

Basic Rock Climbing for the Exploration of Caves

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I . Introduction

When exploring caves, we often encounter rocks and vertical caves about which we do not have enough informations of previous exploration.

But we are not able to carry with us all the professional rock climbing equipment. It is common for us to carry only rope or nothing. So rock climbing here means not to professional rock climbing but to climbing rocks efficiently with rope or only rope without rope, that is, bare handedly we can climb short, easy, safe rocks, while with rope we can climb long, difficult, dangerous rocks. But when we are short of equipment during exploration, we, basically, climb around.

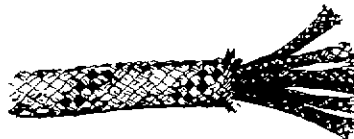
II . Rope and Knots

1. Rope

It is proper for the rope to be 9-11mm in diameter and 30-40m in length.

When you coil the rope, first hold the rope, next extend right and left hands to the maximum, then with right fingers twist semi-circle lightly, and

the with the left hand repeat to grasp. With this we can coil the rope evenly and we can finish the process by folding one end of the rope of circle or a circle and rolling several times halfway.



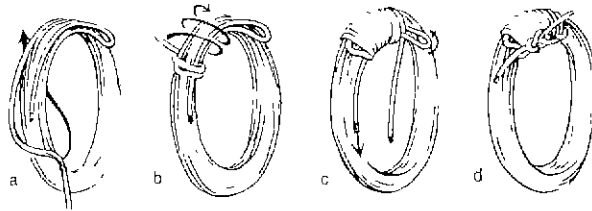
[Fig 1] Construction of a kernmantle rope

And the ways to care the rope are as follows.

1. If a rope is old or shocked severely, we don't hesitate to remove the rope because the rope can be broken at any time.
2. When wet, the should be dried not in the sun but in the shade. If the rope is exposed to the sun though not wet, it will become weak.
3. The rope must be tied with other rope and hung. The rope must not be hung on nail or something sharp. And it has not to be used as a wash-line or as a line for boundary.
4. The rope should be cleaned with only water. Soap and detergent should not be used, and strong scrubs should be avoided.
5. Be careful not to be stained with paint or petroleum, and not to carry with petroleum, gasoline, burner, etc.
6. The rope should be carried in the bags, not be stwisted, and the knots

should be united after used.

7. Be careful not to tread on, to tread on and to put heavy things on the rope. The rope should not be put on the earth or sand.
8. The rope should not be used on the sharp edge of the rocks, if it can not be avoided, sheet must be put on the sharp part of the rocks.
9. Keep the rope away from the hot things. Keep the rope in the dry and cool place. After used, the rope should be checked whether hurt or not.
10. Don't step on the rope during the rock climbing. Especially during the rock climbing you can slip and fall.



[Fig 2] Mountaineer's coil



[Fig 3] Butterfly coil

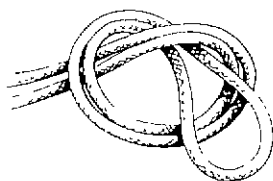
2. Knots

Knots allow you to use the rope for many special purposes. They let you tie into the rope, anchor yourself to the cave, tie two ropes together for long rappels, use slings to climb the rope itself, and much more.

Climbers rely most heavily on a dozen or so different knots. Practice these knots until tying them is second nature. If you really want a test, try tying them in a cold, dark shower to give you an idea of the conditions you may someday encounter on a climb.

1) Overhand knot

The overhand knot is most often used to secure loose rope ends after another knot has been tied. For instance, it can be used to secure rope ends after tying a square knot or a rewoven figure-8.

