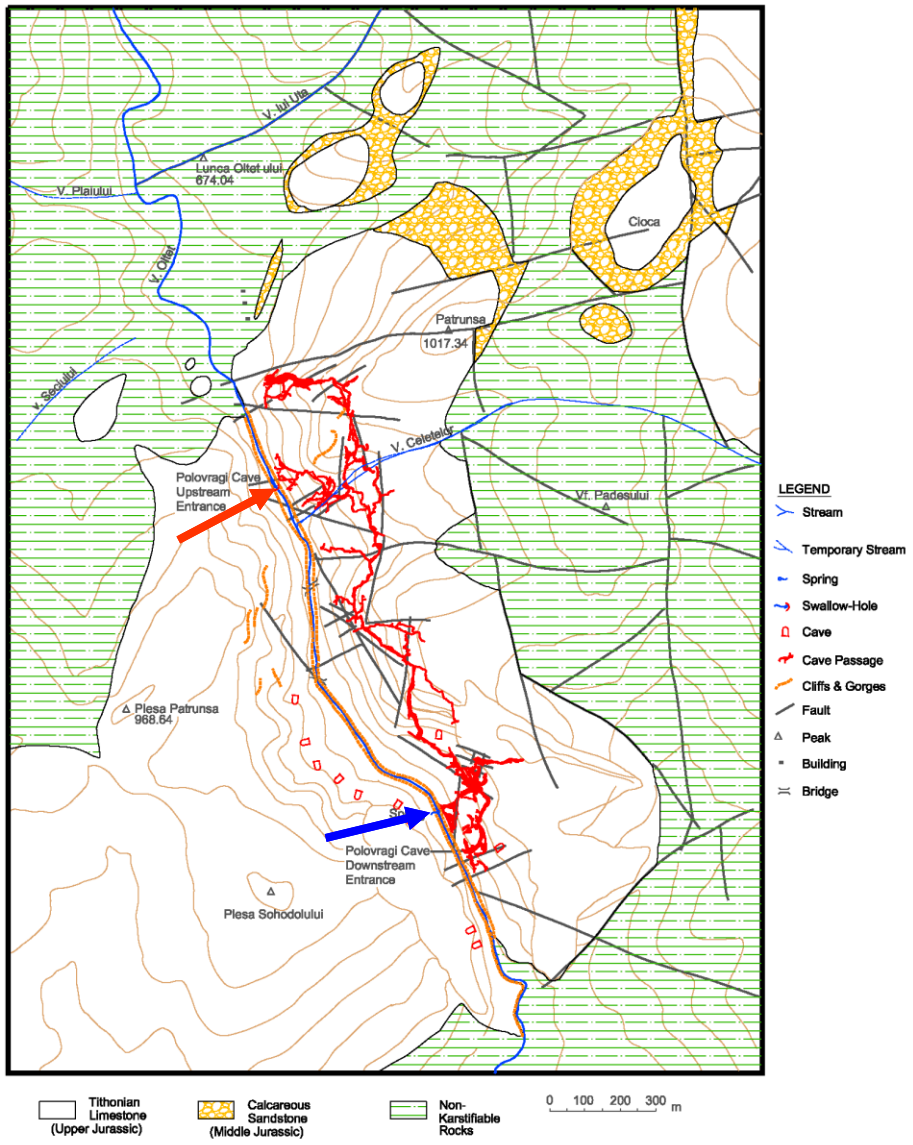


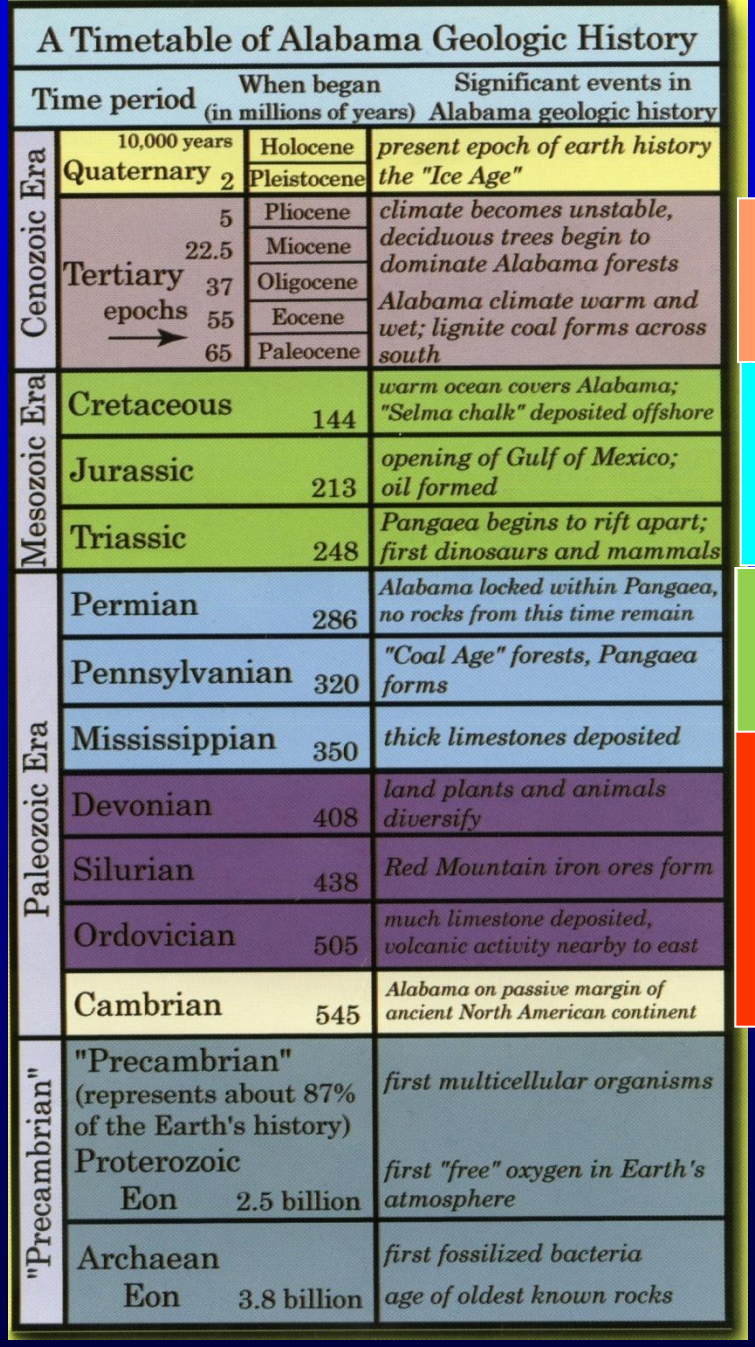
3. Tectonic Condition

GEOLOGIC MAP



CAVE PASSAGES





A Timetable of Alabama Geologic History

Time period		When began (in millions of years)	Significant events in Alabama geologic history
Cenozoic Era	Quaternary 10,000 years – 2	Holocene	*present epoch of earth history*
		Pleistocene	*the "Ice Age"*
	Tertiary epochs →	5 Pliocene	*climate becomes unstable, deciduous trees begin to dominate Alabama forests*
		22.5 Miocene	
		37 Oligocene	*Alabama climate warm and wet; lignite coal forms across south*
		55 Eocene	
		65 Paleocene	
Mesozoic Era	Cretaceous	144	*warm ocean covers Alabama; "Selma chalk" deposited offshore*
	Jurassic	213	*opening of Gulf of Mexico; oil formed*
	Triassic	248	*Pangaea begins to rift apart; first dinosaurs and mammals*
Paleozoic Era	Permian	286	*Alabama locked within Pangaea, no rocks from this time remain*
	Pennsylvanian	320	*"Coal Age" forests, Pangaea forms*
	Mississippian	350	*thick limestones deposited*
	Devonian	408	*land plants and animals diversify*
	Silurian	438	*Red Mountain iron ores form*
	Ordovician	505	*much limestone deposited, volcanic activity nearby to east*
	Cambrian	545	*Alabama on passive margin of ancient North American continent*
"Precambrian"	"Precambrian" (represents about 87% of the Earth's history) Proterozoic Eon	2.5 billion	*first multicellular organisms* / *first "free" oxygen in Earth's atmosphere*
	Archaean Eon	3.8 billion	*first fossilized bacteria* / *age of oldest known rocks*

