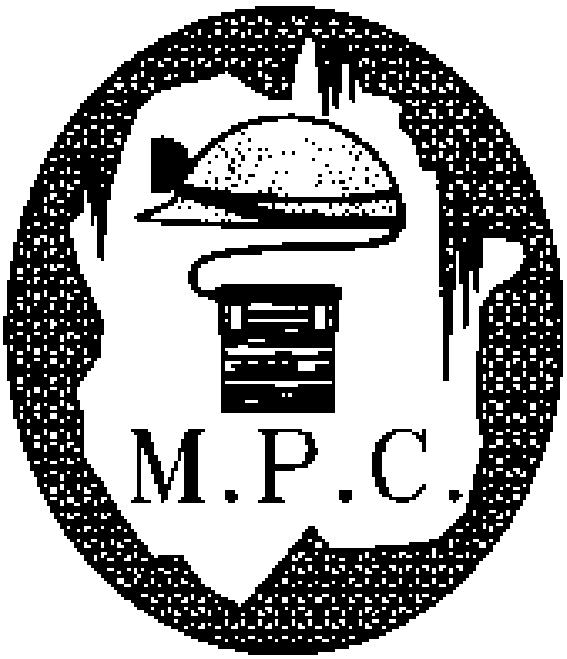
MORLEY POTHOLING CLUB



Members Guide

CONTENTS

Available on video from the club

Cave Safe one	Cave formation; basic safety rules; recognising hazards; basic equipment
Cave Safe two	Ladders and lifelines; ropes; use of knots; principles of rigging
Cave Safe three	Use and application of SRT; advanced ropework

Acknowledgements

Extracts from the following publications:	'Knots in use' by Colin James 'Caving Practice and Equipment' edited by David Judson incorporating articles by Dave Elliot
Contributions from club members:	Di Yarker, Andy Jackson and Dave Roberts

SAFETY ON CLUB MEETS

Clothing

The recommendations regarding clothing set out in this guide should be followed. Members should be encouraged to regard proper over and under suits as a priority purchase before consideration is given to obtaining other caving equipment. Members should be discouraged from embarking on any trips (other than novice trips) without proper caving under garments and in addition club oversuits must be made available and worn on ALL trips by members who do not have suitable oversuits.

Safety Equipment

The meets leader must always carry a survival bag on every club trip. In addition all club helmets should be fitted with a survival bag and all club members should be encouraged to take one with them also.

Food

Whilst the pre-caving breakfast is regarded as somewhat of a tradition there are sound reasons to encourage members to ensure that they eat a full meal before embarking on a caving trip. In addition ALL MEMBERS should take some high energy food/drink with them on ALL TRIPS. This INCLUDES novice trips. Some trips can take several hours to complete and it is essential that individual energy levels are maintained throughout the trip. A good meal beforehand can ensure this in conjunction with additional rations taken on the trip. It is important to remember that even a novice trip could become prolonged in the event of an accident underground and the progress of the whole party is dependant upon the progress of each individual. If any member fails to take food on a trip, other members of the party will be obliged to share their rations, possibly resulting in a weakening of their situation and in turn possibly jeopardising the position of the whole party.

Authority of meet leader

The meet leader will have the authority to refuse to allow a member or visitor to participate in a club meet if in the opinion of the leader there are reasonable grounds to believe that the safety of the individual or the party could be at risk. The grounds for such a decision could be on the basis of improper dress or the relative severity of the trip compared with the experience of the member in question. The decision of the leader in such circumstances is final.

POTHOLING IS BY ITS NATURE A COMMUNAL ACTIVITY. EVERY MEMBER MUST UNDERSTAND THAT THE ACTIONS OF ANY INDIVIDUAL ON A CLUB MEET COULD AFFECT THE SITUATION OF THE WHOLE PARTY.

CLOTHING LIST

Below is a list of suitable clothing, recommended for wearing while taking part in potholing. Caves are dark, harsh environments of water, mud, and hard abrasive limestone rock. So to enjoy the sport more comfortably, the following list has been compiled as a guide:

Under clothing

The under clothing (undersuit), must be a close fit so as to keep you warmer. A one-piece suit is the best as it stays together in the middle to keep the cold off the base of the back. Polyester based material would be ideal, or fibre-pile clothing. Just look in the label of the clothing you are going to wear. Thermal clothing is also suitable for caving, but in some situations two layers may be required due to the thickness of the material. All the above mentioned clothing drains water quickly which will ensure a more comfortable trip.

DENIM JEANS & CORDUROY'S ARE DEFINITELY NOT TO BE USED FOR CAVING.

Over suits

The over-suits' job is to protect you from the abrasion of rock, and more important is to deflect as much water as possible, and guard against heat-loss. The best ones are of a one piece construction, and are made from PVC-impregnated nylon or polyester. Although for the first few novice trips old cagouls and over-trousers will be o.k. PLEASE NOTE that they are not hard wearing. A hood built in to the suit is an added bonus and will play an important part in keeping you warm in a cold wet cave.
An alternative is to keep a hood with you, such as a balaclava made from polyester which will fit under your helmet when not being used. A polyester fleece balaclava is a relatively inexpensive and HIGHLY RECOMMENDED ITEM OF CLOTHING.

Socks

If possible, neoprene socks (known as wet socks) are the best. These will keep your feet warm when wet, which will make the rest of the body feel warmer. Also they are comfortable to wear and will support the ankle. A thin pair of old socks can be worn over the wet socks to protect them and prolong their life span. If wet socks can't be obtained, the next best thing is wool socks or again polyester socks or furry-socks. BUT PLEASE NOTE, these won't keep your feet as warm as wet socks when wet.

Footwear

The best foot wear of all, and the most used in caving is the good old wellie. A good cleated sole that is relative soft will grip better than a hard soled boot.
Walking boots can also be used, but ones that have lacing hooks on will snag when climbing ladders. The above mentioned footwear will support the ankle very well. You may have to get the next size up than normal footwear if wearing wet-socks.

