ABSTRACT

Slaying the Beast — mapping Kubla Khan

ALAN JACKSON, Southern Tasmanian Caverneers

Kubla Khan in Tasmania's Mole Creek karst area is considered Australia's most spectacular cave by many in the caving community. Massive chambers, acres of flowstone and an abundance of exquisite speleothems draw visitors from around the world. Despite its grandeur, and no doubt in part because of it, a thorough survey and detailed map didn't exist until 2017.

Maps produced during the principle exploration period (circa 1967–1973) were relatively low on detail and didn't include all known passages. The sheer size of the cave made the amount of time (and paper!) required to produce a map at anything better than ~1:1000 a mammoth task. In the 1980s, as management of the cave became a key concern by the then National Parks and Wildlife Service, it became obvious a good map of the cave was required.

The Southern Caving Society were commissioned by NPWS to complete such a survey but despite accurate surveying of >80% of the cave's known passages, the project stalled at the usual hurdle — collection of detailed in cave sketches and final map drafting. The idea would sit dormant for over twenty years until a box containing the 1980s data was discovered and the seed was sown.

Liberal applications of water and fertiliser by key personnel during 2013 saw that seed germinate and the first underground survey trip took place in January 2014. Three and a half years (and over 700 person-hours) later a 'final' map was produced which (hopefully!) included all known passages at the scale of 1:250.

This presentation will provide a synopsis of the methods employed to collect and collate in-cave data and create a final digitally drafted map and identify the keys ingredient to success.

Slaying the Beast — mapping Kubla Khan

Alan Jackson

Kubla Khan in Tasmania's Mole Creek karst area is considered Australia's most spectacular cave by many in the caving community. Massive chambers, acres of flowstone and an abundance of exquisite speleothems draw visitors from around the world. Despite its grandeur, and no doubt in part because of it, a thorough survey and detailed map didn't exist until 2017.

Maps produced during the principle exploration period (circa 1967–1973) were relatively low on detail and didn't include all known passages. Some were even hilariously inaccurate. The sheer size of the cave made the amount of time (and paper!) required to produce a map at anything better than ~1:1000 a mammoth task. In the 1980s, as management of the cave

became a key concern by the Parks and Wildlife Service, it became obvious a good map of the cave was required. The Southern Caving Society were commissioned by PWS to complete said survey but despite accurate surveying of >80% of the cave's known passages by Jeff Butt and co, the project stalled at the usual hurdle — collection of detailed in cave sketches and final map drafting. The idea would sit dormant for over twenty years until a box containing the 1980s data was discovered and the seed was sown. Liberal applications of water and fertiliser by key personnel during 2013 saw that seed germinate and the first underground survey trip took place in January 2014. Three and a half years (and over 700 person hours) later a 'final' map was produced which (hopefully!) included all known passages at the scale of 1:250.

Step 1 was sorting the paperwork. Rolan Eberhard (DPIPWE) and the Mole Creek Parks and Wildlife Service made all this happen (it's no coincidence that Parks' abbreviations (PWS) is also an abbreviation of 'Paper Work Service').

With a gold-pass permit and cave key issued the collection of underground data commenced. An initial sweep of the standard tourist trip route was undertaken with a DistoX and PDA. This allowed us to quickly obtain the backbone of the cave and confirm the new data matched the historic SCS dataset (which we believed to be very accurate, since that was Jeff Butt's forte). Every survey station on this backbone had a labelled pink tape attached for the life of the project.

Highly sensitive sections of the cave (e.g. Dulcimer) were only allowed to be visited once so synchronous shot data and sketch collection was conducted. Data was plotted by hand (pencil and paper) and sketching done to scale.

Lower sensitivity areas had shot data collected first (leaving labelled stations), the data was reduced electronically and its accuracy checked, then in-cave sketching was completed on a subsequent trip using a printed line plot (pencil and paper again). Personally I am not a fan of PDA sketching, particularly for projects requiring high detail collection. Significant detail (large speleothems, rocks, other features) were located with DistoX devices and plotted to scale on numerous occasions — otherwise it was very easy to get 'lost in space' even with a printed line plot.

In large passages multiple data lines were collected to allow more accurate positioning of floor detail during the sketch phase (a single centre line plot down the middle of 60 m wide passage simply doesn't cut it).

A large number of strategically placed survey stations were photographed (close up and at a distance) to allow for easy relocation in the future for rectifying errors, tying in future discoveries etc. once the pink tapes were removed at the end of the project.

Some small and or complicated passages (e.g. Helictite Dungeons) were surveyed and sketched simultaneously to rough scale and re-sketched out of the cave following data entry and line plot printing.

Once all shot data and sketches were collected the sketch sheets were digitally scanned and stitched together in Adobe Illustrator (AI), a scalable vector graphics (SVG) drawing software. Some of the 'sketch to scale in the cave' sheets were 'morphed' in Compass 'Sketch Editor' software prior to stitching (note that this only works on fairly accurate sketches as poorly 'to scale' sketches result in too much distortion for the detail to be useful). The sketches were then digitised in AI.

The AI file was broken into multiple layers (e.g. passage outline, floor substrate, water arrows, slope indicator, pretties, rocks, edges and ledges etc.) and many layers were further broken into sublayers (e.g. the 'pretties' layer was divided into straws, stalagmites, stalactites, helictites, shawls, flowstone etc.). While this was tedious to implement it paid enormous dividends later on when producing different maps at different scales as you can selectively remove or add particular features throughout the entire map with the check of

a box. The digital drafting (with SVG software) and layering system utilised allows for simple production of other maps at any scale and various lower scale maps have been produced (e.g. maps for the Cave Access Policy Zoning Statements for Kubla Khan and zoning maps for the cave's Rescue Plan)

Plan view (with cross sections) and a long section view at 1:250 scale were produced. Due to the size of the overall map in plan view at 1:250 it was broken into overlapping A1-sized artboards. The orientation of the majority of the cave passages allowed a single long section view along the 255–75 degree plane to fit on a continuous length, A1 height sheet. A1 was selected for hard copies as printers up to that size are common and it is more manageable than A0. It was anticipated that the majority of map viewing would occur electronically on a computer screen, however a single page electronic version has not yet been produced (file size and artboard size a bit too large for the software and my laptop to handle just yet ...). There's always more to do, particularly with David Wools-Cobb constantly rearranging the bootwash stations and stringlines in the cave, making the map out of date!

Genghis Khan, which is effectively a cut off section of Kubla Khan, was also surveyed during the project and aligns with the plan view map sheets of Kubla.