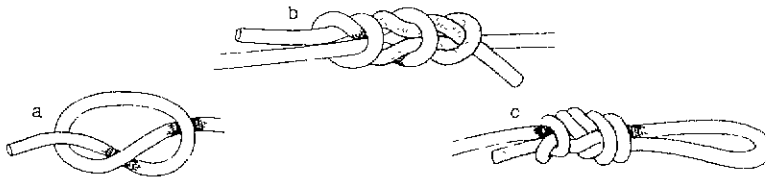


[Fig 4] Overhand knot

2) Overhand loop

The overhand loop is often used for leg loops in prusik slings or to make

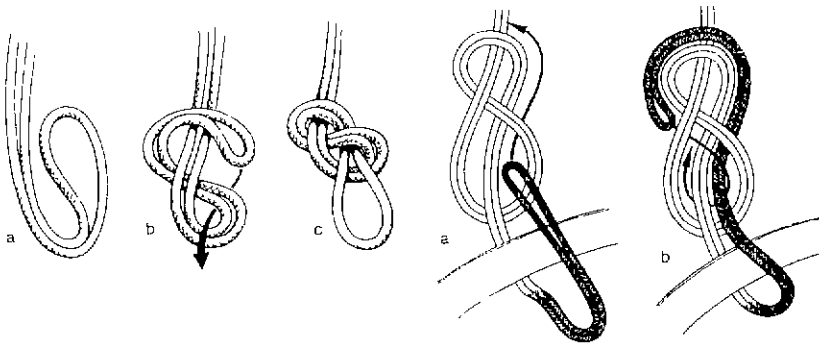
a loop in a doubled rope or a length of webbing.



[Fig 5] Overhand loop

3) Figure-8 loop

The figure-8 loop is a strong knot that can be readily untied after being under a load.

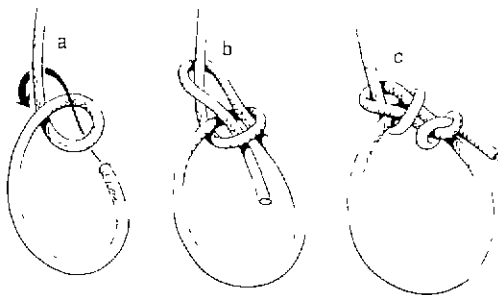


[Fig 6] Figure-8 loop

4) Single bowline

The single bowline makes a loop at the end of the climbing rope that will not slip, and it can secure the rope around a tree or other anchor. Tie off

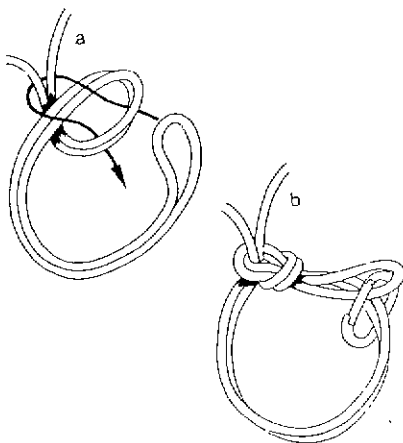
the loose end with an overhand knot. The free end of the rope should come out on the inside of the loop, because the knot is much weaker if this end finishes on the outside.



[Fig 7] Single bowline

5) Double bowline

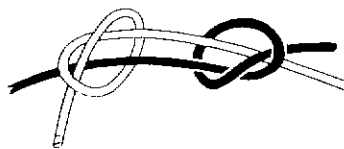
The middle person on a three-person rope tie the double bowline to a seat harness. The resulting end loop should be secured with an overhand knot or a carabiner.



[Fig 8] Double bowline

6) Fisherman's knot

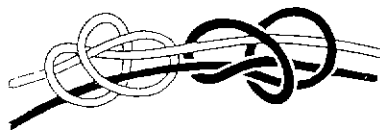
The fisherman's knot can be used to join two ropes together. It has been replaced to a large degree by the double fisherman's knot and is shown here primarily to provide a clearer understanding of the double fisherman's knot.



