FUSSI Newsletter

Vol. 31 | No. 3 | 2019

Nothing is Impossible!

Freshly made scones, jam and cream at the cave entrance!

COMMITTEE

C O N T E N T S

Front Cover Photo: Rigging weekend: Naracoorte. Aug 2019.

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FUSSI has been a Corporate Member of the Australian Speleological Federation Inc since 1988.

GOATS?

Clare Buswell

Have you got it? The geology map? Err, yep. So, we are? 'I think we are about here' Sarah would say.

The crew discussing where to go and search.
Photo: C. Buswell

This was the general topic of conversation for the weekend as we had decided to devote a five-day trip to the far north Flinders Ranges to walk around some Wilkawillina limestone in the hope of finding a cave to challenge the bejesus out of Hang Soon Dong Cave. It is pretty rare for FUSSI members to get the opportunity to visit such inaccessible karst areas as the required 4WDs don't tend to show up on student budgets.

Thus, our quest for fame saw us assemble (at a reasonable hour) nursing litres of water to be drunk during the day (don't think it got below 29 degrees), hats, sunburn cream, lunch, morning tea, fruit cake and compass. Yep, we were ready to take on the heat, the flies and the relentless UP on the stony hills! Well, that was in the car getting to the spot to start walking.

There were: Ken, Clare, Heiko, Andrew, Sarah, Sil, Janice, Jan, Ida, all at the mercy of Stoney, the lightly eccentric manager of Warraweena Station. I mean, who else has a set of snowshoes in the office of a semi-desert Conservation Reserve east of Beltana?

Our first morning saw four of us drive out to an area known as the Long Drop, as it has a long drop loo. Ken suggested: 'Let's go up that creek and then walk slightly northwest to that area there, where all those creek lines drain into that one point'. The one point being a wide and flat but sheltered valley. Sounded like a reasonable thing to do. So we did, crossing ironstone, shales, and occasionally a bit of limestone. The creek, dry as all creeks in the Flinders tend to be in early April, was well shaded. We passed the occasional waterhole or a moist area with evidence of kangaroo diggings for water and looked for rock art in surrounding stone faces. Walking was pleasant, wildlife not seeming to mind, and the day passed with the air of satisfaction that comes from ticking off one possible site to explore, in a drought year, in dry South Australia. Who needed the tropics?

By Good Friday evening the whole crew had arrived, and we settled into our very pleasant, stately, but in need of some TLC, homestead accommodation. We plotted out a few ideas over dinner, began to solve the problems of University research funding and retired to bed.

Up and on the road early attempting to beat the heat, we stopped at a split in the track, followed the fading roadway, then walked about a kilometre before turning our efforts on a hillside of limestone. Then the fun began: People became goats, crawled up and down dales, over rocks, turned over anything that looked like a remote possibility of being a hole in the ground. Any hole in the ground. The goats searched for cave gold and lo and behold they found…

At Left: Mini Mumma.
Looks deep and inviting but in reality, it didn't go much further than a metre in depth.
Photo: J. Chan

To recover from such a massive feat of cave exploration, the following day we had arranged, via the usual cross-club landowner liaison dude, to meet up with them and go visit Narrina Lake cave.

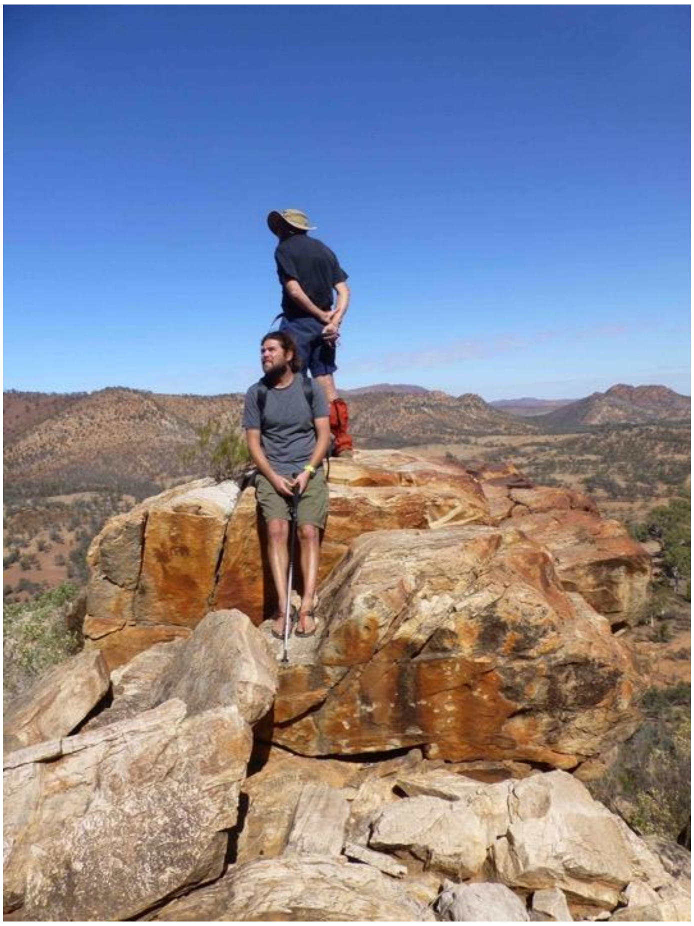
Discussions about the best way to get there, with the ever-helpful Stoney, decided the matter. He said, 'quicker to go via main road than via the mad 4wd tracks. The latter will take you all day one way'.

Off we went with our caving gear, snorkelling gear, and lunch for a day of caving as a reward for hours of goat work. Hours later saw us turn up at the famer's front door, asking if he had heard from or seen our dude and his associated cavers, only to be told, that he knew nothing of the arrangement, nor had he seen anyone. We made our apologies and beat a retreat, not wanting to ruin any landowner liaison protocols. Never a good look landing unannounced at someone's front door with nine people in tow.

GOATS?

We retreated to Second Glance cave, for a bite of lunch and a brief look. It was a long drive back to camp and for those who had wanted to see Narrina Lake cave, two of which had come from Melbourne, a lost opportunity and great disappointment.

For those who only had the Easter break available, Easter Monday called them back to the realities of life, leaving five of us to go back up hills and search. We returned to an area near the efforts of Easter Saturday's find, but on an adjoining hillside. Limestone everywhere, worn in areas by water running down its face, smooth, hard and not a crack in it! We line-searched, we looked under trees, into shadows, back and forth, back and forth, until finally gaining the top of the hill, for a well-earned lunch break and a view. It was unfortunately a day of Zip, Nothing, but if you don't look, you don't know! But wait… we now know that this part of the hill has shown us nothing of note, so that is knowledge in itself.



At Right: Andrew and Ken, looking for cave entrances in the far distant hills. Photo: Clare Buswell

The following article was sent to The FUSSI editor by Ian Lewis. It is reproduced here with the following credits:
The article was first published in the Cave Divers Association of Australia's (CDAA) June newsletter 'Guidelines' No. 146. The author is a palaeontologist from the Australian National University and Griffith University. He is also a CDAA cave diver.
While written for cave divers, the information is relevant to South Australian dry caving too. FUSSI thanks Ian for sending it to us.

A CAVE DIVER'S GUIDE TO FOSSIL DISCOVERIES – OUR OBLIGATIONS AND RESPONSIBILITIES.

Dr. Julien Louys

Fossil protection legislation and regulations

It is not unusual to come across an interesting fossil find while cave diving in Mt Gambier. Our natural curiosity makes us want to know what it is and how it got there, and instinctively we want to pick it up and take a closer look. However, rules and regulations are in place to protect these finds. It is our responsibility, as cave divers, to be aware of them and act accordingly. Here, I outline what our obligations and responsibilities are.

A CAVE DIVER'S GUIDE TO FOSSIL DISCOVERIES

Julien Louys

Federal legislation for protecting all Australian fossils does not exist, and responsibility for looking after our geological heritage is largely the purview of individual states and territories. As such, considerable variability exists in the legislation and regulations that control collection, ownership, and protection of fossils and fossil sites. Some states and territories in Australia can have ambiguous or uneven treatment of different fossil types and their protection in different situations. This is certainly the case for South Australia.

The flooded caves and sinkholes around Mt Gambier are found on private land, Crown land, Forestry land, and in National Parks. While different pieces of legislation cover each of these different property types, it is understood that all fossils found in South Australia are owned by the Crown as stipulated in the *Mining Act 1971*. While the Act does not specifically refer to or define 'fossils', fossils will likely fall under the definition of 'minerals'. The *Mining Act 1971* defines a mineral as "any naturally occurring deposit of metal or metalliferous ore, precious stones or any other mineral (including sand, gravel, stone, shell, coal, oil shale, shale and clay)" (*Mining Act 1971* Pt 1 s. 6). If this definition is accepted as inclusive of fossils, then the legislation is clear over ownership, namely that "the property in all minerals is vested in the Crown" (*Mining Act 1971* Pt 3 s. 16). Because the *Mining Act 1971* does not specifically refer to 'fossils', it could be argued that fossils don't fall into this category. However, the wording of 'minerals' has been kept deliberately vague, allowing the definition to be set by case law rather than specifically through legislation (Bradbrook, 1987). This allows the term to be given a broad or specific meaning based on the intention in which the word is used (Bradbrook, 1987).