Florida/Bahamas Karst

Romanian Karst

Laos Karst

Alabama/TAG* Karst

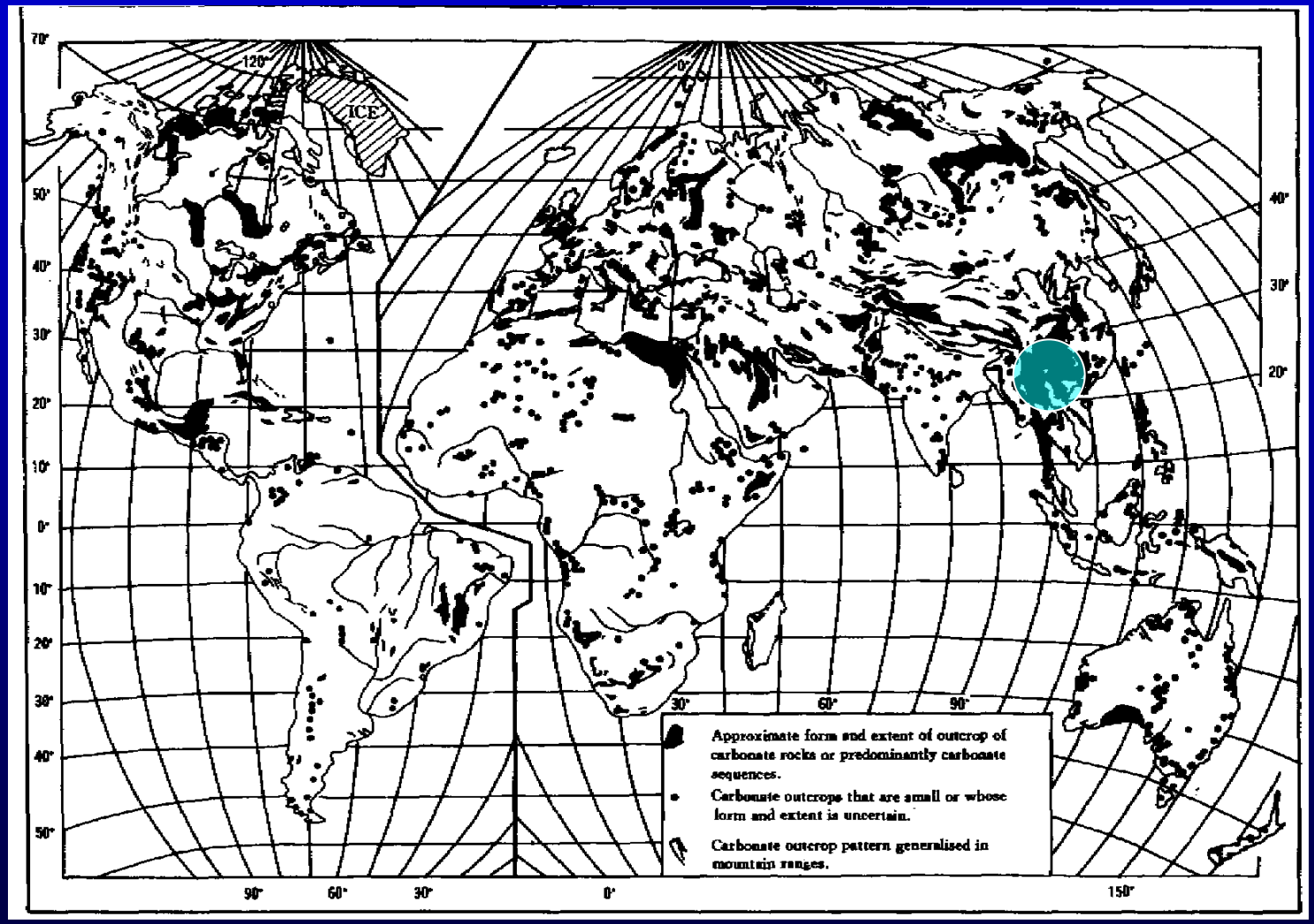
*** Tennessee, Alabama, Georgia**

LAOS 2011

Gheorghe Ponta

PELA GeoEnvironmental/Birmingham Grotto

Distribution of Major Outcrops of Carbonates Rocks in the World



(source: Ford and Wiliams 2007)

Laos Caves

Limestones are dipping between 20 and 90 degrees

Laos Caves

Average precipitation per year is 60 to 80 inches (1,500 – 2,000 mm) with a maximum of 160 inches or 4,000 mm


LAO PEOPLE'S DEMOCRATIC REPUBLIC
CHINA
MYANMAR
THAILAND
VIET NAM
CAMBODIA
Gulf of Tonkin
Hanoi
Vientiane
Simao
Jinghong
Muang Ou Tai
Lao Cai
Cao Bang
Bac Kan
Pingxiang
La Chau
Tuyen Quang
Lang Son
Phôngsali
PHONGSALI
Yen Bai
Thai Nguyen
Dien Bien
Bac Ninh
Cam Pha
Haiphong
LOUANG NAMTHA
Louang Namtha
Muang Khoa
Muang Xai
Pakmong
Xiangkho
Viangxai
Xamnua
HOUAPHAN
Qua Hoa
Nam Dinh
BOKEO
Houayxay
OUDOMXAI
Muang Houn
LOUANGPHRABANG
Louangphrabang
Pakbeng
Thanh Hoa
XIANGKHOANG
Phoukhon
Phônsavan
Ky Son
Xaignabouli
XAIGNABOULI
Kasi
Pua
Vangviang
VIENTIANE
Nan
Ban Nalé
Vinh
Phônhông
VIENTIANE PREFECTURE
BOLIKAMXAI
Pakxam
Phontan
Ha Tinh
Phrae
Paklay
Phontiou
KHAMMOUAN
Xanakham
Nong Khai
Ban Na Phan
Dong Hoi
Uttaradit
Loei
Udon Thani
Nakhon Phanom
Thakhek
Sakon Nakhon
Khengkabao
Xéno
Xépôn
SAVANNAKHET
Savannakhet
Muang Phin
Hue
Khon Kaen
Da Nang
SALAVAN
Salavan
Khôngxédôn
XEKONG
Xékong
Ubon Ratchathani
Pakxé
Pakxong
ATTAPU
Champasak
Attapu
CHAMPASAK
Dac To
Cheom Ksan
Siem Pang
Play Ku
Stung Treng
LAO P.D.R.
National capital
Provincial capital
City, town
National boundary
Provincial boundary
Main road
Secondary road
Railroad
Major airport
0 50 100 150 200 km
0 25 50 75 100 mi
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.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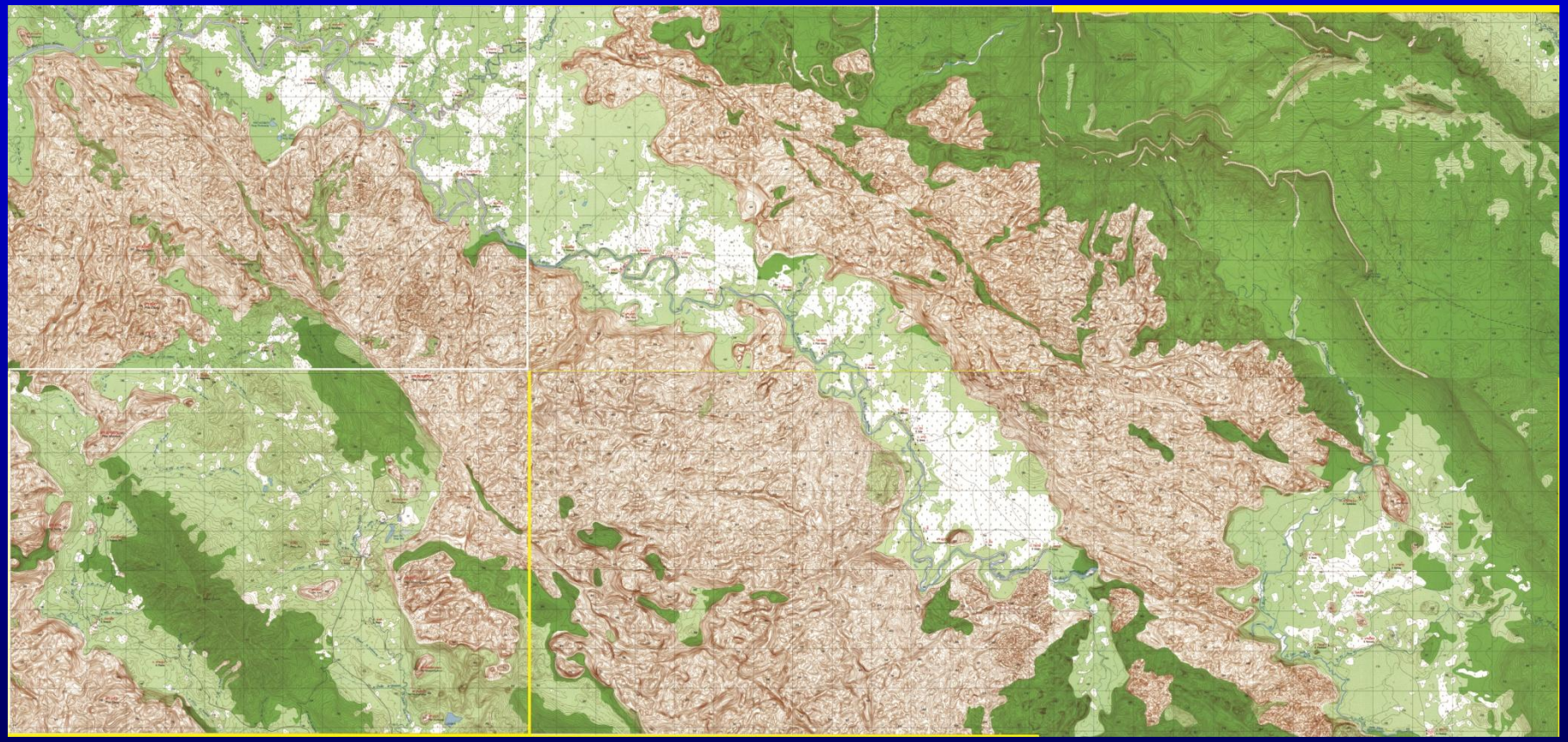
NAKHONPHANOM CUSTOMS