Vital statistics

Cave — Total m: 'cave length' m : depth

Genghis — 1016 : 700 : 79

Kubla — 13,250 : 4,950 : 114.5

102 cross sections

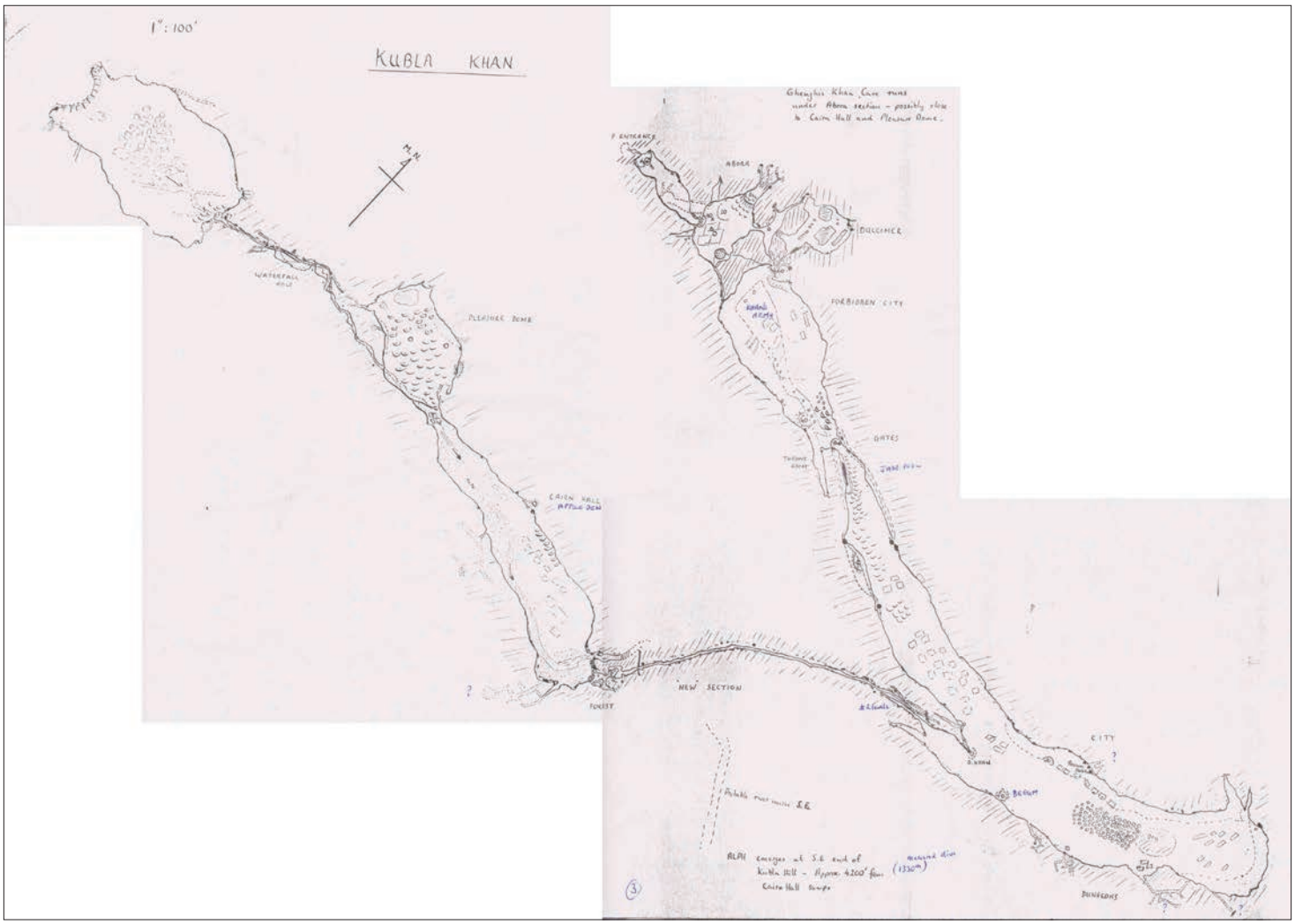
414 person hours underground (AJ — 130)

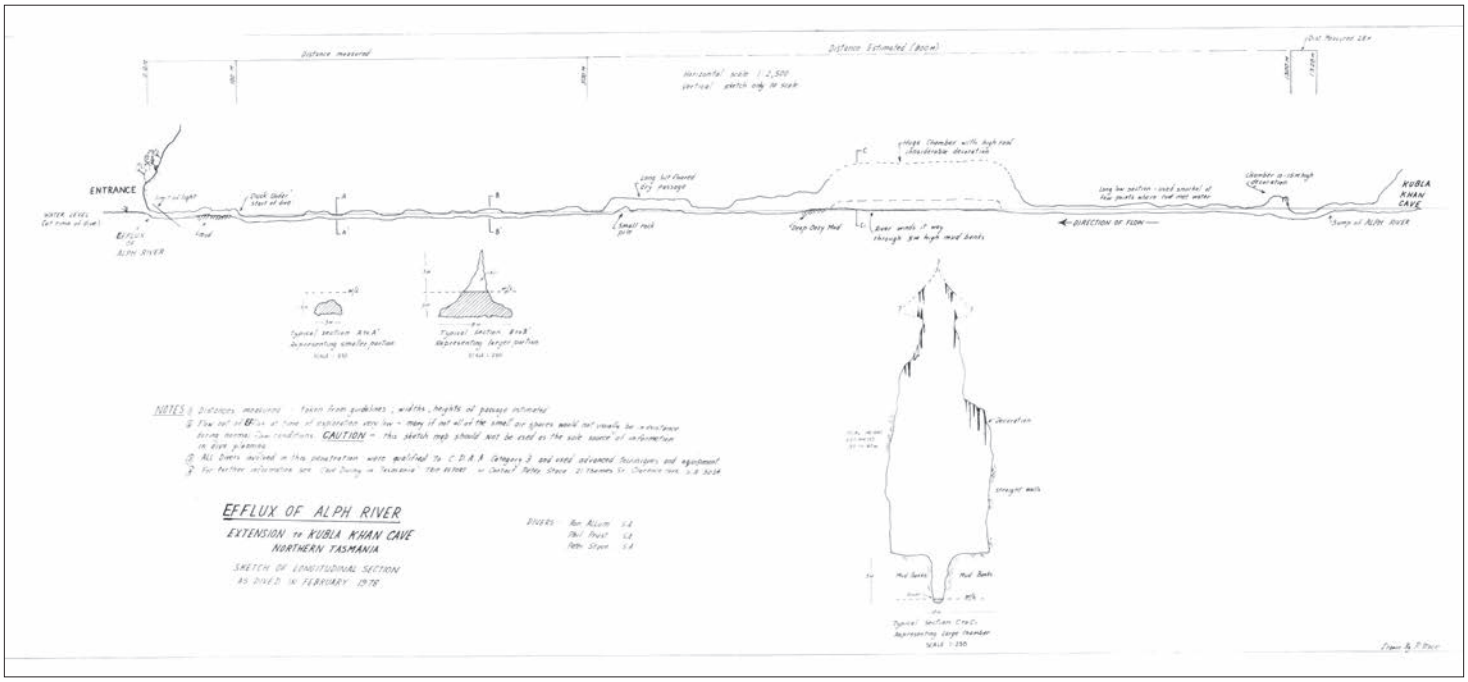
293 person hours 'desktop' (data and digital drafting) — (AJ 286 ...)
(Does not include time spent on travel and reporting, PWS time or 1983 TCC Sunless Sea mapping)

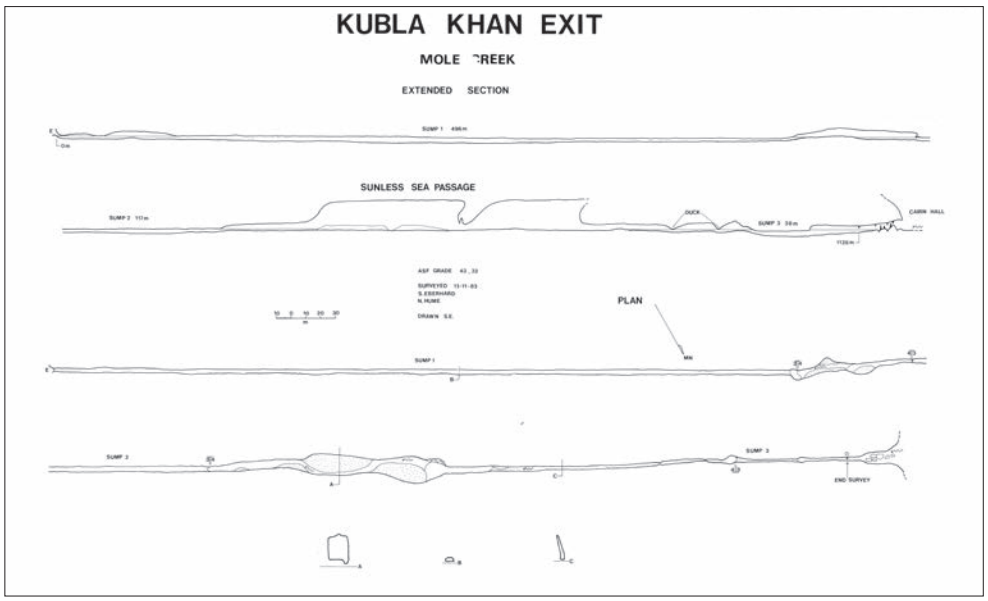
Acknowledgements

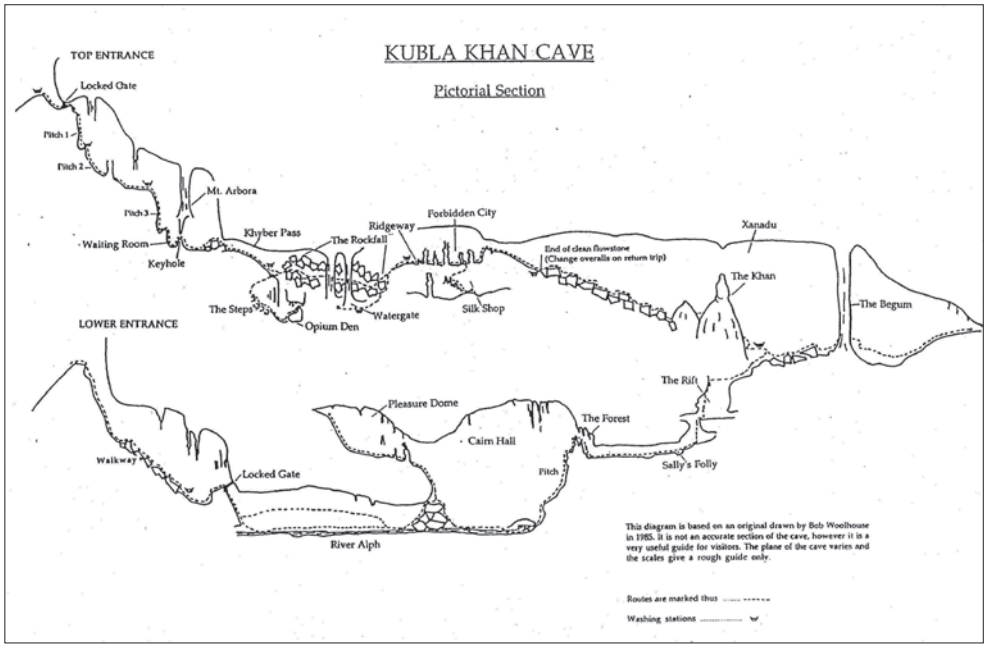
Rolan Eberhard (50+ hours)
Janice March (50+ hours)
Sarah Gilbert (~30 hours)
Various others (too many others to mention individually)