[Fig 9] Fisherman's knot

7) Double fisherman's knot

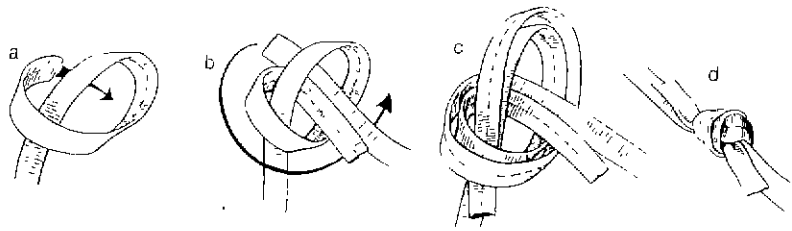
The double fisherman's knot, also known as the grapevine knot, is the most secure and Preferred knot for tying the ends of two ropes together for a rappel.



[Fig 10] Double fisherman's knot

8) Water knot

The Water knot, also known as the ring bend or tape knot, is used most often to tie a length of tubular webbing into a runner. This knot can work loose over time, so be sure the knot is cinched very tight, and the tails of the knot are at least 2 inches long. Check the knot often in runners and retie any that have short tails.



[Fig 11] Water knot

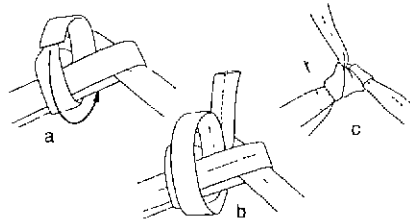
9) Double sheet bend

Double sheet bend is sometimes used instead of a water knot as the tie-off knot on homemade seat harnesses because it is easier to adjust. This knot has a tendency to work loose. Tie off the loose ends with backup overhand knots.

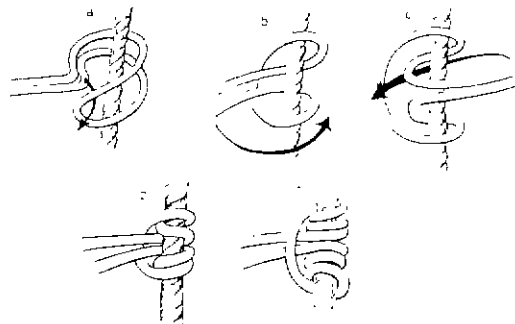
10) Friction knots

Friction knots provide a quick and simple way to setup a system for ascending or descending a climbing rope. The knots grip the climbing rope

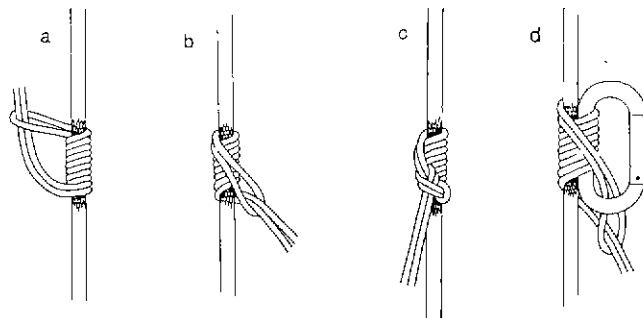
when weight is on them, but are free to move when the eight is released. The best known friction knot is the prusik, but others such as the Bachmann and the Klemheist are also useful.



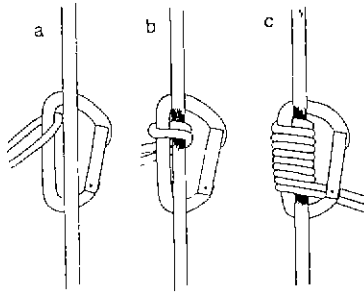
[Fig 12] Double sheet bend



[Fig 13] Prusik knot



[Fig 14] Klemheist knot



[Fig 15] Bachmann knot

III. The Skill of Cave Rock-climbing.

The way of rock-climbing that is going to be explained here is not an expert one, but an effective way to climb up and down a rock that are encountered sometimes during climbing in a situation that climbers are not equipped with rope or equipped with only rope. This method can be performed only on a short length of rock without critical danger. If a rock is quite long and dangerous, climbers should take a safe detour. When climbing up and down a rock, it is recommended that from the start climbers have an specific plan about where to step and grasp and what skill and method to use. Especially climbers have to note that in the middle of climbing a rock if they make a mistake on how and where to lay their feet and hands they can be in trouble.

