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MAP OF CHIANG DAO CAVE

Tripod-Mounted Compass and Tape Survey 1972-73

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Introduction

Chiang Dao Cave is one of the larger and more well known of the many limestone caves in Northern Thailand. It is a major tourist attraction in the region not only because it is large, accessible, and partially lighted by electricity, but olso because it contains many images of religious importance. There are also many stories and legends associated with the cave, showing that it has played a part in local history and folklore for a very long time. In view of these facts, we felt it was appropriate that this cave should be one of the first to be mapped in the North.

The accompanying map shows about two kilometers of the most accessible parts of the cave consisting mainly of large horizontal passages. The heights and widths of these passages are generally in the range of five to fifteen meters. There are a number of narrow fissure passages and small tubes which we have not yet surveyed, but their points of intersection with the larger passages, where known, are shown on the map. We have also not surveyed several of the larger passages to their ends, so the map may be regarded as still incomplete in that sense as well.

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General Description of the Cave

Chiang Dao Cave, to the extent shown on the map, is essentially a horizontal cave of phreatic origin on several successive levels. The map shows about 1400 meters of the lowest, or first, level, 700 meters of the second level, and 50 meters of the third level. The normal cave entrance leads into the first level. About 350 meters of this level are lighted by electricity; from the cave entrance to the reclining image.

The floor of each level generally fluctuates in elevation by only a few meters over the entire level. The average elevations of the three levels are about 6, 20, and 30 meters, respectively, above the present water table. The one exception to this description is a large room at the end of the western branch of the first level (Crystal Cave) whose floor slopes up steeply for more than 40 meters.

We have found no dome-pits or other essentially vertical passages in Chiang Dao Cave, but there are a number of pits in the floor of the second level which go through to the first level. And there are similar pits in the floor of the first level which drop down to the water table, indicating that there may be lower levels of the cave which are still submerged.

The cave floor is generally fairly smooth, consisting of mud, sand, and stone. In a few places, water erosion has cut channels in the stone floor leaving sharp vertical blades which make travel difficult. There are a few areas littered with large breakdown blocks. And there are some places strewn with smaller breakdown of stones and gravel.

Of the three levels, the second has the greatest concentration of stalagmites, stalactites, and other formations such as flowstone and rimstone. Unfortunately, visitors to the cave have caused extensive damage to the formations.

There is a stream at the end of the north-western branch of the first level (Water Passage) whose elevation is less than a meter above the stream which comes out of Chiang Dao Mountain next to the cave entrance, nearly half a kilometer away. This is evidence that the water table is quite flat under this part of the mountain, although we have no

direct evidence that the stream found inside the cave is a branch of the one which flows out of the mountain near the cave entrance. It should be noted that both of these stream levels fluctuate seasonably, perhaps by as much as half a meter.

Cave fauna we have observed includes mainly bats and cave crickets. (The very long antennae of the crickets attest to their adaptation to the cave environment). A pair of healthy rats apparently live in one of the side passages of the second level.

Measurements

Our measuring equipment consisted of a 30 meter fiberglass-filled vinyl tape, a tripod-mounted Brunton style compass, and a metal meter stick. Measurements were made between consecutive points on the cave floor called stations. With the compass set up directly above a given station, four measurements were made to determine the position of the next station; 1) the height of the compass above its station, 2) the distance from the compass to the next station, 3) the horizontal angle, relative to magnetic north, along which the distance was measured, and 4) the vertical angle, relative to the horizon, along which the distance was measured.

The same set of measurements was also made from each station back to the previous station. Thus, there were two complete sets of measurements between each pair of stations. This enabled us to detect any gross errors due to any misreading of the instruments as well as to check for certain kinds of systematic error. It also allowed us to estimate the size of small random reading errors and to reduce their effects through averaging.

The only significant departure from the procedure described above was that in many cases it was more convenient to set the vertical angle equal to zero and measure the distance along the horizontal. In these cases, an additional measurement was required, the height of the compass above the station being measured to. A sighting on the meter stick standing at that station was used for this purpose. In these cases where distances were measured along the horizontal, only one distance

measurement was considered necessary, although all of the other measurements were still duplicated in the forward and reverse directions.

The two sets of measurements for each station relative to the preceeding one were averaged and converted into two horizontal and one vertical distance describing the location of that station relative to the preceeding one. These data for the individual stations were then added consecutively to give the coordinates of all of the stations relative to a single origin. These reduced data are listed in the Appendix.

A thumb tack placed in the wooden sill of the doorway leading into the cave was the origin for the two horizontal coordinates. The origin for the vertical coordinate was the water level of the pond at the foot of stairs outside the cave on 5 December, 1972. Because this water level fluctuates seasonably, this origin is especially arbitrary, but it has the merit of making the vertical coordinates of all of the stations positive. (By subtracting 10.62 from the vertical coordinate listed for any station, one can find the level of that station relative to the cave entrance).

