

# Comments on the "Lori Cori Cave Accident Analysis" and the Proper Use of the Petzl Bobbin Descender

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[Ed. note: This article was submitted almost a year ago and took awhile to get to print due to our backlog of articles and the difficulty of reformatting it. But I feel it is still quite relevant.]

It is always sad when the caving community learns that one of its members was hurt or died in an accident, even when one does not know the victim. It is also fully understandable that close fellow cavers would want to know what happened to their friend and try to analyze the accident. That is exactly what A. Futrell, B. Storage and L. Maish tried to do following the fatal accident of Dick Graham on Sept. 27, 2003 (cf. NSS News, June 2005, pp. 10-13, "Lori Cori Cave Accident Analysis" (1)).

Typically an accident is not due to a single cause, but to a chain of events. If one compares their analysis with aircraft accident analysis performed by the NTSB, it seems that the authors of the "Lori Cori Cave Accident Analysis" only investigated and emphasized the downstream part of the chain of events (the quick link escaping the bobbin gate, allowing the latter to open). If the analysis had started more "upstream," instead of focusing only on the consequential part, it would have better shown what I consider as the root causes of the accident. This would have provided better advice/information to the caving community on how to avoid the repetition of such an accident, and would not implicitly discredit a safe descender.

The picture #1 on page 11 (NSS News, June 2005, reprinted below) says it all. It



shows an accident waiting to happen and very unfortunately it did happen. From that point on, the "detailed analysis" is not as relevant anymore, since the beginning of the

chain of events that has already started earlier is missing (see below "the real causes of the accident"). The report of the accident in the NSS News of Sept. 2005, part 2, *American Caving Accidents 2002-2003* (mentioned further below as ACA or ACA 02-03) also follows the same "downstream philosophy" of the accident analysis. It does not provide new clues; some of the advice can in fact possibly cause unsafe situations if used "as is" without additional "homework."

Unless otherwise specified, we will refer below to the Petzl bobbin descender as the "SIMPLE." For the oldest as well as for the latest models. Furthermore, the technical terms used are mainly the same ones as in the "Lori Cori Cave Accident Analysis" and in the Petzl documentation.

## THE REAL CAUSES OF THE ACCIDENT

**1. Incorrect rigging of the SIMPLE bobbin descender.** Remember: one should never use a quick link (maillon) to attach the SIMPLE to the screw-link of the harness (but do use either a triangular or a semi-circular screw link for the harness). The SIMPLE must always be attached with an oval safety carabiner only. The use of a "quick link" maillon is not just "another contributing factor" as mentioned in the analysis on page 12 (NSS News, June 2005), it is indeed THE major cause of the accident (a 60-80% weight, the other 20-40% being the point 2 below). As correctly stated by ACA 02-03, a normal safety carabiner, with its larger diameter of rod stock, is much less likely to "slip" under the gate mechanism of the SIMPLE than a "quick link" maillon—as suggested for this latter with pictures # 5 and # 6 on page 11 (NSS News, June 2005). The typical diameter of carabiner rod stock is 10 mm compared to a typical "quick link" maillon of 6 mm rod stock. The inside radius of a safety carabiner itself is 30 mm versus 15 mm or less for the "quick link" maillon; the latter has a sharper bend, more likely to slip through the gate, and causes additional wear of the SIMPLE suspension hole due to the small diameter of the rod stock. A carabiner made of 10-mm rod stock is the most appropriate with the 13-mm diameter of the SIMPLE suspension hole (eye), as it gives the necessary play for clipping or unclipping.

**2. Improper use of the descender by the bobbin.** Remember: one should always use a control carabiner ("brake carabiner"), typically an oval carabiner, which is an intrinsic part of the descender's design.

## THE PETZL SIMPLE BOBBIN DESCENDER <SYSTEM>

You notice here the emphasis on the word "system" in the descender "<system>," which consists of several elements that can be combined together in different ways, yet some combinations are inherently dangerous. One cannot simply substitute a bobbin descender for a rappel rack without considering the change to the "<system>" as a whole.