The state repository for fossils is the South Australian Museum, thus, as all fossils technically belong to the state they should be deposited there. However, the South Australian Museum, like all museums around the world, have limited storage and curatorial resources and usually only accept fossils into their collections on the recommendation of palaeontologists. Some fossils occur in their tens of thousands, and not every single fossil ever found needs to be made available for scientific research. Of course, common fossils can be, and often are, of huge scientific value – their richness can be the very thing that makes them valuable. Knowing which fossils are important and need to be properly recorded, extracted, curated, and preserved is the job of palaeontologists.

Despite the relatively ambiguous wording regarding fossil ownership in South Australia, regulations regarding fossil protection are much more explicit. Fossils found on Crown land, such as Fossil Cave and Gouldens Hole, are specifically covered by the *Crown Land Management Act 2009*. There, it states that a person who, without authority or excuse, damages or removed fossils from Crown land is guilty of an offence (*Crown Land Management Act 2009* s. 61 (1)). Regulations regarding fossils found on National Parks, such as Piccanninie Ponds, is even more explicit. Under *National Parks and Wildlife (National Parks) Regulations 2016,* fossils cannot be removed, displaced or intentionally disturbed (s. 21 and 30). The *Forestry Regulations 2013* covers fossils found on Forestry land. Section 17 states that without authority, one cannot intentionally destroy, damage or disturb any fossil or remove it from Forestry land.

Regulations regarding fossil conservation on private land are not explicitly addressed in any legislation, and hinge on who the caves hosting the fossils belong to. How much of the land under the surface is owned by the landowner is a question without a simple answer. While it is commonly referred to the maxim *cujus est solum*, roughly meaning that everything from the sky to the centre of the earth belongs to the landowner, things are not that simple. Case law over the years has established that this only really applies to subsoil on the property (Bradbrook, 1987). Subterranean caves, formed in hard rock and thus well outside any definition of any soil horizon, do not belong to private landowners but instead to the Crown. Fossils found in caves on private land are therefore covered under the *Crown Land Management Act 2009,* as detailed above.

A CAVE DIVER'S GUIDE TO FOSSIL DISCOVERIES

The Cave Diving Association of Australia has its own specific set of regulations, and clauses pertinent to fossil preservation can be found in the Member Code of Conduct. Specifically, all CDAA members are expected to understand and apply the Australian Speleological Federation's Minimal Impact Caving Code. This code states that: *If bone material is found on existing or proposed tracks, the area should not be disturbed, but be taped off pending consultation with the landowner/manager towards timely assessment of the find*. The Member Code of Conduct also outlines the responsibility, shared by all divers, to avoid caving practices that compromise the value, environment, and the surrounds of caves, including fossils.

So, what do I do if I find a fossil?

Fossil deposits are a limited resource – they won't be made again any time soon! Each fossil represents a unique snapshot of past life that, once disturbed, can be lost forever. It's therefore in our interests, as well as our responsibility as cavers, divers, and explores, to make the most out of what is found. Information from fossils allows us to build an understanding of what life was like back then – fossil sites are past laboratories where a one-off biological experiment has been run, and all we need to do is read the results. We can't waste this enormous potential, which can literally rewrite our understanding of Australia and our unique biota.

Fossils are not just objects, they are the remains of once living creatures that fascinate and captivate the imagination. For palaeontologists, however, it's often more than the fossil that we're interested in. For us, the context of the fossil find is just as important, if not more so, than the fossil itself. This is one of the primary reasons that fossils should not be disturbed once they're found. If moved or handled, valuable scientific information is lost. We're interested in more than knowing 'what species is it'? We need the context of a fossil to answer questions like: How old is it? What sort of environment did it live in? Is this leg from the same animal as this skull? How did this fossil get here? etc. In many ways, how a palaeontologist approaches a fossil find is similar to how a crime scene is examined. We're trying to work out exactly what happened, and we need as much information for that as possible. Unlike a crime scene, though, we're working on a case that's been cold for thousands if not millions of years. To unravel the mystery behind every fossil, every bit of data counts.

The best thing to do when finding a fossil is to take a picture of it without disturbing it, preferably with a scale (metric is best, but anything whose dimensions are easy to visualise can be used). This will allow a palaeontologist to at least estimate what the organism is, and how significant it might be. If the fossil has already been unintentionally disturbed, where possible and safe make detailed notes and diagrams and take photos of its original position/location, so that this can be reconstructed. For mammal fossils that have already been disturbed, if the grinding (occlusal) surfaces of the teeth are visible, photographs of these will help enormously with identification to species. However, if taking photos at this angle requires movement of an undisturbed fossil, it's best to leave it where it is.

It's important to note that almost all fossils found in caves have been lying there undisturbed for tens of thousands of years and are thus rarely in any imminent danger. If there is a remote chance that the fossils are at risk of future damage/disturbance, the first step is to make other divers aware of their presence (for example, by using cave line to create a perimeter around the fossil or area, attaching a wet note to a nearby rock). These finds should then be reported to the CDAA National Committee to determine what further protective measures would be suitable. These steps observe the Minimal Impact Caving Code directly and are considered best practice.

If the fossil is in imminent danger of being destroyed or damaged, it's best to move the fossil to a safer, nearby area within the cave. However, the threat of damage to fossils, and indeed to any the cave's values, should never stem from a diver's actions or aspirations. We are but temporary visitors to these places, with the rare privilege of accessing these unique sites. Above all else we share a responsibility to ensure that our impact on these fragile environments is minimised. If a fossil must be moved, they should be kept submerged if at all possible – the drying out process can damage and could potentially destroy valuable palaeontological information. Again, if moved, detailed notes, plans, and photographs should be taken where possible and safe.

Photographs can be sent to any vertebrate palaeontologist for identification. There are many excellent palaeontologists working in universities and museums around Australia, and most are happy to help identify fossils and evaluate significance. Determining species from photographs is not an exact science, and it can be difficult to be accurate, however, we can generally get it in the right ballpark. It's important to note that not all fossils should or would be removed from a cave for scientific study. Palaeontologists weigh up the scientific versus aesthetic value of removing a fossil, and oftentimes it's preferable to leave a fossil in its natural state, for people to enjoy, rather than remove and potentially ruin the site.

In short, here are the six key steps to follow when you find a fossil:

1. Do not disturb the fossil and the area around it;
2. If at risk, mark off the area to indicate its presence to other divers;
3. Take photographs and/or video, use a scale;
4. Take notes regarding location, orientation, and depth;
5. Report the find to the CDAA executive committee;
6. (optional) Approach a palaeontologist for potential fossil identification.

Ultimately, fossils are part of Australian geological and biological heritage. It's heritage that belongs to all of us, and that should be shared widely for all to enjoy. New fossil finds are dependent on the new explorers and pioneers, people who spend considerable time and effort to probe the unknown, who in turn stand on the shoulders of past explorers and their efforts. However, even explorers need to be mindful of the irreversible impact their actions may have on the cave value. It's our duty to make the most of all this effort, and not waste the precious and irreplaceable resources fossils represent.

Note: The information contained in this article is for general guidance only, as the application and impact of laws can vary widely based on the specific facts involved. The information in this article is provided by a professional palaeontologist with the understanding that the author and publishers are not engaged in rendering legal advice or services. As such, it should not be used as a substitute for consultation with professional legal advisers.

Reference:

Adrian J. Bradbrook, 'Relevance of the *Cujus Est Solum* Doctrine to the Surface Landowner's Claims to Natural Resources Located Above and Beneath the Land' (1987). 11*Adelaide Law Review* 462, 462

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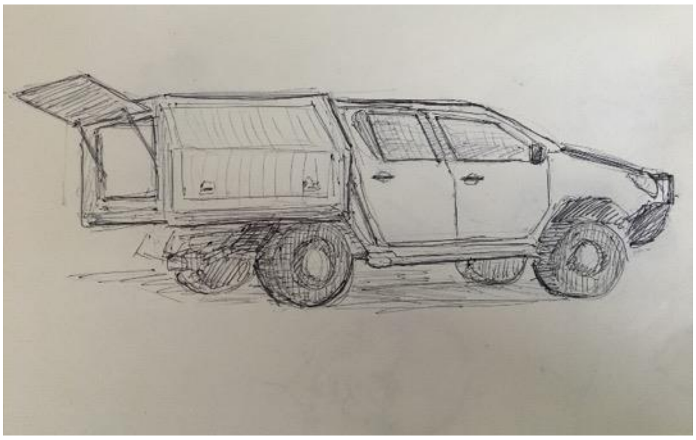
THE FLINDERS in JULY

Liam Keogh

On the cloudless night of Friday the 26th of July, two inexperienced but eager cavers, Jerin and I, along with a caving veteran eclectic knowledge bank, Neville, arrived at a hut in a remote area of the Southern Flinders Ranges. The other cavers had made it earlier that night, with more to arrive later that evening. The roads possessed considerably less of the apparently usual hazard of kamikaze kangaroos, however, a thick fog began to settle as the sun set, causing drivers to slow, slightly delaying the arrival. That was one of very few hiccups that merely accentuated a successful and adventurous weekend.

