# Speleological Expedition to Hidden Creek Valley

# Wrangell – St. Elias National Park and Preserve,

# Alaska, United States of America

# August 2008

*Brian Cullen, Gareth Edwards, Jim Nicholls, Les Brown,*

*Ronan O'Ceallachain and Tony Furnell*

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Hidden Creek Valley is located in the Wrangell – St Elias National Park in south central Alaska near the border with Canada.

The expedition was organised by an international team of six cavers from Alaska , Great Britain, Ireland and Northern Ireland. The expedition was in part funded by the Speleological Union of Ireland (SUI).
The expedition report is divided into three main sections:

- Section 1- Background
- Section 2 - Field Study
- Section 3 - Hydrogeology and Speleogenesis

In total 13 days were spent exploring and studying the karst of Hidden Creek Valley, including Leprechaun Cave. However, due to the remoteness of the valley the logistics of travelling across Alaska from the capital Anchorage to Hidden Valley took a number of days. Transport logistics included travel by train, ferry, car, plane and foot.

The Wrangell St Elias park includes several mountains that peak at over 3000m. The National Park is the largest in the USA stretches from Glennallen eastwards for c.120miles to the Canadian border and northwards from the old mining outpost at McCarthy to Tok c.150miles way. The park has the greatest concentration of glaciers in Alaska, with much of its northern region remains buried below ice up to 1km thick. Expected surface air temperatures will be –5 to 20 deg C for July. During the winter air temperatures drop below –25 deg C.

Prior to departing for Alaska permits had to be granted by the Park Service. The Park Service Guidelines for camping and travel within the backwoods of Alaska were followed in order to reduce the likelihood of an unexpected encounters with bears.

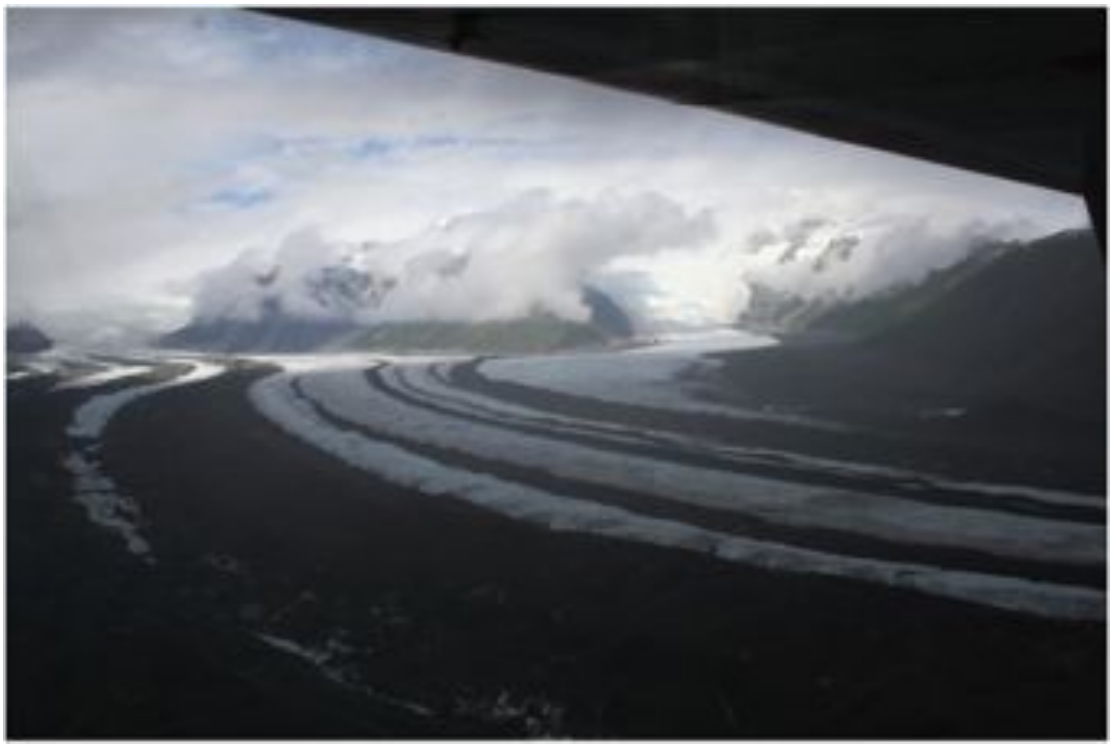
# SECTION 1 - BACKGROUND

Wrangell-St Elias National Park and Preserve


Map of Alaska

## Background

In October 2007 Alaskan caver Jim Nicholls attended the Speleological Union of Ireland (SUI) and the Irish Cave Rescue Organisation (ICRO) annual cave and karst symposium (SUICRO). The paper he presented focused on recent discoveries in the karst of Wrangell-St Elias National Park and Preserve of south central Alaska, where he, with Curvin Metzler and colleagues, had recently discovered a mile long cave. The cave, which has been named Leprechaun Cave, is located in Hidden Creek valley c.15miles northwest of the abandoned Kennicott mines and community of McCarthy across the Kennicott Glacier.



Crossing the Kennicott Glacier to Hidden Valley

The relict entrance to Leprechaun Cave is located c.100m above the valley floor and c.40m above a major resurgence. Residents of McCarthy report that the cave entrance has been known for sometime and that it had entered it for a short distance during the mid 1970s (Metzler, 2008). Additionally, as Leprechaun Cave is located within the main stratigraphic zone of the Kennicott-type ore deposits, at the basal contact between the Chitistone (limestone) Formation and the underlying Niccoli (basalt) Greenstone Formation, it is likely that prospectors entered the cave at around about 1900.

Hidden Creek Valley

By September 2007 the limit of exploration had been pushed beyond the Formalion Borehole passage to a terminal sump. The cave was surveyed, which was published with a report in the NSS Journal (Metzler, 2008).


The entrance to Leprechaun Cave 40m above the resurgence

Following SUICRO 2007, Dr Les Brown contacted Jim Nicholls with an offer to assist with an expedition to Hidden Creek and Leprechaun Cave during late summer 2008. The offer of assistance was accepted and plans were composed for a 13-day expedition to run from the 7th to the 20th August. Ultimately, a team of cave explorers from Alaska, Great Britain, Ireland and Northern Ireland and signed up to the 2008 expedition to further investigate Leprechaun Cave and other caves and karst landforms in Hidden Creek Valley.

The August 2008 expedition members comprise of:

*Brian Cullen (Ireland)*

*Gareth Edwards (Great Britain)*

*Jim Nicholls (United States of America)*

*Les Brown (Ireland)*

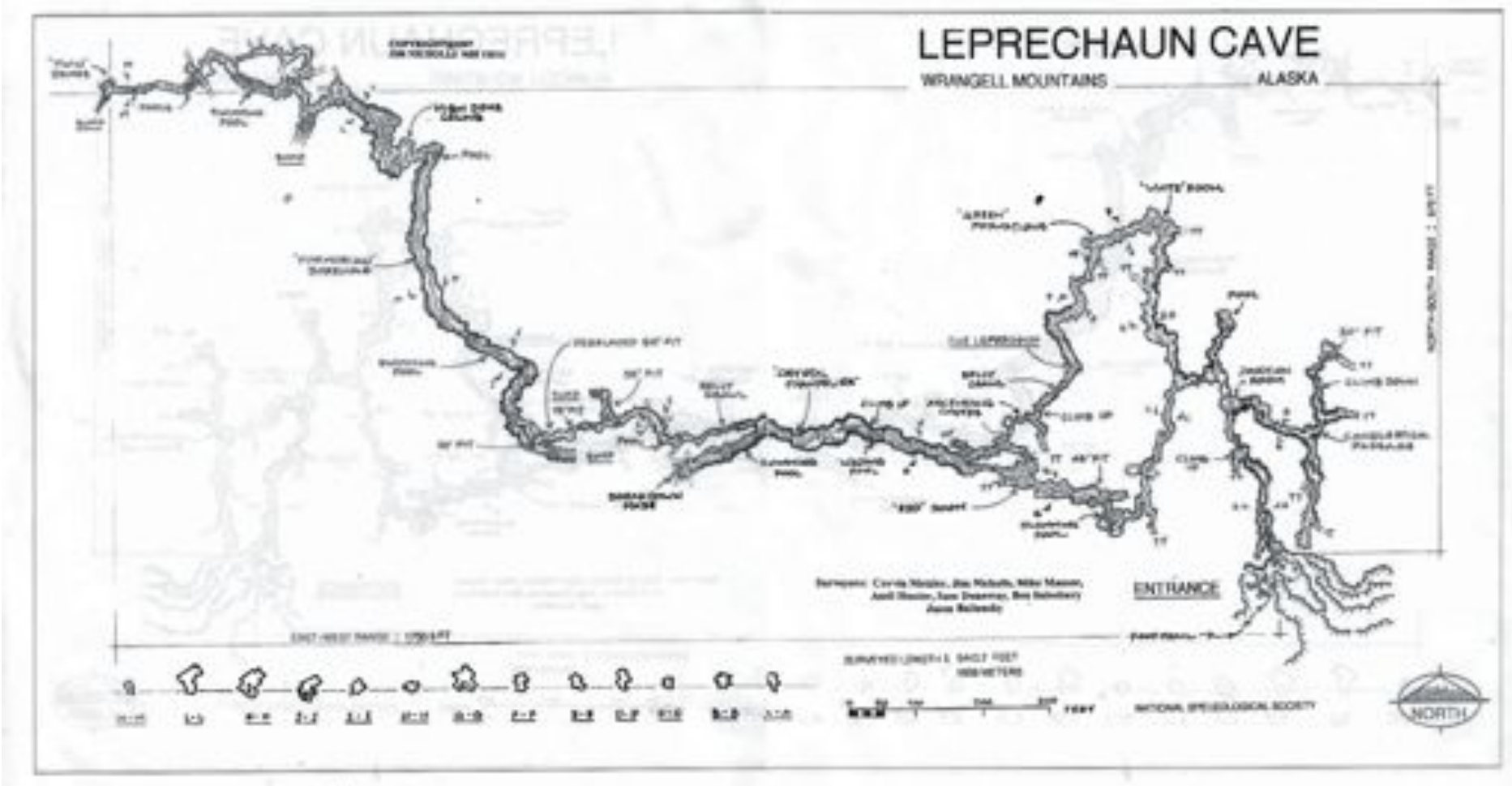
*Ronan O'Ceallachain (Ireland)*

*Tony Furnell (Northern Ireland)*

The expedition has the authorisation of the National Parks Service of America under permit number WRST-2008-SCI-0014 (including amendment PEPC 22593). This work has been made possible by funding sourced from the Speleological Union of Ireland (SUI), which is the official body that represents cavers in the island of Ireland. Handheld hydrochemistry probes (measuring temperature, pH and conductivity) have been provided by Eugene Daly Associates part of CSA Ireland for use during the field visit. Three logging water depth transducers (range of 8m) were provided by expedition member Dr Les Brown, who has 18years experience undertaking research into cave and karst hydrogeology.

Expedition objectives:

1. To explore, map and survey leads of continuing passage in Leprechaun Cave.
2. Explore map and survey other caves and karst landforms within Hidden Creek valley the aim of determining the source of the water emergent at the Leprechaun resurgence.




Survey of Leprechaun Cave (Metzler, 2008)

**Expedition Travel and Logistics**

*Dublin to Anchorage*

The team members from Ireland (Brian and Ronan) and Northern Ireland (Les and Tony) all flew out from Dublin, whilst Gareth flew out from Manchester. The route taken was to fly into Newark, then on to Seattle and eventually to Anchorage. The total travel time was just under 24hrs. There were a couple of issues with missed connections that caused Gareth and Ronan to be separately delayed.

Seattle Airport at 2AM after a missed flight

The cost to fly out to Anchorage was approximately €1,200. Flights were booked six months in advance. Flight was with Continental Airlines and Alaskan Air.

The baggage allowance on transatlantic flights was generous allowing 2 x 22kg in the hold and a total of18kg in the cabin. Most members travelled with 30-40kg of equipment.

Most supplies were purchased in Anchorage. This included all food, bear pepper spray, midge repellent and maps. Bear proof containers were either bought in Anchorage or borrowed from Jim Nicholls. Each member had two c.11itre bear containers in which all food for the full 13day expedition had to be contained. Due to

the constraint in the volume and weight of the supplies everyone relied on dehydrated food for main meals supplemented with cereal bars and breads.

Although personal caving equipment was brought over from Ireland, all rope and rigging equipment was purchased from Inner Mountain Outfitters (Georgia, USA) and posted to Alaska the week before the expedition. A full equipment list for the expedition is provided in the Appendix at the rear of this report.

*Anchorage to McCarthy*


Travel from Anchorage to McCarthy (330miles) (State Tourist Map)

Travel from across Alaska to McCarthy had been booked three months in advance of the expedition. The logistics of getting five team members plus equipment across south central Alaska to McCarthy involved five stages of travel:

1- from Anchorage to Whittier using the Alaskan Railroad Corporation

2-from Whittier to Valdez across the Prince William Sound by the Alaskan Marine Highway System (ferry)

3-from Valdez to Glenallen along the Richardson Highway by private hire

4-from Glenallen to McCarthy by a combination of mail plane and Nicholls VW camper van

5-from McCarthy to Hidden Creek Valley by a two seater lightweight plane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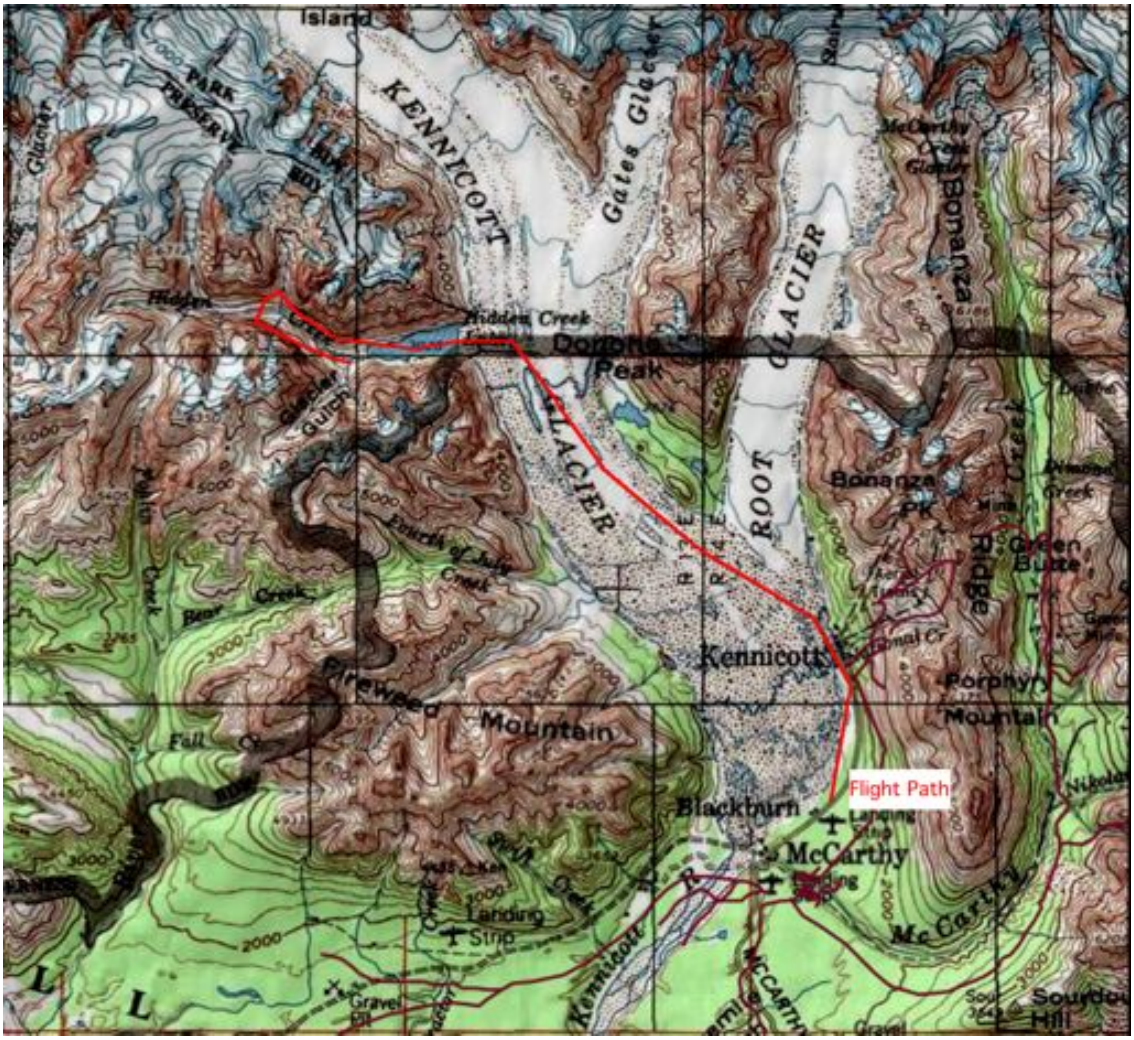
WRANGELL MOUNTAIN AIR

*Hidden Creek Valley*

Due to the limited payload of the two seater plane used to fly from McCarthy to six trips were required to deliver the 6-persons and equipment to Hidden Creek valley. The landing strip In the valley was a short gravel bar elevated slightly above the river. The planes use large foam filled tyres that enable landing on ground that would be unsuitable for normal aircraft.