The Expedition took place in the Khammouane Massif of Central Laos, in the Nam Hin Boun Valley

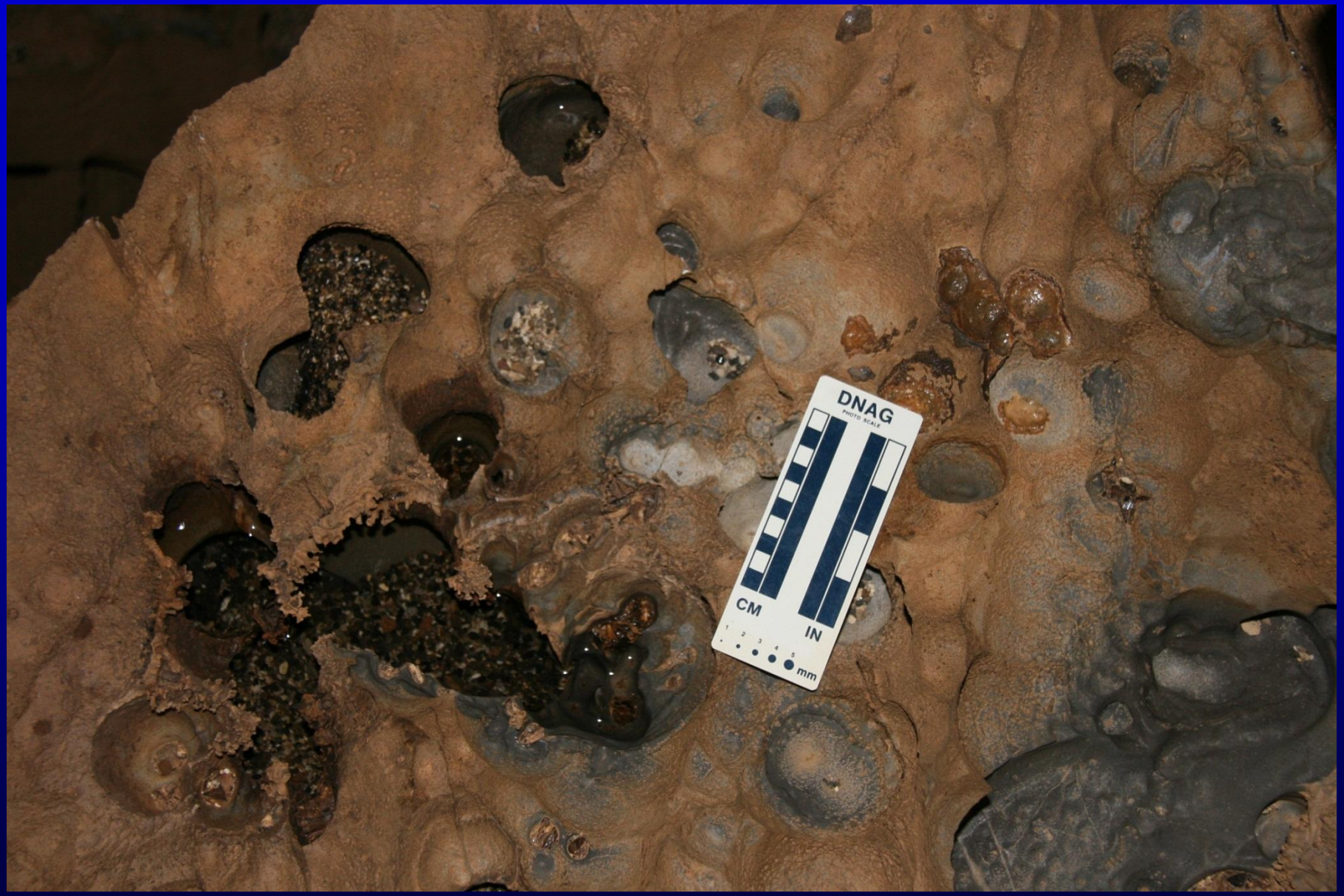

HYUNDAI


RECEPTION


RECEPTION

Tham Houay Sae Cave

February 7 – 9, 2011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IN
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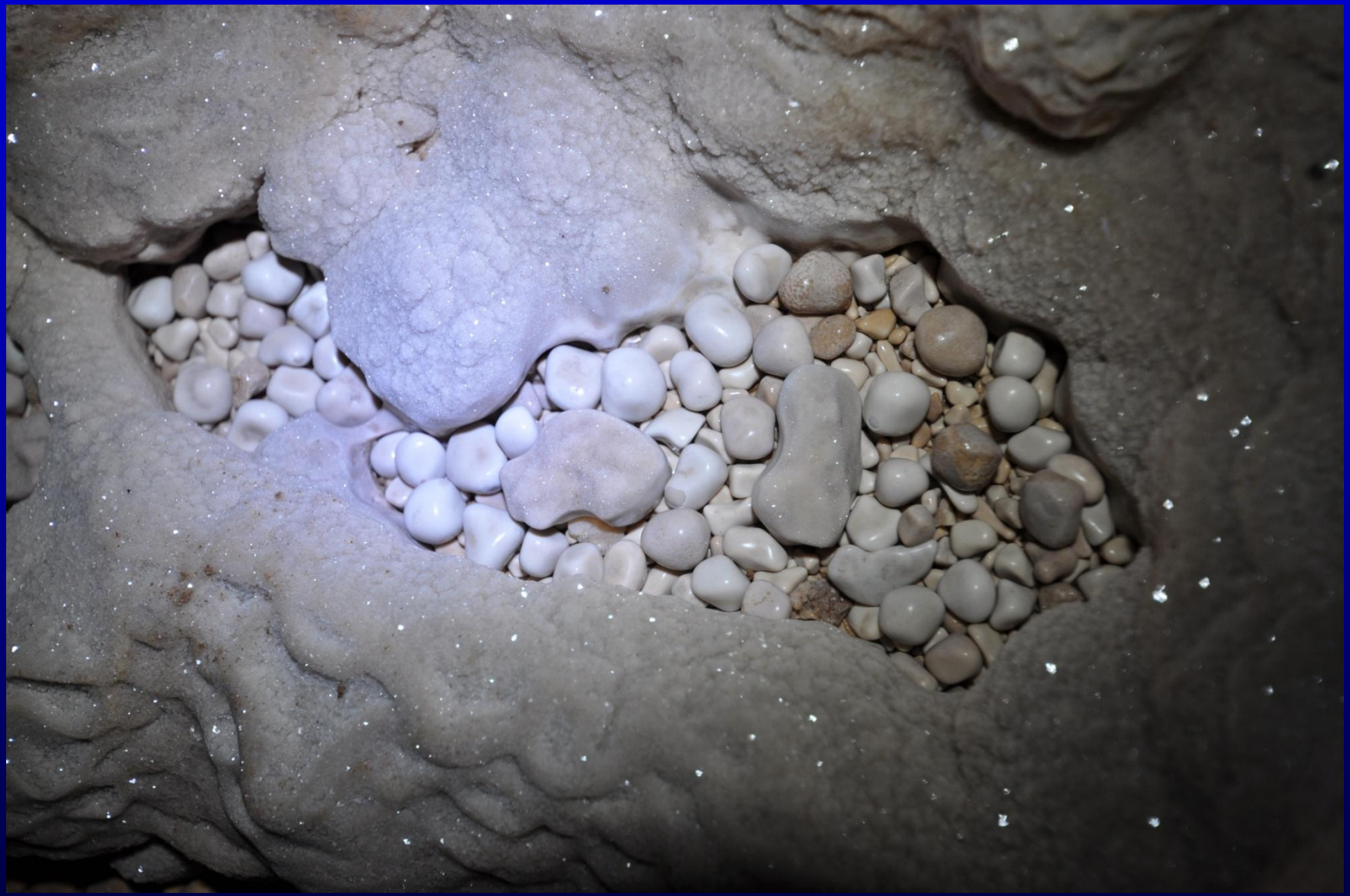