Headgear

Headgear is in the form of hard hats the type miners or builders would wear. This will protect you from knocks and bumps. These are fitted with a lamp bracket for the lamp to fit on to. A "Y-type" chin strap can be attached and is already fitted to all club helmets. This stops the helmet from being knocked off during the trip.
HEADGEAR CAN BE PROVIDED BY THE CLUB.

Lamps

These are also provided by the club for a small charge. The money goes to the up-keep of the lamps and to buy spares etc. The lamps are similar to the ones used by miners giving light for up to 8 hours. You can purchase your own lamp at a later stage and, if you decide to, don't hesitate to ask a club member for guidance.

Extras

Gloves can be worn when caving, to protect your hands and keep them warm. Builders or gardening gloves are adequate and are very hard wearing, or even rubber gloves can be worn but are not hard wearing. Belts are provided with lamps when borrowing a club lamp. Leather belts are not adequate for caving as they tend to rot and then the lamps battery pack falls off!!

If you have any queries about the above list or you would like any advice then please don't hesitate to call a club officer.

CAVE CONSERVATION

Cave conservation is necessary not only to preserve caves for the enjoyment of ourselves and others, but also to keep access to caves open for caving.

By following a few simple guidelines the damage caused to the cave environment can be greatly reduced.

Behaviour Underground:

Never leave litter or spent carbide in a cave or around a cave entrance.

Take care not to damage formations or touch them unnecessarily and do not remove existing broken formations.

When crossing mud floors follow the obvious tracks to avoid further damage

Stay outside taped off areas as the tapes are there to protect delicate formations.

A more detailed conservation code is available through the CNCC, please contact the Secretary for details.

KNOTS

Competence with the basic rigging knots and their application is a fundamental part of caving technique. The strongest rope and soundest belay are of little value if attached by inadequate knots.

Knots weaken the rope by varying amounts according to type. The effective strength of a knotted rope is generally expressed as a percentage of the rope's breaking load without knotting. This reduction in strength varies between about 20 and 50 per cent with the knots commonly used by cavers, though this effect is not cumulative - a chain is as strong as its weakest link.
Although knot strength plays a significant part in determining the load-bearing capacity of a rope on a pitch, there are other considerations. The main features of a good knot are:

1 Strength and security.
2 Versatility.
3 Ease of tying and untying.
4 Readily apparent if not correctly tied.

Figure-eight (Loop Fig 1 & 2)

In effect an overhand loop with an additional half-turn within the knot. The figure-eight is the universal caver's knot - simple, strong and extremely versatile, it lends itself to almost every purpose underground. This is the knot against which other knots are measured. The figure-eight loop may be tied either at the end or along the length of the rope, and is easier to untie after loading than the overhand loop.

Figure-eight (reversed, Fig 3)

The same knot is tied in a different fashion using the end of the rope for attachment to a thread belay. A single figure eight knot is tied in the rope, with the end of the rope then taken around the belay and threaded back through the knot following the path of the rope in the reverse direction, forming in effect a second figure-eight knot within the first.

Use: multi-purpose; rigging, general ropework.

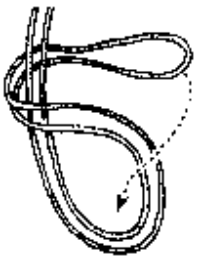


Fig 1 & 2

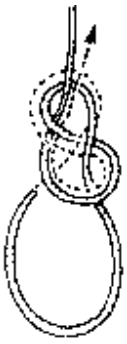
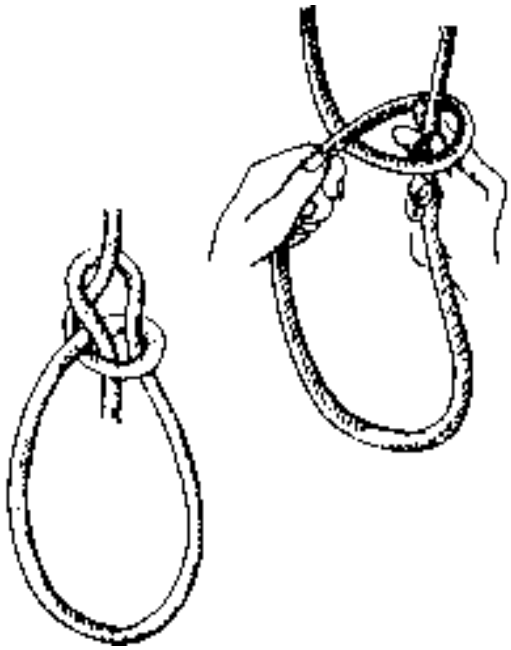


Fig 3

Bowline

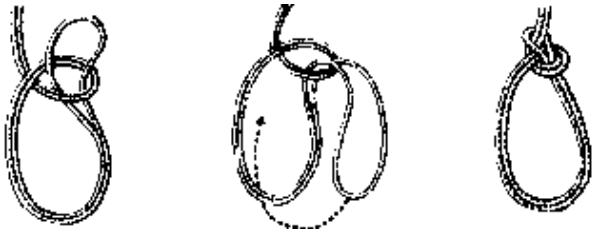
A safe, simple knot used mainly for attaching the end of a rope to a thread belay. The bowline has a tendency to work loose when tied in stiff or resilient ropes and should always be secured with a back-up knot tied on the same side as the rope end. Even so the bowline is secure only if loaded along its major axis; heavy sideways loading may distort it into a slip knot. Less strong than the figure eight, the bowline has two advantages: the loop formed is easily adjusted and the knot is easily untied even after very heavy loading.



Use: multi-purpose; general ropework; traverse line attachment.

Bowline on Bight

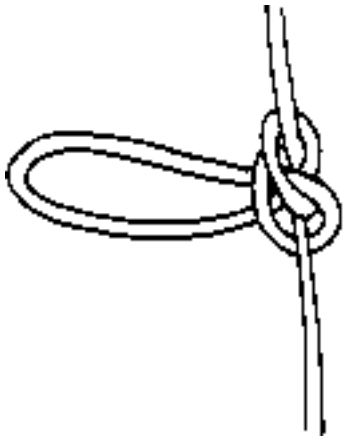
A variation of the bowline tied in a doubled rope (a bight) with the end loop passed back over the half completed knot. The result is a bowline with two loops, each adjustable to the other.