## ELEMENTS OF THE <SYSTEM>

The harness: the choice should be the specific caver harness, with a triangular or semi-circular screw link to close it. Some cavers are using a climbing harness. A climbing harness has typically a rope for webbing attachment point in the front; for climbing purposes, it is where the dynamic rope must be attached with the appropriate knot, and never with a carabiner. A true climbing harness is not the best choice at all, as we will see later in this article.

The triangular or the semi-circular screw link (typically a 10-mm rod stock) of the harness (see above), made of steel, stainless steel, aluminum or zirconium, is the primary attachment.

The suspension of the SIMPLE. It consists of an oval safety carabiner (no substitution).

The Petzl bobbin descender—SIMPLE: (older or latest model), it has one oval hole (for eye) on each of both arms of the device, the one on the right side having an opening allowing the passage of a closed carabiner, and a gate mechanism to close that opening.

The mandatory and essential control carabiner ("brake carabiner").

The accessories, such as a double cow tail of unequal lengths with a carabiner at each end, possibly a Petzl shunt as a backup, gloves, etc.

## BASIC CONFIGURATION

The Petzl Company instructions for their SIMPLE descender (4) are available on the WEB, in case you have lost the pamphlet attached to the device when you purchased it. The basic instructions are valid for the oldest as well as for the latest models.

Petzl recommends using a triangular screw link to close the harness. This screw link is generally made of 10-mm rod stock. Petzl also instructs you to attach the SIMPLE suspension oval safety carabiner and the oval control carabiner, to that primary attachment triangular screw link (see picture #1-1-1 below). This configuration works well, even when the chest ascender CROLL, and the loop of the double cow tail are attached to the triangular screw link, if you place them correctly. The meandering path of the rope through the SIMPLE and the control carabiner is in the same geometric plane. Nevertheless, this configuration may require some caution, as will be described further.

Like most of the cavers today, ACA 02-03 prefers a semi-circular ("demi-trond") screw link instead of the triangular screw link as primary attachment "less likely to cause binding of carabiners, cow tails, and ascender attached to it." But this new trend is known to be dangerous when the control carabiner

is clipped directly to the semi-circular screw link, as found by the Ecole Française de Spéléologie (French Speleology School)—see its WEB site (5). The semi-circular screw link, being wider, allows in some situations the top of the SIMPLE to engage into the control carabiner when it is also attached to the same semi-circular screw link (picture #2-1-2 below). This is much more likely to happen than with a triangular screw link (picture #1-1-2 below), and then the caver may lose control of the descent rate. The same dangerous situation can happen with the use of a climbing harness (this latter has a rope or webbing attachment loop instead of a primary attachment screw link), when both the suspension carabiner of the SIMPLE and the control carabiner are attached to that rope or webbing loop attachment (you will understand when looking at picture #2-1-1 with the semi-circular screw link). The next paragraph mentions two safer methods, describing where to clip the control carabiner to prevent the problem just described.

## THE CONTROL CARABINER

The role of the control carabiner is to control (f) the rate of descent and to stop; the caver increases or decreases the braking effect by changing the position of the rope with the right hand.

The control carabiner is an essential part of the "<system>". The Petzl Company recommends (4) to use an oval safety carabiner as control carabiner (the emphasis on "safety" here is probably motivated by some legal reasons...). Practice and experience show that a safety carabiner as control carabiner is cumbersome in narrow pits or cracks. Many European cavers are using a normal oval steel carabiner (aluminum or zirconium) also, but there is a faster wear on these carabiners, especially with muddy ropes (5) (nevertheless, the pictures below are shown with the safety carabiner).

The control carabiner also plays another important role in the overall safety of the "<system>" (cf. part 2 of the paragraph "the real causes of the accident" at the beginning of this article). In the early days of the first SIMPLE built with a gate mechanism, Europeans cavers started to clip the oval control carabiner in the oval hole (eye) of the device, next to the suspension safety carabiner. Thus, the size of the two carabiners' rod is preventing an inadvertent opening of the gate mechanism (see pictures #1-2-1, #1-2-2 & #2-2-1, #2-2-2 below). The meandering rope path through the SIMPLE and the control carabiner is in the same geometric plane, which is an added safety feature.