After a good night's sleep, awaking slightly earlier than the rest of the group, I passed time by drawing the fireplace. It wasn't long before I was greeted by other early risers and we were informed of what was to happen caving-wise over the next few days. We were to attempt to visit three caves. The first, a lot of tight squeezes before reaching larger chambers and not much "pretties" on the other side. The second a crawling and climbing maze with the promise of large crystal sections being more than enough motivation to pull one through. The third… well, we ran out of time for the third as everyone was a bit tired and preferred to have a more thorough enjoyment of the first two caves. After picking up a ladder and discovering the collapsed entrance of what would have been the third cave, we made our way to the first adventure on the agenda, not before a quick lunch break where I managed to sneak a sketch of Clare's Hilux.



An extremely tight squeeze that I could only fit through by getting rid of all the air from my lungs, was the beginning of the first cave. This cave was very exciting. Two big finds. We found water a small yet curiously impressive puddle of water, and, Neville's keen caving eyes spotted a small bug which everyone had to see. On the way out I managed to get stuck, which I found hilarious yet troublesome, and was luckily saved by Janice who managed to give me a hand and pull me to safety. That night we ate food prepared by Janice and Nicole. Fuelled by thoughtfully prepared and delicious food, many stimulating discussions were had and continued through the dying of the firelight.

The second day and the second cave were just as exciting. An abseil down into what I thought was a huge chamber but was assured was actually "nothing compared to Tasmania" (a common phrase spoken by the caving elites), was a welcome start. I'd abseiled down first and thought it would have been cool to try and draw something whilst the next people were coming down, unfortunately, I'd forgotten my bag. We made slow progress, but as mentioned earlier, it was all worth it as interesting crystal formations dotted the journey. Eventually we finished up and climbed out, pretty tired and satisfied with the last two days of caving. We packed up the equipment, ate a quick lunch and then left for the hut, for final pack ups, cleanings, and goodbyes, to each other and a fruitful weekend in the Southern Flinders Ranges.

REFLECTIONS ON TEACHING S&M

Clare Buswell

At a general meeting of the club a few months back comment was made that they would like to learn how to rig a ladder and a belay. As a long-term club safety and training officer, I took it upon myself to set up a process by which anybody in the club could come along and learn such. I take the view that most people come to rigging as one of the last things they learn when dealing with ropes. People generally learn to abseil, then SRT before doing anything with rigging. When I teach this stuff, I start with the basics and teach a set basic rig, as it is much easier to teach a standard curriculum than a dog's breakfast that hopes you cover it all.

Complicated rigging. Photo: Steve Coulter

Thus, many Sundays in June and July saw a dedicated bunch of members and two instructors, Tania and I, tie up trees with ropes and ladders. The aim was to give each person a set of gear: tapes, karabiners, ladders, trace and rope, and work their way through what became a set rig. Why this particular rig? Because it is simple, has redundancy and safety lines built into it from the start, is easy to set up and to understand the principles behind it. From a teaching perspective you can build in levels of complexity as you go, adding another layer depending on where you know the person's learning is at. This translates as: it's no use teaching complex things when the simple things aren't understood or mastered.

The other part of teaching this stuff is consistency of practice so as to really learn the skills involved. How many of us have done a one or two-day course and come away with only a bit of it really mastered? This was the reason so many Sundays were put to use before the rigging weekend held in Naracoorte in late August. It is also the reason a second rigging weekend has been set down for November sometime.

Anyone who rigs caves regularly, will always think about any rigging they see. They will mentally question how it was done, what knots were used, why this way and not that way? This questioning comes about due to a number of factors: how they themselves were taught to rig: do they come from, say, a climbing or caving or SES or arborist background? What do they rig from most, bolts or bits of dead tree, sides of cars, Uni footbridges? Or how much gear they have to haul up a hill. My own rigging experience and looking at that of other people's, recognises the fact that there are many, many ways to slay the rigging dragon, but the most important reason for examining it is to answer: How safe is it? Is there redundancy in the system if something decides not to play nicely? Is it simple, does it do the job it was set up for? Importantly would I put my life on it?

All of these points influence rigging. For FUSSI there is often an extra factor and that is, we spend most of our time taking people caving who are new to the underground world. We are a Uni club and as such take students who just want to come and try, then move onto to the next outdoor bauble, or sometimes those who are really keen, but being students can be both time and financially poor. Our other priority is that we try and make caving as accessible, inclusive and as fun as possible. That means that our trips will cater for the least through to the highest skilled. If, for example, we run a trip to the Nullarbor and wish to visit say, Thampanna cave, then the rigging will have both a ladder and belay line as well as an abseil/SRT and safety lines. This way we cater for those who don't know SRT but can still go caving. It does not matter that not all are skilled up to the highest standard, rather what matters is that the rigging is safe, people are looking out for each other and everyone gets to see the cave.

As a consequence, on a FUSSI trip a couple of things are a dead cert. You will always be rigging a ladder, belay, and at least two safety lines. If you are in charge of others' safety at the top or the bottom of the pitch, you will always be in safety alert mode as beginners are unpredictable: sometimes full of fear, sometimes not, sometimes they undo things when you have done them up, sometimes they talk to you as if they know everything, but in fact know very little. That list goes on. It is important to ascertain where a club comes from and why things are done in a certain way. Caving clubs do things differently because of where they are. Think of all those nicely bolted caves in Tassie for example.

Thus, the reality for FUSSI caving trips, is that they mostly consist of dependant cavers, and very occasionally a group of peers with the same skill set. It stems from this that our safety procedures and standards have to be up there. It also means that in teaching this crazy stuff, teaching a same way of doing things leads a lot less confusion by those who are learning. Thus, the end game may be to rig some complicated multiple rope and ladder deal off the one, half dead tree on the Nullarbor backed up by another of the same variety, but before you get there you need learn some basics. It was this that the weekend and the Sundays in the Uni forest aimed to address and by the end of the weekend those that attended had not only improved their S&M skills considerably but were ready to go on to the next level.

My thanks to Tania, Andrew for being co-instructors and for your presentations. Thanks also to Edwina for her presentation, reprinted in this issue. To Will and Thomas for destroying things and helping out. A big thankyou to CEGSA and the Scout Caving Group for lending us their gear so we could tie up trees. Finally, I hope that all found it a useful and fun filled process. I know, I did. Just keep practising and see you all soon at the next one.

RIGGING WEEKEND FEEDBACK

William's Comments:

Good things

- Overall this weekend was a very positive experience
- New skills learned by all
- Opportunity to play with new ideas for rigging without people waiting to go caving
- Good conversations and discussion of the club future
    - These weekends could serve in a similar fashion in the future
    - Different 'vibe' from a regular caving weekend may foster spirit of debate and discussion
- Excellent trainers and leadership
    - Very little negativity
    - Positive reinforcement
- Great to see so much different equipment
- Opportunity for people to try out leadership and training roles
- Good group of people
- Catered for multiple levels of competency
- Practical and theory mix
- Built my confidence

Things that could be improved

- Difficult to ensure everyone can develop at their own level
    - Had to cater for the lowest common denominator
    - Maybe assign different trainers to different levels of competency?
- Theory is a dangerous thing to teach after dinner

    - People will be sleepy
- Understandable that we had a lot to get through, but it would be good to have more time rigging actual caves
    - Focus on caves we go to: Sand, S102, VDC, etc.

Conclusion

- We should definitely do it again
- Thank you for putting so much effort in
- Great weekend.

Edwina's Comments:

Overall, I thought the weekend went well. It was fun, a lot was learned, and the practical component of setting up a real cave was unique and challenging. The latter I found was significantly different to simulations in that the lack of a pretend element meant I didn't have to think so much about where the cave was, I could just see it (or at least be aware of its rough location), and it was a constant presence in the back of my mind, so I was always conscious of whether I was too close to the cave or not. This never happened in simulations. I also found I was automatically nervous when I was at a distance I judged to be too close to the cave without a safety line – not so much as to cause problems, but just enough to make me highly aware of all the potential issues, help me see what I had to do to minimise them, and prioritise putting these fixes in place as quickly as possible. This slight nervousness, coupled with the innate awareness of the cave location, was a good thing, as it completely eliminated all the errors related to cave proximity that I had made in simulations. It was interesting to note that, at a real cave, the distance I considered to be safe enough to not require a safety line was much larger than the distance I was using in some simulations. Seeing the cave and being aware of its presence was very different to pretending a cave was there, both in how I reacted to it, and how I set things up.

In the simulations we initially set up ropes around trees just as practice, to get used to the knots and systems, etc. This is a good starting point, and I noticed that over time this naturally evolved into the more experienced people setting up more complex rigging just for demonstrations, or to debate the best way to go about solving a particular problem, or trying things out just to see how they work, or the pros and cons of a system, etc. I found these discussions useful and interesting, and a great way to share knowledge and perspectives.