Use: rigging; mid-rope attachment, ring hanger attachment, Y-anchors.

Butterfly Knot

A mid-rope loop knot which may be loaded from the loop or along the standing rope in either direction without distortion. Easily adjustable and readily untied after loading.



Use: rigging; mid-rope attachment (traverse lines).

LADDERS AND LIFELINES

Lifelining Techniques

The methods described below include the traditional British techniques of **'body' lifelining**, which form the means by which most novices are introduced to caving. However, these techniques are outdated, clumsy and inefficient, and the security they afford can be largely illusory unless they are performed with great care. A large number of vertical caving accidents in this country result from mismanagement of these techniques. However it is important to understand that this method is better than no lifeline at all. **Under no circumstances should anyone attempt to climb or decend a ladder without an adequate lifeline.** Serious accidents have occured from freeclimbing even short pitches.

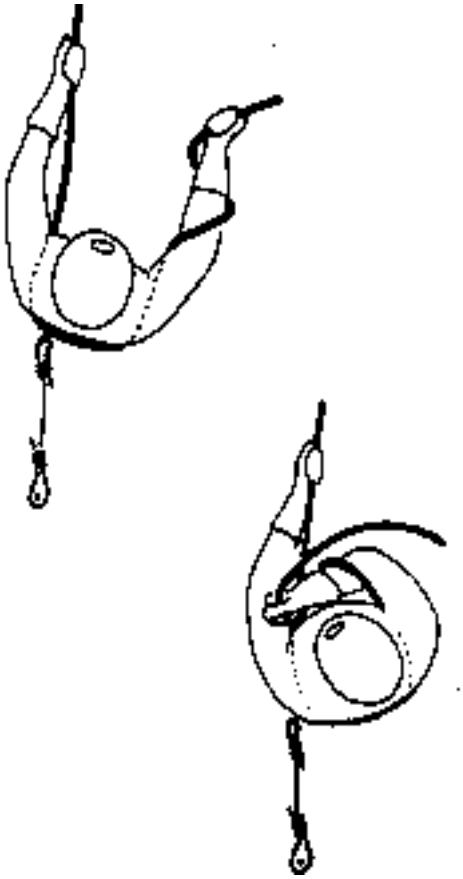
'Direct belaying' is a far better technique and is also described below. Here the lifeline is attached directly to the belay by some mechanical device and the lifeliner stands alongside and controls the rope passing through it. The two main advantages here are:
1 Such devices are far stronger than any caver and therefore are much less likely to fail. Any load is

transmitted directly to the anchor with no strain on the operator. The lifeline system is therefore much stronger.

2 The operator is not trapped within the system; they can with minimal effort lower the fallen climber or anchor them securely to the belay and then be free to go to their aid.

Traditional 'body' lining

Once the lifeliner is securely belayed, the ladder climber fastens onto the other end of the rope. The rope then passes through the lifeliner's guiding hand, around the small of the back and a twist taken around the arm before it is held in the braking hand (Fig 4). The basic principle utilises the friction of the rope wrapped around the lifeliner's body to help control the rope in a fall, which entails tightly gripping the rope and bringing the braking arm across in front of the chest to maximise the friction (Fig 5).

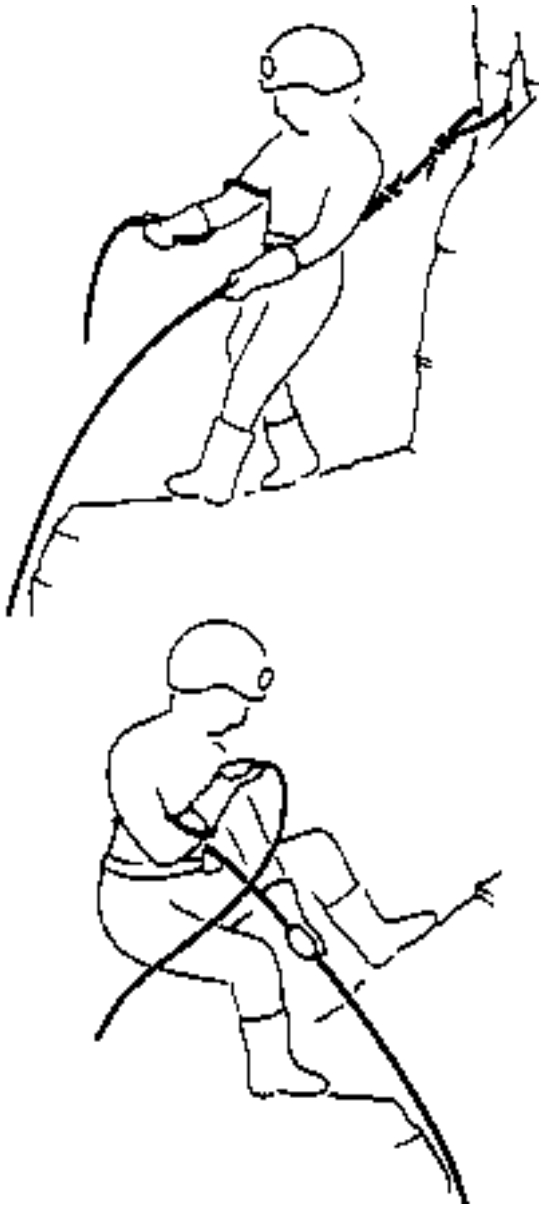


Figs 4 &5 Lifeliner's rope technique: (above) the 'live' end of the rope passes through the lifeliner's left hand and is wrapped around the right arm to act as a brake (or vice versa); (below) if the climber slips or falls, the braking arm is whipped across the chest

The strain on the lifeliner is often severe and the braking hand should be gloved to lessen the chances of instinctively letting go as the rope cuts into the hand. To ensure that undue strains are not placed upon him/her while controlling a fall, the lifeliner's belay system must have no slack in it at all, and be arranged in as direct a line as possible to the anticipated load, so that any force is transmitted directly to the anchor (Fig 6). The lifeliner should be far enough back from the pitch lip to obviate any possibility of being dragged over the edge, and in a stable position sitting down and/or securely braced against any projections (Fig 7).