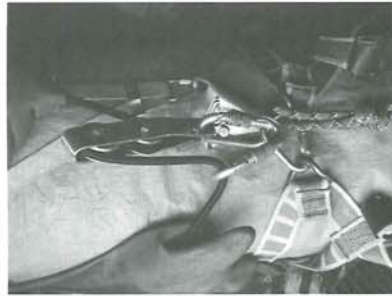
Telephone calls to several European cavers during the fall of 2005 and winter 2005-2006, confirmed that most of them still use this configuration and they feel abso-

lutely safe. Furthermore, in their minds, the oval hole (eye) "must have been especially designed" to allow hooking two carabiners. But with this setting, the caver has to totally unclip the control carabiner to be able to insert or extract the rope to / from the SIMPLE, and he/she can inadvertently drop the carabiner down the pit. This is why the Ecole Française de Spéléologie considers this practice as outdated—but not unsafe, (maneuvers are just too time consuming) and recommends instead to hook the control carabiner directly in the suspension carabiner of the SIMPLE, on the side of the gate mechanism (5). This allows inserting or extracting the rope from the SIMPLE without the risk of dropping or losing the control carabiner. The meandering path of the rope through the SIMPLE and the control carabiner is not totally in the same geometric plane anymore. Nevertheless, the tension on the rope and its path, between the SIMPLE and the control carabiner is such that it prevents even more so the (unlikely) opening of the right arm (side-plate) of the SIMPLE (see pictures #1-3-1, #1-3-2 & #2-3-1 through #2-3-3 below).

With the basic configuration of the two carabiners (suspension of the SIMPLE with the safety carabiner, and the control carabiner) attached to the primary attachment point (triangular or semi-circular screw link), and a single or double cow tail also attached to that primary attachment point, ACA 02-03 suggests to clip a carabiner from the cow tail into the SIMPLE oval hole (eye) to add safety. While this cow tail carabiner is also preventing the opening of the SIMPLE (like with the control carabiner clipped through that same hole, as described above), this practice is not the best: if the carabiner is needed when reaching a bolted suspension point of the rope (rebelay), then it must be unclipped, where and when the risk of an inadvertent opening of the descender is the greatest (even if this is unlikely to happen). This configuration also does not prevent the top of the SIMPLE from engaging into the control carabiner when using a semi-circular screw link as primary attachment point.

I wanted to know more. In a controlled environment and with a backup up SHUNT, I made 2 successive tests with a SIMPLE (old model similar to the one involved in the Lori Cave accident)—but please do not replicate these tests yourself. The first test was with the control carabiner clipped in the eye of the SIMPLE, the second with the control carabiner clipped in the suspension carabiner of the SIMPLE. I used a 10.5 mm supple rope. The purpose of the tests was to go down the rope for some 30 feet with the SIMPLE left intentionally open, and see what happens! In both tests, the control carabiner kept the rope in the right track in

TABLE 1: PRIMARY ATTACHMENT (HARNESSES): TRIANGULAR SCREW LINK



1-1-1 CAUTION!



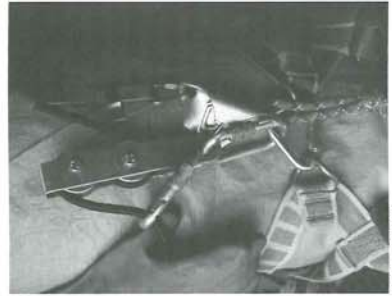
1-1-2 CAUTION!

Attachment of the "SIMPLE" bobbin descender:

- Mandatory oval safety carabiner.
- Use of a mandatory control carabiner: oval carabiner (either safety or normal carabiner).
- **Note the control carabiner position!**
- For climbing up, clip the carabiner of the descender on the other side of the Croll.

**#1-1-1 & #1-1-2: CONTROL CARABINER** is attached directly to the triangular screw link. This is the original configuration from Petzi.

**POTENTIAL HAZARD: # 1-1-2** shows a potentially tricky situation, the head of the bobbin can possibly partly catch inside the control carabiner, causing a difficult control (rather rare situation, unlike the dangerous situation shown in # 2-1-1).



