

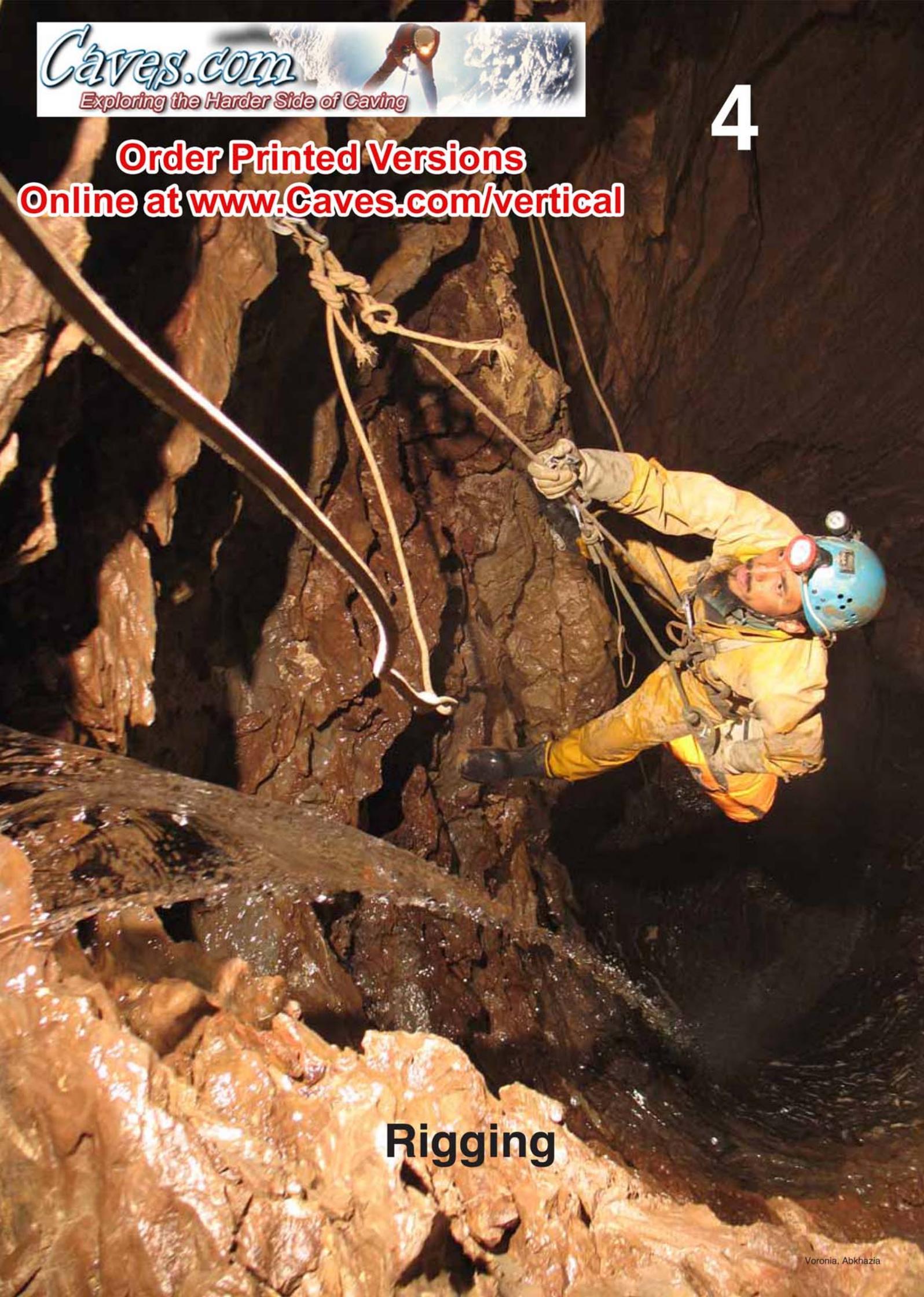
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*Exploring the Harder Side of Caving*



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**Rigging**

Rigging is technically the most demanding part of vertical caving but no matter how difficult a cave is, rigging must conform to three basic constraints.

1. Safety
2. Negotiable by the whole party
3. Conservation

There are two broad styles of rigging that I will call Alpine and Indestructible Rope Technique (IRT). Both styles have a lot in common—they are after all trying to accomplish the same thing. Nevertheless, practices that are acceptable in one style are often regarded as dangerous in the other. This is nowhere more evident than the concept of allowing rope to be hung in contact with the rock: taboo in Alpine rigging and the norm in IRT.

### Alpine rigging

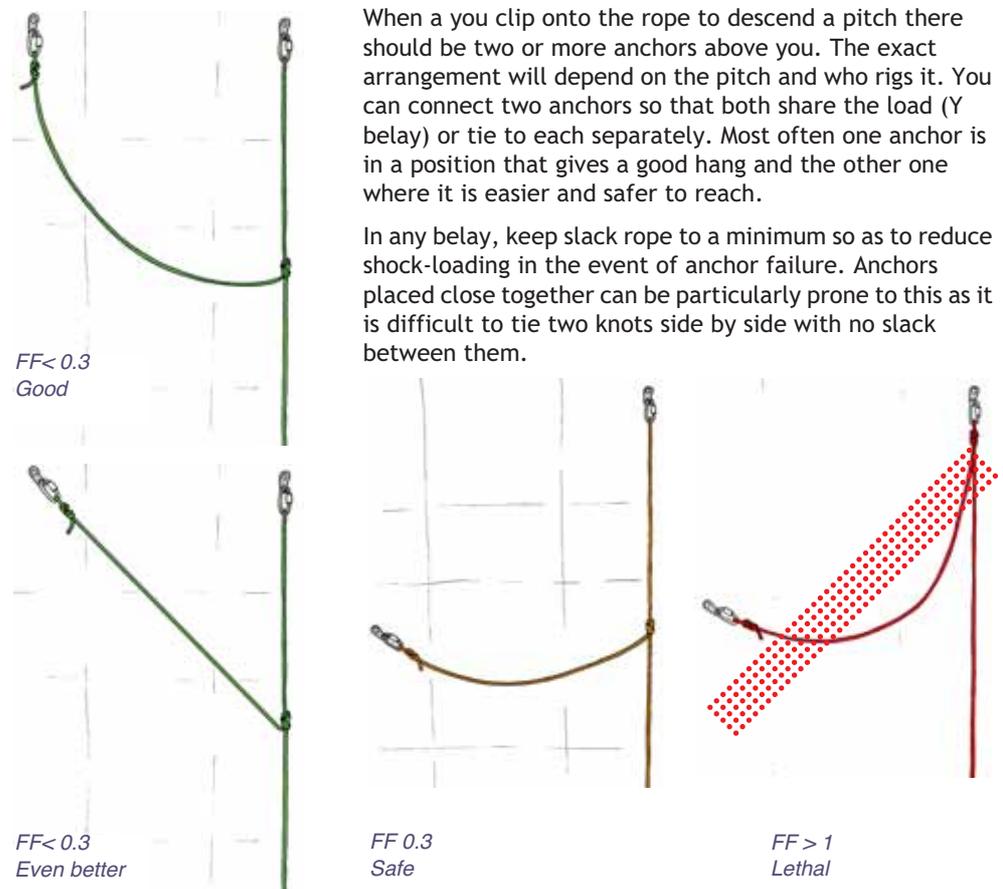
The aim is to keep the rope free of the rock at all times and a safe distance away from water and loose rock whenever possible. Often it is necessary to go to great lengths to achieve this but allowing a thin rope to rub on sharp rock is suicidal.

### Anchors

To obtain a free hang and have the rigging negotiable by the whole party usually demands extensive use of artificial anchors. To hang the rope just right often requires an anchor in a specific spot and there may not be a natural anchor there.

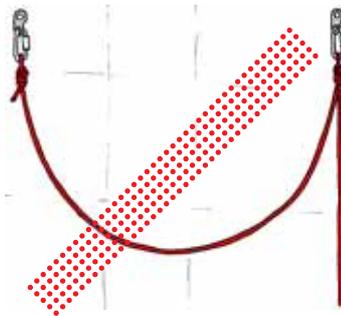
Most pitches require two anchors at the top so as to form a belay that has minimal risk of failure. Possibly one will be a little back from the edge and the other out where it will give a good hang. Below that, you may have to place other anchors as rebelay to keep the rope hanging free to the bottom.

### Primary anchors





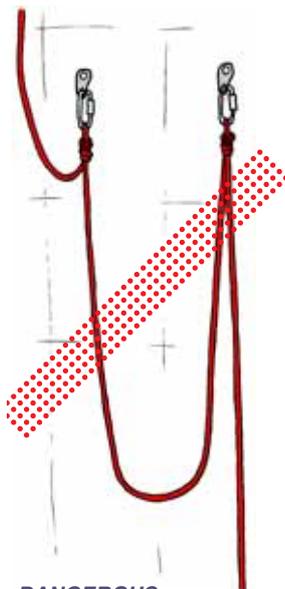
Good



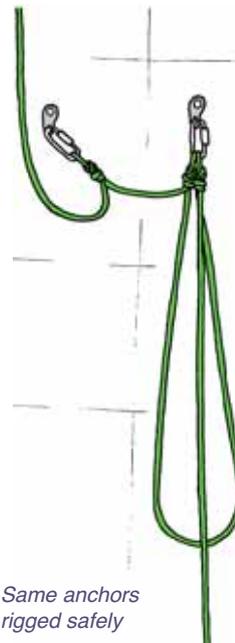
Danger!