One possible idea to expand on this would be to set up a series of challenges to simulate specific scenarios, i.e. organisers select a spot, mark out a pretend cave (so there's something visible, not just purely imaginary) and, if necessary, also mark some trees just to say "this tree is not part of this simulation, pretend it doesn't exist, or pretend it's too unstable to be used for anything". People would then be challenged to set up rigging they think is appropriate to that scenario using just their existing knowledge. People would cycle through the different stations, which would have a range of difficulties so beginners could stick to the easy ones, and maybe try out the occasional more difficult/complex challenge, while more experienced people could do just the trickier ones. This would account for the range of skill levels present, as well as get people thinking about how to solve particular problems, rather than just practice a general rig, although the latter would still happen, especially for beginners.

Setting up rigging at more (real) caves would be great too, although I recognise that time constraints mean this isn't always possible.

Andrew's Comments:

Overall, I think the rigging weekend was a success on many levels. Hard to judge how much people got out of the weekend until we get honest feedback. I do think people gained some knowledge, but without true criticism, we can't make any progress in the training delivered. I know there are a few things I would have changed in hindsight.

RIGGING WEEKEND FEEDBACK

I was quite surprised after a few training sessions/emails, that properly dressed knots were still a problem. Knots were all tied correctly, but it was difficult for folks to identify the dressing issues. Perhaps we should have a brief knot tying workshop a few times a year at the general meetings. We now have some dead rope that we can chunk up into pieces and practice to our heart's content, prior to, during or after a meeting. Really important to get good muscle memory in this department to save precious brain power for more daunting tasks (like how I get down this hole, where is the closest cafe, what time does the pub open?).

Rigging is a very dynamic process that requires thinking on your feet and pooling all of your previously acquired knowledge and skills (the tools in your toolbox) to the front of your brain; and using that information to best rig the pitch. There are a multitude of safe and appropriate ways to rig a cave, so it is difficult to do the same way. Trees (or cars or grates or whatever…) are not always going to be in the same place at every cave. It is very important to understand the systems involved in order to adapt to new and ever-changing environments. This is where I really valued the knowledge sessions. Understanding WHY we do things a certain way based on physics and the real dangers that exist, empowers you to make educated and safe decisions on the fly.

There would have been value in a tutorial/demonstration on basic rigging practices (one tree, belaying off that one solid tree), prior to setting people loose. I also think it would have been great to have spent more time at actual cave entrances. I know the group wasn't quite ready for a full day at the caves, but even a larger demonstration of "concepts" at the entrance to a cave would have had value. This would allow newer folks to ask questions about the decisions made on why we tied that knot there, or why we picked that tree, or why didn't we do this… I think this would have made for a nice final group session, where people could start to understand the complexities of rigging and the "on your feet" thinking that is required to make safe decisions in the field.

I was also extremely proud with the progress people made over the weekend. This is some confusing and complex shit! We all came to the table to learn, and I learned a ton! Thanks to everyone for the enjoyable weekend; I'm now finally caught up on my sleep :).

Thomas' Comments:

1. There was no clear 'curriculum' or agenda set at the start in terms of where we start and where we intend to end up.
2. There were 'animated' discussions among the instructing people about techniques which should have taken place before the workshop.
3. The 'simple rigging' lacked a safety line for the belayed person to approach the cave before they are placed on the belay rope. I appreciate that this was simplified scenario however it may have given the impression to some that the safety line is optional. In reality, 90% of our rigging usually requires a safety for the belayed person as well. Ideally, people should have left the weekend having progressed to also including a 2nd safety line.
4. SES oriented. While it is interesting to learn what the SES do, it is also important to consider what applies to a caving scenario and the audience involved.

Pros

1. Varied content.
2. Ample gear for people to use and play with.
3. Relaxed atmosphere.
4. Hands on demonstration involving destroying gear, ropes, etc.
5. I liked that people were able to practice on the grass with an imagined cave and bounce ideas off each other as well have access to instructors with questions.

RIGGING WEEKEND FEEDBACK

Neville's Comments:
I really enjoyed the weekend, starting with the pub dinner on the Friday evening that involved seven people including Clare & Heiko, Edwina & myself, Danielle from Naracoorte Caves and Sil Iannello & her friend Nina from the VSA.
On the Saturday, three or four FUSSI members, two VSA members and two Naracoorte Caves staff did rigging practice on the trees adjacent to the Wirreanda kitchen, while Clare, Tania and Andrew critiqued and assisted those members.
This was very useful and helped to ensure that people were at a similar standard by spending more time with those who needed help and less time with those who did not. We were also shown different rigging techniques that could be used in different situations. After that we returned to the kitchen area where we attended a session of demonstrations where various rigging tape failures were simulated, followed by an explanation of how the failures could have been avoided through adherence to best practice rigging procedures. I found the day interesting, well planned and professionally executed. The group worked well as a team and there were no issues.

On Saturday evening we enjoyed Indian and Chinese take-away cuisine or dinner, followed by more rigging related discussion and feedback from the earlier exercises. Once again well run and straight to the point.
The next morning, we broke off into two groups, one group to rig Beekeepers Cave, and the other to rig Brown Snake Cave.

I elected to go to Brown Snake Cave to rig that, as I felt it would be more interesting and challenging. Danielle and I travelled with Will in his vehicle, and Thomas followed a short while later, after he had spent some time dropping gear off at Beekeepers. Each of us took it in turns to rig the Brown Snake site, after which Thomas would check and critique. This worked well and was enjoyable for all participants. Once again very professional, but the best was yet to come when Tania rocked up with hot scones with jam & whipped cream, and a coffee or hot chocolate, for all. This was, of course, a reflection of the level of standard and care that many in FUSSI have come to expect, enjoy and appreciate.
After this, we met back at Wirreanda for a debrief, and gear sorting and packing, before returning home.

I was impressed by the organisation that had gone into making this a very smoothly run rigging learning weekend. It was useful, timely and enjoyable. It provided the essentials needed to extend our caving experience, as well as the skills to assist others that might get themselves into trouble at some stage.

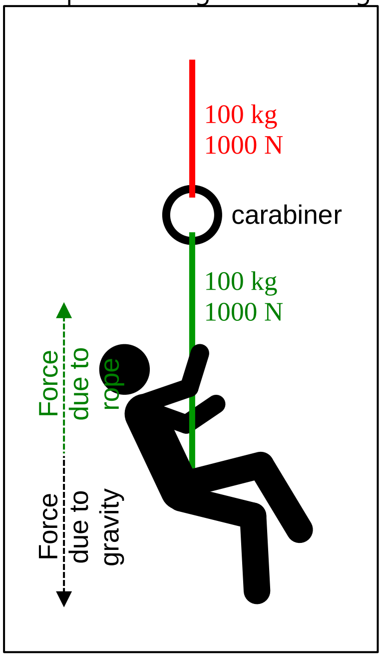
Many thanks to Clare for organising the weekend, to those who assisted Clare, and a special thanks to Tania for providing the scones to all in the field.

THE PHYSICS OF RIGGING

Edwina Virgo

This article aims to give its readers a good understanding of the basics of the forces acting on rigging ropes in different situations, to enable them to intuitively assess rigging, identify and minimise the forces involved, and help create the safest possible setup.

We'll start by considering the simplest possible case, just to help explain the terminology. In this example a 100 kg caver is hanging from a single rope, as shown in Figure 1.



At Left: Figure 1: A 100 kg caver hanging from a single rope.

There are two forces acting on the caver: one is the force due to gravity, which pulls them downwards, and the other is the force exerted by the rope, which pulls them upwards. The force due to gravity is perfectly offset by the force exerted by the rope, so the total force on the caver is zero, and the caver is stationary. These forces are quantities known as vectors, which means they have both magnitude and direction. Compare this to quantities such as mass or time, which have magnitude only, and are known as scalars.

Direction (or lack thereof) becomes important when you are adding quantities together, as demonstrated in Figure 2.

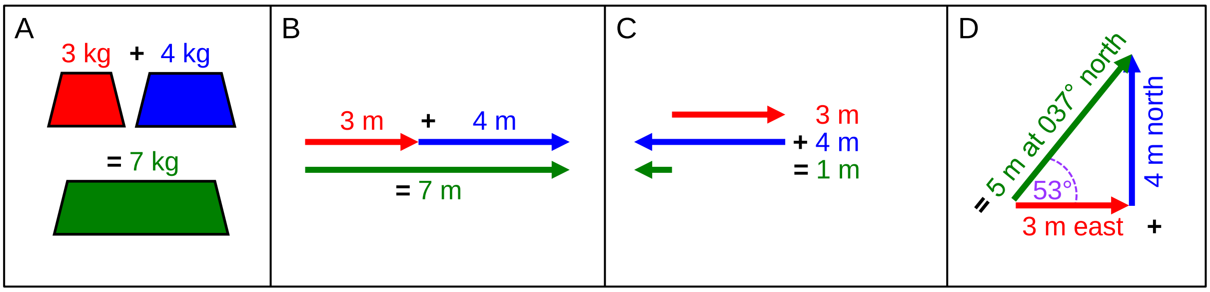


Figure 2: A comparison of the different ways that two quantities (red and blue) can be added together. Part A shows the addition of scalars (i.e. quantities with magnitude but no direction), while Parts B to D shows the addition of vectors (i.e. quantities with both magnitude and direction).