1-2-1 SAFE



1-2-2 SAFE



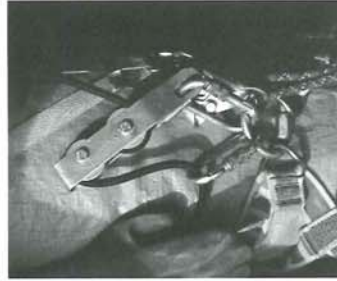
1-3-1 SAFE



1-3-2 SAFE

**#1-3-1 & #1-3-2: CONTROL CARABINER** is attached to the suspension carabiner of the SIMPLE. This prevents any possibility for an inadvertent opening of the SIMPLE. **This is the latest recommended method from the French School of Speleology, VERY SAFE.** The head of the SIMPLE can not be caught in the control carabiner.

TABLE 2: PRIMARY ATTACHMENT (HARNESSES): SEMI-CIRCULAR SCREW LINK



2-1-1 DANGER!

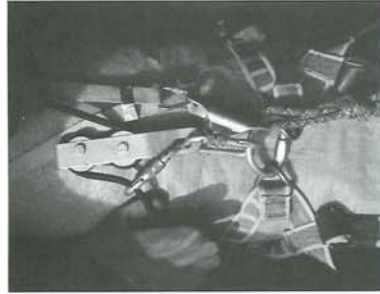


2-1-2 DANGER!

**#2-1-1 & #2-1-2: CONTROL CARABINER** is attached directly to the triangular screw link. Similar to the original configuration from Petzi, but with a semi-circular screw-link.

**INHERENTLY VERY DANGEROUS; #2-1-2** shows a dangerous situation, the head of the SIMPLE is caught inside the control carabiner, causing a loss of control. It has happened! The same can happen with true climbing harnesses (where both the SIMPLE and the control carabiner are attached to the wide rope or webbing loop).

**#2-2-1 & #2-2-2: CONTROL CARABINER** is attached in the oval eye of the SIMPLE. This prevents any possibility for an inadvertent opening of the SIMPLE. This early improvement is **VERY SAFE**, it is still in use today. The rope is in a single geometric plane. The head of the bobbin can not be caught in the control carabiner. Drawback: a little bit cumbersome to insert or remove the rope (the control carabiner has then to be totally removed, and it can be inadvertently dropped in the pit...).



2-2-1 SAFE



2-2-2 SAFE



2-3-1 SAFE



2-3-2 SAFE



2-3-3 SAFE



2-3-1 SAFE

**#2-3-1 & #2-3-2: CONTROL CARABINER** is attached to the suspension carabiner of the SIMPLE. This prevents any possibility for an inadvertent opening of the SIMPLE. This is the latest recommended method from the French School of Speleology, **very SAFE.** The head of the bobbin cannot be caught in the control carabiner (2-3-3)

**#3-3-1:** Same as #2-3-1 — #2-3-3, with an additional SHUNT (controlled by the left hand) as a backup.

the SIMPLE, preventing its escape, contrary to what happens in the figures 7 through 13 of the "Lort Cave Accident Analysis" (1) (NSS News June 2005, p. 11) —see also the comment about the rope further below. In fact, the motion of the rope was pushing the open arm of the descender toward its "closed" position, preventing the rope from coming off the fixed pulley of the SIMPLE. The control carabiner is indeed a key safety element!

#### ACCESSORIES

In some cases, a backup can be useful, such as the Petzl SHUNT; see also "Rappin with the French Wrap" (NSS News, August 2005) (6). The use of a backup is often considered cumbersome, and very few cavers still use one today, except with very muddy and slippery ropes or in exposed situations (see picture 3-1-1).

But contrary to the advice of ACA 02-03 (cf. "19 November 2003, Sotano de las Golondrinas, SLP, Mexico accident," page 40) (3), the SHUNT should not be placed below the rappel device, but above it, attached to one of the two cow ties (if the caver is hanging on his/her locked SHUNT, he/she should still be able to reach it with his/her hands). Why? If the SHUNT is above the descender and locks, the caver can lock off the descender, then bending up the knee, loop and pull one or two times around the foot and pull up the lower part of the rope and hold it against the control carabiner or against the descender. He/she can then step up (the rope loops around the foot acting as a step) to release the tension on the cow tail of the SHUNT, and, reaching the SHUNT with the other hand, depress its safety lever and resume the descent by unwrapping the rope from around the descender. This is a classic emergency maneuver that should be known by everyone using a descender.