Place double bolts at least 30 cm apart to avoid any interaction between the stressed areas of rock caused by the bolts. Anchors more than 30 cm apart are also easier to rig with minimal slack.

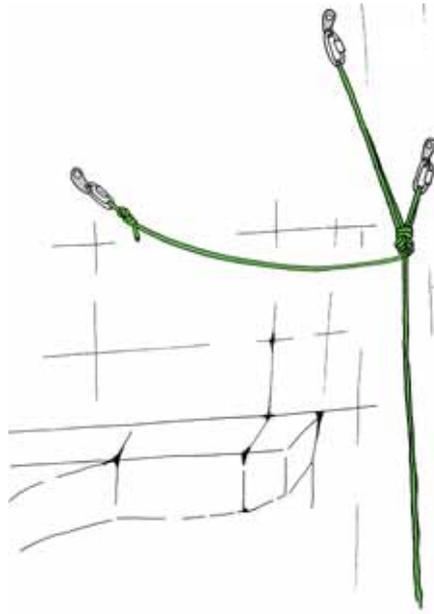
Never rig two anchors that are side by side with a stand-in loop between them. A FF1 fall is possible should either anchor fail! They will be safer if you rig them with a tight sling between them or tie the rope tight and rig the stand-in loop from one or other anchor. In any double anchor belay the individual anchors must be totally independent.



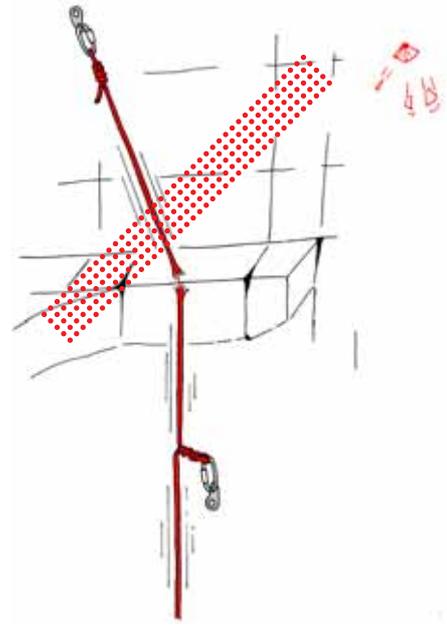
**DANGEROUS**  
stand-in loop



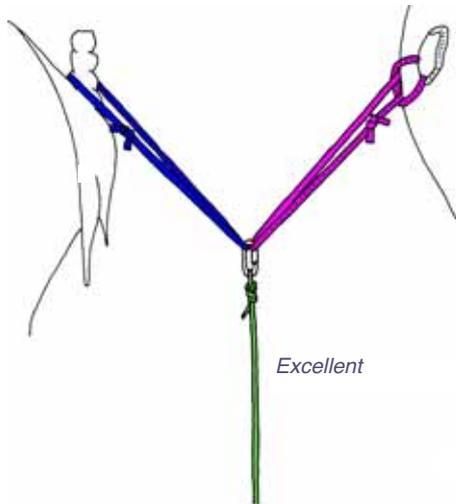
Same anchors  
rigged safely



The back-up line must **always** be protected from the possibility of failure

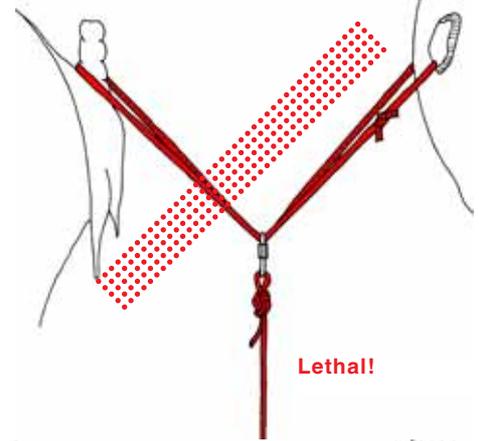


At the same time you must protect the rope from sharp edges should the lower anchor fail even if it involves putting in a double anchor, removing the sharp edge or rethinking the entire belay.

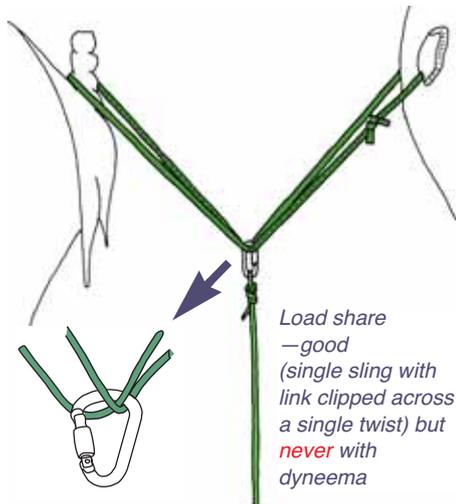


Excellent

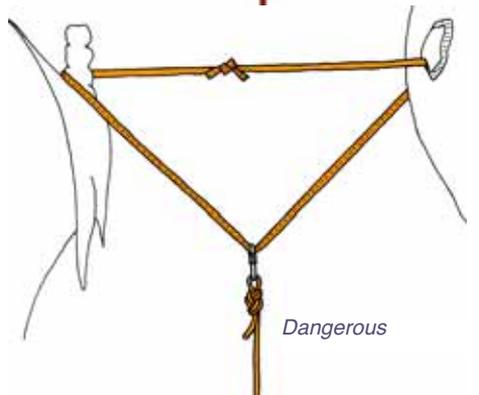
It would be disastrous if the failure of one anchor automatically led to the failure of the other. If you use dependant anchors like the *Lethal!* rig below, you must regard them as a single anchor. A single twist of the sling to form an '8', then clip hole to hole across the '8' turns this dangerous rigging into a good one.



Lethal!

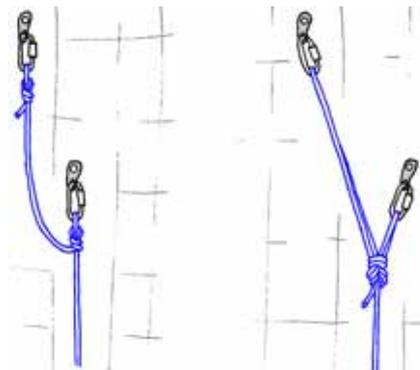


Load share —good (single sling with link clipped across a single twist) but **never** with dyneema



Dangerous

Y belay



Superimposed anchors

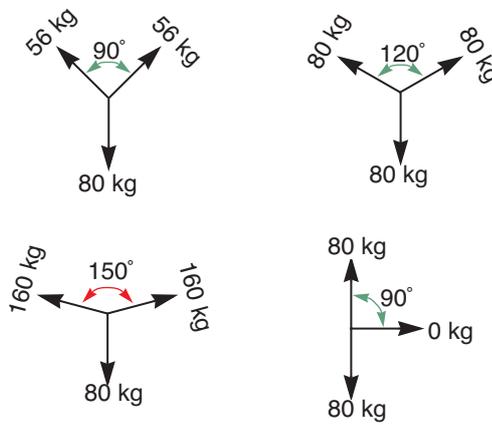
Y belay

An obvious extension of double anchors is the Y belay where both anchors are always loaded. In theory, each anchor bears a less than full load and therefore has a lower chance of failure. In the unlikely event of an anchor failure, the other arm of the 'Y' would take the load without being shock loaded, thereby maximising its (and your) chances of survival.



'Classic' Y belay

Sharing the load between two anchors does not divide it in half. Too great an angle between the arms of the 'Y' will only serve to overload both anchors simultaneously. Keep the angle below 90° and 120° is certainly the upper limit. Keep in mind also that most plate type bolt hangers should not be loaded at more than 45° out from the wall and use ring hangers if this is a problem.

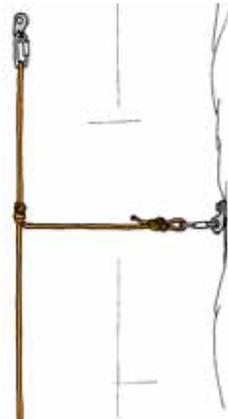


Y belay anchor loads

Y belays are ideal for situations where a single anchor on either wall of a narrow pitch would not give a free hang while a 'Y' with an anchor on each wall creates a belay in mid air. Sharing the load between two or more anchors - as well as backing them up well and having minimum slack in the system - is advisable when the anchors are of dubious quality.

Y belays are versatile, you can use them whenever there are two anchors at about the same level. Like anything though, don't get carried away with it—use what is appropriate to the situation. Just because a belay is mechanically safe it shouldn't be awkward to pass or use excessive rope or anchors.

### Asymmetric Y belay



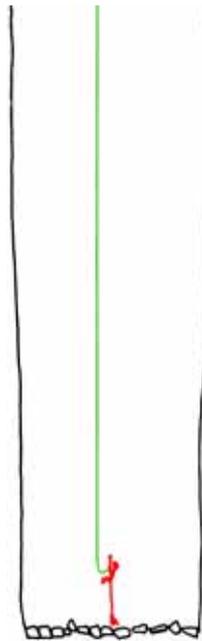
Only just a Y belay

You can vary the position of the arms of the 'Y' to the extreme that one of them approaches the horizontal. Do not exceed this though, as once the knot at the centre of the 'Y' is above either anchor a greater than FF1 fall is possible. A ring hanger is necessary if the lower anchor is a bolt that takes some load.