Tham Houay Khenang Cave

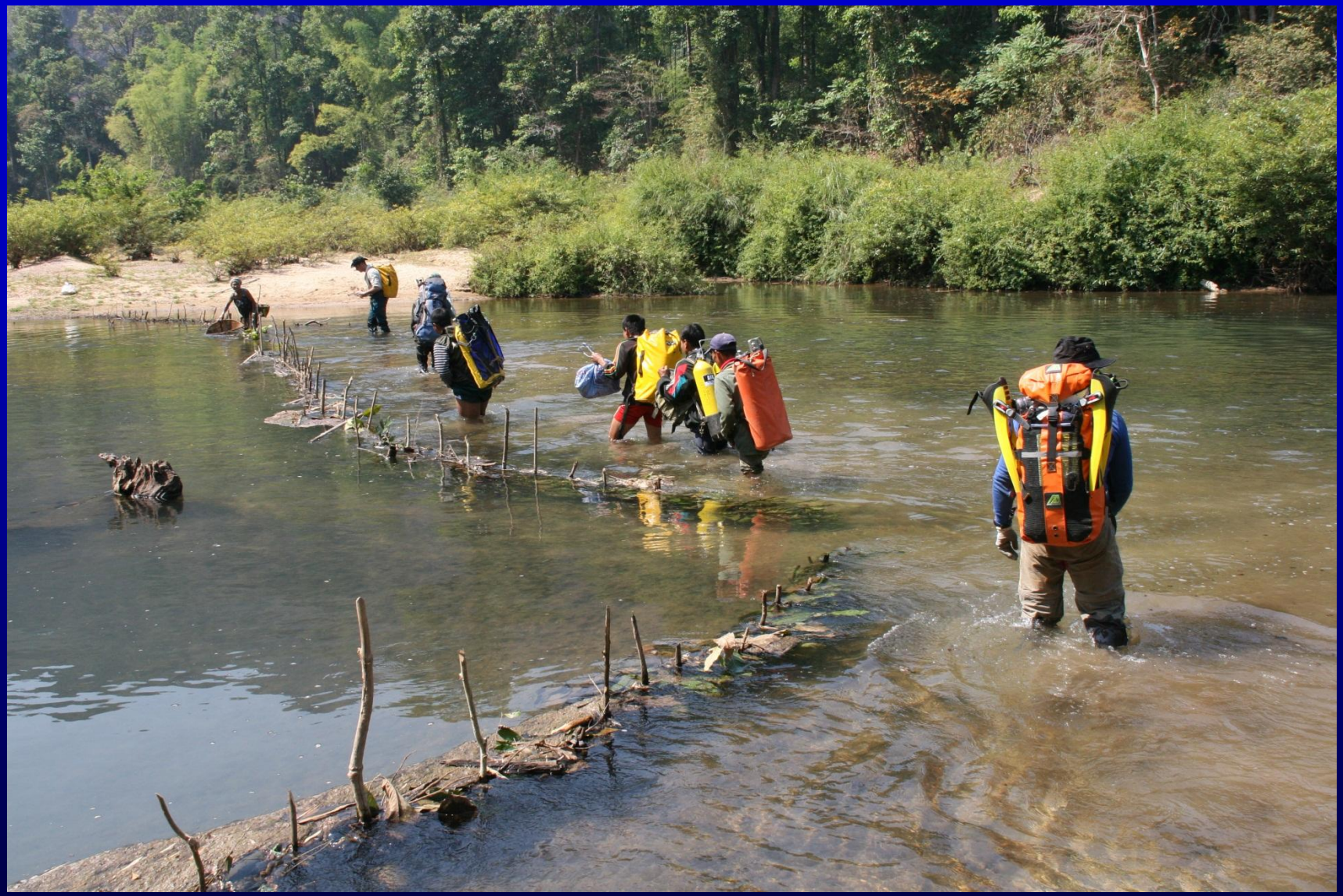
February 10, 2011

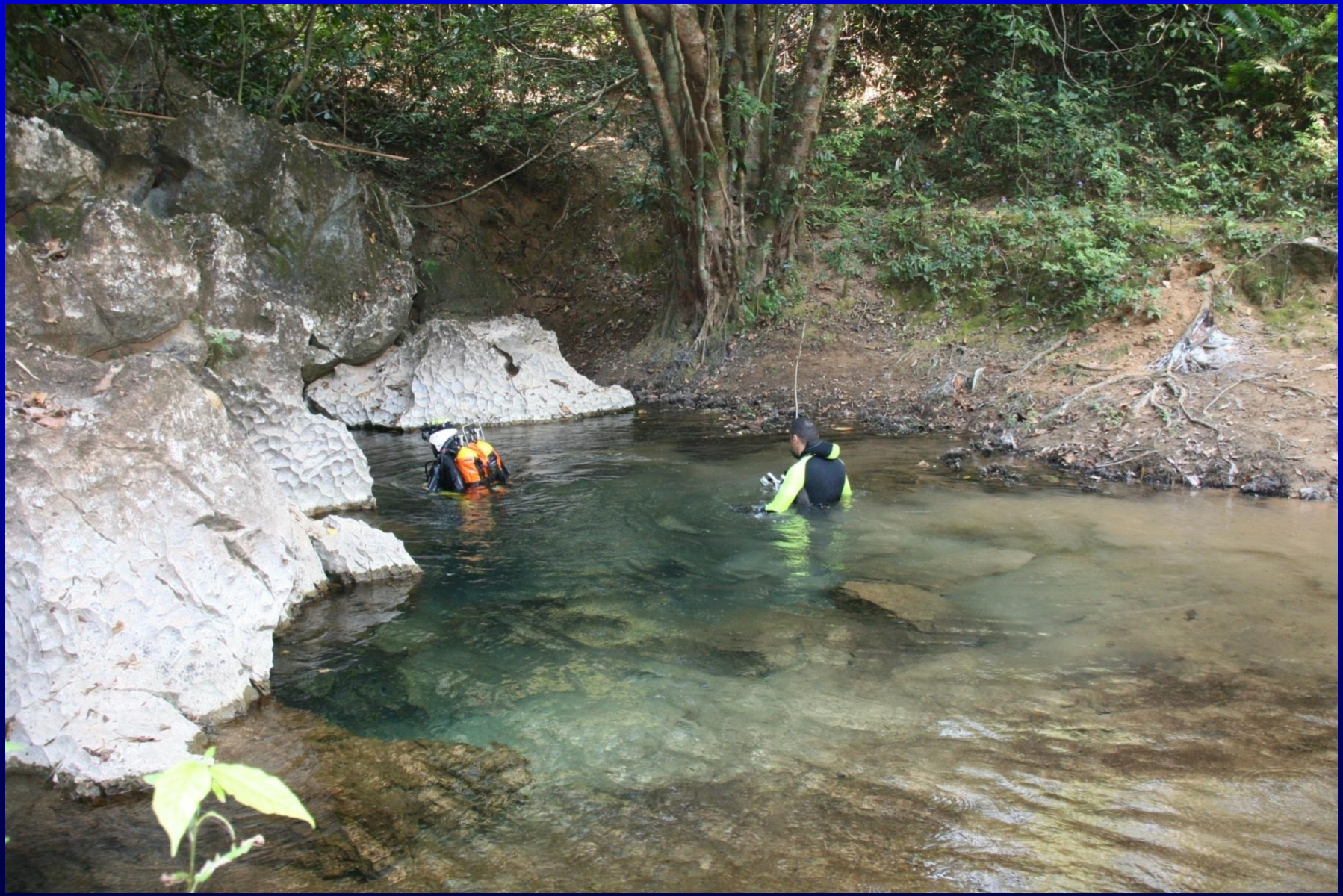

privilege

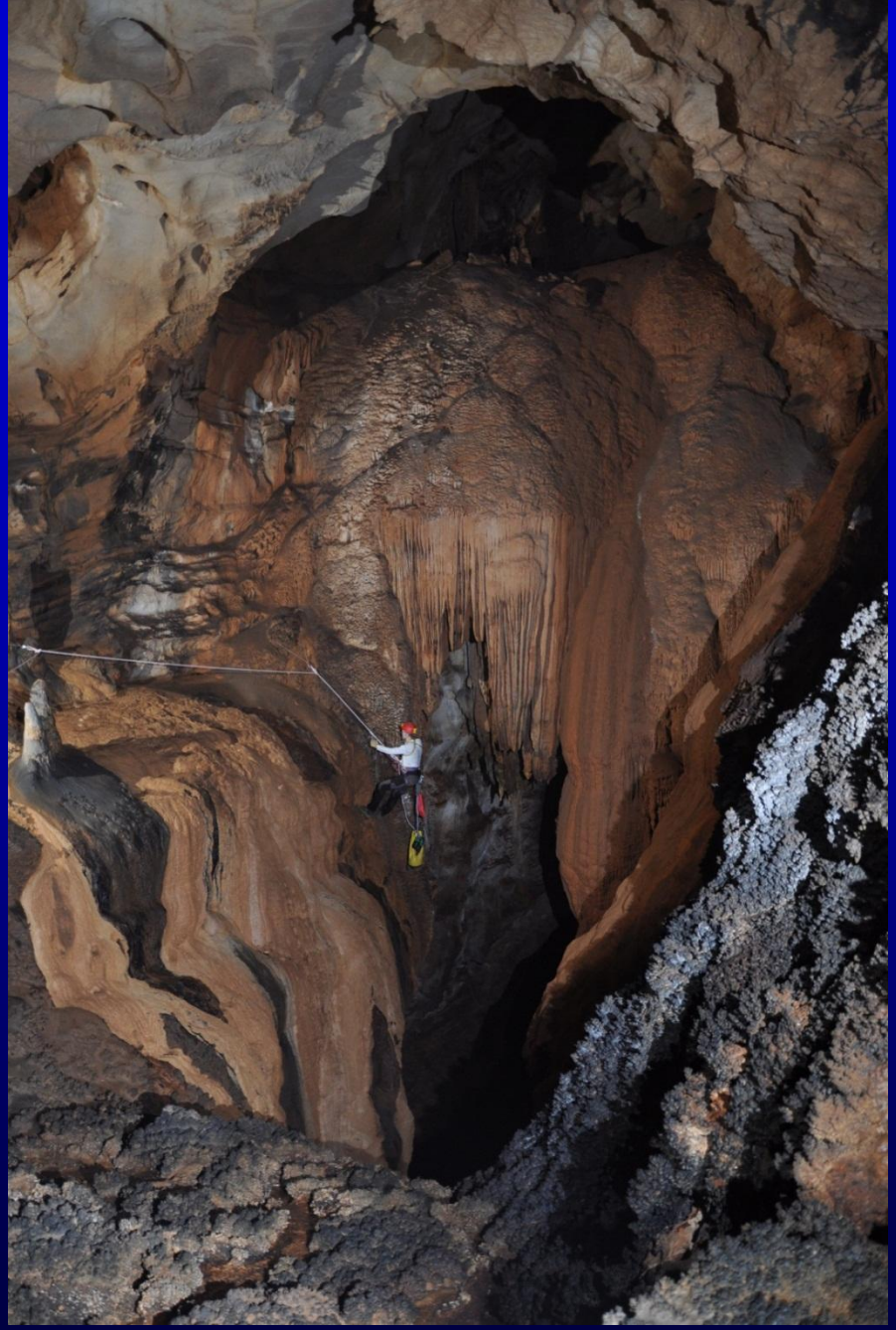