The most important thing of rock-climbing is that climbers stand upright

placing their weight on their feet and grasp the prominent parts of the rock such as an edge to strike a balance. This is the basic principle of rock-climbing. However, there can be used other way that climbers pull up their bodies with their hands in a difficult place to climb up. In any situation, there are always possibility that climber can slip in case that they stick their bodies to the surface of the rock and do not remain balanced because of the fear for falling.

Another principle of rock-climbing is that climbers have to keep the pose throughout the process that three out of their four hands and feet remain supported on the rock. In other words, when moving one hand or foot to other place, climbers should not forget to step on the rock and grasp the rock firmly.

1. rock-climbing

1) slab-climbing: 'slab' means the inclined side of rock. The principle of this method is to climb up the rock by using the friction of the sole of the feet, and it is desirable to use hands only to strike a balance. It should be avoided to climb up The slap of loose rock. Climbers should keep it mind that they climb up the only solid part of rock. With the pose of climbing up the ladder and with their toes directed upward in parallel climbers should take a step as narrowly as possible and take advantage of the friction of the sole of rock-climbing boots to the fullest. To take advantage of the sole of

the shoes fully climbers have to try to put the center of their entire weight on their feet and by leaning against the rock like they push the surface of rock with their hands climbers always have to maintain the balance of their bodies and should avoid sticking their bodies on the rock. Climbers should maintain the position of their hands in parallel with the level of eyes and don't stretch their arms fully and never let their knees and elbows stuck to the side of a rock. If there is an hold(prominent parts to step on and grasp on the rock, climbers have to check it first before they use it.

Once a slip have happened climbers should not stick their bodies on the side of the rock, and try not to hurt their hands by tapping on the side of the rock and try to erect their bodies upright. And in that case, climbers have to try to apply the brake only with the friction power of the sole of the shoes, and the brake can work by striking the balance of the bodies to make the whole weight of the body put on their feet. Climbers have to make sure that toes of their two feet are directed upward in parallel.



[Fig 16] Slab climbing

2) The use of hold: 'hold' refers to the prominent part that climbers are able to step on or grasp. Therefore if there are a lot of holds on the rock, climbers do not have any difficulty climbing up and down the rock. All the holds should be checked out to see if they are solid enough before they are used. And the balance of climbers can be broken if climbers take a step or stretch their arms too widely when they use holds. Therefore, climbers have to use close holds, choose several holds in the course of climbing to use in advance before using one, and be careful about the step order and position of their feet not to let their feet crossed. Especially when stepping on Bucket-hold which is deeply dented, climbers should not put their feet so deeply into the hold that their legs are caught by the prominent part of the rock.

3) the use of Crack: 'crack' refers to narrow chasm of the rock climbers deliberately put their body between the gap to be supported which and climb up the rock. this skill is called Jamming that climbers intentionally put their part of their bodies between the gap and create the friction by twisting their bodies. In this method, the size of the rock chasm determines what climbers put between the gap among fingers, a hand, an arm, an elbow, a foot, a knee, a leg and so on. When climbers try a jamming, they should not put their part of their bodies so deeply that they have difficulty pulling out it. Using the chasm to the level of supporting their body is enough.



[Fig 17] Combining jamming with face climbing

4) the use of chimney: 'chimney' refers to a chasm that is wide enough for climber to be able to put their whole bodies into. The method of this climbing can be different by how big the chimney is.