### Knots for Y belays

Arranging a Y belay can be problematic for the unpracticed and there is a vast range of possible knot configurations. Often the easiest to tie and adjust is a separate sling. When no sling is available, you can use the rope, though this is less economical on gear. Most often a double end loop knot is used, the [Double Figure-8 knot](#) being the most adequate although the [Bowline on a Bight](#) is easier to adjust and uses a little less rope if you are using a rope of 10 mm or more.

### Back-up anchors

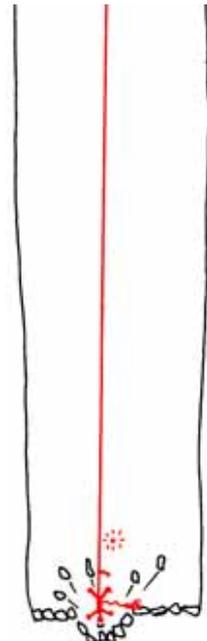


As often as not the primary anchor will be in a position that is not safe to reach without a safety line. You must 'back it up' to another anchor in a less ideal position but is safe to reach.

The back-up may constitute the second anchor at a pitch top or it may be the anchor for a handline out to a double anchor primary belay. As well as providing security for the primary belay, you can clip a cowstail to the line for safety while moving out to the descent rope.

When pitches come one after another you can use the rope from the previous pitch as the back-up for the next pitch. So long as you make sure that if the lower anchor does fail the back-up will take up before you hit bottom.

This is especially relevant when a small pitch follows a big one. If in doubt use double anchors and only use the previous rope to make them safer and easier to reach.



### Rebelays

If the rope hangs from the primary belay to the bottom without hitting the wall or being hit by water then the pitch is rigged. If the rope touches rock or there is water on the pitch you may need a rebelay (intermediate anchor) to keep the rope hanging free or allow you to swing sideways. The usual rule is to place the rebelay in a position where the rope will hang as far as possible before it touches the rock. Usually this is a simple case of identifying a potential rub point and putting the anchor right on it or in a position where the rope hangs away from it. Choose a suitable anchor position by dropping a small rock or hanging some rope down the pitch and putting it against the wall in likely spots to see how well it really does hang. On long drops use rebelays to keep the pitch length less than 40 m, which is a good maximum for a heavily used pitch.

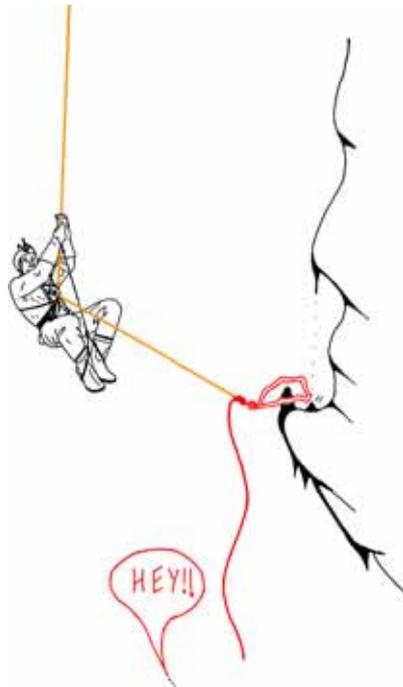
When tying the rope to the rebelay anchor, allow only just enough slack to unclip a descender when the upper rope is not loaded—no more than one metre.

There are several reasons to get this correct:

- minimum slack means minimum shock load should the anchor fail
- too short makes it difficult to remove your descender and pass the rebelay
- too long reduces the effectiveness of the backup
- too long may make it difficult to use the loop as a stand-in loop to help cross the rebelay
- too long uses more rope than necessary.

Accurately allowing for stretch can be difficult on long drops. There are two ways to ensure the correct amount of slack:

- clip your short cowstail to the rebelay and abseil onto it, feed through the right amount of slack. Without unclipping your descender tie a loop knot in the rope below you and clip it to the belay. Finish crossing the rebelay as normal and continue your descent.
- Alternatively, abseil onto the belay as above, then feed through enough slack for the loop and the knot and clip that into the belay. Without ever removing your descender from the rope, undo your cowstail and continue your descent.



*Some belays must be tied down!*

Either way, the belay must have a karabiner, sling or a bolt hanger with a large enough hole to take your cowstail karabiner and the anchor karabiner/maillon. Do not clip your cowstail into a maillon during this maneuver as it will deform if opened under load. While the second method is faster, you do risk a longer fall if the anchor should fail while you have maximum slack out. **Never** clip to the anchor, then undo your descender without first clipping the rope into the anchor. That is, don't put all your trust in one anchor—stay attached to the rope as a backup.

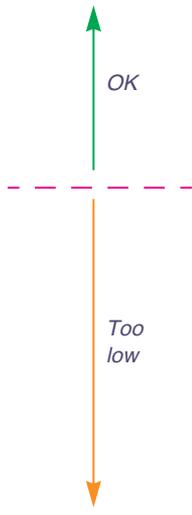
A single anchor is normally sufficient for a rebelay. It is always backed up to an anchor above and its greatest chance of failure occurs when you are at it. Once lower, the rope between you and the anchor will be able to absorb some shock. The possibility of having to ascend a long pitch with a rub point created by belay failure is virtually non-existent. Consider a double anchor when a single anchor failure would risk the rope being cut on a sharp edge, cause a dangerous pendulum, or if the rock or anchor is of such poor quality that its integrity is in doubt.

When you use a natural anchor for a rebelay take care to rig it so that a passing caver cannot lift the sling, nut, etc. out of position on the way past. It is best to rig as fool proof as possible by tying down the rebelay or using a long sling so that it cannot escape.

**Deviations (redirections)**



*Correct position for a deviation*

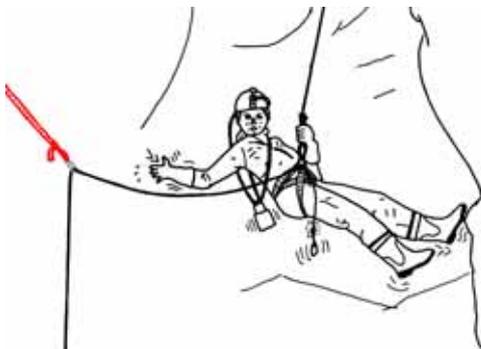


You can often place a deviation as an alternative to a rebelay. Deviations are faster to rig than rebelays and in most cases are nothing more than a sling attached to a natural anchor at one end and clipped to the rope with a karabiner at the other. The sling needs to be the correct length to deviate the rope from its natural path and take it away from the rub point.



*Correct length - easy*

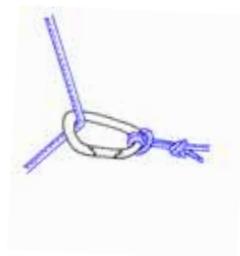
To be effective and easy to pass, you must set up a deviation properly. Use an anchor as near as possible to the same level or a little above the rub point and in such a position that it pulls the rope away from the rub point. The rope only has to avoid touching, not miss the rock by metres. The sling you use should be long enough so that you can easily reach it with your feet on the wall.



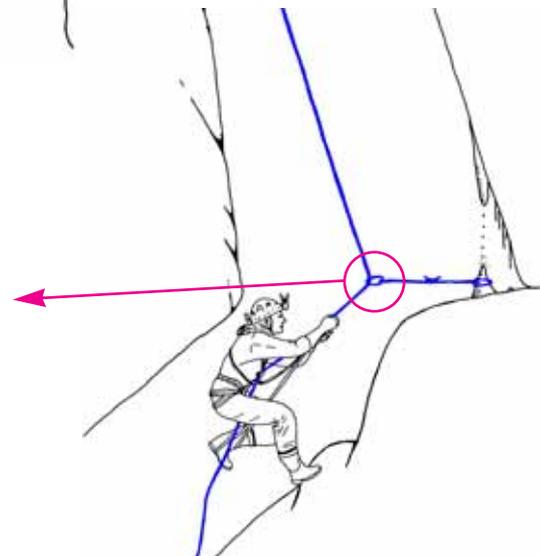
*Too short - difficult*

If the sling is too short and does not allow this, the deviation may be difficult to pass and easily dropped, especially when ascending.

Avoid using extremely short deviations such as one or two karabiners on a bolt hanger - they have so little movement that they are difficult to pass. Avoid severe deviations. The forces on them work similarly to Y belays and it is possible to overload the deviation anchor as well as making it difficult to pass.



*The karabiner should be a snaplink rather than a locking karabiner, and tied to keep it in place*



*A deviation can also be placed in the 'floor'*



Double deviation

The anchor you use for a deviation never receives full body weight, nor can it be shock loaded as can a rebelay. It therefore does not need to be as strong. In most cases a rock spike or jammed knot that is nowhere near strong enough for a rebelay is fine. The sling and anchor need not be of the highest quality either, cheap 5 mm cord and a mini-krab are strong enough and save weight. In those rare cases where there is no natural anchor you can use a bolt and because the loads are low some cavers half drill the hole to save effort. While this is strong enough it is better to take the time to drill **all** bolts properly so that the next caver down does not place a 'good' bolt beside it. The quality of the hanger and its load angle is unimportant as any load on a deviation should be low.