While measurements were being made between pairs of stations, one member of the survey party was making rough sketches of the locations of the walls of the cave relative to the nearby stations. In making the accompanying map, the stations were first plotted to scale, according to their horizontal coordinates. Then the sketches were used to fill in the approximate locations of the cave walls. For clarity, most of the points representing stations were subsequently removed. However, to give some indication of the major trends in elevation within the cave, twenty-one selected stations were left on the map and their elevations indicated to the nearest tenth meter.

We estimate that the standard deviation associated with our distance measurements is about 5 cm. Also, the standard deviation associated with our horizontal angle measurements is about 20 minutes of arc. These figures lead to a standard deviation in the horizontal distances describing each station relative to the previous one of about 8 cm in each horizontal dimension. As these distances are added to form the horizontal coordinates of each station relative to a common origin, the errors also accumulate. However, a statistical analysis of the data

shows that the errors associated with the various legs are independent of one another. This means that the errors tend to cancel so that the standard deviation associated with each horizontal coordinate of the station furthest from the cave entrance is still only about 60 cm. These numbers represent uncertainties which are much smaller than the uncertainties in the rough sketches from which the map was drawn. So the positions of the various branches of the cave are known with a much greater relative precision than are known the positions of local features relative to each other.

Our measurements of vertical angles are somewhat more accurate than our measurements of horizontal angles. As a result, the standard deviation associated with the change in elevation from one station to the next is about 5 cm. And the standard deviation in the vertical coordinate of the station furthest from the cave entrance is about 40 cm.

We found no evidence for significant systematic errors in our data.

Conclusion

We think this work has provided new and interesting information about Chiang Dao Cave. We hope it will stimulate further interest in caves in Northern Thailand. But we would urge people entering caves in the area to follow good conservation practices; a cave is a part of the natural environment which cannot be replaced once defaced or destroyed.

Acknowledgements

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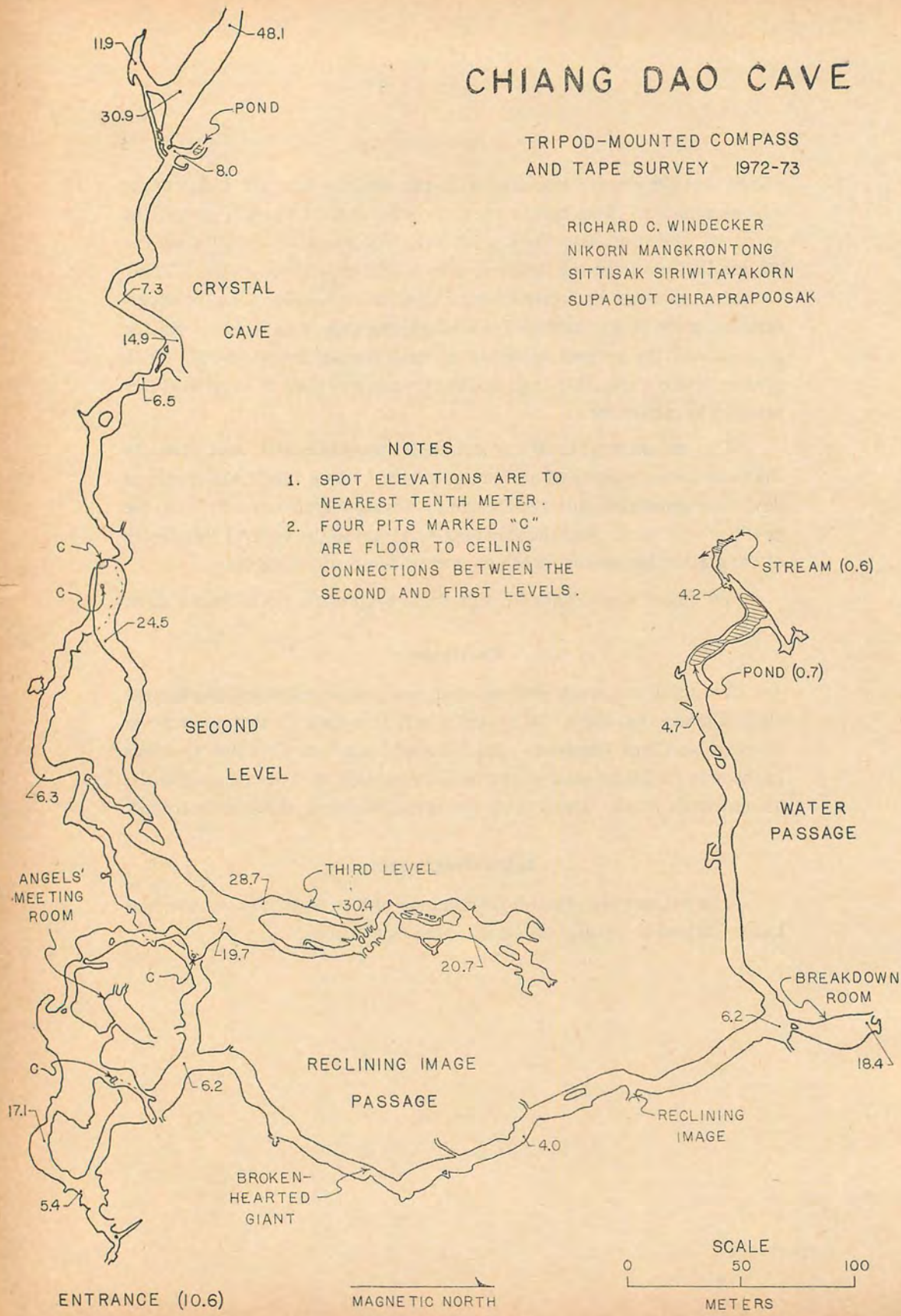
CHIANG DAO CAVE
TRIPOD-MOUNTED COMPASS AND TAPE SURVEY 1972-73
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NOTES
1. SPOT ELEVATIONS ARE TO NEAREST TENTH METER.
2. FOUR PITS MARKED "C" ARE FLOOR TO CEILING CONNECTIONS BETWEEN THE SECOND AND FIRST LEVELS.
11.9
48.1
30.9
POND
8.0
7.3
CRYSTAL CAVE
14.9
6.5
C
C
24.5
SECOND LEVEL
6.3
ANGELS' MEETING ROOM
28.7
THIRD LEVEL
30.4
19.7
20.7
C
C
C
6.2
17.1
5.4
RECLINING IMAGE PASSAGE
BROKEN-HEARTED GIANT
4.0
RECLINING IMAGE
STREAM (0.6)
4.2
POND (0.7)
4.7
WATER PASSAGE
BREAKDOWN ROOM
6.2
18.4
ENTRANCE (10.6)
MAGNETIC NORTH
SCALE
0
50
100
METERS