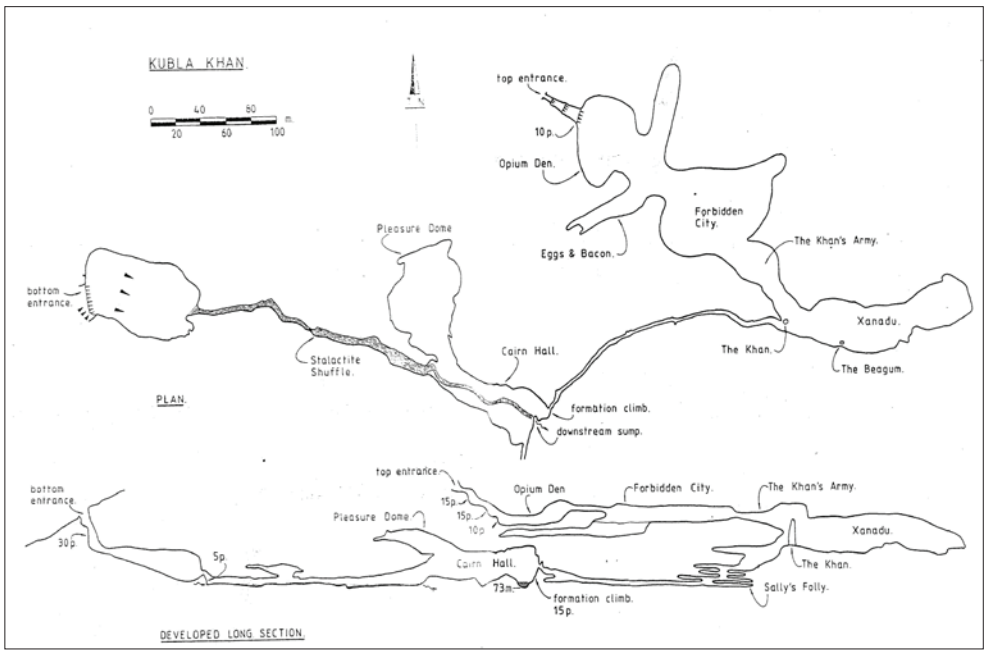
It was a massive project but luckily I'm a particularly anally retentive individual who was just the right balance of 'too dumb and egotistical to say no but sufficiently proud to make sure failure was not an option'. I kind of enjoyed it in a way, but don't tell anyone I said that.


1": 100'
KUBLA KHAN
ABOVE
DOLICHER
FORBIDDEN CITY
GATES
CAIRN HILL
NEW SECTION
FOREST
CITY
DUNEDIN
ALPH emerges at S.E. end of
Kubla Hall - Approx. 4200' from
Cairn Hall Sumps


ENTRANCE
EFFLUX OF ALPH RIVER
KUBLA KHAN CAVE
Sump at ALPH RIVER
DIRECTION OF FLOW
EFFLUX OF ALPH RIVER
EXTENSION to KUBLA KHAN CAVE
NORTHERN TASMANIA
SKETCH OF LONGITUDINAL SECTION
AS DIVED IN FEBRUARY 1978

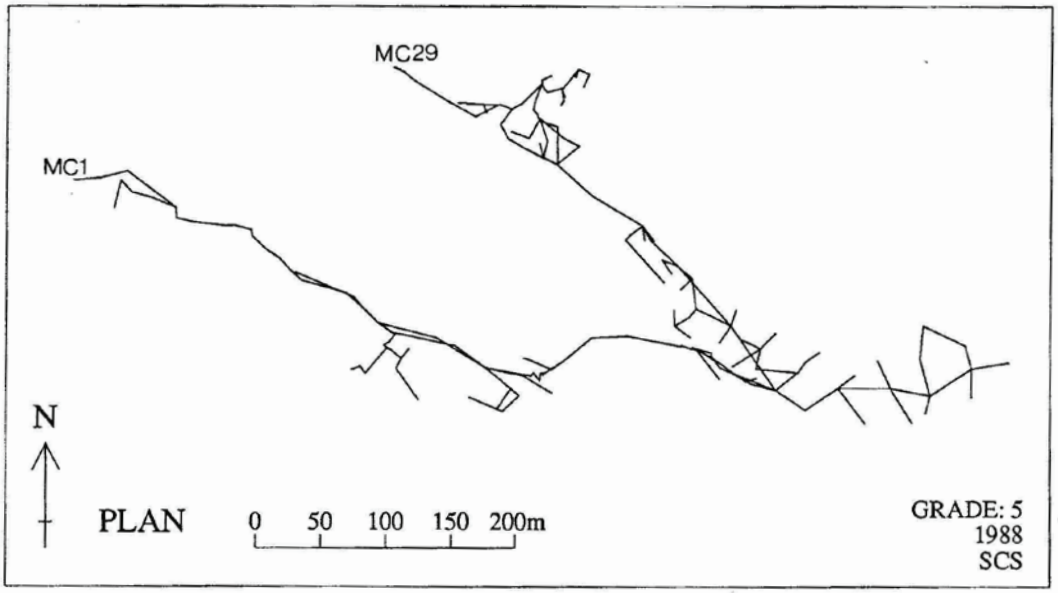

KUBLA KHAN EXIT
MOLE CREEK
EXTENDED SECTION
SUNLESS SEA PASSAGE
PLAN
END SURVEY


KUBLA KHAN CAVE
Pictorial Section
TOP ENTRANCE
Locked Gate
Pitch 1
Pitch 2
Pitch 3
Mt. Arbora
Khyber Pass
Waiting Room
Keyhole
The Rockfall
Ridgeway
Forbidden City
End of clean flowstone (Change overalls on return trip)
Xanadu
The Khan
The Begum
The Steps
Opium Den
Watergate
Silk Shop
LOWER ENTRANCE
The Rift
Pleasure Dome
The Forest
Cairn Hall
Walkway
Locked Gate
Pitch
Sally's Folly
River Alph
This diagram is based on an original drawn by Bob Woolhouse in 1985. It is not an accurate section of the cave, however it is a very useful guide for visitors. The plane of the cave varies and the scales give a rough guide only.
Routes are marked thus
Washing stations


KUBLA KHAN
top entrance.
10p.
Opium Den.
Forbidden City.
The Khan's Army.
Eggs & Bacon.
Pleasure Dome
bottom entrance.
Stalactite Shuffle.
Cairn Hall.
The Khan.
Xanadu.
The Beagum.
formation climb.
downstream sump.
PLAN.
top entrance
Opium Den
Forbidden City.
The Khan's Army.
bottom entrance.
15p.
Pleasure Dome
Xanadu.
30p.
5p.
Cairn Hall.
The Khan.
73m.
Sally's Folly.
formation climb.
15p.
DEVELOPED LONG SECTION.

MOLE CREEK

KUBLA KHAN



APPROVAL AND AUTHORITY TO UNDERTAKE CAVE SURVEYING ASSOCIATED WITH THE KUBLA KHAN CAVE MAPPING PROJECT ON RESERVED LAND (MOLE CREEK KARST NATIONAL PARK)

Granted to:

Alan Jackson, the Survey Leader / Coordinator.

All appointed participants of this activity from Australian Speleological Federation (ASF) affiliated caving clubs.

Approval is hereby given to organise and conduct cave surveying within Kubla Khan Cave, Mole Creek Karst National Park for cave management purposes subject to the conditions listed below.