Deviations are good for rotten rock where a rebelay may be unsafe or where it is better to hang the rope down the centre of the shaft and avoid the walls altogether. When prospecting or when short of rope, deviations require a minimum of time to rig and use less rope than rebelays.

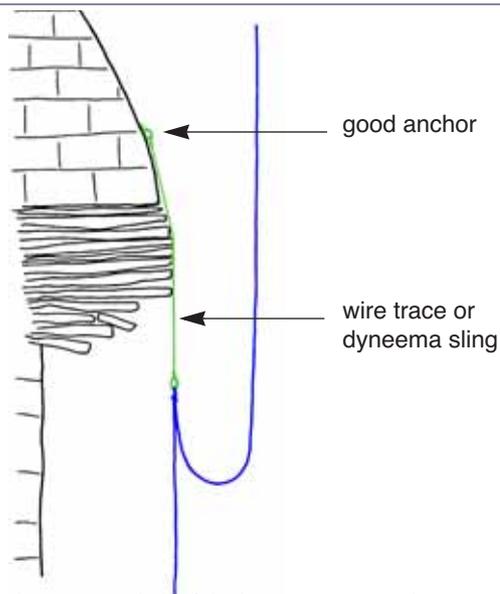
Deviations do not break pitches into shorter units. While a deviation is faster in the short term (exploration or sport trips for instance) a rebelay may be better if many people are going to use the pitch as may happen on a 'trade route'.

At times you must constrain the descent rope precisely. To achieve this, use two slings on opposite walls and clip them to the same karabiner in order to hang the rope in exactly the right spot.

Rebelay?	
	
+	-
secure—rope less able to move around	slow to rig and pass
more cavers can climb at once	rockfall danger increased
easier to climb (less rope bounce)	needs more gear
	ascenders/descender must be detached from the rope

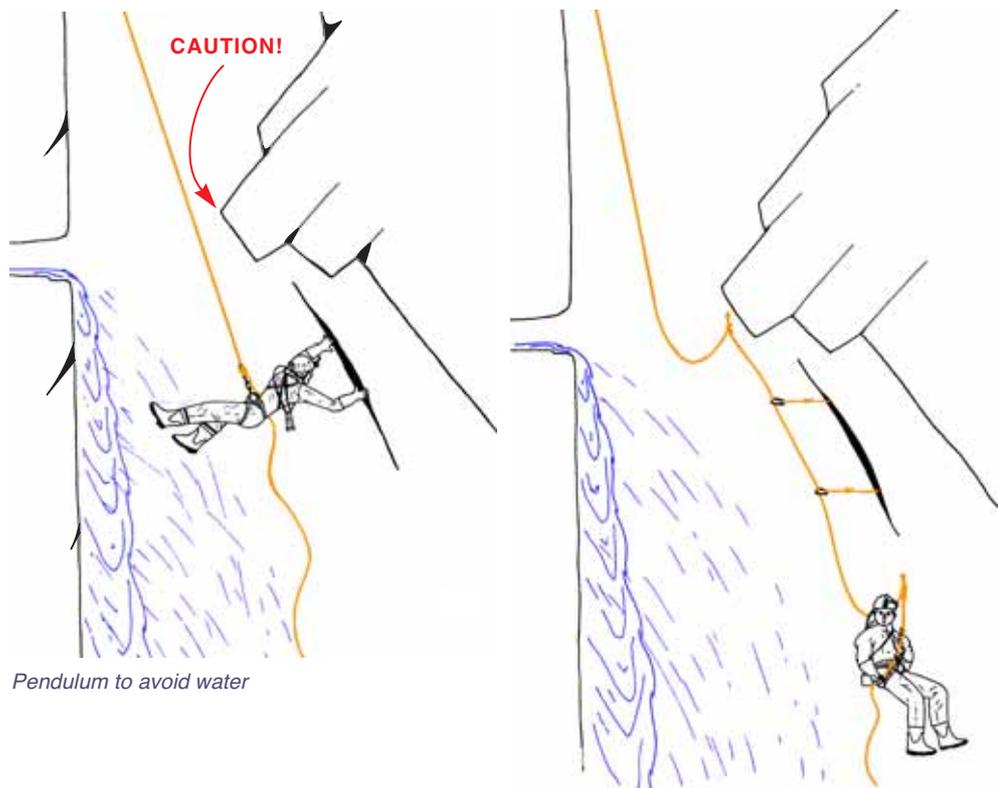
Deviation?	
	
+	-
fast to rig and pass	rope less constrained
reduced rockfall danger	only one caver can climb at a time
uses minimal gear	awkward at times (more rope bounce)
ascenders/descender always attached to the rope	

## Rotten rock



*A secure method of rigging past rotten rock*

If the rock is bad it may be difficult to place a secure rebelay. Often a deviation will work or perhaps a rebelay higher up, if not you may be able to use a wire trace. Find an anchor above the problem and connect the trace to it so that it runs down over the poor rock, then put a rebelay on the end of the trace. It will not be comfortable to negotiate, and the rope will twist around the trace, but it works! If you do not have a trace, a dyneema sling, well padded rope or tape (possibly doubled or tripled) can serve the same purpose.



*Pendulum to avoid water*

*Several small swings are easier than one big one*

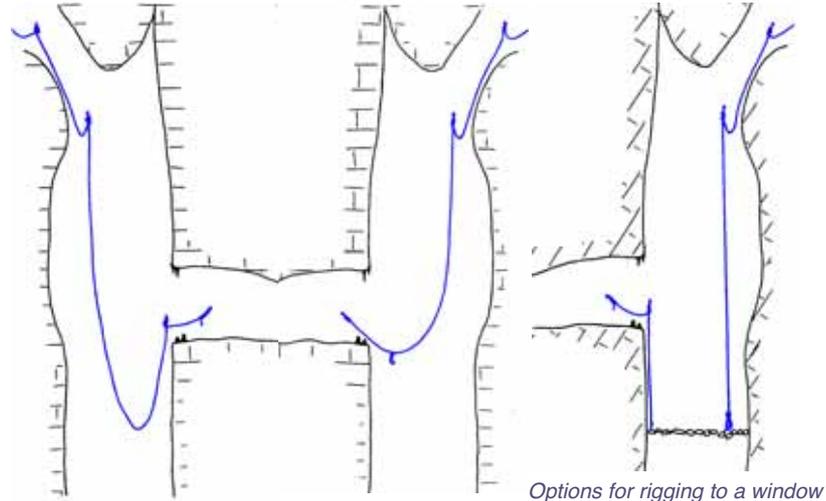
## Pendulums

You often need to swing sideways on wet pitches, if there is a deep pool at the bottom, or there is a danger of falling rock. Occasionally you will encounter a drop where the passage continues through a window partway down.

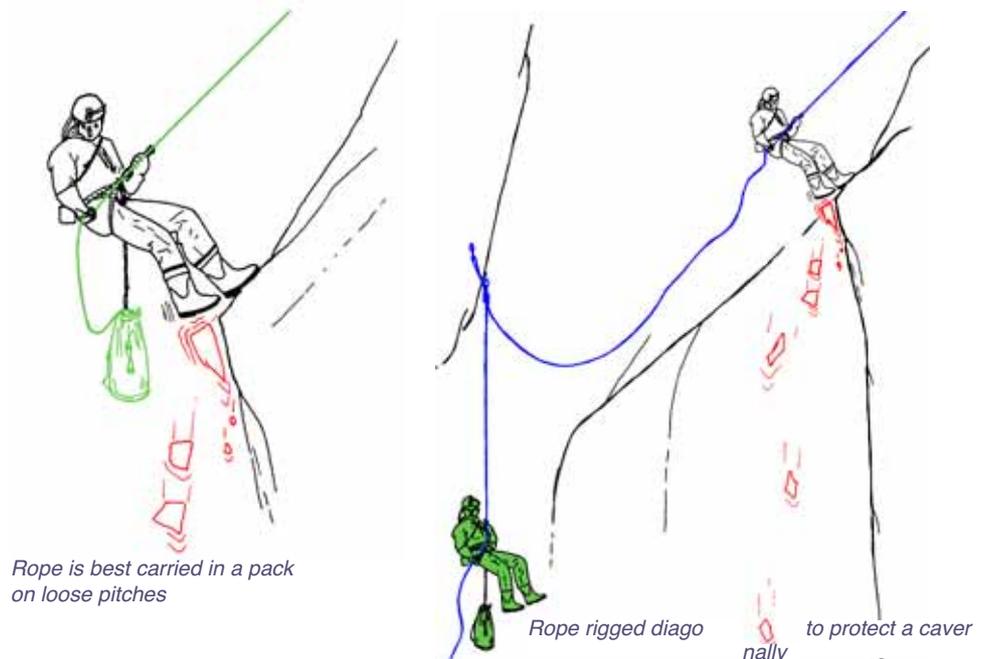
To pendulum sideways while hanging in space is exceptionally difficult. With a wall to push off or claw across you can expect to go sideways a maximum of 25% of the distance below the last anchor. To go further try lassoing something or jamming a knot or grappling hook and prusiking across. The price of failure may be a horrifying swing back to your starting point and beyond!

On long wet pitches one solution is to make a series of small pendulums rather than one large one. In any case place the anchor you swing from so that the rope does not grind as it swings sideways. You may have to place a second anchor or deviation to achieve this.