Location map of McCarthy, Kennicott and Hidden Creek Valley

The landing strip is located near to an old A-frame hut used by prospectors over the last centaury. Hikers had been leaving food in the hut and this had lead to a number of incidents with bears in previous years. On the day we arrived in the valley we met the local park geologist who advised us that a large grizzly bear had been seen just days earlier near the hut.


Supplies for the 13 day expedition


11ltr bear vault

Leprechaun Cave lies 1 mile upstream from the landing site. The portage of equipment and setup of the campsite below the cave entrance took ¾ of a day. The campsite was at an elevation of 3,200ft at the base of several 4,000-8,000ft peaks. Vegetation in the valley was low alpine scrub with no trees to hide food out of bear reach. As is the norm for camping in the Alaskan backwoods. The campsite was set up with a food free area for pitching tents, a kitchen area for preparing and eating food and a food storage area for bear proof containers to be buried below rocks. The three points, tent-kitchen-storage form an equilateral triangle so that each point is at least 50m away from the next. Food was forbidden from being in the area of the tents to prevent any incentive for the bears to approach.

# SECTION 2 – FIELD STUDY

Hidden Creek Valley

## Introduction

The main objectives for the expedition were twofold. Firstly, to explore the further reaches of the Leprechaun cave system with a view to extending a number of known leads and also revisiting the terminal sump identified the previous year, and secondly to undertake a surface reconnaissance above the cave to determine if there are any surface inputs to the cave system.

Additionally, the remainder of the valley was to be explored for any other karst landforms or cave systems. A number of scientific instruments were also brought over from Ireland to measure the properties of the water emergent at the resurgence below Leprechaun Cave, and any other resurgences found in the valley. These instruments included:

- temperature, pH and conductivity probes
- electronic (logging) flow meter, and;
- water level loggers.

The data from these instruments would be analysed back in Ireland and be used to provide any additional data that could be used in assisting with determining the origins of the karst water.

## Geomorphology and Hydrology

Hidden Creek Valley is unusual in that it is one of few valleys in the region that is largely ice free. The valley has a number of tributaries including Glacier Gulch, which joins Hidden Creek at the airstrip as well as Boulder Creek which forms the headwater of the valley and Canyon Creek that drains joins Hidden Creek just west of Leprechaun Cave.

All of the tributaries are fed by glacial melt water and they have a predictable daily pulse of sediment laden flood waters. Noticeably the water emergent from the main resurgence below Leprechaun cave remained very clear for the duration of the expedition. During particularly warm days the glacial melting caused significant flows in the valley that required the team members to ford the river with caution. Water temperatures are very cold and are typically 1-3 degrees C.

At the downstream end of the valley the creek encounters the ice wall of the Kennicott Glacier. During the melting season a large melt water lake collects at the ice wall and builds up a significant head of water. Ultimately the pressure build up

fractures the ice and the lake drains into melt water channels below the glacier. Often the lake can disappear within a day and the sudden increase in water flow below the glacial can result in spectacular water fountains erupting from  glacier downgradient.

The melt water lake collecting at the ice wall of the Kennicott Glacier

Stranded icebergs following the draining of Hidden Creek Lake

During the August 2008 the Hidden Creek Lake drained leaving icebergs stranded upon the dry lake floor.

Clear emergent water from Leprechaun resurgence meets sediment laden glacial melt water

Eruption of water from the Kennicott Glacier as the Hidden Creek Lake drains (1913)

Based upon published maps of Hidden Creek Valley the glaciers in Boulder Creek that now lie 3km upstream from Leprechaun Cave have retreated by 1km in 23years. In that time sparse low lying vegetation has started to grow. At a rate of 1km per 20-25yrs, Leprechaun Cave would have been emerging from the ice only 100years ago.

Glacier at the head of Boulder Creek, c. 3.5km upstream from Leprechaun Cave

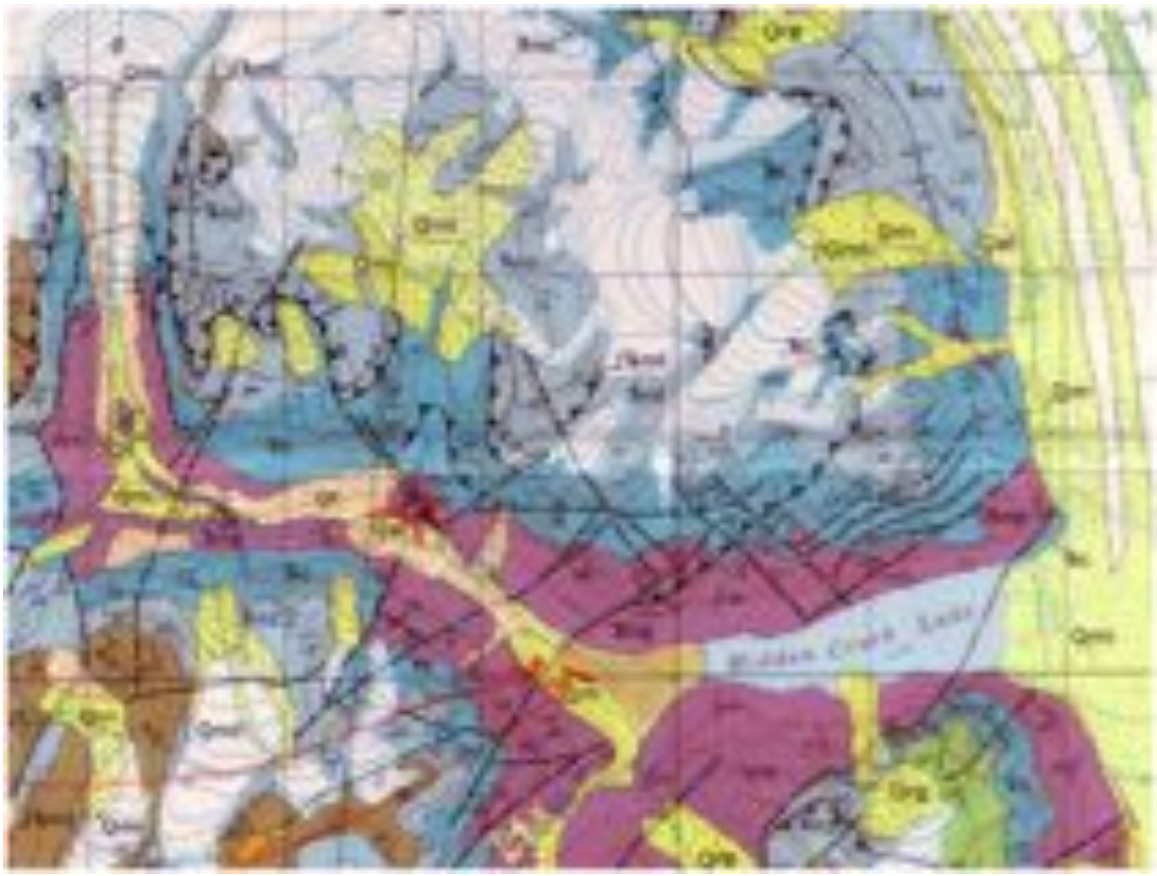
The daily rise and fall of the Hidden Creek River had its peak in late evening and was often at its lowest in the morning. In order to assesses if the emergent water from the Leprechaun resurgence had the same synchronicity in water level and temperature as the surface water systems one water level logger was placed in Canyon Creek and another in the Leprechaun Stream. These loggers remained in position for the duration of the expedition. The stream head data were analysed on return to Ireland and are discussed in Section 3.

Although a number of attempts were made to measure the flow rate in the Leprechaun stream and Canyon Creek, the water velocity was too turbulent to make any recordings of flow rate.

Glacial melt water in Boulder Creek (initiating mid afternoon)

**Geology**

The geology of the region is from the Jurassic period and comprises mudstones, siltstones, sandstones and limestones that have been moderately metamorphosed. Limestone comprises approximately 1/5 of the exposed geology (most of the geology remains under ice). The main limestone formation is the Chitistone Limestone, which forms most of the area directly north of McCarthy. The McCarthy area is world famous for the late 1800s discovery of the copper ore deposit named Mother Lode at Kennicott. This mine (worked out) has the record of being the largest discovered copper ore deposit.