Authority issued in accordance with Regulation 26 & 28 of the National Parks and Reserved Land Regulations 2009 to organise and conduct a group activity on reserved land within a limited access area, subject to the conditions listed below, that would otherwise be prohibited under Regulations 16 and 17 of the *National Parks and Reserved Land Regulation 2009.*

***Authority or approval valid**: From: Wednesday the 1st January 2014 To: Monday the 30th June 2014*

Please note that for the purposes of this authority the following definitions apply:

Survey Trip: is defined as a trip with the primary purpose of undertaking the Kubla Khan Cave mapping project

Survey Leader/Coordinator: the caver who has agreed to be responsible for coordinating the mapping project, in accordance with the documented proposal and these permit conditions.

Survey Personnel: means all individuals who are appointed as survey assistants by the survey leader/coordinator and will include only persons actively engaged in practical tasks related to surveying.

Kubla Khan: is defined as the system of passages directly connected to cave entrances numbered MC1 and MC29 and the resurgence of the River Alph (Kubla Khan Efflux). It is taken to include Genghis Khan (MC38).

Land Manager: Means the Parks and Wildlife Service ("PWS").

Land: Means the Mole Creek Karst National Park (MCKNP).

Cave: MC-29 KUBLA KHAN Personnel: ALAN JACKSON & ROLAN EBERHARD

Date: 7 FEBRUARY 2014 Instruments: TJ's DISTO X

Comments: DULCIMER / MT ABORA (PITCH 3 ↓) Page 1 of 4

	Station			Instruments					Passage			
	From	To	Comment	Distance (metres)	Forward bearing	Back bearing	Forward clino	Back clino	L	R	U	D
	Make a useful comment			Forward, backward or both readings can be taken. * or - means no measurement was taken.					LRUDs are always taken at the first (from) station. P = passage.			
1	1.15 fixe	A1	1.15 BELOW REDIRECT P3	15.10	/	199.0	/	53.2	\	\	\	\
2	A1	A3	Floor	4.02	037.4	/	-04.4	/	17.5	1.83	22.5	0.4
3	A3	A2		10.08	258.0	/	02.5	/	/	/	/	/
4	A3	A4	Floor	6.85	091.5	/	32.4	/	5.2	1.2	17.5	0
5	A4	A5		9.30	087.2	/	07.4	/	1.6/7	0.7	21	1.7
6	A5	A5a	A5 is old survey stn 1.19 stal after keyhole	8.66	203.0	/	-28.2	/	6.5	5.6	9.8	0/2
7	A5a	1.19		12.22	186.0	/	13.1	/	6.1	2.1	11.6	0/3.8
8	A5	A6		5.30	078.6	/	02.6	/	5.8 Fo Fs	P	9.8	0/2
9	A6	A7	Stal	5.13	020.7	/	30.6	/	4.6 Fs	1.6	10	0.6
10	A7	A8		6.92	023.8	/	-14.2	/	2.3	0.3	2	1.2
11	A8	A9 jcn		6.41	058.2	/	-32.1	/	5.3	1.3/4	2.6	1.8
12	A9	A10		10.83	164.9	/	-10.8	/	3.2	8.2	5.2	1.4
13	A10	A10a	Top of low road pitch	4.91	133.6	/	-30.0	/	0.1	0.9	2.7	0.3
14	A10	A10b	Stal spar	5.72	230.3	/	-38.3	/	0/P	1.3	2.7	0.3
15	A10b	A10c	bottom of dive dead end	2.88	017.5	/	-53.2	/	1	0.2	2	2
16												
17	A20	A21		3.39	/	169.2	/	-7.3	2	4+	4	1
18	A21	A22		7.21	/	173.1	/	10.6	1.4	0.1	2	1.4
19	A22	A23		6.39	32.8	/	25.7	/	O/P	2.1	3.5	1.3
20	A22	A24		6.00	/	99.3	/	-0.3	2.3	O/P	3.5	1.3
21	A24	A25	24 - shelfy of 2 stals	4.32	31.6	31.6	/	13.4	0.8	6.5	2.9	1.1
22	A25	A26	big stal on drop	4.79	/	65.5	/	37.3	1.3	2.9	8.4	1.3
23	A26	A27	Dulcimer wall	6.77	/	4.7	/	-12.4	1.1/3.6	0	10.8	1.4
24	A27	A28		3.68	/	13.6	/	7.7	0	3/9.4	4.8	1.6
25	A28	A29	28 is small rockfall	9.22	177.2	/	4.4	/	1.4	8.1/2	2.8/3	1.1
26	A28	A30	on sediment slope	6.93	30.8	89.8	/	1.7	/	/	/	/
27	A30	A31	Fat stal	7.36	/	42.6	/	14.0	7.4	0/2.6	12.3	0/0.3
28	A31	A32	31 - penis stal & hole	3.77	/	91.7	/	7.4	4.9	1.7	3.6	0.5
29	A32	A33	near lip of sed bank	4.26	312.7	/	-28.8	/	2.8	2.4	1.4	0
30	A33	A34	Dulcimer crawl 1	0.99	/	60.2	/	0.8	0.5	2	1.3	0
31	A34	A11	Dulcimer crawl 2	4.21	/	133.7	/	-5.0	1.1	1.3	1.4	0
32	A11	A12		6.46	031.4	/	18.6	/	3.5	2.8	9.1	0
33	A12	A13		4.89	/	256.4	/	-41.4	2.6	1.2	1.5/9	0
34	A13	A14	A14 end	2.78	19.8	/	36.5	/	1.1	0.3	5.1	1.0
35	A9	A11		11.31	14.0	/	-19.3	/	/	/	/	/