Once across a pendulum, anchor the rope and leave enough slack so that the next caver can cross. Tie a loop knot in the rope to indicate when to stop descending and when to start swinging. The amount of slack rope in the pendulum could mean that double anchors are necessary before descending the next part of the pitch. The sideways pull from the pendulum may be sufficient to require a stand-in loop to facilitate crossing the lower rebelay. Each of the various rigging options has its merits, depending on the pitch.



## Gardening



Many caves contain an abundance of loose rock. The first caver down must clear or 'garden' the pitch head of loose rock **before** lowering the rope and starting down. While descending he should try to rig away from loose areas and continue to clean as he goes.

When rigging loose pitches, make a conscious effort to move sideways between anchors. This will allow any rocks dislodged by cavers on the upper rope to fall past any cavers below instead of onto them. If rocks are dropped while the rope is rigged and there is any chance of them cutting the rope, eg. if the rope lies against the wall and a falling rock hits in its vicinity, it may be prudent to check the rope before anyone ascends it.

## Handlines

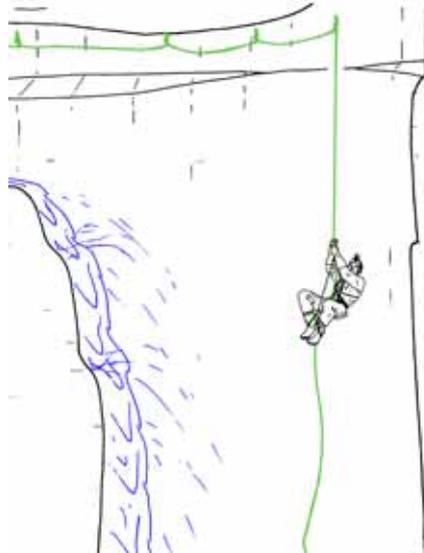


Tonio-Cañuela, Spain

A handline gives security at a pitch heads, and can also be rigged to avoid the risk of falling down rifts or holes. You do not normally weight the line, simply clip in a cowstail and slide it across with you. Double cowstails make it a simple procedure to pass belays in the line without detaching yourself from it. Rig the rope as tight as you comfortably can without tensioning it. The anchors and rope should be shoulder high to minimise the length of a fall. As the rope is normally not loaded it can go around corners with little risk of severe wear.

## Traverse lines

Occasionally you will have to rig a handline to give direct aid to cavers climbing out to the descent rope. More often you will rig a traverse to protect cavers climbing along a deep rift or narrow ledge. Horizontal traverses with the rope tied in to several anchors along the way are both slow and strenuous to cross if there are no footholds and the passage is too wide to bridge. Fortunately they are also rare.



Protected traverse on a ledge



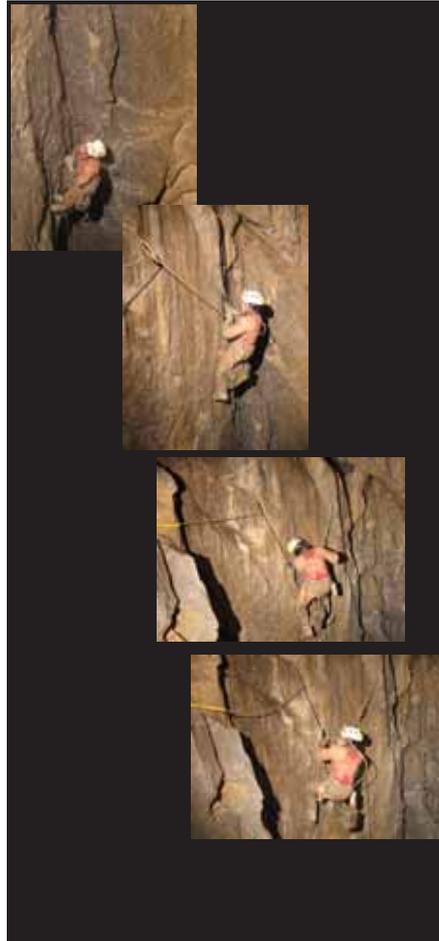
Small pendulums



Tyrolean without a ledge



Bolt traverse



Pass a rope rigged to a line of anchors about a metre apart and tied in to each one by swinging ape-like from one rope span to the next:

- clip both cowstails to the first span (gate outwards as always)
- slide across as far as you can
- remove your long cowstail and clip it to the next span
- lean back and release your short cowstail and reclip it to the second span beside your long cowstail
- repeat until you reach the end of the traverse!

Such traverses are rarely necessary and if you really need one, always try to follow above a ledge or series of footholds to make life easier for everyone. You may be able to rig a rope that needs to go sideways as a series of small tension traverses by descending a few metres, placing an anchor as far sideways as possible, descending again and so on. You can also rig a Tyrolean traverse.



*Simple, really!*

### Tyrolean traverses



Ozto Ocotol/J2, Mexico

Tyroleans may look good in photos, however they usually require a lot of energy to pass. A slightly sloping line is easy one way and just plain hard work the other. Any sag in the rope means that you end up in the middle and have to struggle up the other side. Especially difficult are tyroleans across space—even a smooth wall to ‘walk’ across is better than flailing in space.

## Tyrolean - horizontal

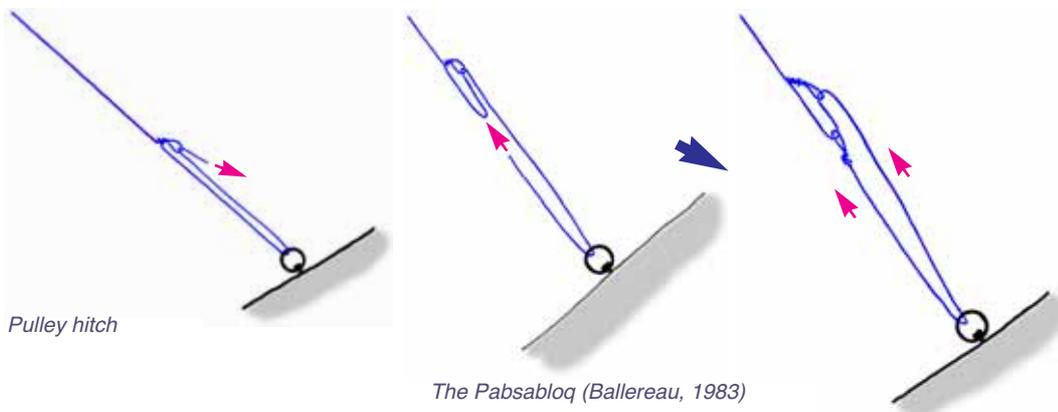


Caballos-Valle, Spain

A Tyrolean traverse across a pitch or pool is faster in the long run than re-climbing the traverse each time or paddling a boat back and forth. Once someone has climbed or floated across, rig one tight and an optional loose rope, each using separate anchor points. The tight one is to ride on with a cowstail and the loose one acts as a safety should the tight one fail (the load on the tight rope can be very high). When the tight line is not quite horizontal or sags so much that you will slide down it, use the loose rope to abseil/prusik on as well.

Use the least stretchy rope available for the tight rope—heavy fencing wire or wire cable is great, but who carries that? A length of dyneema is a more sensible alternative. If you use a low stretch line like steel or dyneema you must use a separate safety rope and everyone crossing should have a steel karabiner, or plenty of disposable aluminium ones. A simple block and tackle, pulley hitch or Pabsabloq is

helpful for tensioning normal rope. While illustrated with rope loops, you can use karabiners to increase efficiency. Don't use external tensioning for wire cable or Dyneema, which is best tied as tightly as you can to avoid enormous anchor loads. On low level Tyroleans over pools people normally dispense with the safety and just risk a dunking—in most cases the slack line would take up after you hit the water anyway.



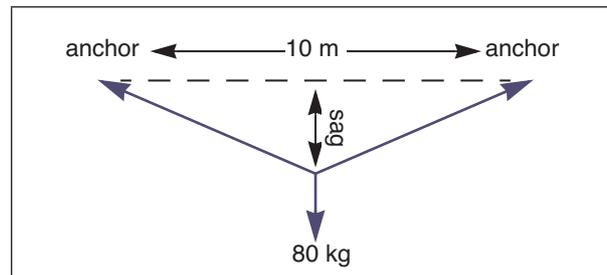
Pulley hitch

The Pabsabloq (Ballereau, 1983)

The tighter you can pull the tight line, the easier it will be to cross but as the Tyrolean becomes more horizontal the strain on the anchors, even with body weight, can be enormous. The maximum load occurs when you reach the middle of the rope.

Table 4:1

**Tyrolean anchor loads\***



Sag (m)	Load per Anchor (kg)
3	80
2	100
1	200
0.5	400
0.1	2000

\* For an 80 kg caver in the middle of a 10 m Tyrolean. Initial anchor loads taken as 0 kg.