HONDA

Tham Khoun Howay Set

February 12, 2011



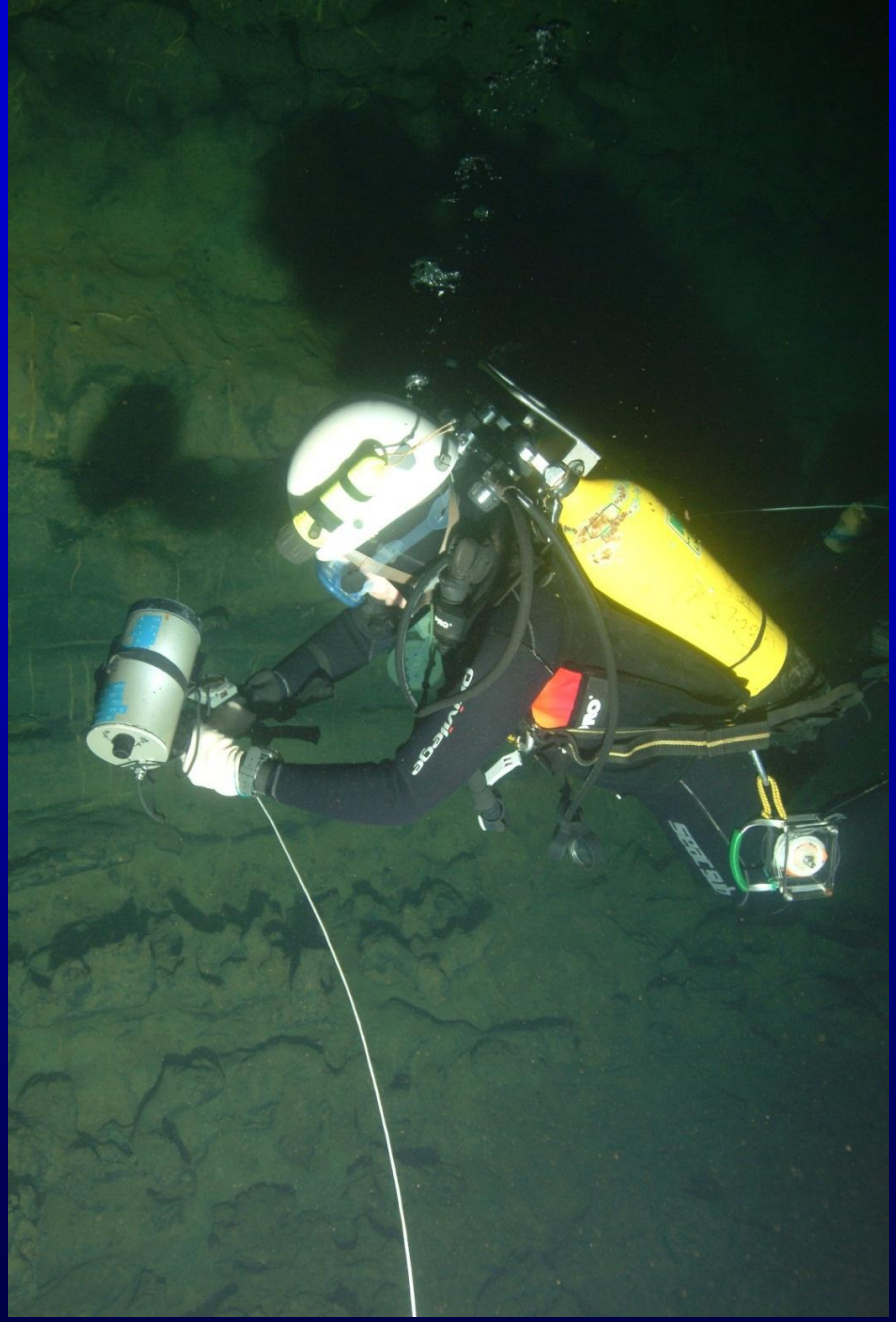


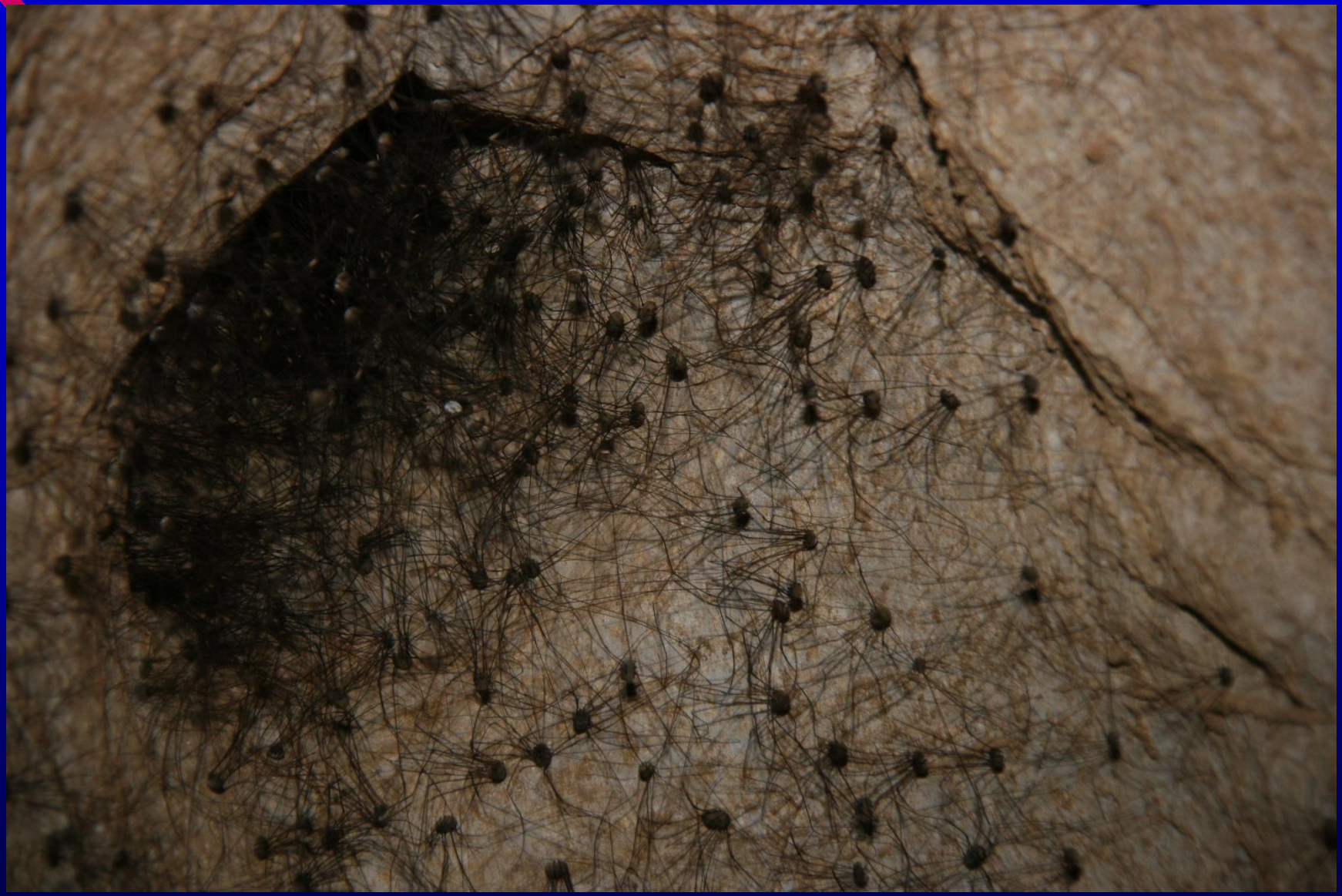


Puie Pu and Tham Pessong Caves