If there's no direction (Figure 2, Part A) then adding them together behaves exactly the same as the addition you've been taught since you first started school; e.g. if you hold a 3 kg object, then pick up a 4 kg object, then you are holding a total of 7 kg. Direction is not a factor. If the quantities all have the same direction (Figure 2, Part B), then adding them together is just as simple; e.g. if you walk 3 m east, then walk a further 4 m east, then you are a total of 7 m east of your starting point. If the quantities have directions that are parallel (Figure 2, Part C), then their addition is more complex, but still quite intuitive; e.g. if you walk 3 m east, then turn around and walk 4 m west, you will end up a total of 1 m west of your starting point. The situation becomes far more complex and counterintuitive if the directions are unrelated (Figure 2, Part D); e.g. if you walk 3 m east, then 4 m north, you will ended up a total of 5 m from your starting point, at a bearing of 037 degrees north. How we arrived at these figures will be discussed later, but for now, it's sufficient just to recognise that direction plays an important role, and forces can't be simply summed together in the standard manner you're used to.
Another important thing to be aware of is that force is measured in Newtons (N), but it's common to also see this expressed in kilograms (kg), as the two quantities can be related. A force given in kilograms

can be considered to be equal to the force exerted by a stationary object of that mass, when acted on by gravity.

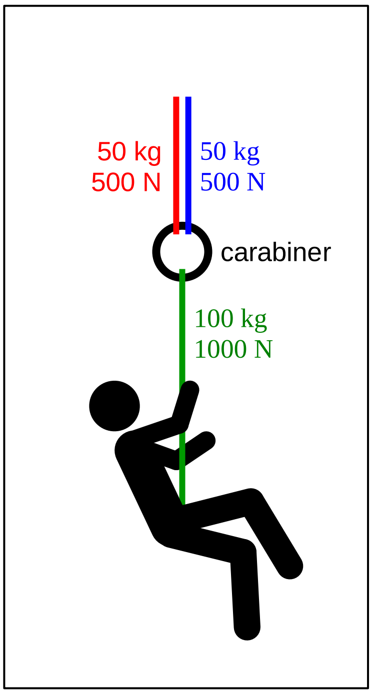
Mathematically, the force exerted on the rope by the caver in Figure 1 is given by:

$$Force = mass \times acceleration$$
$$F = m\,a \qquad \textbf{(Eq 1)}$$

Acceleration in this context means the acceleration due to gravity, which is approximately 10 m/s2 in any cave you're ever likely to visit (at least until astro-speleology becomes a thing). So a caver with a mass of 100 kg will exert of force of about 1000 N on the rope. Note that this only applies if the caver is not moving. If they fall and are suddenly halted by the rope, then they will exert a much larger force for a brief moment. We will discuss this scenario later in this article.

Note: some readers may recognise that the acceleration due to gravity is actually closer to 9.8 m/s2, rather than the more approximate figure of 10 m/s2 that we're using here. I consider this approximation acceptable because in most practical situations you are not going to have the means to measure all your masses, angles, distances and other variables to a sufficiently high degree of accuracy so as to get any real benefit from using an equally precise value for acceleration. A figure of 10 m/s2 also makes the maths easier to do in your head, allowing you to more readily estimate forces on the fly.

In our very simple example in Figure 1, the rope the caver is hanging from (green) is attached to a carabiner, which is attached by a single rope (red) to an anchor point. This means the entirety of the forces on the green rope will transfer through to the red rope, so both will take the full weight of the caver, and each will experience a force of 1000 N.



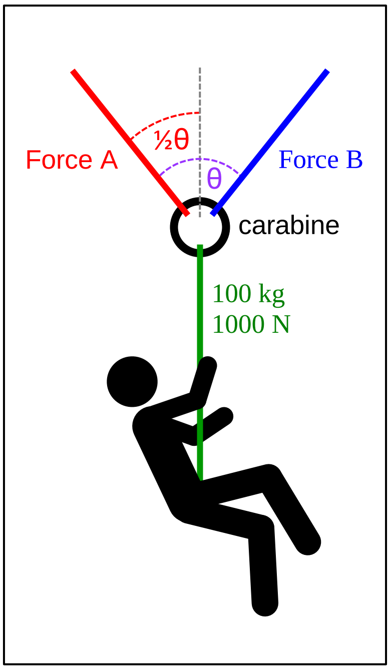
Let us now adjust our rigging to add another rope into the mix, as shown in Figure 3.

At Left: Figure 3: A 100 kg caver hanging from a single rope that is supported by two separate ropes.

The carabiner is now attached to the anchor point by two separate ropes (red and blue), all in a straight line, so instead of one rope taking all the force, it is split equally between two. The red and blue ropes therefore experience only 500 N of force each, instead of the 1000 N experienced when there was just one rope. The total forces on the system are unchanged, but just spread over more ropes.

This shows why it is just so important to have multiple ropes: it's not just a backup in case one fails, it drastically reduces the forces on the individual ropes, thus reducing the likelihood they will fail in the first place.

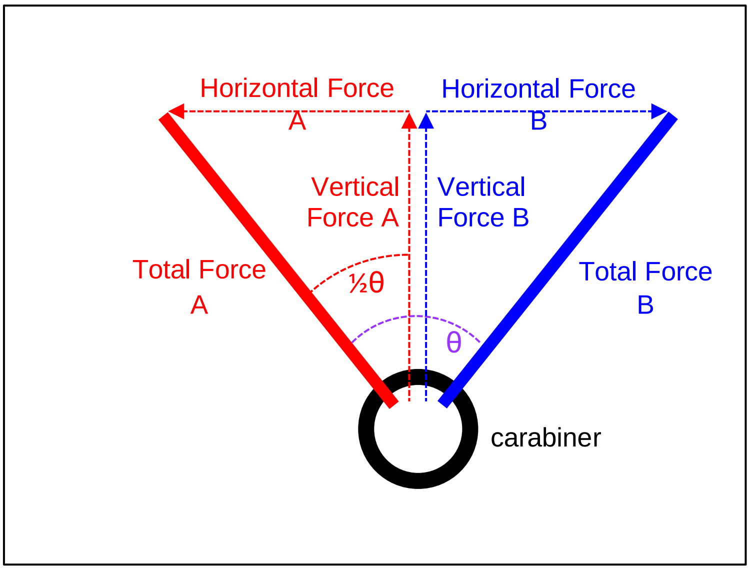
Let us now consider a more plausible example, in which there is an angle between the red and blue ropes, instead of being perfectly parallel. This new scenario is shown in Figure 4. We'll label the angle between the red and blue ropes as θ (theta) and assume the angle between each rope and a vertical dashed line (grey) is half of this (½θ).



At Left: Figure 4: A 100 kg caver hanging from a single rope that is supported by two separate ropes at an angle.

In this scenario it's useful to think of the force on each rope in terms of horizontal and vertical components, where their vector sum gives the total force, as shown in Figure 5.

Below: Figure 5:
Horizontal and vertical components
of the total forces on each rope.



The vertical component of the total force on a rope is equal to the force exerted by the weight of the caver, and is identical to what we would get if the red and blue ropes were vertical, which is what we saw in Figure 3. The horizontal component of the total force is the force required to pull the rope sideways away from the vertical position, and it depends on the angle the rope is at. The horizontal force on the red rope is perfectly counterbalanced by the horizontal force on the blue rope, meaning the total horizontal force on the whole system is zero, but the total force on any single rope is higher than what it would be if the ropes were simply vertical. The total force on each red or blue (anchor) rope can be derived using some basic trigonometry, and is given by:

$$Total\ Force = \frac{Vertical\ Force}{\cos(½\theta)}$$
$$F_{\text{anchor rope}} = \frac{F_{\text{vertical}}}{\cos(½\theta)} \qquad \text{(Eq 2)}$$

where the vertical force (F_{vertical}) is equal to half the force on the green rope (since there are two anchor ropes), which for a stationary caver is given by Equation 1, i.e.:

$$Vertical\ Force = ½ \times mass\ of\ caver \times acceleration[Gravity]$$
$$F_{\text{vertical}} = ½\, m\, a_{\text{g}} \qquad \text{(Eq 3)}$$

For those unfamiliar with trigonometry, the only important thing you need to know is that cos (or cosine) is a function that depends only on the angle between the ropes, and whose value varies from 1 to 0 in this setup. The result is that the total force is minimised when the ropes are near-vertical, and it exponentially increases as the angle between them increases. This behaviour is demonstrated in the graph in Figure 6, which plots the total forces on the red and blue ropes with respect to the angle between them. It assumes the caver hanging from the green rope is 100 kg. A few key points have also been illustrated to give a better visual demonstration of exactly what is happening to the rigging system as a whole.