Geology of the Hidden Creek Valley area.

Purple = Niccoli Greenstone Formation (Basalt)

Dark Blue = Chitistone Formation (Limestone)

The contact between the underlying Niccoli Greenstone Formation and the Chitistone Formation can be followed for the full length of the Hidden Creek Valley. There are significant faulting, with estimated throws of up to 250m. At Leprechaun Cave the faulting is at its most complex with low angle faults displacing the stratigraphy so that the older Niccoli Formation lies on top of the younger Chitistone Formation.

There has been significant alteration of the Niccoli Greenstone Formation from its original basalt. The events leading to the alteration of the Niccoli formation from Basalt to Greenstone is related to the significant ore bodies that occur in the region. There is also significant alteration of the Chitistone Formation, which like the Niccoli can be seen to have significant mineralization, particularly along the formation contact.

The well exposed contact between basalt and limestone


The geology of Leprechaun Cave

**Karst Landforms and Caves**

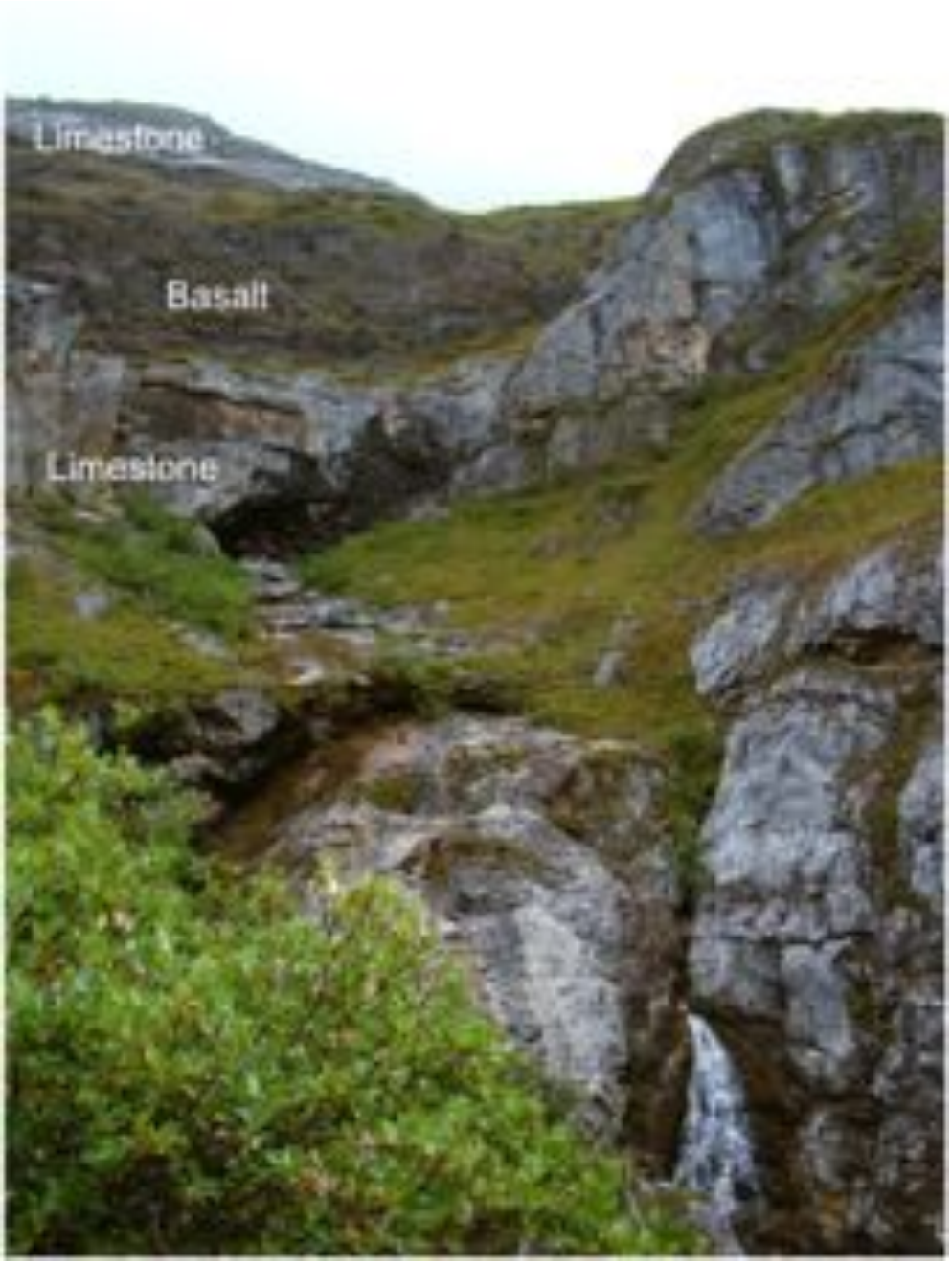
Leprechaun Cave is the only recorded karst feature in Hidden Creek Valley. However, elsewhere in the McCarthy region there are reports of other karst landforms including sinks, caves and risings within the Chitistone Formation. As part of this expedition the team planned to visit several potential karst landforms that had been observed from a distance, as well as verbal reports of additional risings further upstream in Hidden Creek Valley.

*Leprechaun Cave*

The entrance to Leprechaun cave lies approximately 40m higher up the cliff face from the main resurgence. For the duration of the expedition the flow from the resurgence was very strong, which is most likely a consequence of the relatively wet

summer and previous 2 weeks of heavy rainfall. Although the water flow was to high to approach the resurgence it was noted that in addition to the main conduit outlet (which appears to be phreatic in shape) there are at least 4 other minor water issues.

The entrance to Leprechaun Cave is water worn and shows signs that it is likely to become active during periods of high flow. Although the cave was not active during the time expedition it is likely to be come occasionally active during the spring thaw. There is evidence of relatively recent water scouring over the lip of the entrance and reduced vegetation cover.




The entrance to Leprechaun Cave and one of smaller upper risings

The first phase of the expedition was to explore Leprechaun Cave and push a number of the leads that remained unvisited at the further reaches of the cave beyond the Formorion Borehole at the Twin Domes. On the last visit to the cave there was an ominous booming sound emerging from the sump, which caused curiosity and concern amongst the cavers explorers at the time.

Entrance to Leprechaun cave looking out over the Hidden Creek Valley

Entrance chamber of Leprechaun Cave

The survey of Leprechaun Cave has the appearance of a single main tributary cave that branches out into multiple conduits immediately before reaching the valley. However, the cave also has moderate vertical development and includes a 45ft vertical climb and a 50ft near vertical drop. At this time it is not possible to show a section through the cave. However, it is anticipated that a section through the cave would show a good correlation with the contact of the limestone and greenstone as a control to the ‘lifts’ and ‘drops’ within the cave system.

The Red Room of Leprechaun Cave

Leprechaun Cave is rather unusual in its geology. Although the cave entrance and entrance series is developed in limestone, the area from the roof of the junction room to just past the wading pool is located largely within the greenstone. Within this part of the system the cave is notably angular, loose and dominated by reds, greens and blue colouration of the rock (and indeed speleothem). The colouration is best shown in the Red Room, which is a chamber formed within the greenstone but with a limestone roof. The remainder of the cave is largely developed in limestone. However, in places the rock has is discoloured with red or blue tinges indicating that the rock has been altered. In places the alteration of the limestone is quite extreme and the contact between the greenstone and limestone is not distinct.