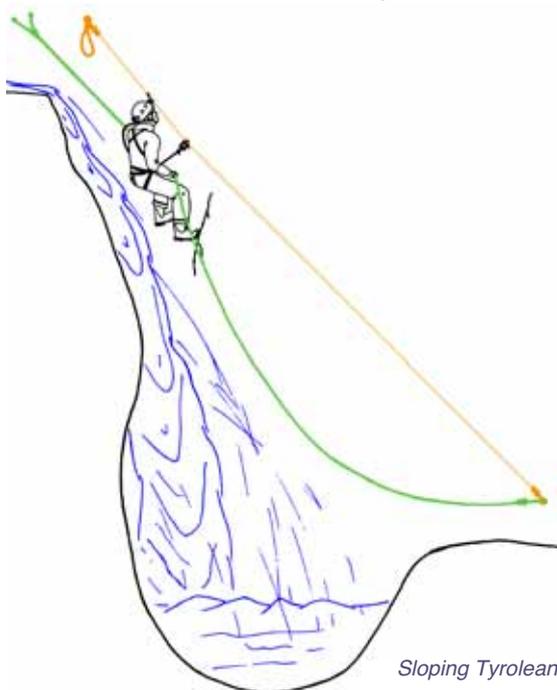
Caving ropes have enough stretch that even when rigged as tight as possible, without using a mechanical advantage to tension them, it is not possible to generate dangerous loads. However, take care when using low stretch line such as wire cable or dyneema.

Do not run Tyroleans around corners. The loaded rope undergoing side to side abrasion wears through very quickly. Wherever the rope touches rock place an intermediate anchor and preferably fit a stand-in loop to make it easier to pass.

**Tyrolean - sloping (guided descent)**

If you are faced with a long stretch of rotten rock that overhangs at the bottom or a cascade that ends in a pool, try a diagonal tyrolean.

Initially, descend straight down, protecting the rope with pads if necessary. When you reach the bottom set up a belay away from the base of the pitch. Rig the least stretchy rope you have from a separate belay and pull it as tight as possible—the gentler the slope the tighter the rope needs to be. Those following descend on a separate rope with a cowstail clipped to the Tyrolean and as they descend, the tight line pulls them to one side.



## Water

Avoid water on pitches. Most stream caves have a clean-washed zone that you can regard as the flood risk level. Depending on the likelihood of a flood and the water temperature, rig pitches a safe distance from the water. In extreme cases this may require a traverse to the far side of the pitch to descend in safety.

Ropes rigged in or close to water can be dangerous in several ways. Should you become soaked in a cold cave it will lead to undue fatigue and possibly exposure. If there is a flood while you are on the rope you could be at immediate risk of drowning. Should you be below a wet pitch when a flood occurs it may be impossible or dangerous to ascend. When the flood has passed, the rope may become thrashed by the flood waters so that it is unsafe to ascend. Even in non-flood conditions ropes can wear to a dangerous degree when rigged in moving water.

When there is no choice but to rig in or close to the water, hang the rope as far from the walls as possible to avoid the rope being thrashed against the rock. At the same time keep the rigging uncomplicated so that it never becomes necessary to cross a knot, deviation or rebelay while under a waterfall. Once the group is down and there is no one following, pull the rope away from the water and rock and tie it so that it cannot touch the rock no matter how high the water becomes.

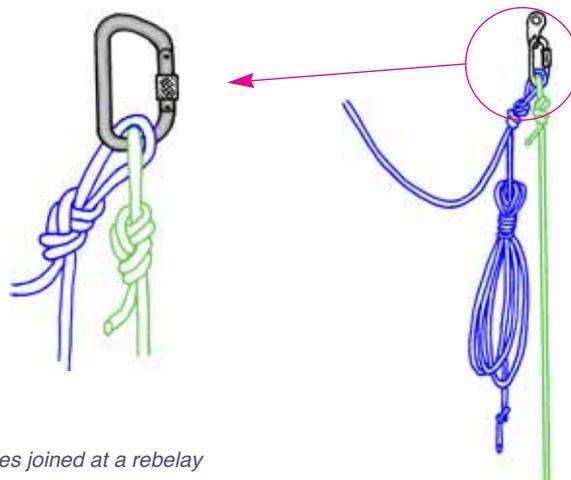
If you are leaving the cave rigged the last person should haul the rope up on the way out and coil it at or above the belay to keep it out of danger.

## 'Horizontal' water

When the water is cold it is desirable to stay as dry as possible. If a Tyrolean cannot or has not been rigged over deep water you can float across on a large inner tube with a cross of tape or cord tied to sit on. Balance is delicate and progress slow but it is better than full immersion. For long pools you can use small inflatable boats but they are heavy and bulky to carry and you may have problems with hauling them back and forth across the pool for each person. Boats are only worth the trouble for exceptionally long pools or those near the entrance.

Swimming should be a last resort especially in cold caves. If you **must** swim, stay buoyant: a partly inflated garbage bag or wine cask liner inside your oversuit works wonders. The same goes for packs: a well loaded pack will fill with water and sink like a stone, and take you with it if you don't let go! Make the pack buoyant or leave it behind and haul it across with a rope once you've crossed the pool. Wetsuits of course go a long way to solving most of these problems. In passages with a low airspace it is well worth rigging a tight line through the best route so as to have something to follow for a 'roof sniff' or short dive. In that worst case, the divers who come in to rescue you will have something to follow through the brown floodwaters.

## Short ropes



*Ropes joined at a rebelay*

If it looks as if the rope will not be long enough tie on extra rope before you start the descent, you can always remove it at the bottom if you do not need it. Knots are always a nuisance to cross. Wherever possible arrange a knot so that there is a ledge to swing onto to pass it and never put a knot near falling water. Even a smooth wall to balance against makes crossing easier than free space and psychologically it is easier for many cavers to cross a knot closer to the ground.

It is better to join ropes at a belay even if it means wasting some rope. Do this by tying two end loops linked through each other and then clipping the down loop (or both) to the anchor. Use any excess rope to make a stand-in loop or bundle it at the anchor and **tie a stopper knot** so it's still safe even if someone descends it accidentally.

## IRT rigging



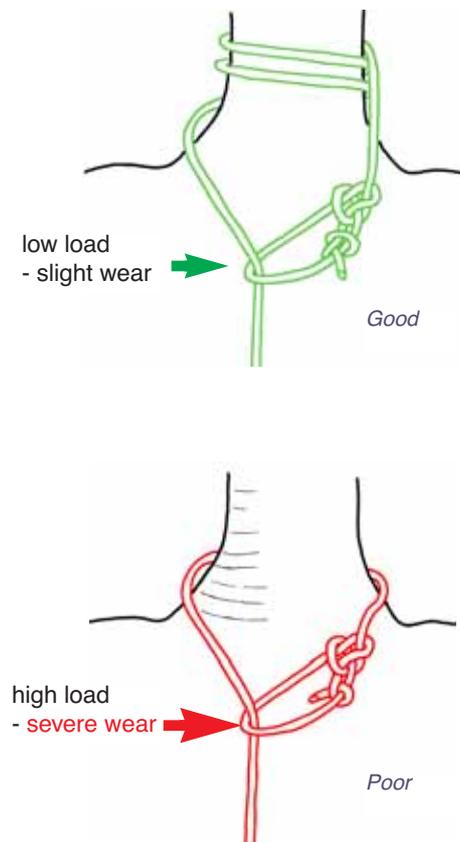
*The "Bad old days" – thick polyester rope rubbing all the way down, and in the water.*

IRT (Indestructible Rope Technique) is where it all began. Take a rope, throw it over, slide on down, then climb back up it. Fairly soon cavers began to run into problems. For a start, limestone is harder than nylon. In France the solution was obvious—rig the rope so that it didn't touch that nasty limestone. Away to the west, the answer was just as obvious—get tougher rope.

Instead of relying on complex rigging and abundant hardware to keep the rope intact, IRT requires a tough heavy rope that can withstand some abrasion. Rigging is considerably easier when you're not too concerned about whether the rope touches rock or not. Without doubt the strong point of IRT is its simplicity.

## Anchors

IRT avoids hanging the rope in contact with the rock or water as much as possible but rarely to the extent of placing bolts or needing a handline to reach difficult anchors. A single 'bombproof' anchor is normally all that is used, the position not being vital. Above all it must be easy and safe to reach the rope and as with any rigging, high belays make this easier.

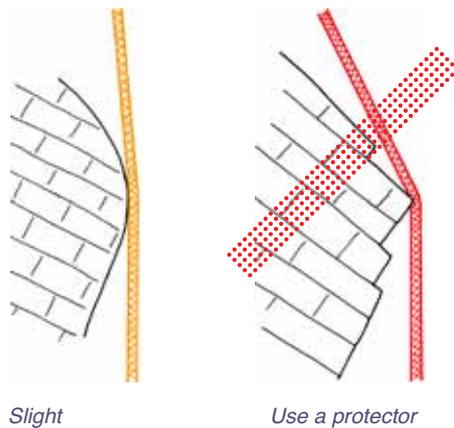


A popular knot for the natural belays normally employed is the 'Lasso' Bowline that tightens securely onto the anchor. You can also use Figure-8 knot tied in the same manner for improved security. Separate slings are considered unnecessary as they can weaken the system and are extra gear to carry.

Should the only good anchor be at floor level it may be difficult to exit the pitch on the way up. I have seen cavers hook the rope over or wrap it around a knob near the edge to lift it up a little. If the rope slips off or the knob fails a large shock load would occur. The danger to the rope is usually not great as 11 mm rope is very strong but the consequences for the caver could be severe. Most of the time however, the opportunities for generating a shock load in IRT are rare.