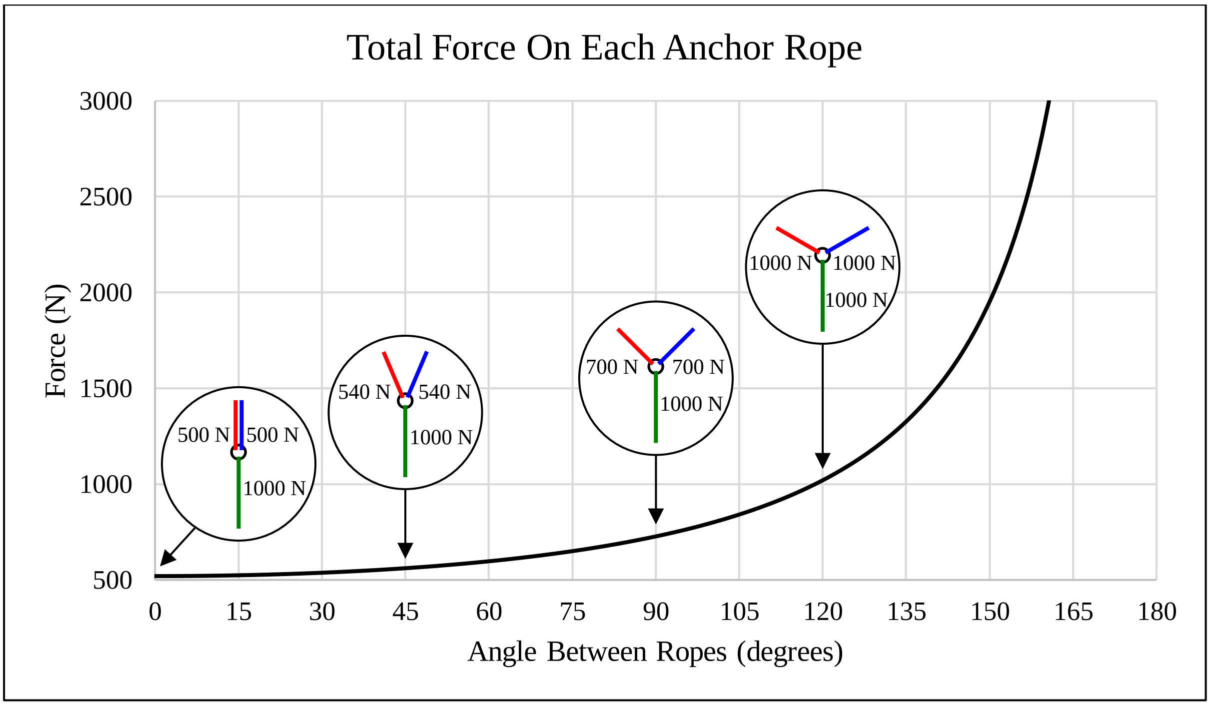


Figure 6: The total force on each of the red and blue anchor ropes as the angle between them changes. The green rope is supporting a 100 kg caver, who exerts a force of 1000 N.

This graph also gives a good quantitative demonstration of the IYT rigging method. In brief, IYT is a simple way of remembering whether the angle between the ropes is good, bad, or ok. If the ropes form a rough 'I' shape (i.e. near-parallel), the angle is Ideal, and the forces are minimised. In the graph we see this corresponds to a near-flat region at the beginning, where the forces barely increase at all. If the ropes form a rough 'Y' shape (up to 90 degrees), then Yes, it's ok. In this region of the graph we start to see the forces increase a bit, but still remain within acceptable levels. And finally, if the ropes look more like a 'T' shape, then it's Terrible (expect Trouble), and you should redo your rigging. The graph clearly shows that above 90 degrees these forces increase extremely rapidly and start to put unreasonable strain on the ropes. In general, you should aim to have the angle between the ropes be as small as is practically possible so as to minimise the forces involved, and always less than 90 degrees.

So far, we have only considered a stationary caver, i.e. where the only force they exert on the rope is solely due to their mass. We will now consider what happens if they are in motion, such as if they fall, and are then caught by the rope. The green rope in Figure 4 now needs to support both the original force due to the weight of the caver and provide an additional force to stop their fall. The maths behind this is a little complex, so for now I will simply give the result, and instead provide a full derivation in the appendix, for anyone who wants to know where this comes from.
The total force on the green rope when the caver falls is given by:

$$\begin{aligned} \mathit{Total\ Force} &= \mathit{mass} \times \mathit{acceleration}[\mathit{Gravity}] \\ &\quad + \frac{\mathit{mass} \times \sqrt{2 \times \mathit{acceleration}[\mathit{Fall}] \times \mathit{distance\ fallen}}}{\mathit{time\ it\ takes\ to\ stop}} \\ F_{\text{main rope}} &= m\, a_{\mathrm{g}} + \frac{m \sqrt{2\, a_{\mathrm{f}}\, d}}{t_{\mathrm{s}}} \end{aligned} \qquad \text{(Eq 4)}$$

As before, acceleration [Gravity] (a_{g}) means the acceleration due to gravity (approximately 10 m/s2), and the new term acceleration [Fall] (a_{f}) is the acceleration experienced by the caver while falling. If the caver is in free-fall this is exactly the same as the acceleration due to gravity, but if the caver is able to slow their fall in some manner then this will be less. This could include things like sliding down a steep slope instead of falling freely, or using a friction device like a whale-tail. The time it takes the caver to stop after the rope takes hold (t_s) will depend on factors such as the stretch of the rope, and may be further complicated by things like how much they bounce when the rope catches them, etc. For simplicity, we're going to assume these factors are minimal.

To get the total force on the red or blue anchor ropes in Figure 4 we use Equation 2, where the vertical force is equal to half of Equation 4. See the appendix for more details.

To demonstrate how a fall can change the forces on the red and blue anchor ropes, a few different scenarios have been modelled in Figure 7. This includes falls ranging from very minor (10 cm, 30 cm) to moderately large (1 m, 2 m), as well as a stationary caver (**no fall**) just for comparison. These models assume a 100 kg caver, and a relatively short stopping time of 0.2 seconds. From this graph it's clear that even a tiny stumble like 10 cm is enough to significantly increase the forces on the ropes. This shows that it is essential that you design your setup such that both individual ropes, and the rigging system as a whole, are capable of tolerating forces far in excess of what they would experience during typical usage.

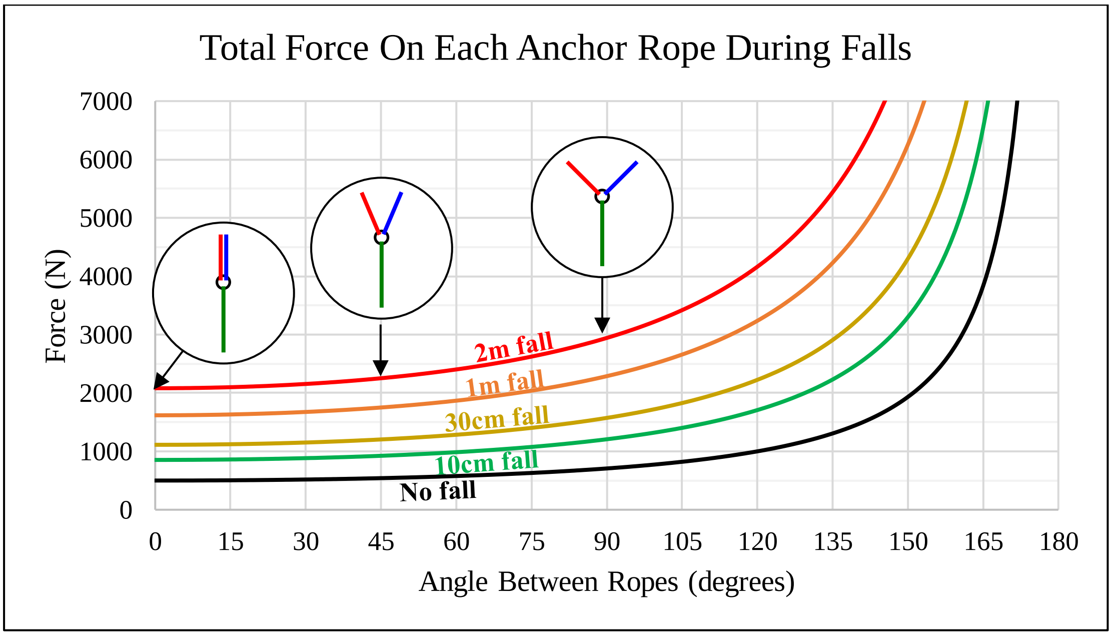


Figure 7: The total force on each of the red and blue anchor ropes when various falls take place. The green rope is supporting a 100 kg caver. If no fall takes place, they exert a force of 1000 N on the green rope, as in Figure 6, but this force is much higher if even a small fall occurs.

In this article we have now covered several of the fundamental concepts of how forces behave, and how this applies to ropes and rigging. Although this has been at times complex and counterintuitive, it is hoped that this gives the reader sufficient background to understand some of the underlying factors, and therefore better judge the safety of ropes and rigging, recognise issues before they arise, and optimise their rigging setup.

If the reader has any further questions, or would like clarification on anything, I encourage them to contact me via FUSSI, and I would be happy to explain things further.

Appendix

THE PHYSICS OF RIGGING

The following is a derivation of the equation for the total force experienced by the green rope in Figure 4, when the caver falls. It is not essential to understand where this equation comes from in order to understand this article, so readers are welcome to skip this section if they wish.