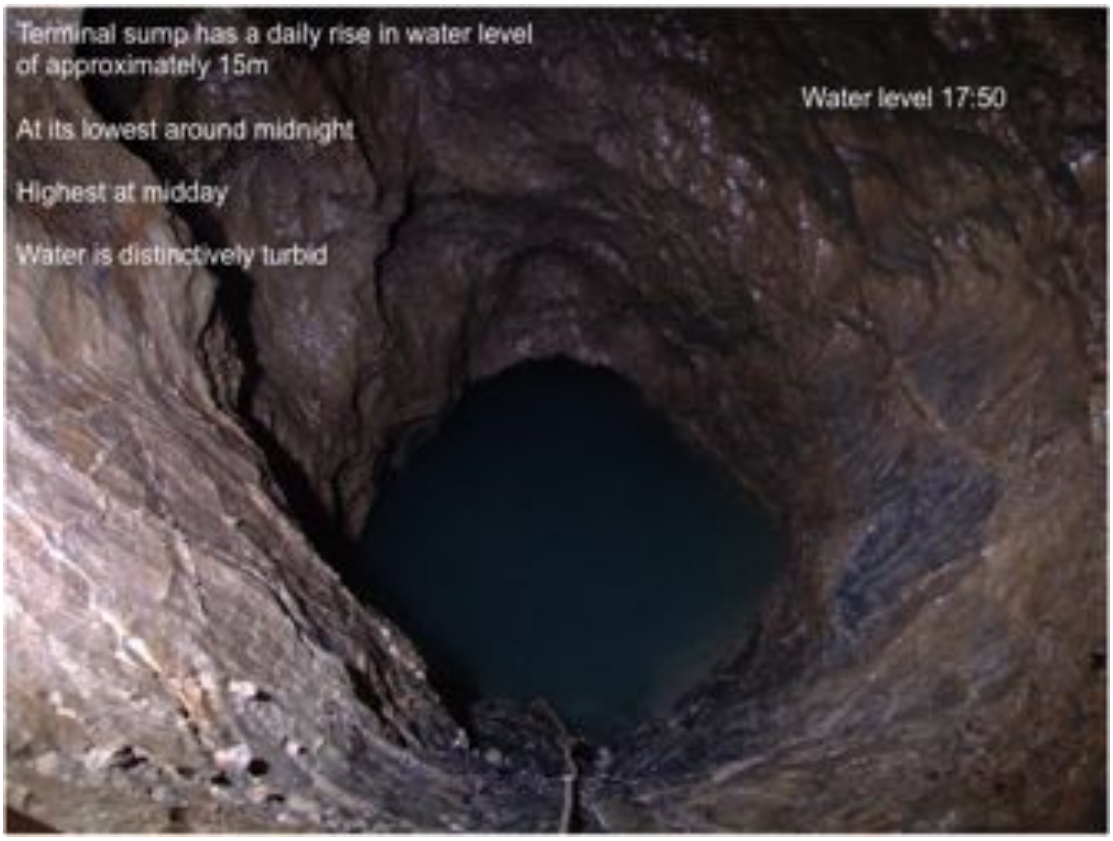
Climb above the wading pool

One of the most significant discoveries of the August 2008 expedition was the realisation that the terminal sump appears to have a daily fluctuation in water level by of approximately 15m. The water level is at its highest around approximately mid-day and then continues to drop to its lowest level at approximately midnight. Throughout the afternoon the clarity of the water also changes from clear to increasingly turbid. It

was intended to install a water level logger in the terminal sump of Leprechaun Cave for the duration of the expedition. However, the range of the logger was only 4m and as damage could occur to the logger if the range was exceeded the logger was not installed at that time. A logger with a significantly greater range is required.




Water level 15:30
Water increasingly turbid


Terminal sump has a daily rise in water level of approximately 15m
Water level 17:50
At its lowest around midnight
Highest at midday
Water is distinctively turbid

The observations from the cave and those from the water level loggers located in Canyon Creek and the Leprechaun Resurgence are discussed further in Section 3.

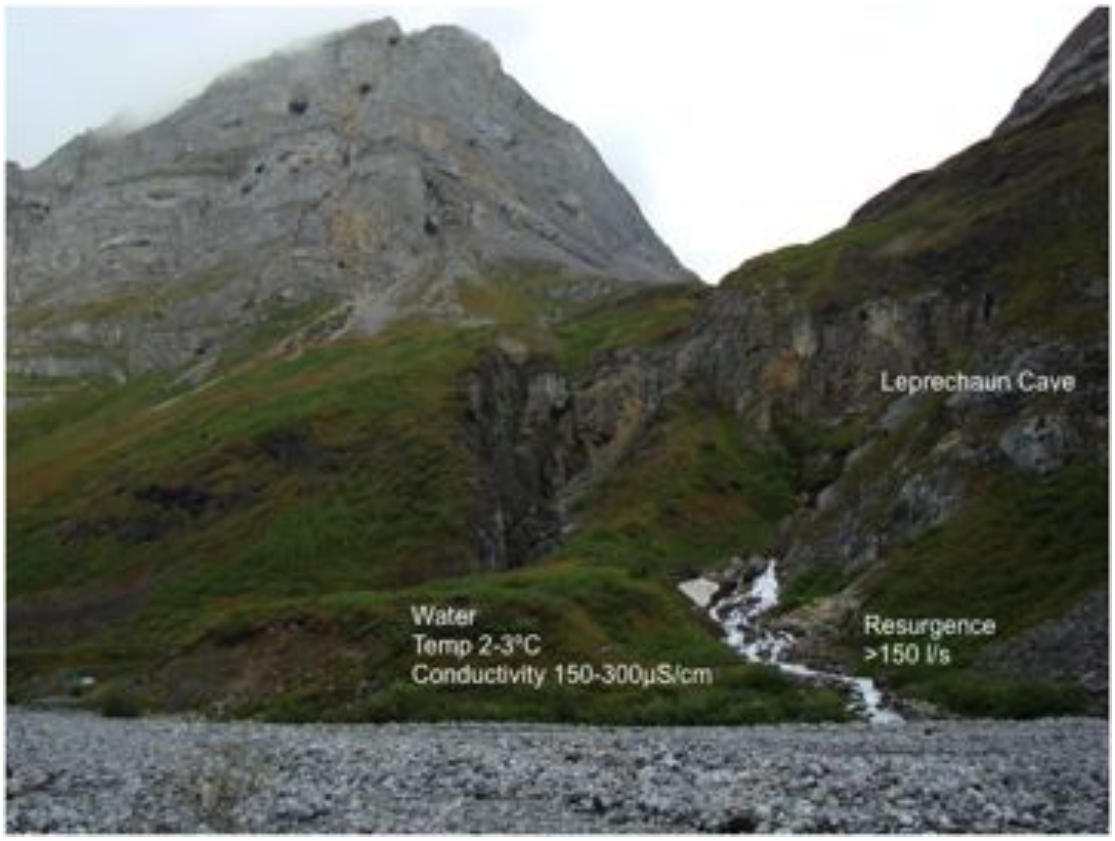
*Surface Karst*

There are a large number of shaded hollows located on the valley sides of Hidden Creek. Several of the lower lying features were investigated during the expedition and all were either very short frost pockets or very short tectonic caves. Many hollows of these are visible high on the cliffs and steep sides of the Hidden Creek Valley and although these were not accessible they were examined using a camcorder with a 150x zoom lens. None of these features appear to be solutional in shape, although a number may be tectonic fissure caves.

One of the many frost pockets investigated in Hidden Creek Valley

Although no other cave entrances were encountered a collection of springs were found on the opposite side of Hidden Creek Valley approximately 1.5km further upstream and high up on the southern valley side above where Hidden Creek and Cobble Creek meet. This collection of four springs have a discharge similar to or slightly less than that of the Leprechaun rising. There is no accessible cave passage at these risings or at a higher elevation.


'Four springs'