February 14, 2011


PONS
PONS

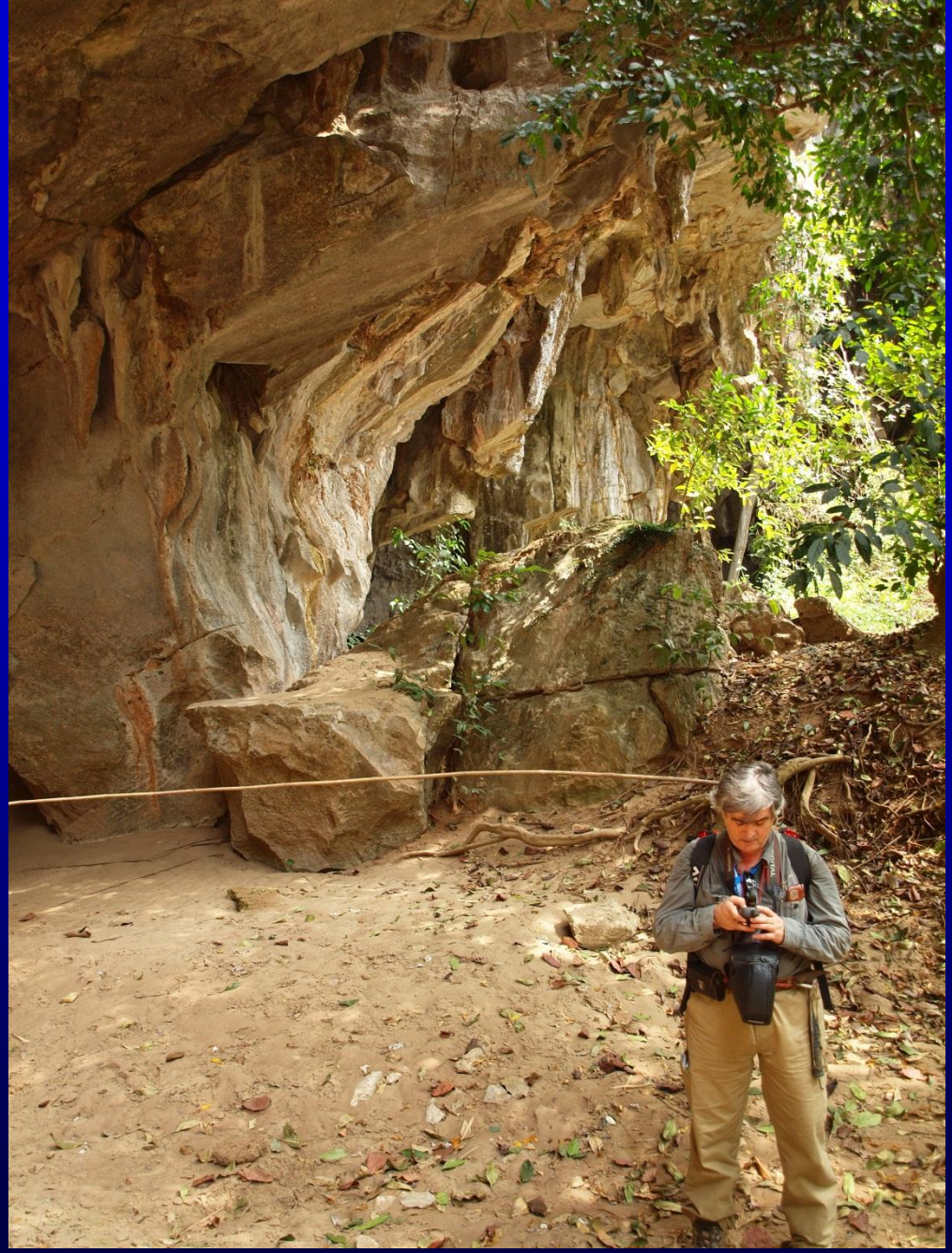


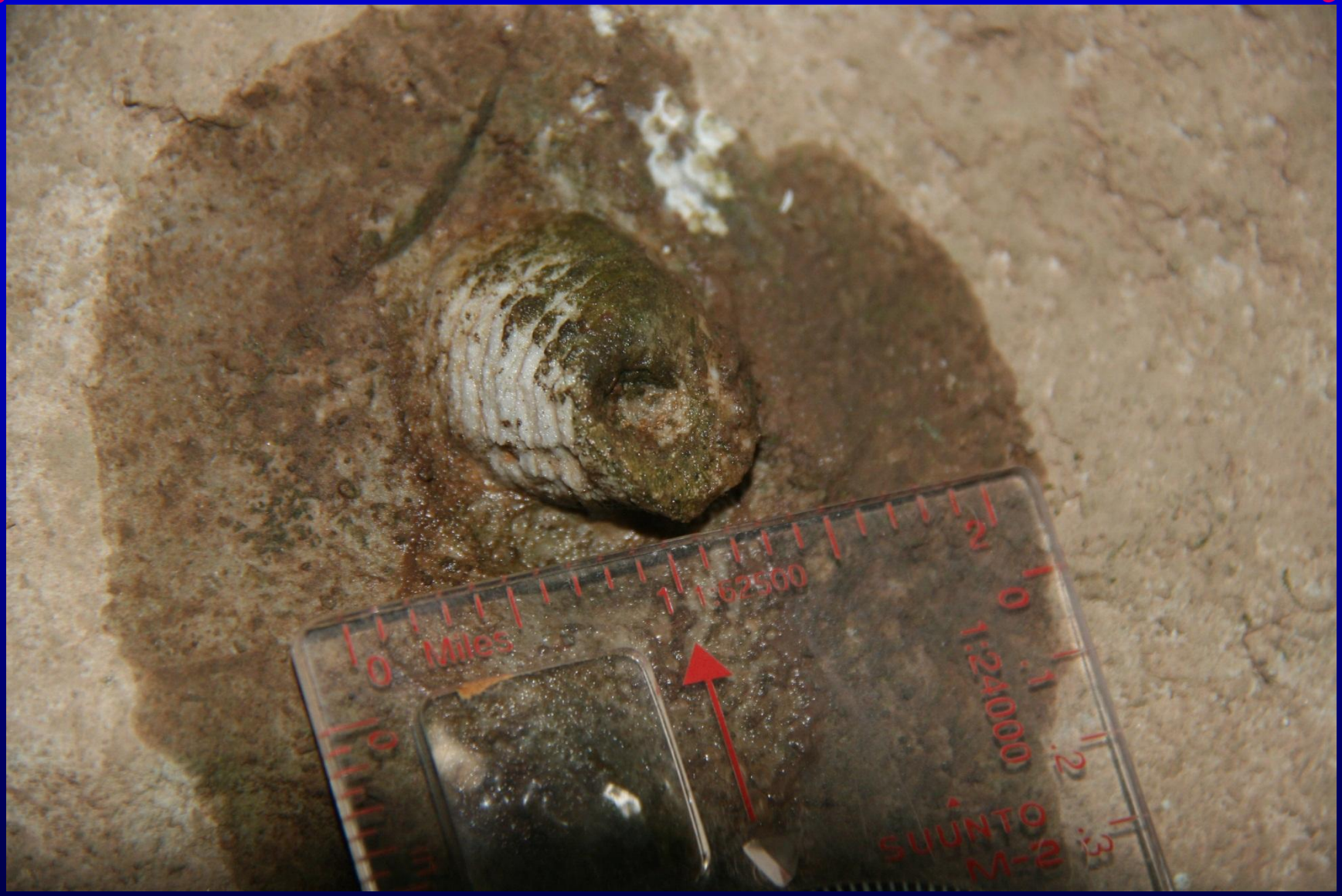



CAMP

Tham Houay Kaew and Khoum Houay Gneg (spring of Tham Nam Non)