If the SHUNT is below the descender and locks on the rope (in case of an emergency situation), the tension on the rope above the SHUNT (due to the weight of the caver) will prevent to lock off temporarily the descender as described above. Thus, it will not be possible to release the SHUNT and resume the descent...

#### Moving?

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rather inaccurate, e.g., regarding the use of the 8 mm rope. It was a "second hand" description taken from an earlier Australian publication, who was referring to an already outdated French book with, in addition, obvious translation problems — the language and communication barrier!

A good example of the general translation problem is mentioned by Gordon Birkhimer in his article in the NSS News of August 2005 (6) "Rappin with the French Wrap."

Fortunately today, for the US caver interested in "alien" caving techniques and equipment, the latest book of G. Marbach & B. Tourte (9) has been translated and adapted by a US caver, Melonie Alspaugh (10) *Alpine Caving Techniques, a complete guide to efficient caving*. English, Edition 2002 published by Speleo Projects of Urs Widmer in Basel, himself a competent caver. This book is available from your favorite caving equipment store or caving bookstore. In fact, Basel was possibly the best location for such a translation and adaptation through the eye of a US caver, being next to many famous karstic areas, and at the crossroads of the Swiss, French, German and even Austrian and Italian caver communities.

The WEB-site of the Ecole française de spéléologie is also of interest, even for the cavers that cannot read French, as the figures are pretty much self-explanatory. The very valuable work of the ACA 02-03 team would have drastically been improved by devoting also in its accident analysis the showing also in the recommended use and safe practice of the SIMPLE descender, especially when considering that this life-saving information is available in English (4, 10).

#### HISTORICALLY SPEAKING...

In the sixties, the first Petzl descender and ascending *-systems* were a revolution, a welcome alternative to the heavy steel and aluminum cable ladders then in use. The first Petzl descender had only a single circular closed hole (eye) on each arm (side plate) to attach it to the triangular (or semi-circular) screw link of the harness. Its name then was not the SIMPLE, but the DRESSLER. To engage the rope in the device, it was necessary to unhook it totally from the harness, and more than one caver dropped his/her DRESSLER down a pit or crevice (want to know some locations to find one?...). The rope, after meandering around the spools, had to go through the control carabiner even then, as Petzl still recommends for the latest models.

The earlier DRESSLER model was soon modified by Petzl, with oval holes (eyes) on both arms (side plates), the one on the right side being open, with a gate mechanism,

more primitive than today, but quite similar to the latest one. With this modification, it became possible to open the descender for inserting or extracting the rope with the device still connected to the harness by the carabiner. Some cavers questioned the new concept of the gate mechanism, and were concerned about the unlikely but possible opening of the device. They decided to attach the control-carabiner directly in the oval hole (eye), next to the descender suspension-carabiner from the "spool side" of the oval hole. This safe configuration definitely prevented an improper closure or inadvertent opening of the SIMPLE, due to the size of the stock rod of the carabiner filling the oval hole and blocking the gate mechanism. The procedure became rapidly common practice, and was the technique taught to me in the seventies in the vertical caving clinics of the SSS (Swiss equivalent of the NSS); it was also the practice taught in France and elsewhere. In these early days of single rope technique, it was recommended to use a Petzl SHUNT as a backup.

The alpine caving techniques were described in detail already in the well known 1973 reference book of J.C. Dobrilla & G. Marbach, "Techniques de la spéléologie alpine" (7). In 1980, a new edition was published by G. Marbach & J.L. Rocourt (8), and in 2000, as mentioned earlier, G. Marbach & B. Tourte published the latest (3rd) edition (9), followed in 2002 by its English translation and adaptation by Melonie Alspaugh (10).

Technically and etymologically speaking, the Petzl SIMPLE, as well as any rack, is a descender only (from the verb to descend, to go down). For a language purist, the rapped in the strictest sense is a technique in which the user can "call the rope back" once the bottom is reached (from the French word rappeler, to call back). For the true rapped, the rope is hung on its middle point (in a loop—metal, rope, webbing, etc., or around a tree, etc.), then the user goes down on the double rope (body rapped or with a mechanical device). When at the bottom, he/she pulls on one side of the rope to recover it, and continues his/her way. In the early days of the descender, Petzl had a true rapped device/descender, very similar to the present days SIMPLE, but it was possible to use it with a double rope—there were two parallel spools on the same lower axis, one for each rope, and one wider spool on top of the descender, to accommodate one or two ropes. This device could be used with a single rope (as "descender"), or also with a

double rope (rapped device) and the possibility to retrieve the rope from the bottom. Sounds too technical and theoretical? Let's try to be accurate. It can avoid accidents!