MT ABORA

DULCIMER

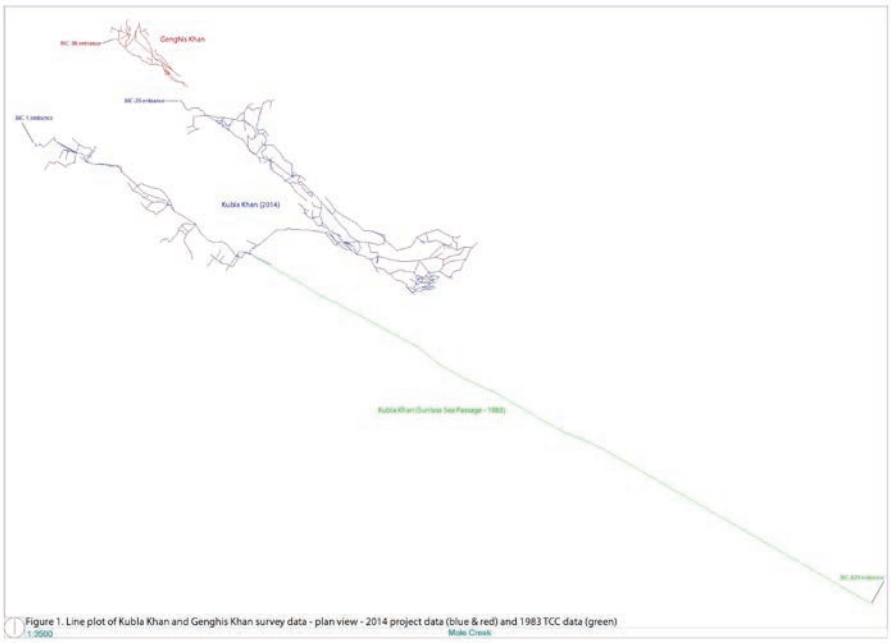
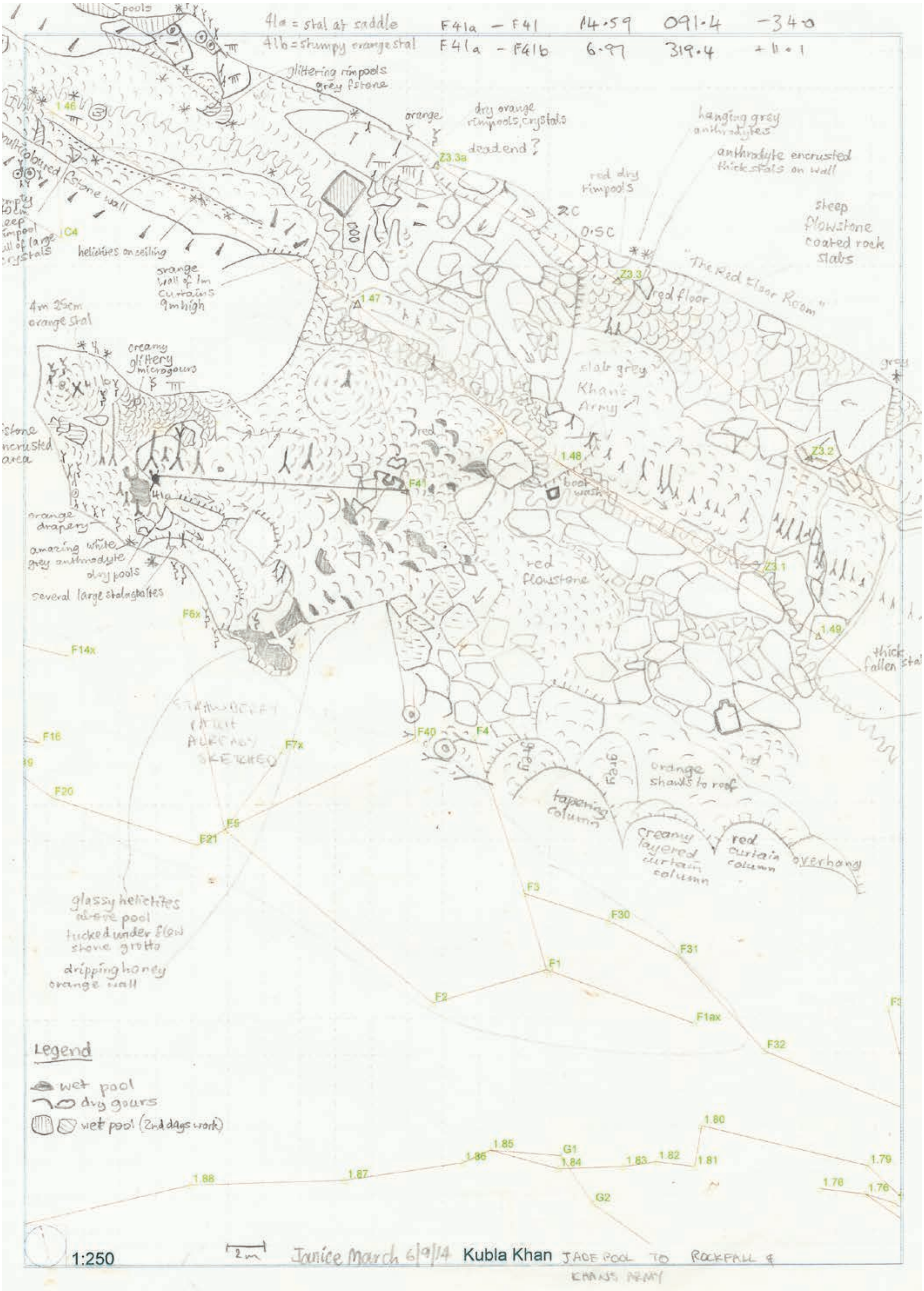
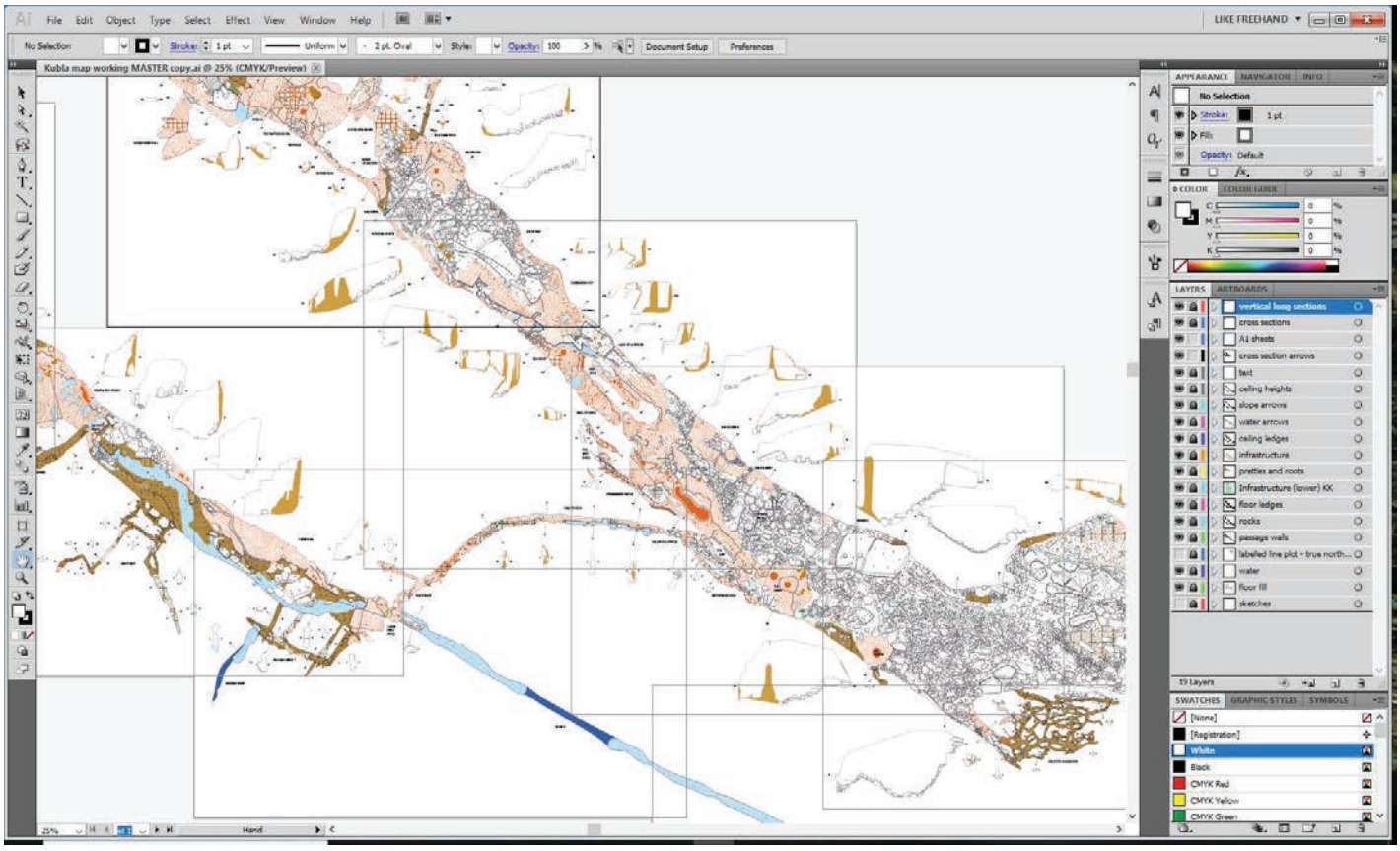
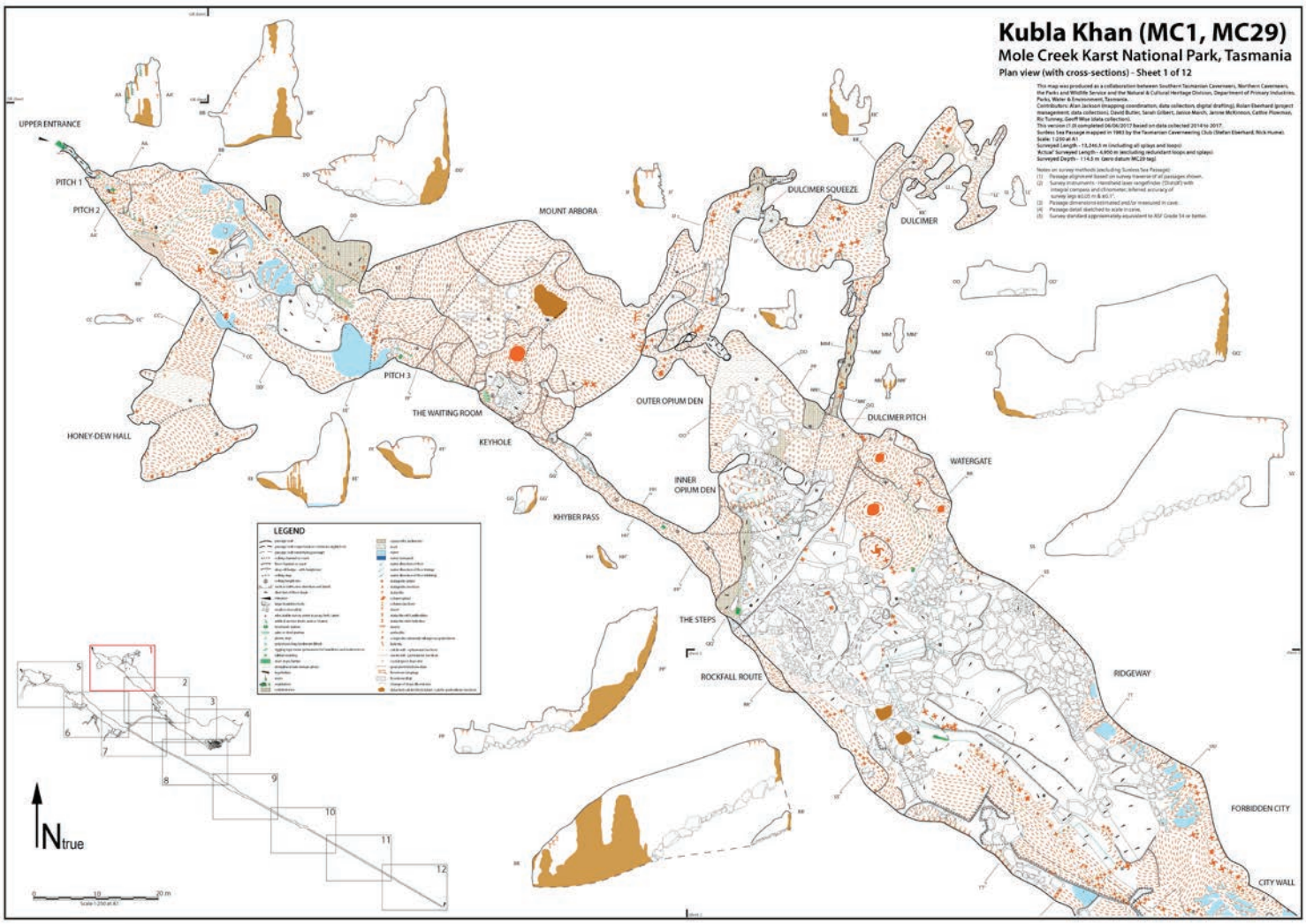