The force on the green (main) rope will depend on the distance the caver falls, which is given by one of the Equations of Motion:

$$d = \frac{1}{2} a_{\mathrm{f}}\, t_{\mathrm{f}}^2 \qquad \textbf{(Eq A1)}$$

where a_{f} is the acceleration experienced while falling (which may or may not be the acceleration due to gravity), and t_{f} is the time the caver spends falling.
This can be rearranged into the form:

$$t_{\mathrm{f}} = \sqrt{\frac{2\, d}{a_{\mathrm{f}}}} \qquad \textbf{(Eq A2)}$$

The speed of the caver at the end of their fall, the instant before the rope catches them, is given by:

$$v = a_{\mathrm{f}}\, t_{\mathrm{f}} \qquad \textbf{(Eq A3)}$$

If we substitute Equation A2 into Equation A3 it becomes:

$$v = a_{\mathrm{f}} \sqrt{\frac{2\, d}{a_{\mathrm{f}}}} = \sqrt{2\, a_{\mathrm{f}}\, d} \qquad \textbf{(Eq A4)}$$

In general, the force on an object is given by:

$$F = m\, a = m \frac{(v_{\mathrm{final}} - v_{\mathrm{initial}})}{t} \qquad \textbf{(Eq A5)}$$

where m is the mass of the object, and a is the acceleration it experiences. In the second part of this equation we have written acceleration in terms of a change in speed over a given time period, where v_{initial} is the object's initial speed, v_{final} is its final speed, and t is the time it takes to change from the initial to the final speed.

When a rope breaks a caver's fall, their initial speed will be given by Equation A4, and their final speed will be simply zero. Substituting this into Equation A5, we find that the force on the caver when their fall is stopped by the rope is given by:

$$F_1 = -m \frac{\sqrt{2\, a_{\mathrm{f}}\, d}}{t_{\mathrm{s}}} \qquad \textbf{(Eq A6)}$$

where m is now the mass of the caver, and t_{s} is the time it takes for the rope to bring them to a stop.
When the above force is exerted on the caver by the rope, then likewise an equal and opposite force will be exerted on the rope by the caver. The rope therefore experiences a force given by:

$$F_2 = m \frac{\sqrt{2\, a_{\mathrm{f}}\, d}}{t_{\mathrm{s}}} \qquad \textbf{(Eq A7)}$$

This is in addition to the force required just to support the weight of the caver, which is given by:

$$F_3 = m\, a_{\mathrm{g}} \qquad \textbf{(Eq A8)}$$

where a_{g} is the acceleration due to gravity.
The total force experienced by the green (main) rope in Figure 4 when the caver falls is therefore given by:

$$F_{\mathrm{main\ rope}} = m\, a_{\mathrm{g}} + m \frac{\sqrt{2\, a_{\mathrm{f}}\, d}}{t_{\mathrm{s}}} \qquad \textbf{(Eq A9)}$$

where m is the mass of the caver, a_{g} is the acceleration due to gravity, a_{f} is the acceleration the caver experiences while falling, d is the distance fallen, and t_{s} is the time it takes for the rope to bring the caver to a stop from the moment it starts to take their weight.

To work out the subsequent force on the red or blue anchor ropes, we use Equation 2 from earlier in this article, i.e.:

$$F_{\text{anchor rope}} = \frac{F_{\text{vertical}}}{\cos\left(\frac{1}{2}\theta\right)} \qquad \textbf{(Eq A10)}$$

where θ is the angle between the red and blue ropes, and the vertical component of the force is given by:

$$F_{\text{vertical}} = \frac{1}{2}\, F_{\text{main rope}} \qquad \textbf{(Eq A11)}$$

The total force experienced by the red or blue rope in Figure 4 when the caver falls is therefore given by:

$$F_{\text{anchor rope}} = \frac{m\, a_{\mathrm{g}} + m\dfrac{\sqrt{2\, a_{\mathrm{f}}\, d}}{t_{\mathrm{s}}}}{2\,\cos\left(\frac{1}{2}\theta\right)} \qquad \textbf{(Eq A12)}$$

where the meanings of the terms are the same as for Equations A9 and A10 above.

HOW TO TIE UP YOUR CAVE

Sil Iannello

With thanks to Nina for reviewing and comments

FUSSI SRT Rigging Training Weekend 24th to 25th August 2019. Wirreanda Bunkhouse Naracoorte, South Australia, Beekeeper Cave (5U15), Wombat Cave (5U58), Brown Snake Cave (5U14). **Attendees:** Neville, Clare, Heiko, Thomas, Tania, Nina, Sil, Barb, William, Andrew, Daniella, Edwina

The first FUSSI rigging training weekend went off with a hoot! Held over two days at the customary Wirreanda Bunkhouse and surrounds, it was jammed packed full of learning and good times. Arrival of members commenced on Friday evening with a group meeting at the Naracoorte pub for dinner. Other members trickled in over the evening to settle in at the bunkhouse for a 9am start.

Nina, Edwina, Clare, Neville, Andrew, Daniella and Heiko at dinner. Photo: Sil Iannello

Training topics and exercises covered over the weekend included:

- Bomb proof rigging
- All about ropes including terms, calls and knots
- Rigging equipment
- Rigging a backup anchor
- Safety, safety, safety whilst rigging
- Scenario exercise on why not to rig a particular way
- Evening presentations
- Inspecting gear; rope and webbing
- Rigging at Beekeepers Cave, Wombat Cave, and Brown Snake Cave

Additional: The group was supplied with training course notes, a useful resource to look back on, thanks FUSSI.

Day 1: Introduction to rigging the FUSSI way!

The morning started off with Clare introducing the activities for the weekend as well as distributing and discussing training course notes. These included the FUSSI, daily trip log in procedures, ASF safety guidelines, personal caving log, ropes and what not to do with them, rope calls and knots.

The first topic off the rank included rigging a rope, ladder and a belay using the Keep It Simple method. Following on from this, the group gathered around outside where Andrew and Clare had set up 9 rigging kits loaded with:

- 4 webbing tapes
- 4 Karabiners – two for the caving ladder (aluminum) and two for webbing (metal)

Rigging equipment used during training set out for each participant: Photos: Sil Ianello

HOW TO TIE UP YOUR CAVE

- Stitch plate – Belay
- Carpet – for gear and tree protection
- Caving ladder with a trace
- Velcro rope protectors and ground tarp
- Rope 11m l (30m)

Each participant gathered around a kit, whilst Clare provided a rundown of the gear, and where rigging was going to take place. The aim of the rigging was to practice setting up two safety lines, a ladder and a belay line. The knots used included a tape, figure eight and an alpine butterfly. The setup of the rigging was to be repeated at different tree locations, until we were comfortable setting up the rig without assistance.

The first step to rigging a bomb proof anchor was to find a bomb proof tree! Lucky, we had some good examples of this just a stone's throw away from the bunkhouse. Selecting the right tree was not complex, at the very basic level we looked for durability and a decent girth as well as conducted a visual tree inspection before we started. This was to ensure that we were aware of any hazards that may be lingering above our headlines and surrounding the tree. To assess for tree durability, inspect the physical characteristics for example, base of the tree for erosion, and the trunk to ensure it's not rotted away or dead.

William demonstrating bomb proof FUSSI rigging.
Photo: Sil Iannello

Before getting started, William provided a demonstration on how to set up basic rigging with a belay line and cave ladder with a trace. This was a useful demonstration because it displayed how to set up the equipment.

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Andrew taking rigging very seriously and, on right, helping with a ladder.
Photos: Sil Iannello

Above: Left: Basic Rig. Centre: a ladder with a trace showing the use of two karabiners to hold the sides of the ladder in place to prevent sideway pulling, Right: Two anchors, two safety lines, and a belay line. Photos: Sil Iannello

Why Not to Rig a Particular Way?

Bomb proof rigging training concluded around lunch time, with the next session being a scenario-based exercise on *Why Not to Rig a Particular Way*, this was to demonstrate how failures in the rig system can occur. Before getting started, we had lunch and I was amused once again for FUSSI's love for coffee when William started complaining that I did not bring the coffee machine that was used on the last trip. FUSSI loves coffee! Others were mingling outside, talking gear and knots around the webbing that was set up for the different rigging scenarios.

A series of webbing and ropes were hung from the veranda composing of eight different rigging set ups. One by one each rig was weighted with a 40kg bag of rocks and then *cut to simulate a failure of either, the anchor, or the tape or the knot*. The demonstration revealed how a failure in just one spot could affect the entire rig setup.

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Failed rigging set ups included:

1. Single tape loop test on 1 karabiner – Failure of the tape.
2. Two tapes in a cross-formation test on 1 carabiner – Failure of the tape.
3. Two tapes with two carabiners – not in a cross formation, just independent of each other – Failed.
4. Nullarbor death knot – non-traditional style of threading a tape knot – this scenario had a backup with a normal tape on a carabiner. Death knot Failed
5. Bunny ears incorrectly loaded; 'ears' in extreme - more than 90 degrees – Failed
6. Bunny ears correctly loaded but still failed.
7. Y angle – the bigger the Y the significantly higher the force is put on the system causing it to fail.

Photo above: Webbing and ropes hung from the verandah composing of eight different rigging set ups.