IRT rigging rarely breaks pitches into short sections. An effort is made to make them as long as possible to take advantage of the fast but unmanoeuvrable prusik systems usually employed and to avoid having to clip past artificial obstacles on the pitch. The pitch is only ended when you reach a big ledge or the bottom—even to the extent of crossing ledges and turning corners on the way.

## Rope protection



Despite attempts to make tougher and tougher ropes, a truly indestructible rope that you can still carry into a cave has not yet been invented.

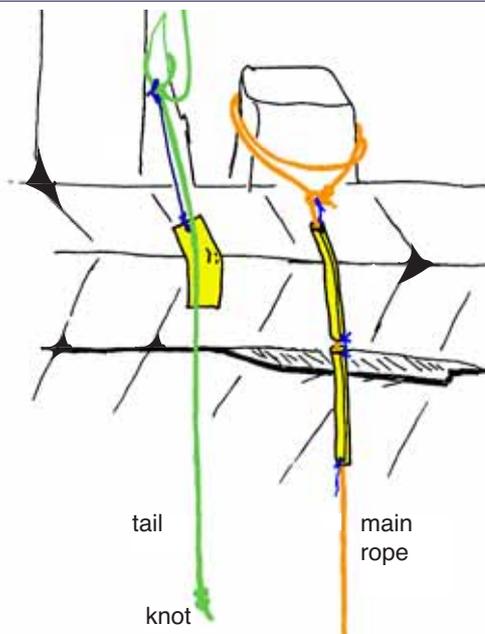
IRT rigged ropes are often in contact with the rock, making rope protection of paramount importance. The trend has been to tougher ropes that are better able to withstand the wear and tear, even so it is often necessary to pad pitch edges.

Once below the edge of a pitch the rope moves around too much and pads become ineffective, so you're forced to resort to wrap around pads. In most cases the worst abrasion occurs in the top 20% of the pitch or at the last edge that the rope touches. Apart from obviously serious problems, rope protection is rarely worthwhile lower down the pitch.

In practise I have found all rope protectors unreliable unless you can place them above the point where you clip on the rope. Protection on the main lip works tolerably provided everybody is careful to replace the rope and pad in the right place, which is not always the case! Even then, protectors are ineffective once the rope eats a hole in them. Once more than five metres down a rope, you should expect all protectors to fail at least 50% of the time for various reasons—the rope pulls to one side, covers of different weights stretch the rope different amounts and make the protector sit too high or low, or it is simply placed or replaced in the wrong place.

Abrasion damage to the rope varies with the nature of the rub point. Acute bends in the rope are more dangerous than blunt ones. Smooth polished rock will usually be harmless to the rope while sharp bedding ridges or crystals can damage a rope very quickly indeed. Mud covered or dirty rock is a particular hazard as it may look smooth but hide rope-eating edges beneath. See also [Other equipment—rope protector on page 42](#).

## Pitch Edges



*Tail to negotiate an otherwise dangerous edge*

Negotiating pitch edges is often the most difficult part of an IRT rigged cave. The rope is forced into contact with the rock and passing the edge on descent and ascent may require considerable strength and technique.

The most significant factor in reducing such problems is placing the anchor as high and close to the edge as practical. This decreases the angle that the rope bends through, making the edge easier to pass as well as reducing rope wear.

When an edge is unavoidably difficult, you can make it easier by hanging a stand-in sling over the edge so that it is not necessary to lever the rope out from the rock in order to pass on ascent.

Another device that has gained some popularity is to hang a 'tail' over a difficult edge or on one which requires excessive padding. The idea is to descend the tail past the lip, then change over to the main rope below the padding. Rope pads stay in place and there is no problem with rope

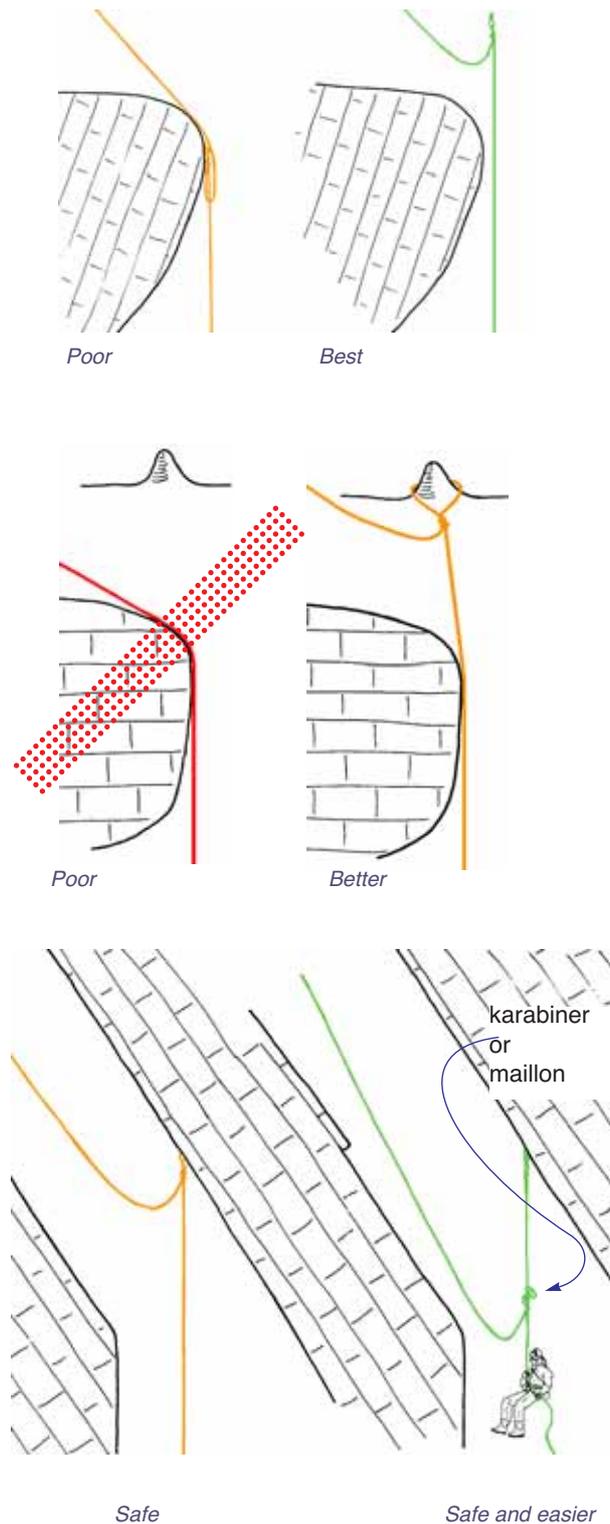
weight. Unfortunately, tails use a lot of rope and are slow to pass, especially on descent. A more efficient rig is to use a 'floating rebelay' as already described in this chapter under [Rotten rock on page 64](#).

## Compromise

IRT can be terrifying for Alpine cavers who cannot afford to tolerate the slightest rope abrasion. IRT riggers find Alpine style far too light, flimsy and complex to be at all safe.

Despite a general lack of understanding between cavers on different continents some uses of one 'pure' technique, be it Alpine or IRT, lack either efficiency or safety. Prospecting is faster without spending time putting in bolts and careful use of rope protectors can save a lot of effort in Alpine rigging. Similarly, IRT cavers could use some Alpine techniques to keep them away from water, make their ropes last longer, get a group through the cave faster.

## Rigging for comfort



During exploration, prospecting or one-off sport trips you can tolerate some difficult rigging. However, when you are rigging a cave for a large group or heavy usage rig it for ease of travel, so long as you never compromise safety. Comfort considerations are a collection of small, often subtle features that you usually learn by experiencing uncomfortable rigging.

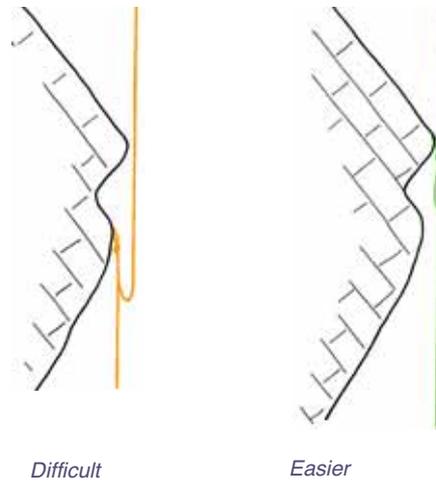
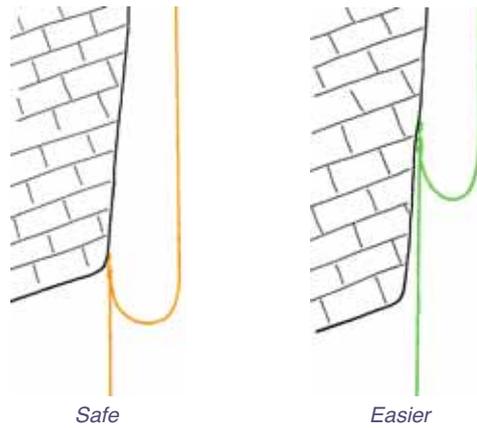
- Rig high. Look for anchors that you reach up to rather than down to, both at the top of the pitch and for rebelays. High anchors avoid the need to grovel over edges and often provide a freehang with no immediate need for another anchor.
- Rig difficult traverses high enough to allow cavers to weight the rope rather than forcing everyone to climb unaided all the way.
- It is often necessary to make long reaches and acrobatic moves but once the rope is installed there is rarely a need for the whole party to suffer the same inconvenience. Attach a sling or long rope loop to a distant anchor so that those following can pull the belay toward them rather than stretching across to the anchor itself. This also reduces the fall factor should the anchor fail and is a good, economical way of rigging pitch heads. When this type of rigging must be crossed as a rebelay, clip a karabiner or maillon at the knot to make insertion and removal of a cowstail easier and faster than trying to force a karabiner in and out of a loaded loop of rope.