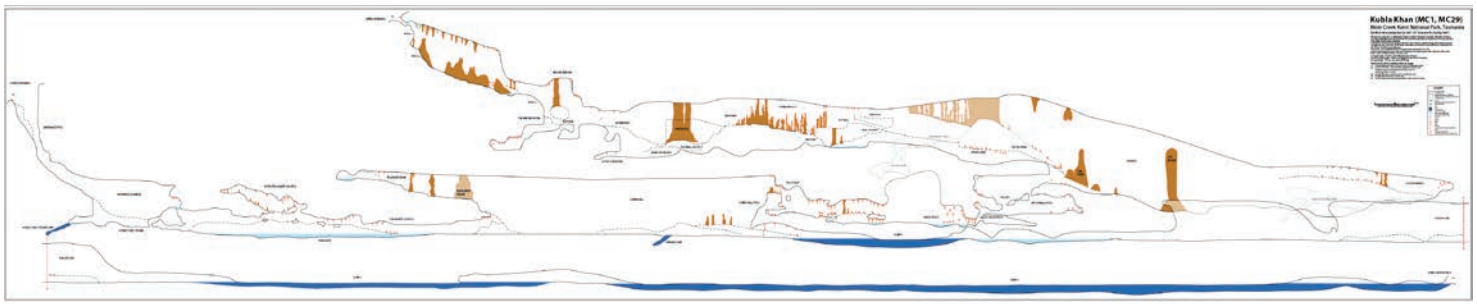
Figure 1. Line plot of Kubla Khan and Genghis Khan survey data - plan view - 2014 project data (blue & red) and 1983 TCC data (green)

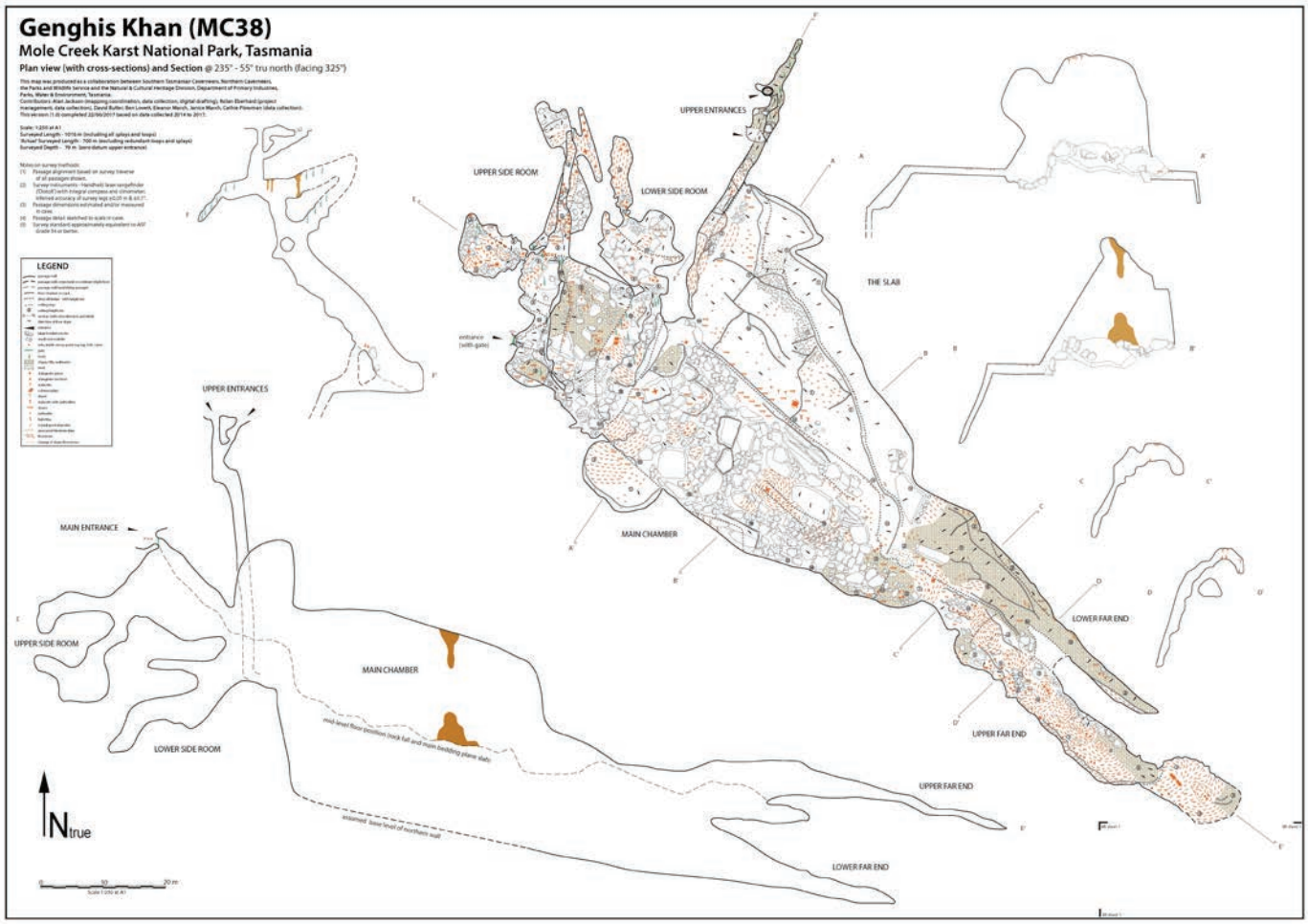

41a = stal at saddle
41b = stumpy orange stal
F41a – F41 14.59 091.4 −34.0
F41a – F41b 6.97 319.4 +11.1
glittering rimpools
grey fstone
orange
dry orange
rimpools, crystals
dead end ?
hanging grey
anthrodytes
anthrodyte encrusted
thick stals on wall
red dry
rimpools
steep
flowstone
coated rock
slabs
"The Red Floor Room"
red floor
multicoloured flowstone wall
helictites on ceiling
orange
wall of 1m
curtains
9m high
4m 25cm
orange stal
creamy
glittery
microgours
slab grey
Khans
Army
red
boot
wash
orange
drapery
amazing white
grey anthrodyte
dry pools
several large stalagmites
red
flowstone
thick
fallen stal
STRAWBERRY
FRUIT
ALREADY
SKETCHED
orange
shawls to roof
red
tapering
column
creamy
layered
curtain
column
red
curtain
column
overhang
glassy helictites
above pool
tucked under flow
stone grotto
dripping honey
orange wall
Legend
wet pool
dry gours
wet pool (2nd days work)
C4
Z3.3a
Z3.3
Z3.2
Z3.1
1.46
1.47
1.48
1.49
F41
F40
F4
F6x
F14x
F16
F7x
F20
F5
F21
F3
F30
F31
F1
F2
F1ax
F32
1.80
1.85
G1
1.86
1.84
1.83
1.82
1.81
1.79
1.88
1.87
G2
1.78
1.76
1:250
2m
Janice March 6/9/14
Kubla Khan
JADE POOL TO ROCKFALL &
KHANS ARMY