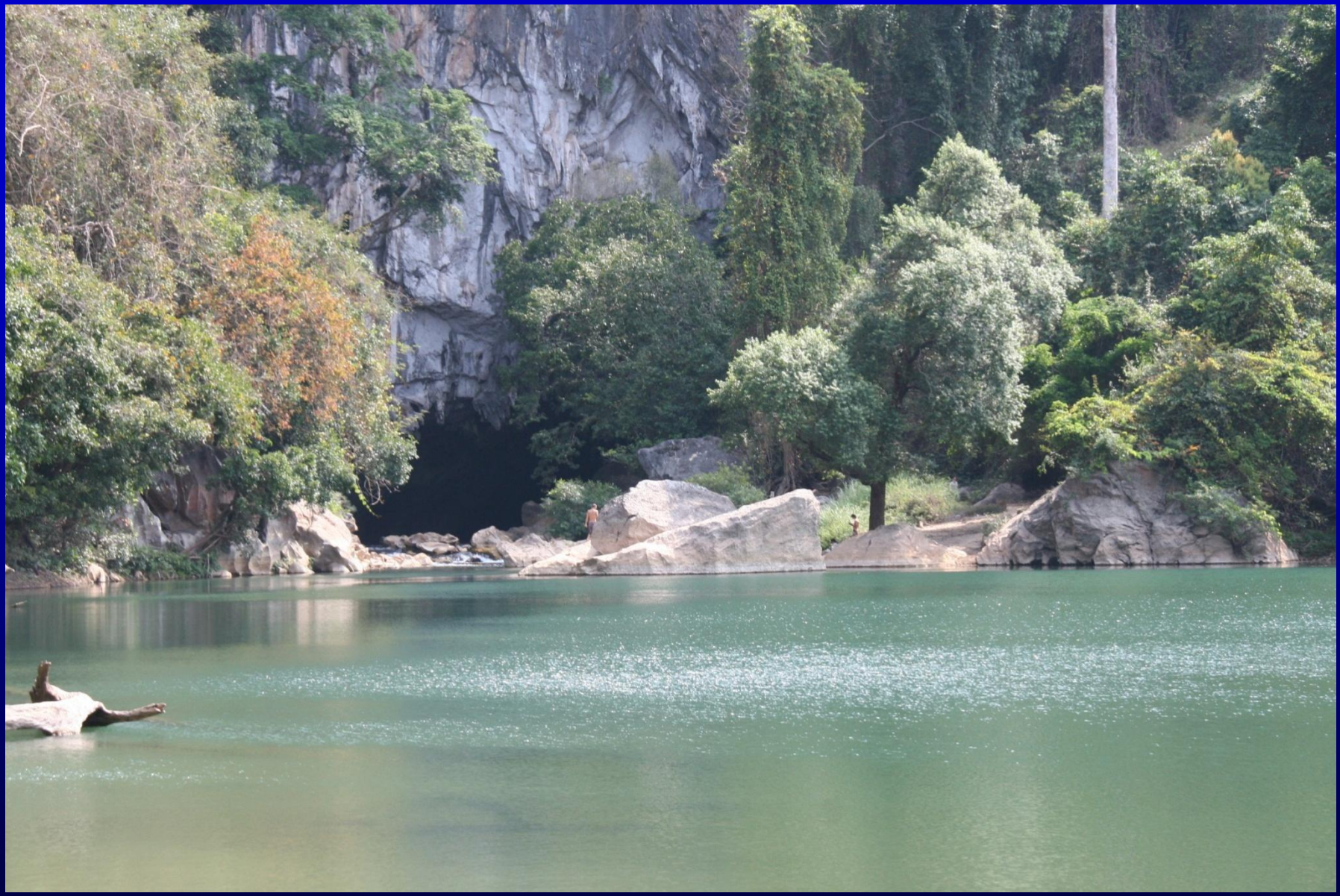
February 15, 2011

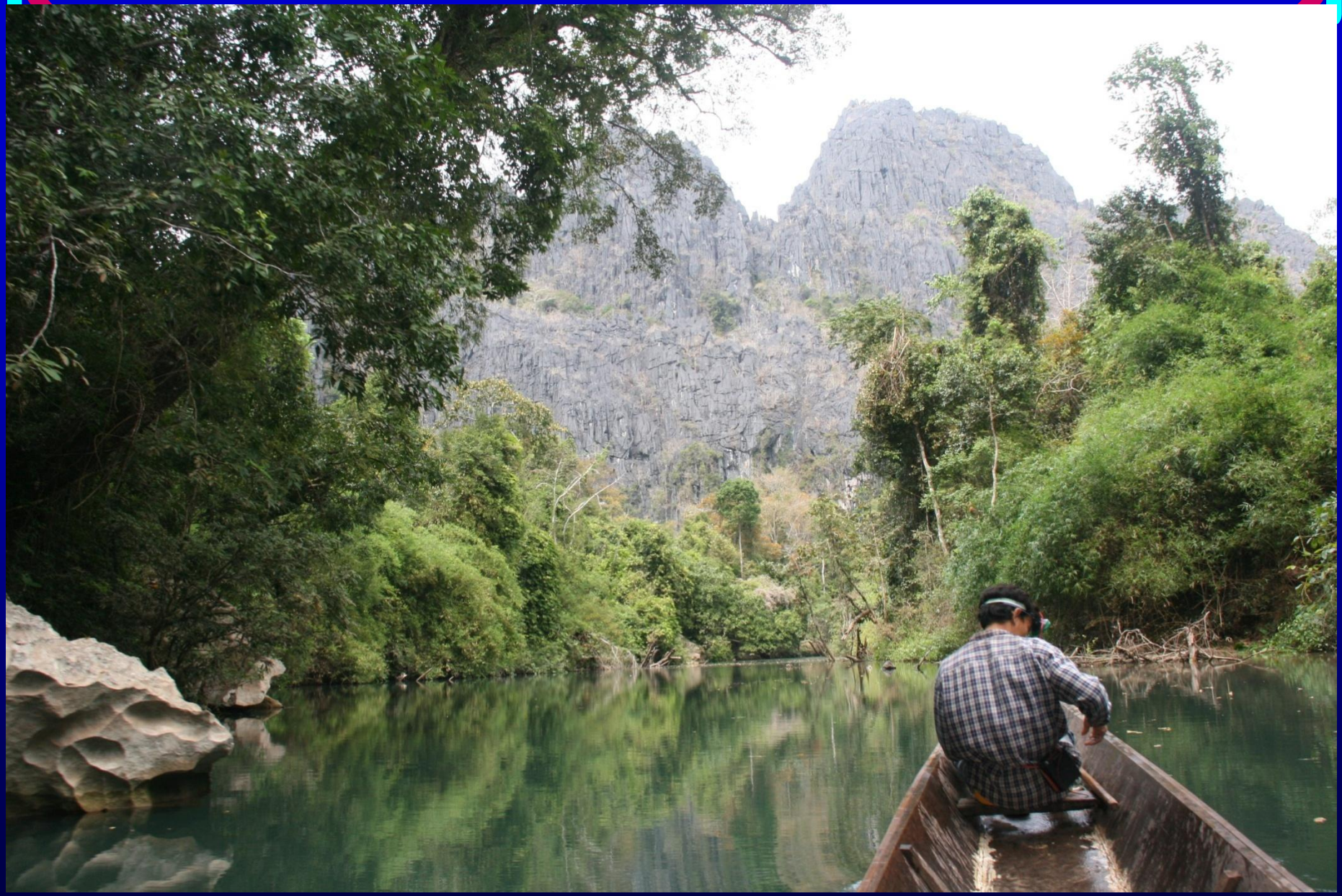



0 Miles
1:62500
1:24000
SUUNTO
M-2

Konglor Cave

February 12, 2011





Tham Nam Non Cave

February 16, 2011

- Planet Earth was formed 4.6 billion years ago

- All the natural resources generated during that time will be wiped out by the end of this century


NIVEAU DU GLACIER
LEVEL OF THE GLACIER
1980


1980
Global Warming?


But the people of Laos will survive

The „Expe Laos 2011” Expedition was organized by the Geokarst Aventure Association under the patronage of the French Speleological Federation and its Commission for International Relations and Expeditions and the Romanian Speleological Federation and its Commission for Exploration, during February 4 – 28, 2011.

LAOS 2011 EXPEDITION TEAM

Laurent Mestre

Agency Director, caver, cave-diver. Caving expeditions: Bulgaria 2001, Spain 2003, Laos 2006, 2009, 2010, Romania 2006, 2007, Papua New Guinea 2005, Patagonia 2008

Richard Huttler

CEO of a heating and air-conditioning company, photographer, cave-diver. Caving expeditions: Croatia 1998, 1999, Bulgaria 2001, Spain 2003, Laos 2006, 2008, 2009, 2010, Romania 2006, Vietnam 2007

Isabelle Perpoli

Engineer, caver, cave-diver, photographer, in charge of photography for CRPS RABA

Damien Vignoles

Firefighter, dangerous environments rescue specialist, caver, cave-diver, climber. Caving expeditions : Slovenia 2000, Bulgaria 2001, 2002, Greece 2002, 2003, 2004, Crete 2005, Poland 2003, Spain 2003, 2004, 2005, 2007, Italy 2006, Romania 2007, Laos 2010

LAOS 2011 EXPEDITION TEAM

Placido Carlito (Mowgli)