Safe

Safe and easier

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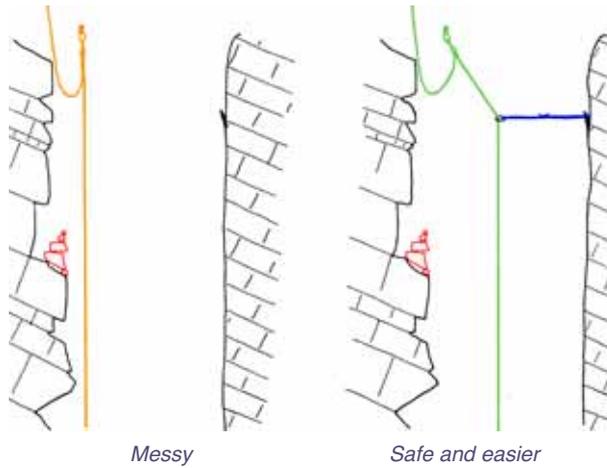


- Do not insist on a freehang from the start of a pitch. It may be easier to descend a short way against a wall or slope and then place a rebelay that gives a free drop.
- When a swing after a pendulum is extreme, a stand-in loop may be useful.
- Keep aerial rebelays to a minimum. Place rebelays where there is a landing platform or at least footholds to aid crossing over.
- Make a special effort to make awkward rebelays easily passable. Save direct attachment bolt hangers and tight loops for tiebacks and anchors that do not need to be crossed - they do not easily take cowstails.
- Avoid rigging deviations with no footholds.
- Make deviations as gentle as possible.
- Avoid rigging deviations with very short slings that reduce their manoeuvrability.
- Rig double anchor rebelays so that it is only necessary to cross one rebelay.
- A rope is easy to climb when it is hanging just off a smooth wall so that your feet touch lightly when prusiking, but there is no need to fend off.
- Do not be tempted by bolt farms or an abundance of natural anchors to use more anchors than you need. A complicated lacing together of several anchors can be confusing for all but the person who rigs it.

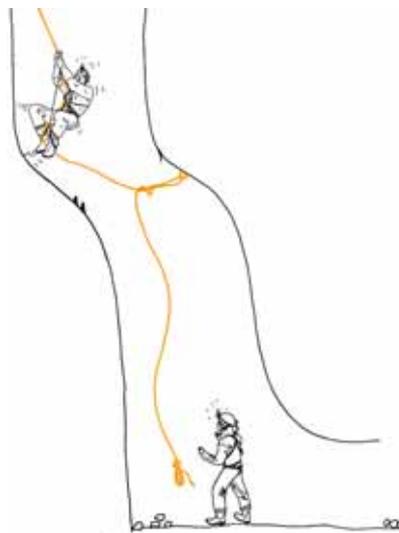


Simple(?) rigging

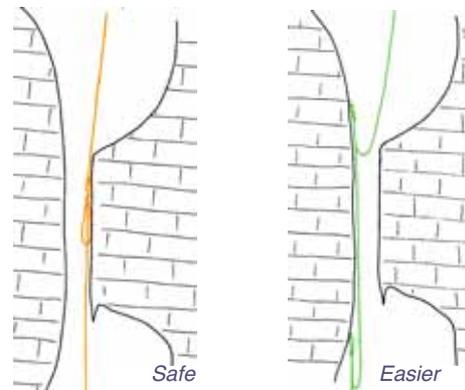
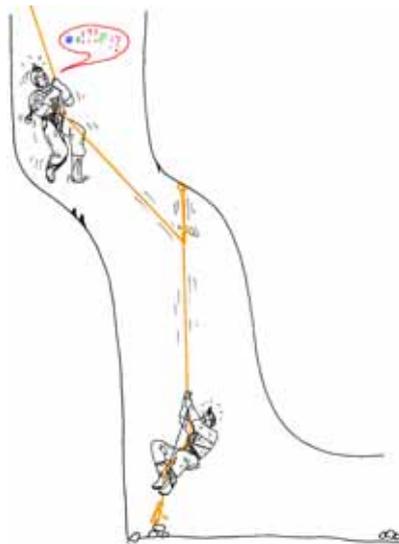
Crnlesko Brezno, Slovenia



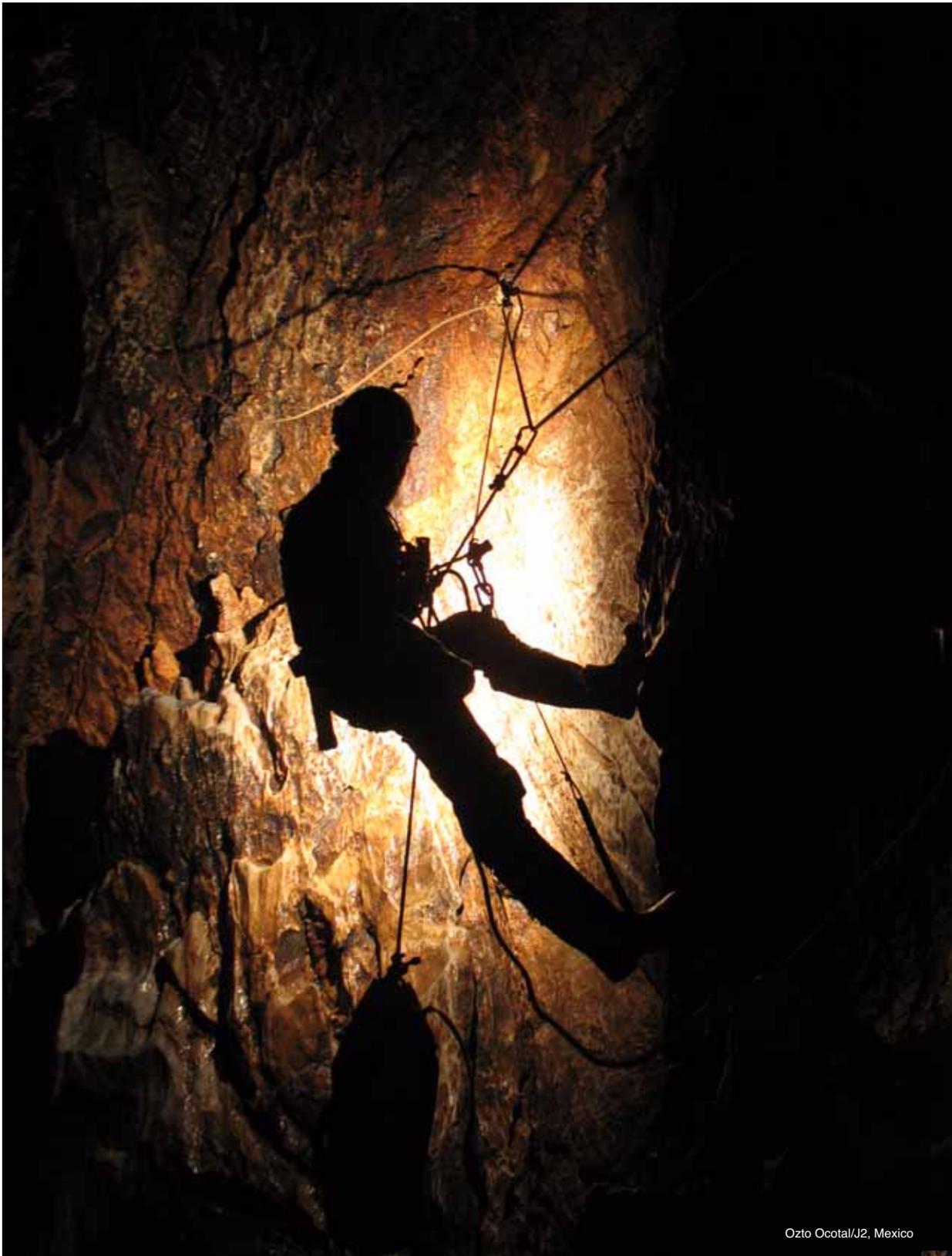
- You only need to rig a rope so that it is free when in use, not as far from the rock as possible. It is often acceptable to have the rope lying against the rock so long as it pulls free when you are on it.
- Rig rope clear of spiky walls that can make prusiking difficult.
- Rig away from loose rock. Failing to do so may mean that it is only safe to have one person on a pitch at a time - or that it is dangerous for all who use the rigging.



- Rig clean. A rope or cover not covered in mud is much easier to handle than a dirty one.
- If there is a ledge to stand on during the changeover, it is possible to arrange no slack in the upper rope. This may be worthwhile if the anchor is of poor quality but if there is insufficient slack it will be impossible for two people to be climbing (one either side of the rebelay) at the same time.
- Avoid placing rebelays or deviations in narrow sections. One above and a second below a constriction are easier to pass.



- Do not regard all these hints as compulsory. Indeed some are contradictory! Ultimately each pitch has its own rigging requirements.



Ozto Ocotal/J2, Mexico



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