While talking about safety in vertical caving, pictures in NSS News show once in a while that some cavers are still using the JUMAR hand ascender (e.g., on the cover of NSS News of June 2005; see also "Cover photo vertical gear" by Bill Davis (11) in the "Letters" section on page 33 of the NSS News of Sept. 2005).

The JUMAR was developed for some specific mountaineering situations like climbing on fixed ropes and/or for crevasse rescue on glaciers. It was deemed not advisable for caving use, because it is made of cast aluminum, which breaks all at once instead of bending when submitted to a shock or torsion, causing the user to fall. The frame of ascenders like that of Petzl or similar construction, are made of rolled aluminum plate, which is going to bend first before breaking when submitted to an abnormal stress (torsion or shock). So the advice was/is not to use a JUMAR for caving purposes.

#### CONCLUSIONS ABOUT CORRECT USE OF THE PETZL "SIMPLE" DESCENDER

1 Attach the Petzl SIMPLE bobbin descender to the primary attachment exclusively with an **oval safety carabiner** (and nothing else but an oval safety carabiner). Reminder: the primary attachment is the triangular or semi-circular screw link of a caving harness, or the attachment loop of a climbing harness, although the latter is not recommended. For climbing up, the carabiner with the SIMPLE should be clipped next to the semi-cylindrical side of the CROLL, so that the descender does not interfere with the cam of the CROLL, or with the rope.

2 Always use a **control (brake) oval carabiner**, steel, aluminum or zinc (more wear with the two latter), either a normal model (most commonly used) or a safety model (more cumbersome without real added safety).

3 Clip the control carabiner either through the oval hole of the SIMPLE (above the SIMPLE attachment oval safety carabiner), or, even better, clip it directly on the oval safety carabiner holding the SIMPLE (on the gate side of the SIMPLE). Avoid clipping it directly to the triangular screw link of the harness, and never clip it to a semi-circular screw link, nor directly to the loop of a climbing harness.

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(2) ACA, American Caving Accidents 2002-2003, 27 September 2003 Omega System, Virginia [..]. NSS News, pp. 36-38, September 2005 / part 2.

(3) ACA, American Caving Accidents 2002-2003, 19 November 2003 Sotano de la Golondrinas, SLP, Mexico [..]. NSS News, pp. 39-40, September 2005 / part 2.

(4) Petzl Company WEB-site: [www.petzl.com](http://www.petzl.com). Select the English language; see the search function and type "Simple".

(5) <http://ecole-francaise-de-speleologie.com> Web site of the French School of Speleology (EFS), [http://ecole-francaise-de-speleologie.com/fr/guide/decendeur/decendeur.htm](http://ecole-francaise-de-speleologie.com/fr/guide/descendeur/decendeur.htm) Web pages on descender, after an article in Spalanza N°66, June 1997, "L'utilisation du descendeur—the use of the descender," by the Technical Study Group of the EFS, updated by Rémy LIMAGNE July 2002.

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André M. GAUTIER is 64 years young, from Geneva (the French speaking part of Switzerland).

He started caving at age 16 in the cave of La-Diau in the French Alps (Haute-Savoie). He was secretary, then vice-president of the Swiss Speleological Society (SSS-SGfH).

He has a Ph.D. in geology/mineralogy (+ minor in physics engineering), did research & teaching at the University of Geneva (Switzerland), was an international geologist/mineralogist & consultant for government geological surveys, mining & exploration companies (mainly uranium), nuclear industry, in Switzerland. He was also former head of the Academic (Faculty) Human Resources of the University of Geneva and a lecturer of economic geology.

He grew up in an environment of mountaineers, cavers, and scientists; has military winter high mountain expertise, is a US private pilot. He joined the NSS in 1983.