Top-roping

The active rope is paid out and taken in with the guiding hand; the braking hand is slid along it so that the rope is never completely released. The sequence when caver is climbing the ladder is as follows: in the rest position the braking hand is held close to the body with the guiding hand a half-metre or so away. As the rope is taken in,



Figs 6 & 7 - Lifeliner's position: (above) there must be no slack in the belay sling. The sling and the live rope should be in a direct line; (below) a stable stance must be assumed - sitting, or perhaps standing with feet against projections (lifeliner's belay omitted for clarity)

both hands move an equal distance in opposite directions. The guiding hand is then returned to its original position where, still gripping the rope, it also

temporarily grasps the dead rope in front of the braking hand, allowing the braking hand to be slid back to its original position close to the body (Fig 8).

As a climber descends, the lifeliner allows the rope to slip through the grip so that the rope between them is just taut: he must not feed the rope out and allow slack to accumulate. This way any fall that does occur should be no more than a metre or so until the rope becomes tight and the lifeliner arrests it. Subsequently the climber is either allowed to regain the ladder or is gently lowered to the foot of the pitch. With top-roping each member of the party may be safeguarded apart from the lifeliner, who must be protected on descent from below with the lifeline running through a pulley at the pitch head (double-roping).

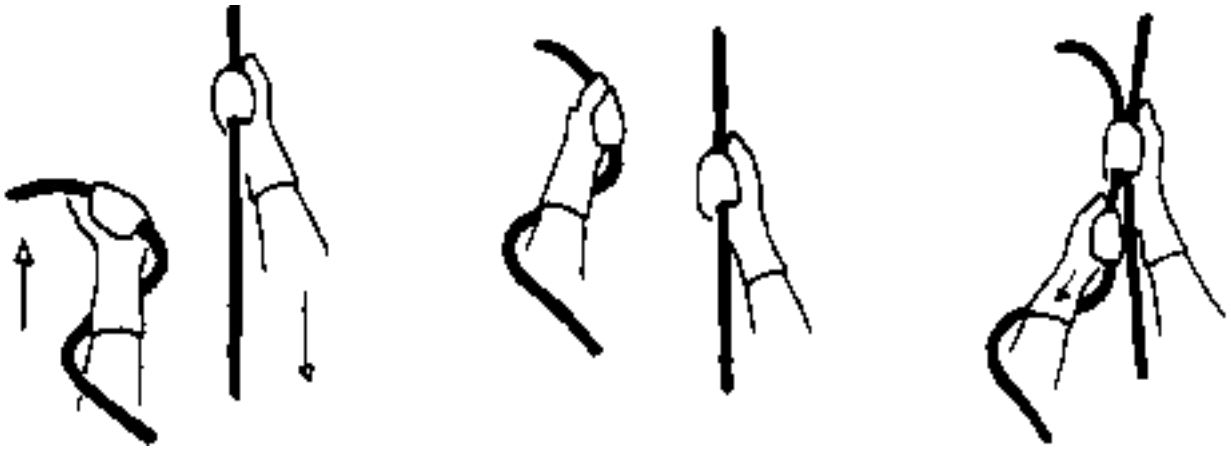


Fig 8

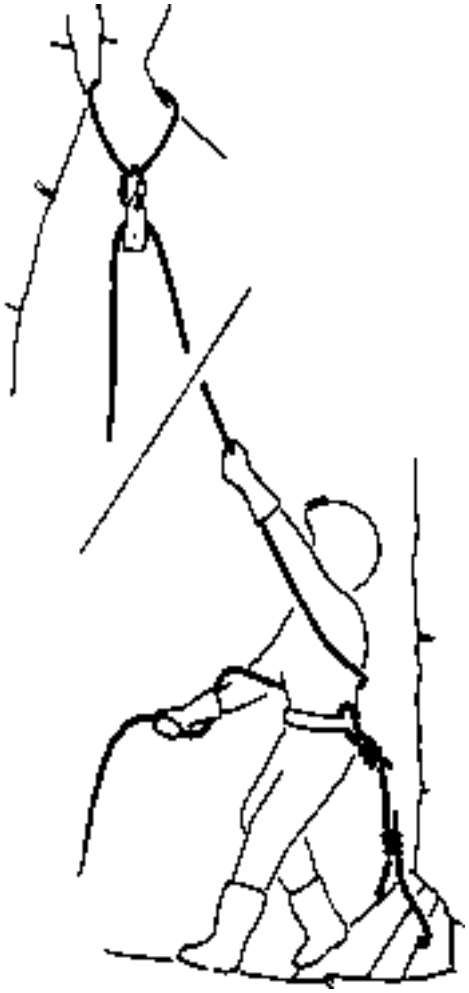


Fig 9 Lining from the base of a pitch: (above) the lifeliner must be securely belayed, held by another Caver and/or have a number of people helping with the taking-in;

Double-roping

To safely protect the final member of the party (the previous lifeliner) down the pitch, double roping,from has to be utilised, from below. One of the party at the foot of the pitch **belays themselves to a suitable anchor**, out of danger from stone-fall and secure with an upward pull.

They then take in the slack rope ready to lifeline the climber down. The person at the top of the pitch may now release their attachment from the anchor and should

ensure that they are fastened to the other end of the rope. He/she is protected by means of the rope running over the pulley as they climb down. Both ends of the rope are now at the foot of the pitch with the middle passing over a pulley at the pitch head (Fig 9).