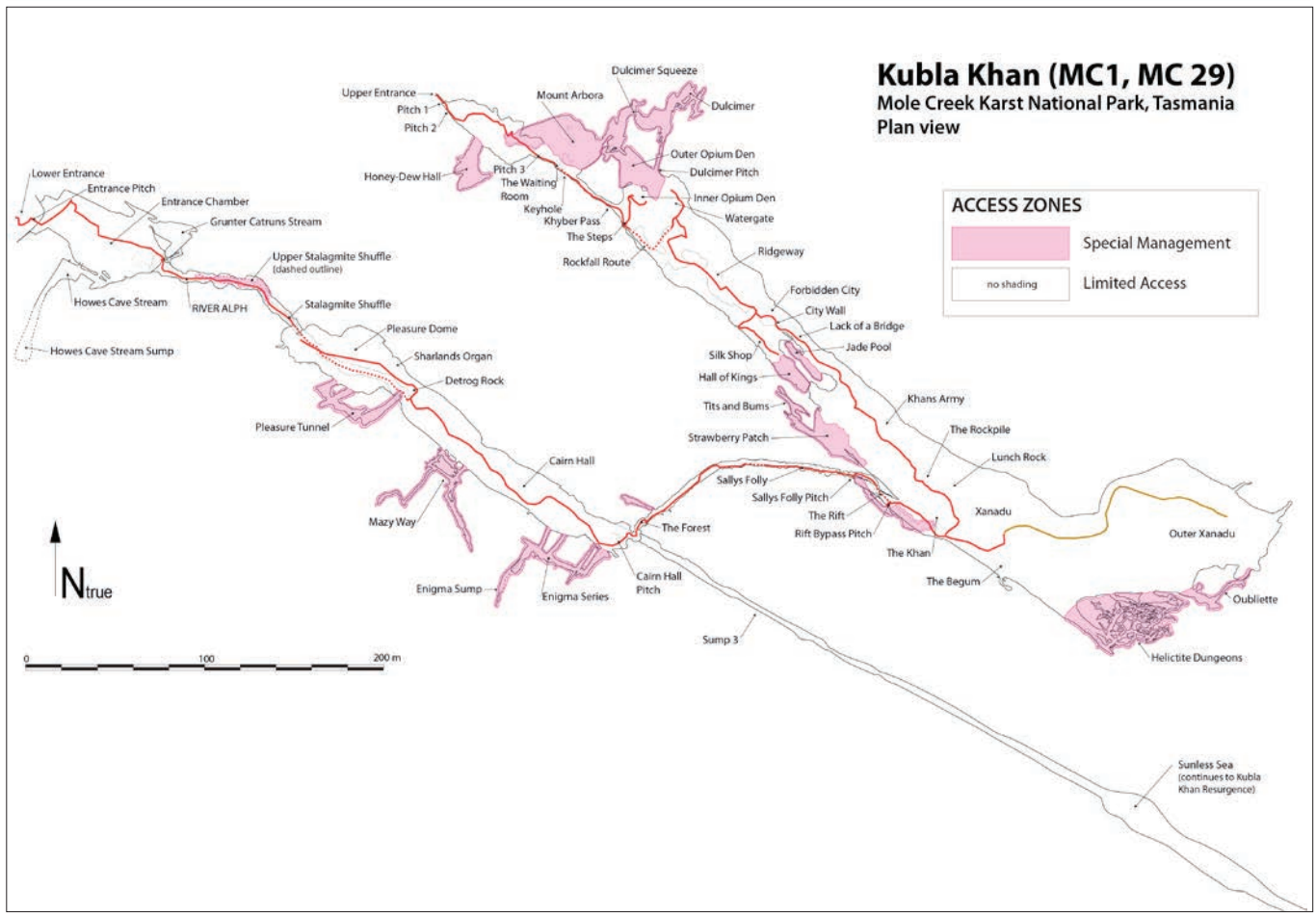

MAGNETIC
1:250
Kubla Khan - Helictite Dungeons
SKETCHED 9/9/2014

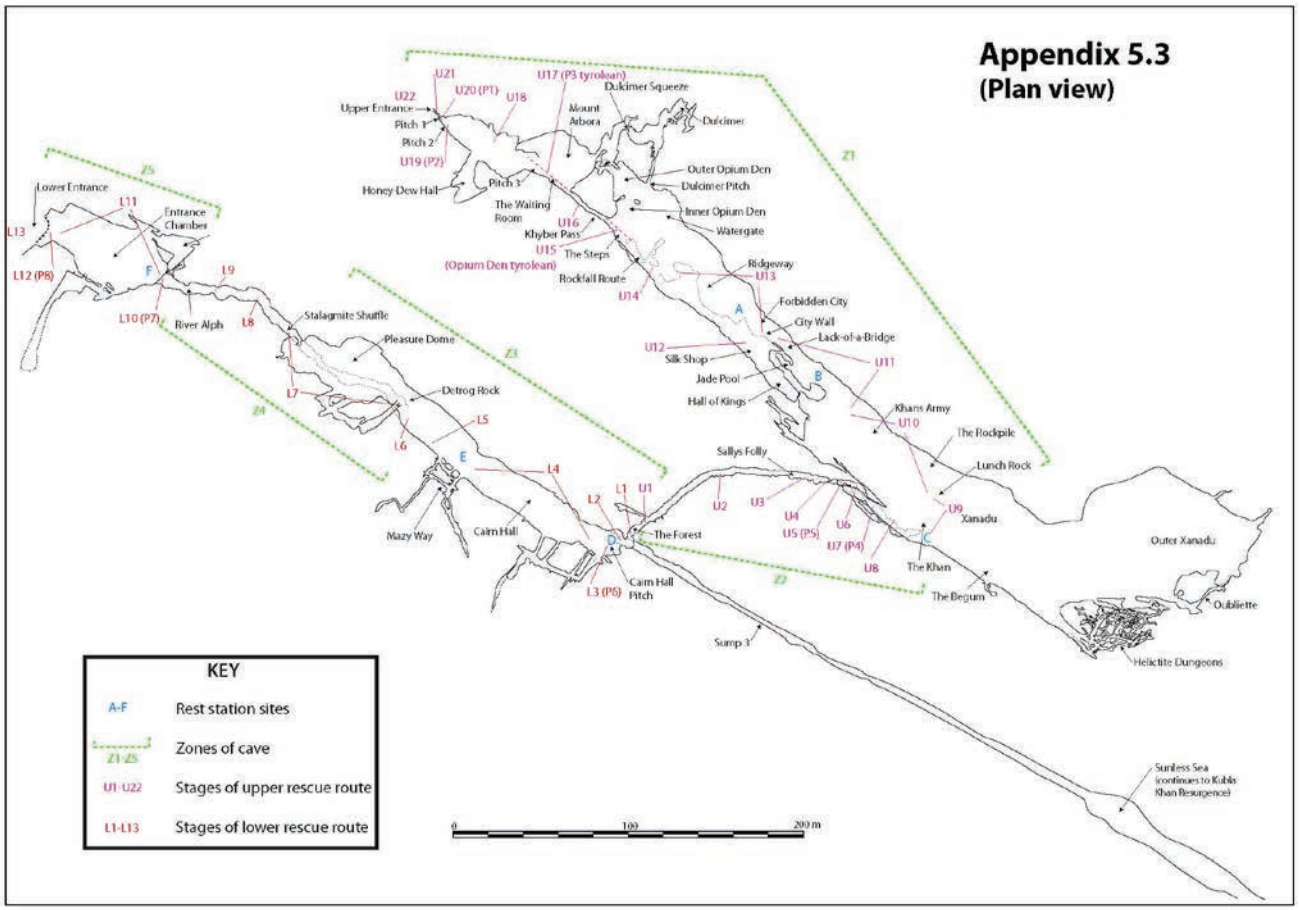

File Edit Object Type Select Effect View Window Help
LIKE FREEHAND
Kubla map working MASTER copy.ai @ 25% (CMYK/Preview)
APPEARANCE NAVIGATOR INFO
No Selection
LAYERS ARTBOARDS
SWATCHES GRAPHIC STYLES SYMBOLS