Photo Below: Bunny ears in extremis as per 7.
Photos taken by Sil Iannello

Important things to Note:

- A way to remember the best angle for a multiple anchor system is the letter **IYT,** which refers to the pattern made by the slings and rope.
- **I** – Ideal (less than 90-degree angle,
- **Y** – Yes (the angle is 90 degrees and is ok),
- **T** – Trouble (angle greater than 120 degrees is not suitable)

Alpine butterfly – directional knot to be used in the middle of the rope and not a figure 8 because Figure 8s' deform on load in a midline situation.

HOW TO TIE UP YOUR CAVE

At right: William taking rigging and cutting webbing very seriously. Photo: Sil Iannello

At Right: Impressive gear storage solutions. The Scout Caving Group's gear roll. Photo: Sil Iannello

How to Inspect Gear

The next session after having an eye opener of how rigging fails, was inspecting your gear. This was a great exercise because it demonstrated what to look out for when you need to retire gear.

HOW TO TIE UP YOUR CAVE

Points learnt from this session included:

1. Webbing and Velcro are not friends. If you have rope protectors or any other gear with Velcro do not put these two together including in the wash. Or in your rigging bag! Post contact, webbing will show a sign of fuzz/fluffing, this demonstrates that webbing strength is compromised as per photo below.

At left: What webbing looks like when it has come in contact with Velcro. Photo taken by Sil Iannello

2. Shelf life of a rope.

If you have not recorded the date you purchased your rope you can check for a Batch Marker Colour located internally in the rope. Blue Water Australia for example, prior to May 2014, TWO marker colours were used. From May 2014 onwards, three marker colours are used to permit the manufactured date to be placed with a three-month period.

More info go to:
www.spelean.com.au/downloads_a.html

For a good article to read on rope shelf life go to:
www.paci.com.au/downloads_public/PPE/13_Rope_shelf_life_PToomer.pdf

3. Rope. A visual inspection, feel test, and loop forming check was practiced inspecting the rope for any defects.

At left. Edwina, Barb, and Daniella practicing a rope inspection. Photo: Sil Iannello

Pulley Rig Systems / Equipment

Next excircse Tania demonstrated how to set up and use a Z drag pulley system using mechanical devices, used in rescue scenarios with the SES. Devices used: pulley, rope mate, prusik minding pulley, no worries descender.

Below: Tania demonstrating how the Z drag pulley system works with mechanical devices.
Photo at right shows a Ropemate with Karabiner and Pulley.

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Photos: Sil Iannello

:

Mechanical devices starting from the left, pulley, rope-mate,
prusik minding pulley, No-worries descender. Photo: Sil Iannello

The day concluded around 5pm, with everyone settling in for the evening around some Chinese and Indian food and listening to presentations.

Evening Presentations

Evening presentations started off with Tania. The presentation covered a review of the types of devices and equipment used in caving as well as on rope safety calls.

1. Up and Down
   - In line Descending devices: the Petzl Stop and how parts can be replaced when they wear out
   - Rack – 3, 4 or 6 bars
   - Belay devices; Petzl Tubular and Sticht plate
   - Carabiners – steel for rigging only

- Spelean Whaletail
- Descender – Figure 8. Does not get used in caving, as it puts twists in rope
- Ascenders – Hand and Petzl Croll
- Carabiners, straight gate, oval clip gate
- Calls – Gear check, rope below, on rope, belayer ready, take in, that's me, climb when ready, climbing, safe, off rope
- Safety calls – Below! – STOP

2. The Physics of Rigging

Presented by Edwina, was a comprehensive talk on rigging which covered

- Forces
- Loading
- Vectors and
- Statistical information

3. The ASF Codes

Andrew presented an overview of the Australian Speleological Federation's codes including

- Ethics
- Landowner and management authorities
- Caves:
- General – leave no trace
- Minimal Impact caving Code
- ASF Diving Code.
- Safety Guidelines:
- Planning and Preparation
- Belay, Ladders, Climbing, SRT.
- Party Leader Responsibilities
- Individual Responsibilities
- Personal Equipment
- Bottom line.

4. Rigging in Caves – What Works and What Doesn't Work

Clare's presentation reviewed caving gear, ropes and rigging

Caving Gear

- Safe and has to do the job
- Reliable
- Durable
- Easily cleaned
- Comfortable
- Identified as yours
- Store correctly
- Store records – including all use

Ropes Record:

- Purchase date and cost
- Type/make of rope
- Where and how was it washed.
- Its Length
- Its Use: i.e., used to tie down the load on the trailer.
- Things not to do with ropes:
- Store wet or dry in direct sunlight.
- Tread on them.
- Two types of ropes: dynamic and static
- Problems with dynamic rope in a cave environment
- Characteristics of static nylon Kernmantle rope
- Rope & knots terms: working end, standing end, bight Vs loop, dressing knot

Rigging

- Safety of the rigger comes first
- At least two back-ups
- Bomb proof anchor
- Bomb proof backup anchor

Overnight the classy act of FUSSI shenanigans detailed the finest Glenlivet Malt Scotch Whiskey, beer, wine and the not so classy good old Jimmy Beam. FUSSI members stayed up late discussing many global problems. If only they could have remembered the solutions that they thought of.

HOW TO TIE UP YOUR CAVE

Nina and Sil use meditation to help pack the gear.
Photographer is unknown

Day Two, Off to the Caves:
Cave descriptions from the *Australian Karst Index.*
Beekeepers Cave at Upper South East (5U15)
Entrance is pothole type; (3 entrances); development is large passages and domes interconnected through small low-level section; length is 670.0 m, vertical extent is 18.00 m

Wombat Cave at Upper South East (5U58)
Entrance is pothole type; development is large interconnected chambers; length is 150.0 m.

Brown Snake Cave (5U14)
Entrance is pothole type; development is large rockfall chambers and passages leads from deep tube; length is 360.0 m, surveyed; vertical extent is 20.00 m

The final morning of this jam-packed weekend involved an early start as we all grabbed our rigging kits and headed off to rig a vertical cave entrance pitch. William and Tania volunteered to do a coffee run - there was mention of some more homemade scones from the Caves Café, whilst the others split up to rig different caves. Myself (Sil), Nina and Andrew headed off to Beekeepers Cave and with all the 'let's get going' excitement it soon transpired that we had arrived at our cave with no rope. Lucky, we had our trusty UHF radios (aka walkie-talkies) to get some rope from another group.

HOW TO TIE UP YOUR CAVE

Sil, trying to tie up her cave!

At Beekeepers Cave, we all got a chance to test our new knowledge contending with awkward slopes, scrubby undergrowth, even a patch of rain. It turns out our bomb proof trees don't always grow in the most ideal locations and entrance pitches may have any number of added complications or inconveniences. The final test was a success in solidifying all our new knowledge – even if it left us all with itchy fingers, peering into the dark entrance pitches we had just rigged.

Back at Wirreanda, we packed and cleaned before departed ways for our journeys home. Thanks to everyone who helped contribute to the weekend, all the knowledge, setup, resources and equipment. Special thanks to Clare and Tania for their expertise. Until the next time FUSSI - Over and Out

Top-class: Neville, Tania, Edwina, William, Nina, Andrew.

Middle-class: Clare, Daniella, Heiko (missing), Barb, Sil.
Lower-class: Thomas

SPELEO IN THE PUB

William Cooper

For years, scientific and adventuring clubs have been hosting nights in the Flinders Tavern to engage members and convince the public to join. For years, FUSSI has slumbered, waiting for the time to make our debut.

Eventually, I got around to organising a Speleo In The Pub event at the Uni Tav and found that, though event planning will never be my cup of tea, the night went ahead wonderfully, and everyone seemed to have a great time.

Aside from food and booze, the main entertainments were two speeches from highly experienced and much-loved cavers, and a showing of a David Attenborough program on caves - which we managed to get going after struggling with technology for far longer than was dignified. Tania Wilson was the first speaker and gave an introductory talk on cave formation and the different types of caves. Though I like to pretend to be a seasoned spelunker, there was a lot of details that I didn't know, and it left me with many more questions to bombard her with the next time she is foolish enough to follow me into a hole in the ground. Dee Trewartha went next and gave a humorous account of what someone could expect when they come caving with FUSSI. I wouldn't say she scared anyone off, but the one member of the public who attended did leave shortly afterwards...

In all, the inaugural Speleo in the Pub could be classed as a great success and FUSSI will hopefully put another one on before the end of the semester.

WHAT IS ON

EXAMS 11th - 22nd Nov

YEAR BREAK 25th Nov – 22nd Feb 2020

Sat Oct 26th	One Day trip	Corra Lynn Trip. Dee Coordinating. Beginners welcome.
Thurs Nov 21st	6.30pm TBC:	Talk on Hydrology. Professor Todd Rasmussen. Hydrology & Water Resources. University of Georgia, Athens or Map reading, with compass and paper. Sarah and Tania coordinating.
Dec 7th-8th		Mt Gambier trip. Sarah Coordinating.
Sun Jan 12th	11am onwards	New Year's get together. Venue TBC.
Jan 18th – 26th. 2020		Buchan Caves Vic. Vertical experience would be useful. Sil and Clare Coordinating *Dates Confirmed.*
Feb 24-28th		O'Week, Stalls. Help needed.
March 1st		Murray River Beginners Trip. Thomas Coordinating.

March 2nd 2020 SEMESTER 1 STARTS