Wherever a double-rope system is arranged for the return, particularly where the rope hangs in a waterfall, the two ends should be tied together, preferably around the ladder. Otherwise falling water tugging at one end of the double rope may work it gradually through the pulley so that the returning cavers find it piled up uselessly at the foot of the pitch. To ensure the smooth operation of a double rope system, the pulley should be located reasonable close to the ladder, **on a separate anchor point**, and if possible with a clear run down the pitch. A double rope should never be rigged so far back from the pitch head that it twists

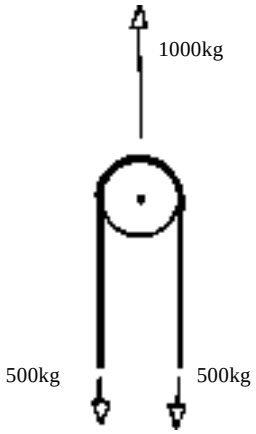


Fig 10

beneath the ladder, nor hung so that the pulley is below the pitch head. The anchor selected for a pulley needs to be secure in the direction of applied load and ideally twice as strong as the lifeline rope. If a falling climber generates a force of 500kg on their way down, then it requires an equal and opposite force to restrain them! If both these forces are acting in approximately the same direction over a fixed point, in this case a pulley, then the load on the pulley and its anchor is around twice the original force generated, ie 1000kg (Fig 10).

Body Ballast

Many caves exhibit a lack of anchor points at the foot of pitches suitable for lifelining from below. Where there is no anchor available at the foot of a pitch to provide a belay for a double rope, one or two of the party may simply attach themselves to the lifeliner as additional 'ballast'. Perhaps the most convenient way of doing this is by linking harness karabiners and, provided that the combined lifeliner and ballast' are substantially heavier than the ladder climber, the system is functional and safe.

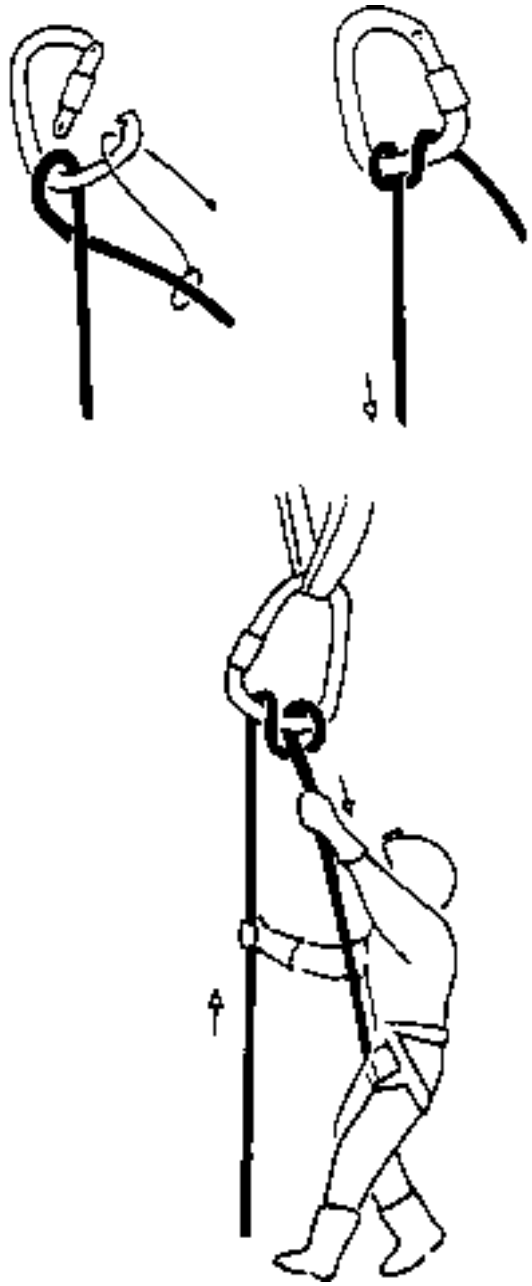
Direct belaying

There are numerous types of direct belay methods including the use of descenders such as the 'figure 8' or a 'sticht plate' used often by mountaineers. Described below is probably the simplest and arguably the best method for caving use.

Italian Hitch

This lifelining method requires no special equipment, and consists of just a simple knot tied around a karabiner. There are many ingenious methods of belaying using various configurations of rope and karabiner to form 'self-locking' knots, which run easily in one direction but not the other. The safest and most adaptable is a versatile 'friction' hitch known in Britain as the 'Italian hitch', easily recognised by its distinctive rope-across-rope friction contact. The easiest method of forming the hitch around a karabiner is that shown in Fig 11.

The hitch allows the rope to move in only one direction controlled by friction created by tension in the non-loaded rope. With this friction and the 'tightening' effect on the karabiner, you can arrest even a very severe fall with one hand. In addition, while unloaded, the hitch is reversible; by pulling on the non-loaded side it will rotate through 180° around the karabiner and, thus inverted, the rope will slip in the opposite direction. It is a simple matter to take in the slack rope as the climber ascends, using one hand to lift the load rope and the



Figs 11 & 12 Lifeline controllers: friction knots (Above) the Italian Hitch: an extremely useful knot for lifelining; (below) a simple two-handed operation will take in slack rope as the climber ascends.

other to pull it through the hitch (Fig 12). Should the climber fall, the knot will automatically reverse itself, and holding the non-loaded rope will then arrest the fall with little effort. Subsequently either the climb can be

resumed, the hitch 'locked off' (Fig 13), or by releasing rope into the hitch the climber can be lowered.

Nothing could be simpler or more effective, but bear in mind two points: firstly, the reversing action of the Italian hitch is essential to its operation and the karabiner must be wide enough across its base to allow this - there are karabiners made specifically for the purpose; secondly, ensure that the running rope does not undo the locking sleeve of the karabiner.

Petzel Stop Descender

A modern alternative to the Italian hitch is to use a petzel stop descender for lifelining. This offers full control during descent and the caver can be either held

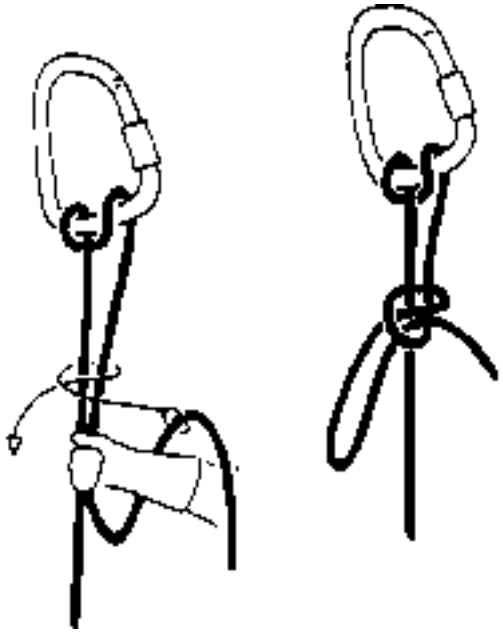


Fig 13 - A sudden fall reverses the knot, and the rope is easily held with one hand; (above) the hitch can easily be locked-off, or by feeding rope into it the climber can be lowered to the base of the pitch

mid-climb or lowered, with control, to the base of the pitch. Taking in slack on climbing is probably not as easy as with an Italian hitch but still offers advantages over the "body belay" method described earlier. One disadvantage is that you may not always have a "stop" device with you on a ladder trip!