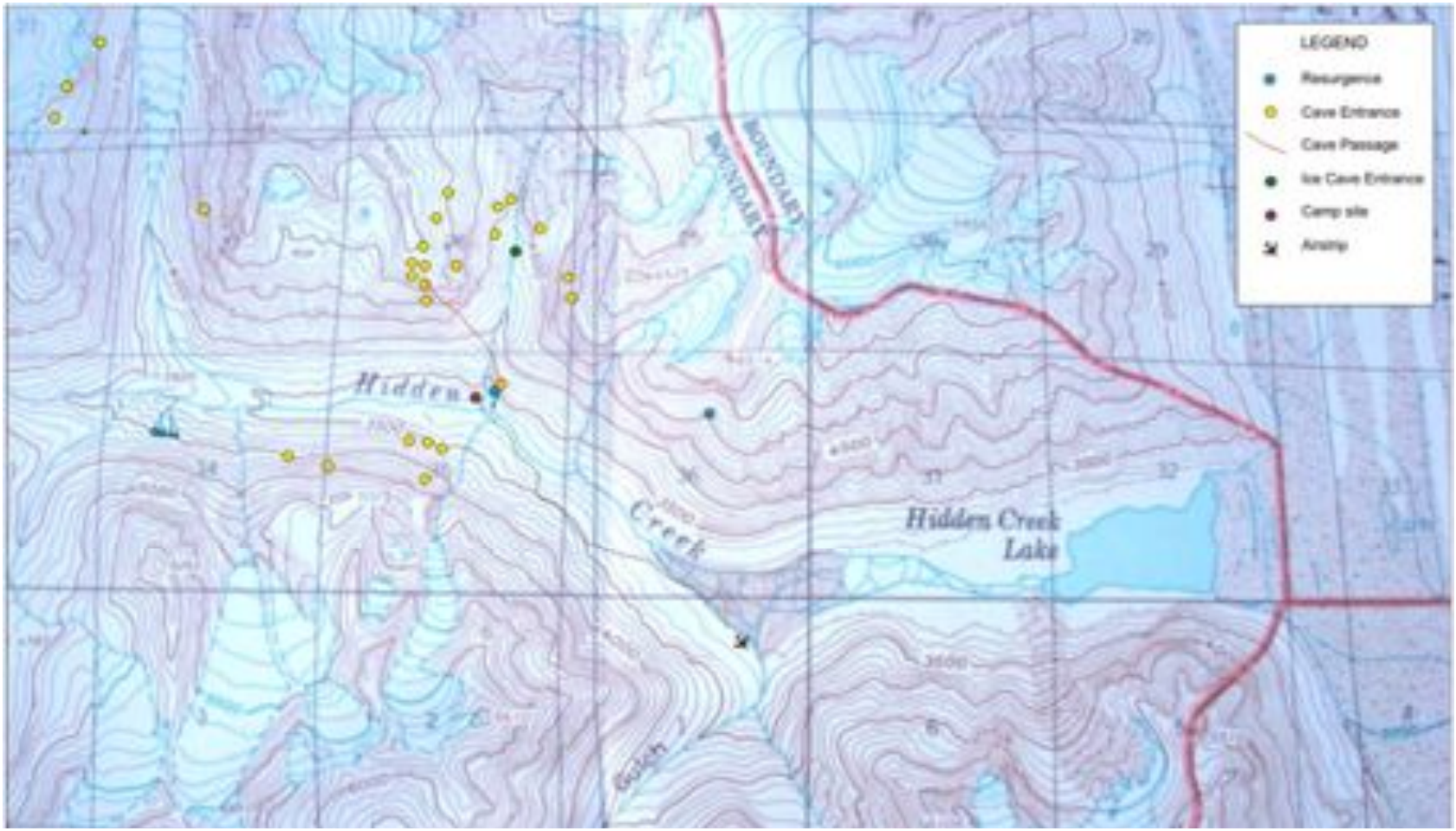



Leprechaun Cave and resurgence

In addition to the karst landforms and Leprechaun cave there were a number of ice caves encountered on the expedition. Although these were remnant snow bridges from the winter snow, one area of extensive snow cover in the lower part of the Canyon Creek (directly adjacent to Leprechaun Cave) should be revisited to observe for any karst landforms, especially as Leprechaun Cave passes directly below Canyon Creek.

Snow fill in Canyon Creek (upper)

Deeply incised gorge of Canyon Creek (lower)




Location of risings, cave entrances, frost pockets and ice caves located in Hidden Creek Valley

# SECTION 3 – HYDROGEOLOGY

Leprechaun Cave, Hidden Creek Valley

**Hydrogeology**

Although there are other springs in Hidden Creek Valley, Leprechaun Cave to date is the only recorded cave system. The system is complex and extensive considering the relatively young age of the topography and the likelihood that until a relatively short time ago (100s of years) it was covered by ice.

In the absence of any surface karst landforms it is difficult to delineate the surface catchment for the cave. It is likely that as the surface topography is so young, the scree cover so think and extensive and the temperature so cold that there has been very little time for surface karst landforms to develop. Given this then Leprechaun Cave is unusual for the setting and is likely to predate the topography. It is likely that valley incision intersected the phreatic conduit of the proto-Leprechaun Cave and that successive down cutting has led to the development of a multiple level system, the upper part of which has become drained. The lower section, including the active resurgence and the sumps observed in the cave appear to be active during the spring thaw but may dry up during the winter when all surface water freezes.

The logger data from the expedition has been downloaded, corrected for air pressure and analysed for the fluctuation in water depth and water temperature. These data are presented in a series of three charts, showing the fluctuation of both glacial melt water and the leprechaun Resurgence and then I individual charts, each with location more detail and temperature data.

*Chart 1 Water depth fluctuation*

Chart 1 shows that the melt water surface stream has a 24hr cycle in the depth fluctuation with the greatest depth (and flow) occurring at midnight and the lowest flow occurring at midday. The stream from Leprechaun Resurgence shows exactly the same 24hr cycle but the depth of water (for a comparable stream channel) is significantly more slight. This indicates that the surface water stream (Canyon Creek) is largely melt water. Although melt water is also an important component in the resurgence waters the effect is significantly more subdued, which is probably a feature of storage within the rock. However, on this basis much of the conduit system is likely to be flooded as there is no (apparent) timing offset between the cyclic pattern of the two streams.

*Chart 2 Water depth and temperature Canyon Creek*

The comparison between water depth and temperature shows that the increase in depth is coupled with a decrease in temperature. On this basis, the increased flow is entirely due to glacial melt water entering the surface water channel.

Chart 3 *Water depth and temperature Leprechaun Cave*

The emergent water at Leprechaun Cave shows the same trend as the water in Canyon Creek. An increase in water depth (and flow) is caused by an influx of colder water. In this case there is glacial melt water draining into Leprechaun Cave. This may be a mix of snow melt within the catchment that drains via fractures down to the cave system and by direct glacial melt water entering the system some distance away. As the system responses with a similar synchronicity to the surface water system then it i likely that at this time of the season that the conduit system is water filled and interconnected from source to rising. However, the presence of the significant drain sections of Leprechaun Cave may be an indicator that significant sections of passage exist beyond the terminal sump that is not flooded.

The response of the terminal sump in an apparent inverse relationship between flow at the resurgence is likely to be a Venturi effect caused by an increase in velocity of the flooded conduits as the melt water flows through the system. This would indicate that the increase in turbidity of the terminal sump as it drains is a consequence of the increased sediment load being carried by the melt water, similar to that observed in the surface streams.