APPENDIX

Coordinates of Stations in Metres

An asterisk (*) marks each station whose location and elevation is shown on the accompanying map.

First Level, Reclining Image Passage and Water Passage

Station	West	North	Vertical	Station	West	North	Vertical
0	0.00	0.00	10.62	21	87.79	268.35	5.05
1	4.64	1.47	9.74	22	101.82	284.71	5.91
2	7.93	4.18	8.80	23	102.91	289.08	5.40
3	23.50	−6.25	7.64	24	105.76	289.55	5.99
4	40.30	−6.77	5.74	25*	104.61	298.15	6.20
5	65.53	1.61	7.33	26	118.72	294.91	5.70
6	66.75	23.08	6.38	27	131.27	278.92	4.97
7*	89.45	35.28	6.16	28	160.63	277.38	5.79
8	91.81	57.20	6.57	29	187.60	274.40	3.73
9	67.46	71.26	5.76	30	207.01	282.09	4.65
10	53.49	86.17	6.14	31	212.54	277.54	3.29
11	43.45	106.31	5.95	32	222.12	277.86	5.39
12	40.34	118.68	5.89	33*	242.71	263.98	4.66
13	34.30	128.87	4.97	34	267.69	261.85	0.88
14	43.94	148.20	4.96	35	281.50	288.56	0.83
15	49.43	172.47	4.41	36	283.78	295.13	1.46
16*	56.67	185.28	3.96	37	296.72	282.30	1.25
17	66.04	187.33	4.07	38	300.69	279.16	4.12
18	74.86	214.06	4.22	39*	299.98	277.02	4.21
19	84.68	225.04	4.54	40	307.23	271.92	2.72
20	79.14	244.15	4.81	41	313.37	273.92	0.64