SINGLE ROPE TECHNIQUES (SRT)

This chapter describes the basic skills necessary to negotiate vertical sections of cave safely. The techniques are simple enough, but their value is, initially, in direct ratio to practice on the surface and then to subsequent experience underground. There is no substitute for experience.

Frog Rig

The system most commonly used in British caves is without doubt a straightforward Frog rig (Fig 14), with good qualities of safety and versatility. Fundamental to the Frog system is a comfortable leg-loop type sit-harness allowing free and independent movement of the legs while suspended.

The harness is linked at the front by a strong (10mm) Maillon Rapide 'D-ring', which unlike a krab may be loaded in any direction without significant loss of

Fig 14 The Frog Rig

strength. The 'body-mounted' jammer is fastened directly into the M/R and supported by a figure-eight type chest-harness. This is just a 3m length of tape with a quick-adjustment buckle at one end, wound around the upper body and threaded through the jammer and the M/R. This harness serves mainly to tow the jammer, and consequently it need be neither load-bearing nor restrictive; by locating the buckle somewhere handy, you can easily adjust the harness while climbing and loosen it between pitches.

The upper jammer carries a foot-loop and is also linked to the sit harness so that, should the body-jammer slip or fail, you hang safely from the upper jammer. Low stretch cord (8mm) can be used for the footloop, with dynamic rope being used for the safety cord between the harness M/R and the top ascender. Alternatively, the foot-loop and safety-cord can be tied from a single length of low-stretch cord. A large single loop takes either one or both feet, dependent on whether against a wall or free-hanging, and also allows you to trap the rope between the feet while climbing the initial few metres so that no one is needed to hold it (Fig 15). The foot-loop is attached to

its jammer by a 7mm M/R or screwgate karabiner and its length is adjusted so that the two jammers almost touch when the legs are fully straightened. The safety cord linking jammer and sit-harness should be long enough to permit the maximum gain with each climbing cycle, but not so long that the jammer is out of reach while hanging from it.

Also attached to the main M/R are two cow's-tails tied from sturdy 10 or 11mm **climbing rope**, one short (45cm) and the other longer (70cm), each with a karabiner at its end. These are necessary for safety attachment at anchor points or traverse lines, such as while gaining the rope at a pitch head, or passing intermediate anchors further down. Because cow's-tail krabs are rarely attached for very long, they may not always be screwed up; for this reason, use asymmetric-form krabs with a 'pin-and-slot' type latch.

Posture on the rope is important. Lying back is wasteful of energy. The leg push should be as vertical as possible in order to minimise effort (Fig 16). The chest strap must be very tight whilst on the pitch in order to keep the upper boby as close to the rope as possible. If the arms ache ascending a long pitch you can almost guarantee that the chest strap is too loose.

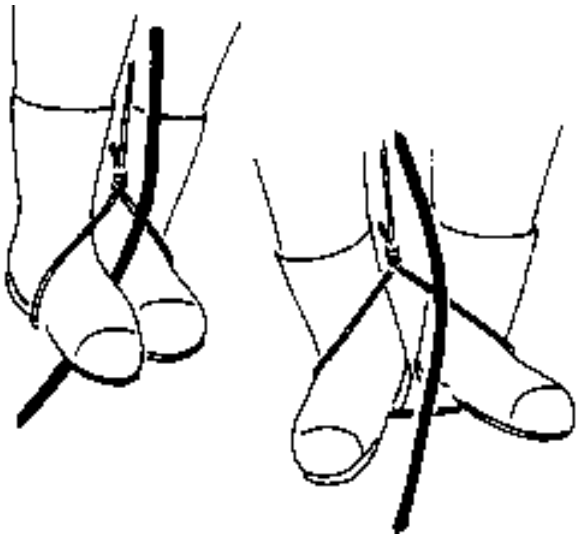


Fig 15 Trapping the rope with the feet makes it unnecessary for anyone to hold the rope at the start of the climb

On the pitch tackle-sacks are carried on a length of cord reaching from the main M/R to just below the feet. The weight of the sack is transferred directly to the chest-jammer for much of the climbing cycle with no pull on the climber. Using both feet in the loop allows a powerful lifting action and the additional weight beneath helps maintain you vertical to the rope. The same principle with minor modifications can also be used to rescue an injured caver from mid-rope.

Descending/Ascending Manoeuvres

Abseiling an underground pitch is as hazardous as it is exhilarating. Because the techniques involved are simple and relatively effortless, the inherent dangers are not always appreciated.