Caver, cave-diver, Caving expeditions: Spain 1999, Turkey 2000, China 2000, 2001, 2003, 2005, 2007, 2008, 2009, 2010, Borneo 2010

Tudor Marin
Engineer, Technical Counselor for National Cave Rescue, Instructor with the Romanian Speleological Federation, diver. Caving expeditions: China 1996, France 1996, 1997, 1999, 2002, 2006, Ukraine 1997, Spain 1999, Papua New Guinea 2005, Serbia 2007, 2008, Laos 2008, 2010, Crete 2010.

Mihai Baciu
Engineer, caver, cave-diver, NAUI instructor, photographer and cameraman (on land and underwater). Explorer of Isverna cave with the longest sumps in Romania, Caving expeditions: Laos 2010.

Andreea Cohn
Phys. Ed. Teacher, caver, cave-diver - PADI DIVEMASTER, photographer (on land and underwater). Caving expeditions: Laos 2010

LAOS 2011 EXPEDITION TEAM

Calin VODA

Engineer, caving and canyoning instructor, cave rescue team leader, instructor for vacation club entertainers and directors, Secretary General of the Romanian Speleological Federation, President of the Center for Environmental Initiative. Expeditions: Madagascar 2008, Burkina Faso 2009, 2010.

Ioana Axinte

Economist, sales specialist, caver, canyoneer. Organizer of the National Speleological Congress 2006, CORSA secretary - Salvaspeo (Cave Rescue) Romania. Expeditions: Greece 2008

Elena Buduran

Economist, caver, canyoneer, cave rescue technician, adventure film producer. Caving expeditions: France 2006, Serbia 2007, Serbia 2008, Laos 2010, Crete 2010.

Gheorghe Ponta

Geologist, worked at the Geology and Geophysics Institute in Bucharest, Romania. Consultant Geologist for PELA GeoEnvironmental, in Tuscaloosa, Alabama.


Thank You!