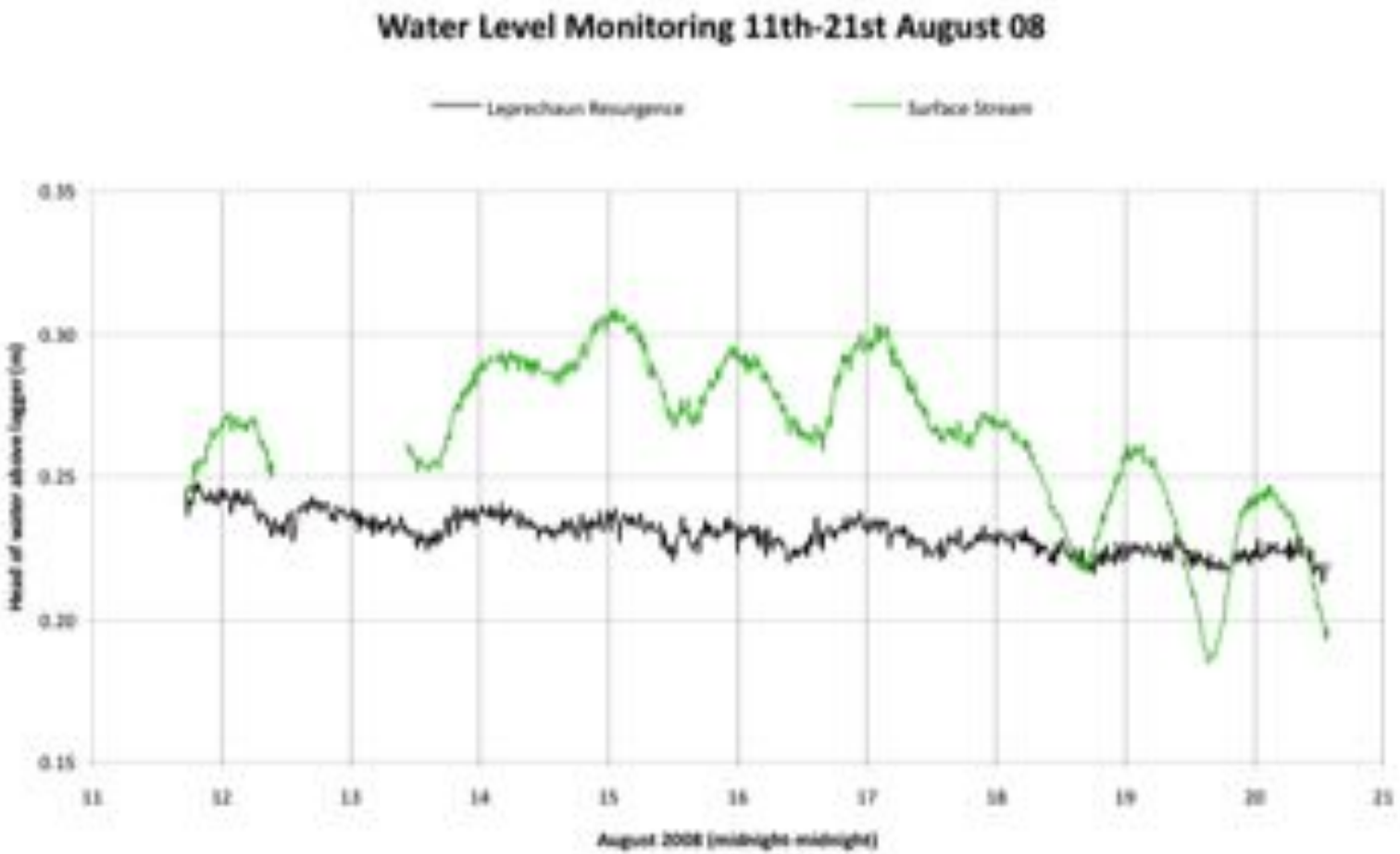
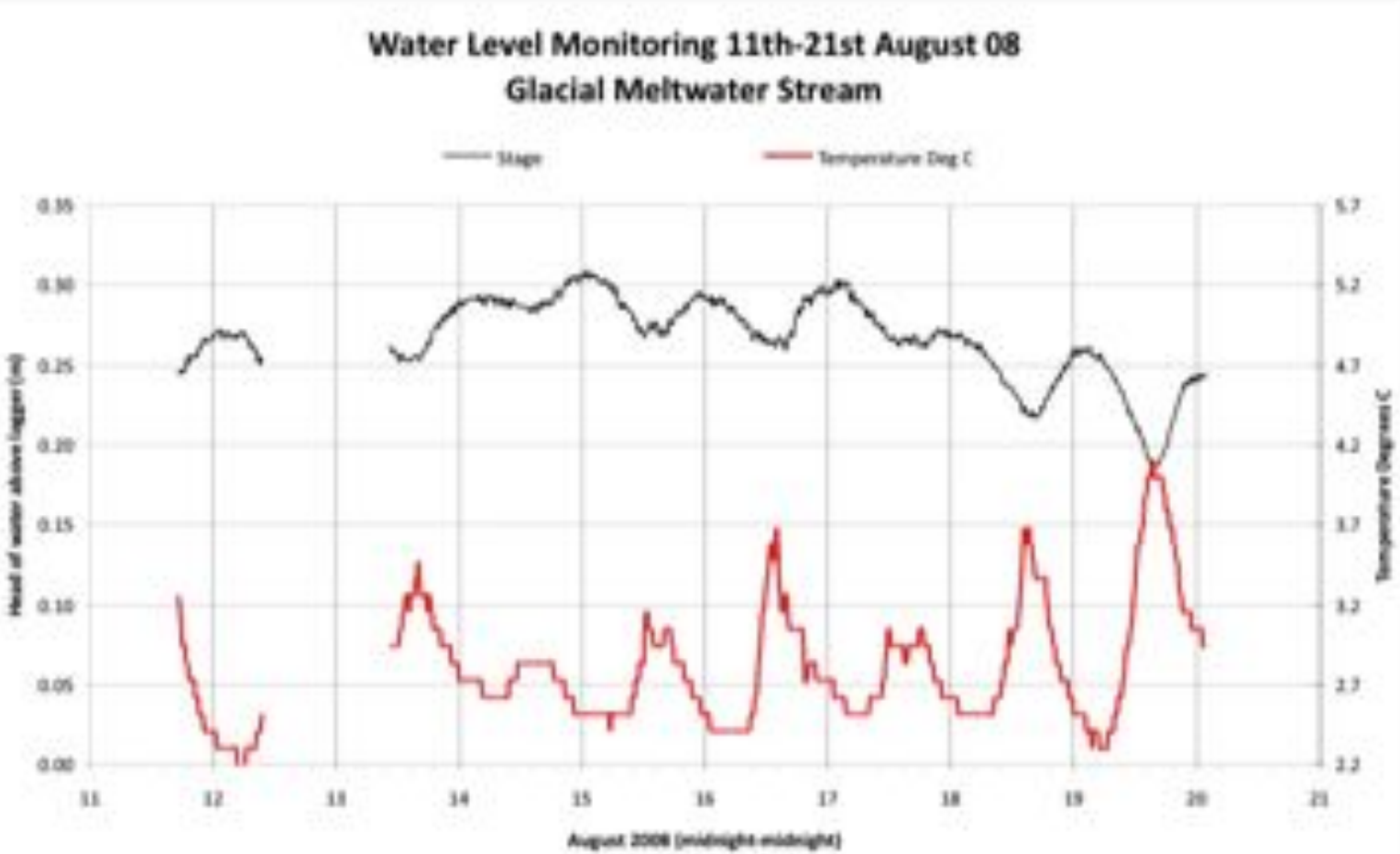
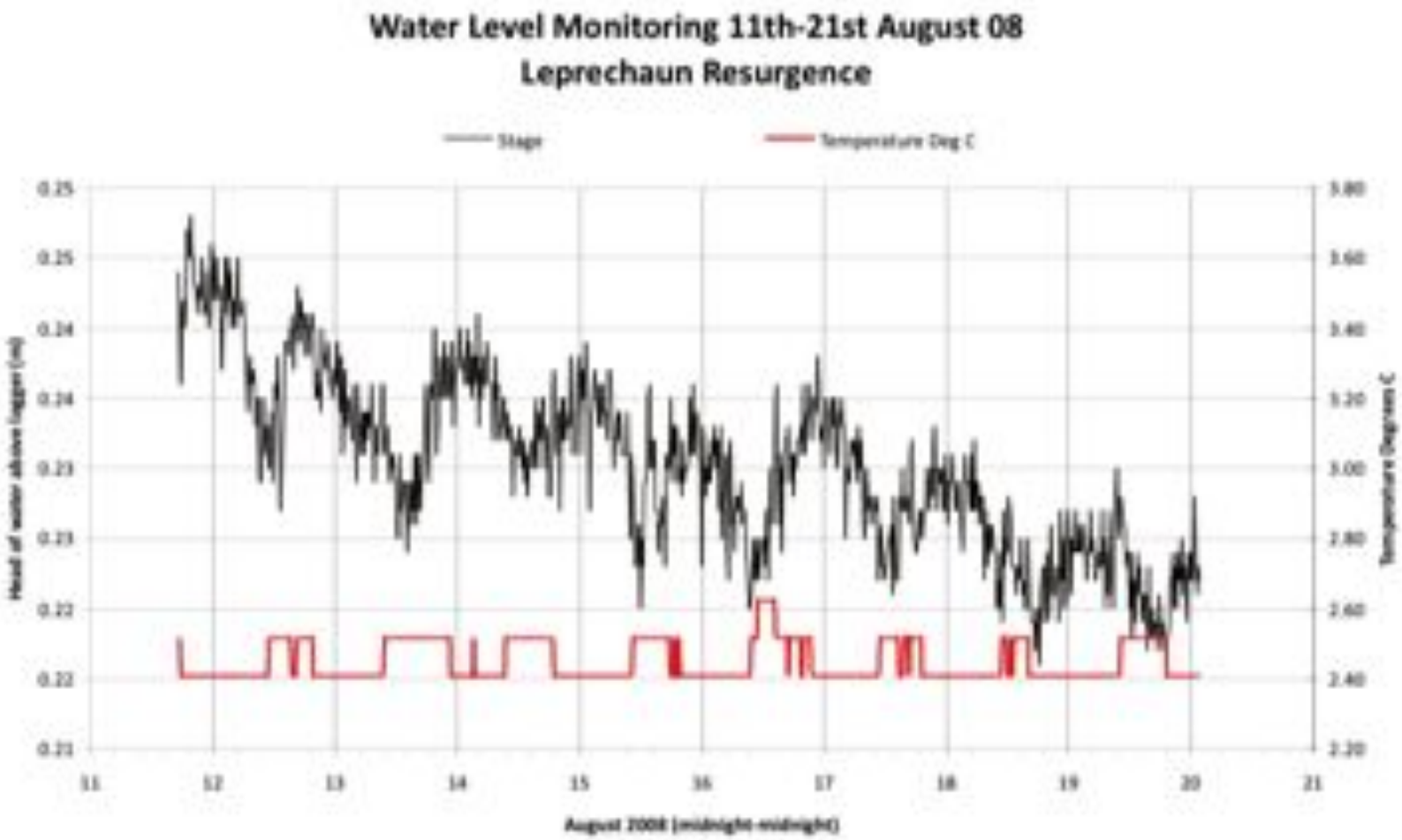


Chart 1 - Water level monitoring in Canyon Creek and Leprechaun Cave Resurgence



Water level and temperature monitoring in Canyon Creek




Water level and temperature monitoring at Leprechaun Cave Resurgence

**Update**

During the late summer in 2010 Jim Nicholls returned to Leprechaun Cave with a water level logger that has a 76.5m range and baro logger. The water level logger was installed in the terminal sump and the baro logger was installed into the high level passage above the sump. Both loggers were programmed to log on a 3hr frequency and on on this basis will continue logging for three years. A return trip is proposed for 2013 by Jim Nicholls to retrieve the logger and determine the daily, seasonal and annual fluctuation in water level at the terminal sump.