[Fig 18] Chimney techniques

In the case of narrow chimney, climbers proceed by the friction letting their knees and palm of their hands lean against the front side and their backs and the sole of their shoes lean against the back side. In the case of the middle size of chimney, climbers climb up the rock with a continuous motion as the picture shows. In the case of wide size of chimney, climbers proceed by the help of holds, cracks and the friction with their right hands and foot stucked to one side and their left hands and foot stucked to another side.

5) Lieback

The classic lieback technique, another form of counterforce, uses hands pulling and feet pushing In opposition as the climber moves upward in shuffling movements. It's used to climb a crack in a corner, or a crack with one edge offset beyond the other, or along the edge of a flake.

Grasp one edge of the crack with both hands and lean back and to the side on straightened arms. Push your feet against the opposite wall of the crack. Then get a move on. It's a strenuous technique, and it's best to move as quickly and efficiently as possible.

Keep arms extended to minimize stress on tensed muscles. The right relationship of hands and feet will vary, but it becomes easier to determine with practice. In general, keep your feet high enough to maintain friction on the rock, unless a is foothold is available. But the higher you bring your feet, the more strenuous the lieback becomes.

The lieback has variations. You can lieback on a single handhold in combination with other holds, or use one hand and foot in a lieback while utilizing face holds for the opposite hand and foot.

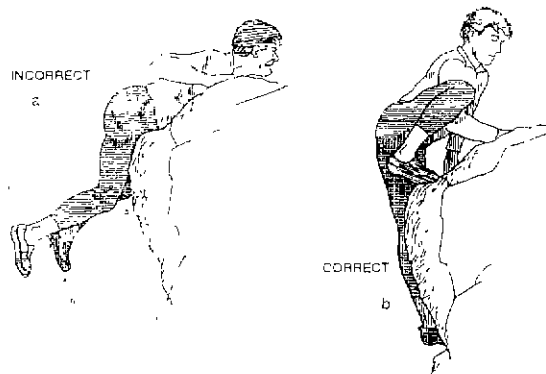


[Fig 19] Lieback

6) Exiting onto Ledges

As you approach a ledge, avoid the temptation to reach forward and pull yourself onto it. This may throw you off balance and also make it impossible to keep an eye on your footholds.

Instead, continue to walk your feet up the rock, and then used own pressure with the hands near the edge of the ledge. You might do a classic mantel. Be careful not to exit onto the ledge on your knees and then find yourself beneath an overhang, unable to stand.



[Fig 20] Exiting onto a ledge

7) Traversing

Traversing—going sideways across a section of rock instead of up or down—again calls for a catalog of climbing techniques. The main ones are side clings, liebacks, and stemming. And counterbalance is important when making a long sideways reach.

The Climber usually faces into the rock, toes pointed away from each other. Hands and feet are commonly shuffled sideways, although exchanging one hand for the other, or one foot for the other on a single hold can be very useful. You may occasionally cross one foot behind the other to reach the next hold, or cross one hand over the other.

On a steep pitch it's very tiring to hold yourself into the rock on bent arms. When possible, lean out from the rock on straight arms. This conserves arm strength, and it gives a better view of where you're going.

A specialized type of traverse is the hand traverse, used when footholds are marginal or non-existent. The hands grip a series of holds or shuffle along an edge, while the feet provide a counterforce by pushing against the rock, as in a lieback or undercling. Keep the feet high and the center of gravity low so the feet are pushed into the rock. And once again, keep the arms straight to conserve arm strength and to let the legs do as much of the work as possible.

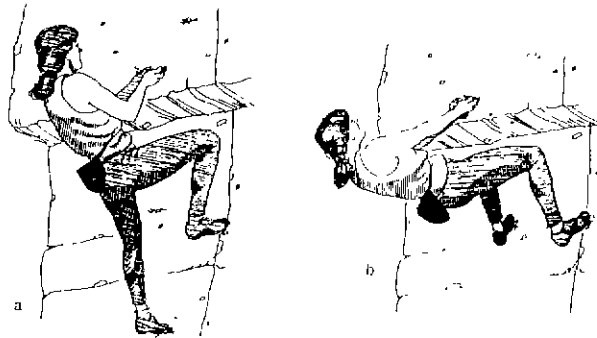


[Fig 21] Traversing a steep face

8) Undercling

In the undercling, the hands (palms up) push up beneath a lip of rock while the body leans out and the feet push against rock. The arms pull while the feet push, creating a counterforce. Try to keep your arms extended. Both hands can undercling at the same time, or one hand can undercling while the other uses a different type of hold.