While abseiling, the descender is the sole point of contact with the rope, and this is a sliding rather than a fixed connection. Any loss of control or failure of the descender or its attachment will be serious. A smooth, fully controlled descent places the least amount of strain on the descender, the rope system and the caver's nervous system. Some surface rock climbers (and the odd half-wit caver) are given to abseiling in apparently great style, thrusting away from the rock with huge bounds and

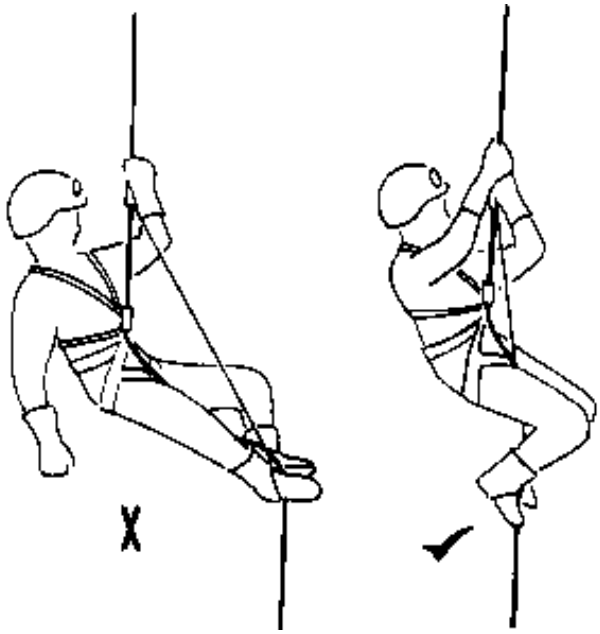


Fig 16

hurtling down the rope in spectacular curves. Any caver performing this way should be given a wide berth. Once control is lost it is always difficult and may prove impossible to regain it.

In mid-rope the caver is very exposed; vulnerable to anchor failure, rope failure, gear failure, water- and rock-fall, loss of control and other indignities arising from carelessness, such as loose hair or clothing drawn into the descender, knots in the rope or running out of rope before the bottom of the pitch. The most skilful caver cannot abseil effectively if knocked unconscious by falling rock, or if the descender falls to bits. To redress the balance towards survival you need to carry prusiking gear on all abseils. This enables passing of knots and intermediate anchor points, freeing trapped fingers from the descender, changing ropes and even changing your mind and climbing back up again should the situation prove too hairy! Abseiling down a pitch without the facility for stopping and climbing back is only for the extremely stupid.

Basic manoeuvres are few and simple but nonetheless essential. It is important to perfect these on the surface before trying them underground:

1 Stop and securely lock off the descender at

any point during the descent.
2 Pass intermediate anchor points.
3 Change from abseil to prusik and vice versa.
4 Pass knots in mid-rope.

Descender Lock

It is important to know how to 'lock-off' the particular decending device you are using. Different descenders have varying degrees of difficulty in carrying out this procedure but it is essential that this is practiced on the surface to ensure proficiency before trying the process underground. Don't be tempted to take short cuts; always 'lock off' when carrying out a manoeuvre. 'Self-lock' descenders may not need to be tied off, but should be if you do not completely trust them.

Passing Intermediate Anchors (descent)

Descend until level with the intermediate anchor and if necessary lock off the descender, clip the short cow's-tail into the krab, Maillon Rapide, or knot loop of the anchor (Fig 17 L), then continue abseiling until your weight is taken entirely by the cow's-tail (Fig 17 C). The long cow's-tail should then be clipped into the main loop of rope coming from above, for security. Now the descender can be transferred to the rope immediately below the anchor and locked off securely. In order to disconnect the cow's-tail the weight must be removed from it. Often in a pitch there is a ledge or foothold you can stand on momentarily but, if not, place a knee or foot into the loop of rope coming from above and stand up in this (Fig 17 R). If all else fails, you could wrap the lower rope around your foot a few times as a foothold, or clip your prusiking footloop into the anchor. Then lower yourself onto the locked descender and check that all is well before removing the long cow's-tail, unlocking the descender and resuming the descent.

Passing Intermediate Anchors (ascent)

Climbing past an intermediate anchor is simple with the Frog rig; stop a few centimetres short of the belay knot and attach the long cow's-tail to the anchor as a precaution (Fig 18 L). Transfer the body-jammer to the upper rope (Fig 18 C) by standing in the footloop. The footloop jammer is then transfered (Fig 18 R) and once everything is working well unclip the cow's-tail and continue up. Climbing past a belay, it is essential to transfer the body-jammer first, otherwise the elasticity of the rope above will make unloading this more difficult.

Deviation

An alternative method of redirecting the rope to avoid abrasion or falling water, is the technique of deviation (Fig 19). An adjacent anchor (perhaps on the opposite wall) is used to pull the rope away from the rub point or clear of the water by means of a sling or length of cord and a karabiner clipped around the rope. To pass, each caver removes and then replaces this karabiner, above the descender (on descent) or belew both ascenders (on

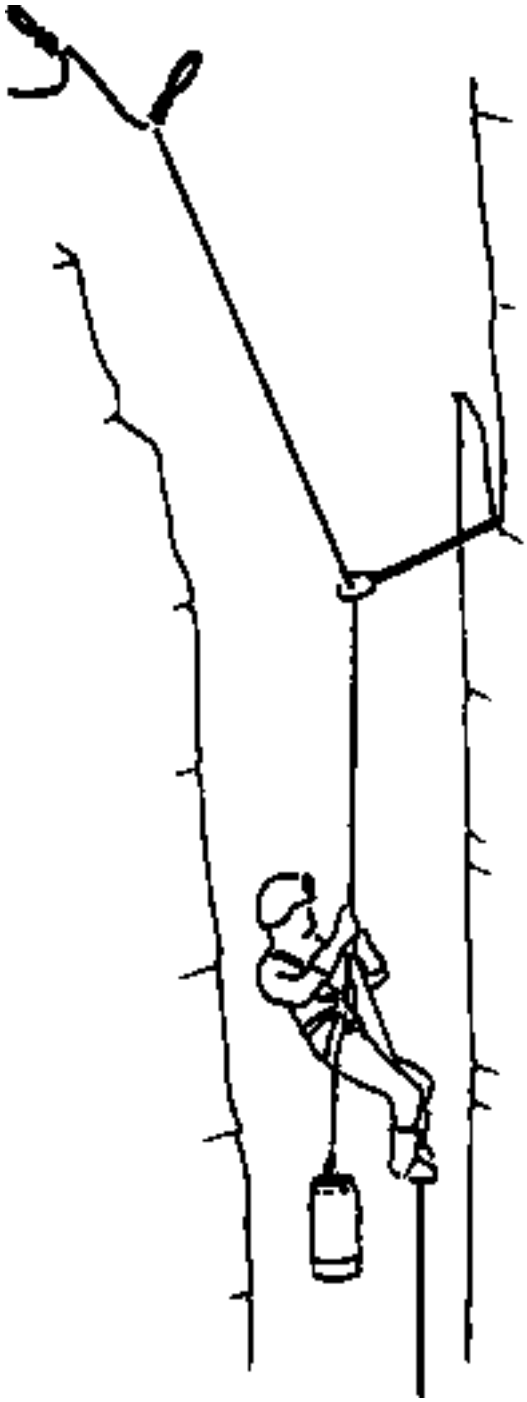


Fig 19

ascent). **Under no circumstances should any descending or ascending gear be removed from the rope when passing a deviation.** The force on this belay is not very great as the rope is not fixed to it and would not result in a shock-load should it fail. Many belays are suitable for this technique which would be extremely dangerous if used as an intermediate anchor, for instance a single piton, a stalagmite or a partly-inserted bolt.