First Level, Crystal Cave

Station	West	North	Vertical	Station	West	Northe	Vertical
7*	89.45	35.28	6.16	A22	325.00	2.37	5.96
A1	101.98	39.41	5.63	A23	340.09	−6.39	7.27
A2	116.11	37.30	4.91	A24	365.80	−2.55	5.83
A3	123.60	44.66	4.69	A25	375.24	−4.57	4.92
A4	143.83	29.55	5.47	A26*	392.98	19.51	6.54
A5	148.12	19.57	6.13	A27	391.85	24.55	8.58
A6	157.94	15.15	6.11	A28	396.89	26.83	14.77
A7	162.84	7.22	6.43	A29*	409.63	34.83	14.92
A8	178.56	3.37	5.86	A30	416.07	27.05	10.02
A9	189.51	0.43	6.07	A31*	426.78	8.31	7.27
A10	200.94	−14.07	5.99	A32	429.65	6.24	9.83
A11	210.39	−9.81	6.50	A33	437.71	8.40	7.37
A12	222.55	−8.42	5.88	A34	443.88	23.15	8.80
A13*	217.66	−27.34	6.29	A35	458 24	19.57	8.67
A14	230.68	−29.40	6.40	A36	472.39	20.10	8.09
A15	240.72	−26.99	7.11	A37	479.45	26.03	8.76
A16	253.25	−24.95	7.26	A38*	493.20	33.89	8.01
A17	260 10	−19.50	7.48	A39	493.82	29.91	14.68
A18	272.35	−16.08	2.29	A40*	517.47	36.58	30.92
A19	292.57	0.88	6.41	A41	536.26	51.59	38.60
A20	309.22	3.52	6.73	A42*	546.05	59.24	48.14
A21	315.36	11.22	6.40				

First Level, Side Passages

Station	West	North	Vertical	Station	West	North	Vertical
2	7.93	4.18	–	25*	104.61	298.15	6.20
	9.59	3.92	–		101.74	313.82	11.72
	12.61	6.54	–	*	105.98	335.64	18.38
	15.83	11.49	–				
			–	34	267.69	261.85	0.88
5	65.53	1.61	–	pond	–	–	0.68[a]
	70.14	11.97	–				
	73.70	9.65	–	41	313.37	273.92	0.64
	78.56	8.98	–	stream	–	–	0.59[a]
	82.09	5.43	–	A40*	517.47	36.58	30.92
					519.76	25.51	21.38
				*	532.18	17.97	11.88
					542.48	19.97	11.12

Second Level, West Branch

Station	West	North	Vertical	Station	West	North	Vertical
4	40.30	–6.77	5.74	B14	148.28	29.67	17.68
B1*	31.88	–11.66	5.42	B15	147.28	32.65	18.40
B2	42.98	–27.22	15.17	B16	143.93	35.67	18.25
B3*	54.73	–28.63	17.14	B17*	151.75	52.91	19.66
B4	63.86	–25.90	17.47	B18	165.97	46.47	19.96
B5	70.63	–23.70	18.81	B19	179.96	32.77	19.76
B6	85.29	–5.68	19.22	B20	203.12	22.09	20.74
B7	111.43	–16.91	18.89	B21	209.82	17.49	21.82
B8	133.64	–14.63	19.27	B22	218.40	10.61	22.64
B9	133.35	–12.09	18.65	B23	233.37	11.49	23.79
B10	142.73	–6.55	18.52	B24	255.20	15.93	24.46
B11	146.57	3.60	18.21	B25	263.96	11.39	25.56
B12	145.71	21.45	17.16	B26*	276.58	0.70	24.54
B13	145.68	28.69	17.28	B27	292.36	0.91	24.71

a) Measured 3 February, 1973

Second Level, North Branch

Station	West	North	Vertical	Station	West	North	Vertical
B17*	151.75	52.91	19.66	C10	156.10	129.62	18.61
C1	143.05	76.70	18.72	C11	158.40	136 50	18.59
C2	139.36	81.58	18.93	C12	156.43	147.53	18.91
C3	137.88	101.55	18.51	C13	159.39	154.55	19.06
C4	141.25	112.99	18.49	C14	154.73	159.07	19.98
C5	140.93	116.70	18.43	C15*	148.20	161.61	20.65
C6	143.28	116.45	18.79	C16	142.24	168.67	21.54
C7	147.76	123.20	18.92	C17	137.62	173.37	22.36
C8	151.01	121.40	18.05	C18	134.42	181.47	20.78
C9	158.33	127.40	18.19	C19	127.41	195.02	19.82

Second Level, Side Passages

Station	West	North	Vertical	Station	West	North	Vertical
B6	85.29	−5.68	—	B19	179.96	32.77	19.76
	84.97	−1.09	—		189.78	12.02	18.60
	83.20	1.97	—		197.00	16.53	18.54
	83.94	4.72	—		202.29	11.69	17.60
	81.64	9.66	—		203.68	4.44	17.85
	74.18	16.14	—		216.18	−7.50	18.48
	62.98	20.44	—				
B6	85.29	−5.68	—				
	91.20	−6.83	—				
	104.39	1.74	—				
	107.12	4.03	—				
	119.78	7.19	—				

Third Level

Station	West	North	Vertical	Station	West	North	Vertical
B17*	151.75	52.91	19.66	D4	153.34	99.13	29.53
D1	151.19	54.09	19.77	D5	154.10	101.27	30.18
D2*	160.33	70.83	28.69	D6*	151.97	105.37	30.42
D3	155.93	93.21	29.41				