**Appendix A**

**Expedition Day by Day Summary**

The 13-day expedition to Hidden Creek was divided between time spent underground in Leprechaun Cave and time on the surface locating cave entrances and karst landforms. The 6-person team flew into Hidden Creek on Saturday the 7th August and began portaging equipment from the airstrip to a base camp 1-mile up stream below the entrance to Leprechaun Cave. Below is a day-by-day itinerary of the expedition.

Day 1- Flight from McCarthy to Hidden Creek, portage and setup of base camp

Day 2- Trip into Leprechaun Cave to observe water levels and determine status of fixed ropes. Installation of water level loggers into resurgence below Leprechaun Cave and adjacent unnamed stream.

Day 3- Mapping of karst landforms between Leprechaun Cave and Gravel Creek

Day 4- Rigging of ropes and installation of dingy to swimming pool in Leprechaun Cave. Water level in the terminal sump was high preventing access to the last 20m of passage.

Day 5- Mapping of karst landforms between Leprechaun Cave and unnamed creek adjacent to cave.

Day 6- Surveying in Leprechaun Cave. Water level in terminal sump had risen by c.6m vertically.

Day 7- Mapping of karst landforms at the south-western end of Hidden Valley

Day 8- Photography trip into Leprechaun Cave. Also, geological mapping of the cave system

Day 9- Surveying of extension at rear of cave. Additional observations made from the terminal sump indicate that the depth of water oscillates on a daily basis by up to 8m.

Day 10- Portage back down to airstrip

Day 11- Jim Nicolls departs back to McCarthy. Remaining team members make observations on karst between airstrip and Hidden Creek Lake.

Day 12- Observation made on karst in Glacier Gulch. Data loggers removed from resurgence at Leprechaun Cave and adjacent unnamed stream.

Day 13- Return to McCarthy A summary of the cave and karst landforms identified are presented in the annotated map below. GPS coordinates and dimensional data collated.

**Appendix B**

**Equipment**

One of the most important things for selecting caving equipment for Alaska was to find out what kind of caves we would be dealing with. For this we consulted Jim Nicholas, our contact in Alaska. One of the first things we realised was the average temperature of the cave was about 1 degree Celsius. Our experinece of caving in Ireland is pleasant in comparison. Getting wet in an Irish cave is not too much of an issue as you can warm up easily when needed. However when the water temperature is only 1 degree Celsius, getting warm is a lot harder. Also at that temperature, wetsuits just don't work. So we realised that the best technique for caving was to avoid water and just not get wet. We packed 2 sets of thermals and fury suits each. If any of our clothes got wet, we would simply wear a different set the next day while the wet gear dried. A combination of seal skins and Wet socks were enough for our feet. Gloves and wellies were also packed however some of us bought thermal gloves and wellies in Alaska as this would be the most suited gear for the environment.

Caving Kit (Rónán O'Ceallacháin kit as example)

- Helmet
- Petzl duo 14 LED
- Petzl Tikka XP (back up light)
- Balaclava
- SS rash vest
- SS thermal t-shirt x2
- LS thermal top x2
- Furry suit x2
- Meander Oversuit
- Thermal gloves
- Caving Speedos
- Thermal Leggings

Seal skin socks

Wet socks

Thermal Wellies rated to -5

While caving, we also ensured that the group always had a stove with them with tea bags/coffee/soup and water. This was mainly due to the environment of the cave. We all had energy/cereal bars with us and each member had there own water/energy drink with them. Some of us even used energy gels however this didn't always go to well.

Between the whole group we had 3 surveying kits that allowed us to survey different parts of the cave at once.

Part of the expedition was also the photograph the caves. For this Rónán O'Ceallacháin often brought into the cave the following kit:

Photography gear: Camera

Slave flash

Tripod

Peli case

Spare batteries

Spare memory cards

Camping Gear

Each member of the expedition had their own tent. The requirement for the tent was 3 season, 2 man and weight of about 2 kilos. Thermorest and down sleeping bags rated to about -10 were also used along with sleeping bag liners. The goal was to have as light a camping set up while still being very warm. We all brought our own

stoves and cooking utensils and pooled it all together along with our fuel. The goal was to save fuel by cooking together but we were still able to cook alone with our own gear if needed. We also used a tarp to shelter the eating area. We each had 2 Bear proof containers kindly supplied by Jim Nicholas to store our food.

***Alaska 2008: First Aid Supplies***

While members of the expedition were recommended to carry their own supplies of simple first aid treatments, such as common painkillers, sticking plasters, insect repellent, etc., the group kit was assembled to cope with more serious medical occurrences, with only a little scope for minor treatments such as blisters and insect bites.

All of the treatments listed below were available from a central first aid kit held by Tony.

**Internal treatments**

| **Commercial name** | **Pharmaceutical name** | **Dose** | **Treatment** |
|---|---|---|---|
| Ciproflaxin (tabs) | Ciproflaxin | 500 mg | Antibiotic |
| Clarithromycin (tabs) | Clarithromycin | 500 mg | Antibiotic |
| Piriton (tabs) | Chlorphenamine maleate | 4 mg | Anti-histamine |
| Stemetil (tabs) | Prochlorperazine maleate | 5 mg | Anti-nausea (anti-emetic)<br>Anti-vertigo |
| Buscopan (tabs) | Hyoscine | 10 mg | Anti-spasmodic |
| Senokot (tabs) | Sennosides | 7.5 mg | Constipation relief |
| Imodium (caps) | Loperamide hydrochloride | 2 mg | Diarrhoea relief |
| Aspirin (tabs) | Aspirin | 81 mg | Painkiller, blood anticoagulant |
| Ibuprofen (tabs) | Ibuprofen | 200 mg | Painkiller, anti- |

| | | | |
|---|---|---|---|
| | | | inflammatory |
| Voltarol (tabs) | Diclofenac Sodium | 50 mg | Strong painkiller, anti-inflammatory |
| Paracetamol (tabs) | Paracetamol | 500 mg | Painkiller |
| Tradorec XL (tabs) | Tramadol hydrochloride | 100 mg | Strong painkiller |
| Dioralyte (powder) | Oral electrolyte | - | Rehydration powder (for diarrhoea) |

All tablets/capsules had their dosage and treatment written onto the blister packs for quick access and to avoid confusion, where they had been removed from packaging. Drug information leaflets were kept separately in the base first aid kit, in case required.

**External treatments**

- Adhesive strips (Steri-strips), 3 × 75 mm
- Adhesive tape, microporous (Transpore)
- Antiseptic cleansing wipes
- Antiseptic cream
- Anti-histamine cream
- Bandage, crepe, 5 cm
- Bandage, crepe, 7.5 cm
- Bandage, triangular
- Blister patches (Compeed)
- Dressing, sterile eye pad with bandage
- Dressing, sterile low adherent, 10 × 10 cm
- Dressing, sterile low adherent, 5 × 5 cm
- Gloves, non-latex disposable
- Irrigation solution, sodium chloride, 20 ml

- Safety pins
- Scissors
- Splint, foldable (SAM splint)

**Miscellaneous**

- Pen
- Small pad of paper
- All present had a knife in their personal kit

**Caving/trekking kit**

An additional selection of emergency-only treatments was set aside for cave/trekking use, intended to be small and lightweight:

- Selection of the strongest painkillers
- Irrigation solution, sodium chloride, 20 ml, ×2
- Antiseptic cleansing wipes, ×10
- Dressing, sterile low adherent, 10 × 10 cm, ×1
- Dressing, sterile low adherent, 5 × 5 cm, ×2
- Bandage, triangular, ×1
- Bandage, crepe, 5 cm × 4.5 m, ×1
- Adhesive strips (Steri-strips), 3 × 75 mm, ×5
- Adhesive tape, microporous (Transpore), ×1 roll
- Splint, foldable (SAM splint), ×1
- Safety pins, ×6
- Scissors, ×1 pair
- Gloves, non-latex disposable, ×2 pairs
- Pen/paper