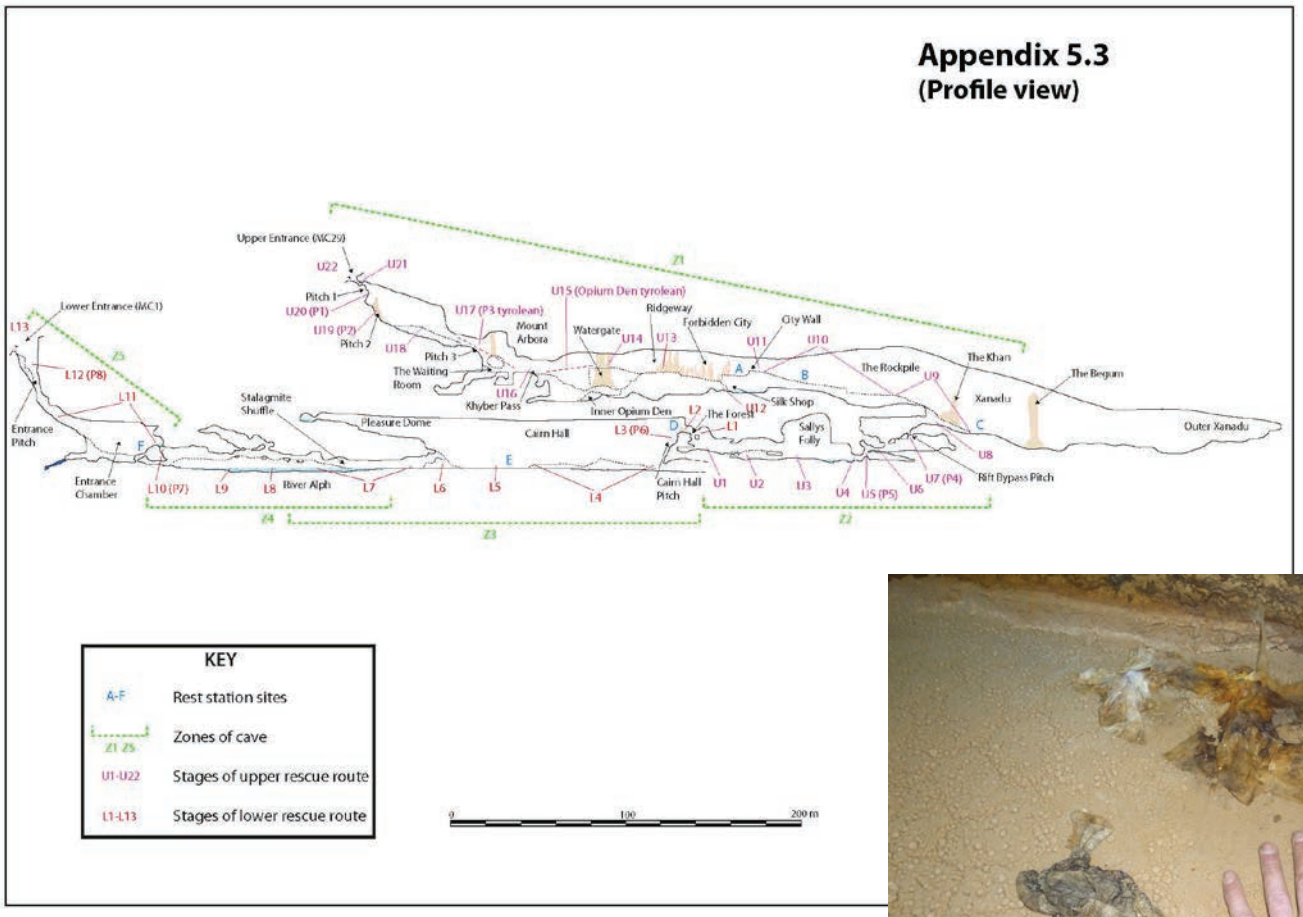

Kubla Khan (MC1, MC29)
Mole Creek Karst National Park, Tasmania
Plan view (with cross-sections) - Sheet 1 of 12
UPPER ENTRANCE
PITCH 1
PITCH 2
PITCH 3
MOUNT ARBORA
DULCIMER SQUEEZE
DULCIMER
DULCIMER PITCH
OUTER OPIUM DEN
INNER OPIUM DEN
THE WAITING ROOM
KEYHOLE
HONEY-DEW HALL
KHYBER PASS
WATERGATE
THE STEPS
ROCKFALL ROUTE
RIDGEWAY
FORBIDDEN CITY
CITY WALL
LEGEND
N true




Genghis Khan (MC38)
Mole Creek Karst National Park, Tasmania
Plan view (with cross-sections) and Section @ 235° - 55° tru north (facing 325°)
LEGEND
UPPER ENTRANCES
UPPER SIDE ROOM
LOWER SIDE ROOM
THE SLAB
MAIN CHAMBER
LOWER FAR END
UPPER FAR END
MAIN ENTRANCE
Ntrue


Kubla Khan (MC1, MC 29)
Mole Creek Karst National Park, Tasmania
Plan view
ACCESS ZONES
Special Management
no shading
Limited Access
Upper Entrance
Pitch 1
Pitch 2
Mount Arbora
Dulcimer Squeeze
Dulcimer
Lower Entrance
Entrance Pitch
Entrance Chamber
Grunter Catruns Stream
Honey-Dew Hall
Pitch 3
The Waiting Room
Keyhole
Khyber Pass
The Steps
Outer Opium Den
Dulcimer Pitch
Inner Opium Den
Watergate
Rockfall Route
Ridgeway
Upper Stalagmite Shuffle (dashed outline)
Howes Cave Stream
RIVER ALPH
Stalagmite Shuffle
Howes Cave Stream Sump
Pleasure Dome
Sharlands Organ
Detrog Rock
Pleasure Tunnel
Forbidden City
City Wall
Lack of a Bridge
Jade Pool
Silk Shop
Hall of Kings
Tits and Bums
Strawberry Patch
Khans Army
The Rockpile
Lunch Rock
Sallys Folly
Sallys Folly Pitch
The Rift
Rift Bypass Pitch
Xanadu
Outer Xanadu
The Khan
The Begum
Oubliette
Helictite Dungeons
Cairn Hall
Mazy Way
The Forest
Enigma Sump
Enigma Series
Cairn Hall Pitch
Sump 3
Sunless Sea (continues to Kubla Khan Resurgence)
Ntrue
0
100
200 m


Appendix 5.3
(Plan view)
Lower Entrance
Entrance Chamber
Upper Entrance
Pitch 1
Pitch 2
Pitch 3
Honey Dew Hall
The Waiting Room
Mount Arbora
Dulcimer Squeeze
Dulcimer
Outer Opium Den
Dulcimer Pitch
Inner Opium Den
Watergate
Khyber Pass
The Steps
(Opium Den tyrolean)
Rockfall Route
Ridgeway
Forbidden City
City Wall
Lack-of-a-Bridge
Silk Shop
Jade Pool
Hall of Kings
Khans Army
The Rockpile
Lunch Rock
Xanadu
Outer Xanadu
Oubliette
Helictite Dungeons
The Khan
The Begum
Sallys Folly
The Forest
Cairn Hall
Cairn Hall Pitch
Mazy Way
Pleasure Dome
Stalagmite Shuffle
River Alph
Detrog Rock
Sump 3
Sunless Sea
(continues to Kubla Khan Resurgence)
KEY
A-F Rest station sites
Z1-Z5 Zones of cave
U1-U22 Stages of upper rescue route
L1-L13 Stages of lower rescue route
0
100
200 m


Appendix 5.3
(Profile view)
Upper Entrance (MC29)
Lower Entrance (MC1)
Entrance Pitch
Entrance Chamber
Pitch 1
Pitch 2
Pitch 3
The Waiting Room
Mount Arbora
Watergate
Forbidden City
City Wall
Ridgeway
U15 (Opium Den tyrolean)
U17 (P3 tyrolean)
Khyber Pass
Inner Opium Den
The Forest
Silk Shop
Sallys Folly
The Rockpile
The Khan
The Begum
Xanadu
Outer Xanadu
Rift Bypass Pitch
Stalagmite Shuffle
Pleasure Dome
Cairn Hall
Cairn Hall Pitch
River Alph
Z1
Z2
Z3
Z4
Z5
KEY
A-F Rest station sites
Z1-Z5 Zones of cave
U1-U22 Stages of upper rescue route
L1-L13 Stages of lower rescue route
0
100
200 m