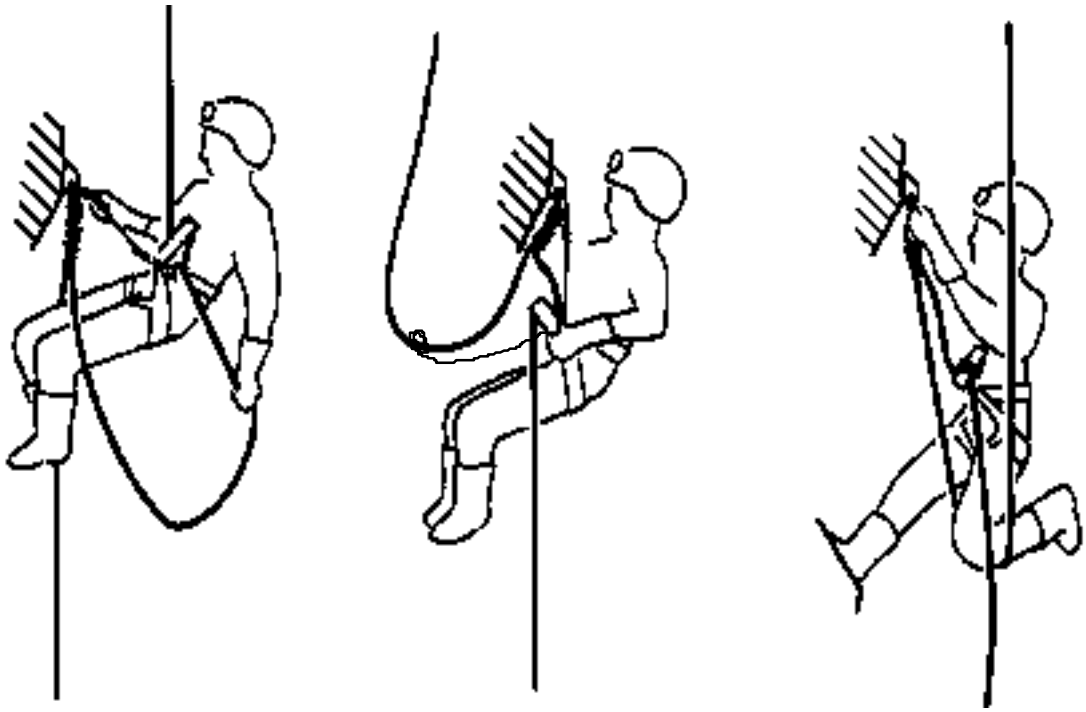


Fig 17 Method of passing an intermediate anchor on descent: (left} abseil until level with bolt and attach short cow's-tail; (centre) descend further until weight is on Cows-tail. Attach long cow's tail to large loop of rope, transfer descender to lower section of rope and lock off; (right) remove cow's-tail by standing up in rope loop and continue descent.

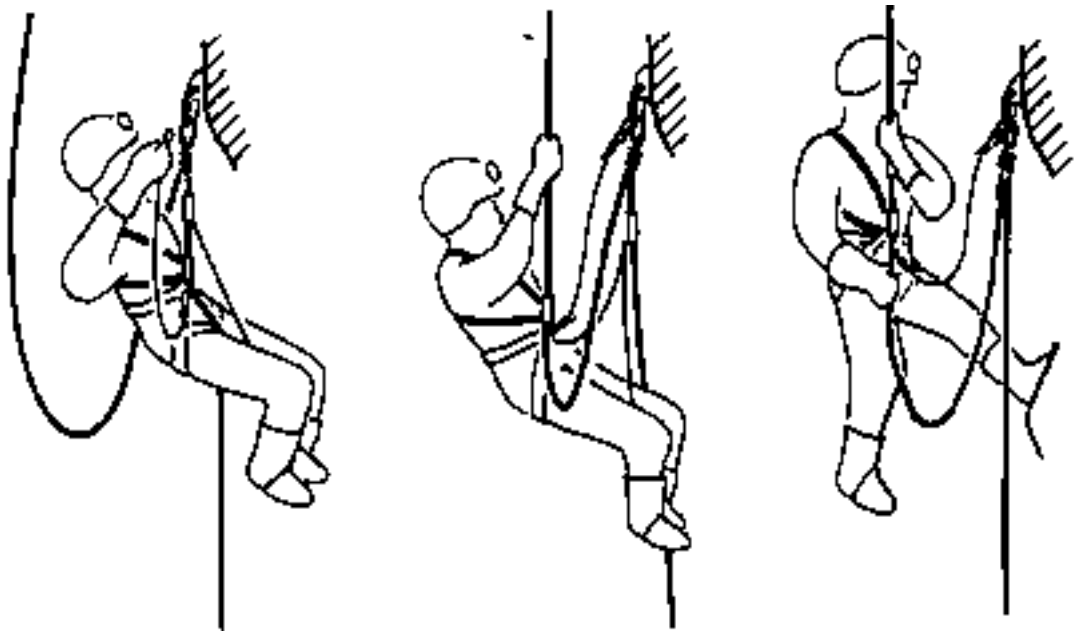


Fig 18 Passing an intermediate anchor on ascent: (left) prusik up to the knot and attach long cow's-tail; (centre) transfer body jammer to upper rope; (right) transfer footloop jammer, unclip cow's-tail and continue to prusik.