An undercling hold may have multiple uses. For example, you can hold the bottom edge of a rock flake in a pinch grip from below, then convert to an undercling as you move up to the flake.



[Fig 22] Undercling

9) Downclimbing

While you're learning lots of ways to climb up ward, also allow some time to learn the valuable technique of downclimbing.

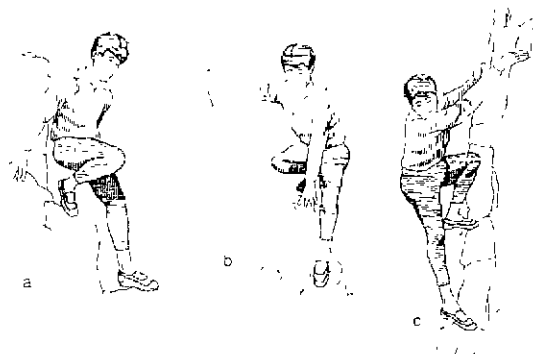
Downclimbing at times is faster, safer, or easier than rappelling, such as when rappel anchors aren't readily available. Downclimbing provides a way to retreat when you find yourself off route or on a pitch where the rock above is more difficult than you care to attempt.

Downclimbing has its special difficulties, however which helps explain why some climbers resist learning the skill. Holds are harder to see than when you're climbing upward—and holds on the steepest, most difficult

sections are the most difficult to see, especially if the rock is undercut below a bulge or small roof. It's hard to test holds without committing to them, an unpleasant fact if you doubt the soundness of the rock. And unless you've imbed up the same way, the terrain below is unknown, and you may not be able to anticipate the consequences of a fall.

For downclimbing on low-angle rock, face outward for the best visibility. Keep hands low and use downpressure holds whenever possible. Going down friction slabs, keep weight over your feet to maximize friction. It may help to keep your center of gravity low, with knees well bent.

As the rock steepens, turn sideways, leaning away from the rock for better visibility. If the cliff gets even steeper, face into the rock. Keep hands low, and lean away from the rock to look for holds below.



[Fig 23] Downclimbing

IV. Rocks which caves should pay attention to.

Rock-climbing should be performed on the solid and ordinary rock but in some cases can be performed on the dangerous loose rock or wet rock.

1. Loose Rock

when climbing up loose rock the system of warning and taking shelter of all the members of a climbing team should be well organized. On loose rock, fall of stones easily happens and even climbers themselves can fall from the rock by the collapse of the rock. When climbing up loose rock, it is better to climb obliquely rather than straight, to behave individually rather than in a group, and climbers should not forget to make sure. Also, climbers should not forget to check out holds to see if they are solid. And when grasping holds with their hands climbers should not pull them but press them with the palms of their hands. And it should be avoided that climbers put their entire weight on one or two holds. If fall of stones have happened, climbers have to warn their members of that by shouting out loud 'fall of stones' and in the case that the stones fall straight to one's head, climbers should escape rapidly or if time doesn't allows, climbers have to protect their heads at least by preventing the stones from falling to their heads by blocking the stones with their bags.

However, climbers should avoid climbing up loose rock and take a detour except for an unavoidable situation.

2. Wet Rock

Wet rock refers to rocks such as rocks on whose surface there are moss, on whose surface water flows, or on whose surface there remains water. The wet rock is very slippery, so climbers have to take a firm step on the rock and use apparent holds and cracks and avoid support their bodies by friction of the surface of the rock.

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