# Safety and Techniques

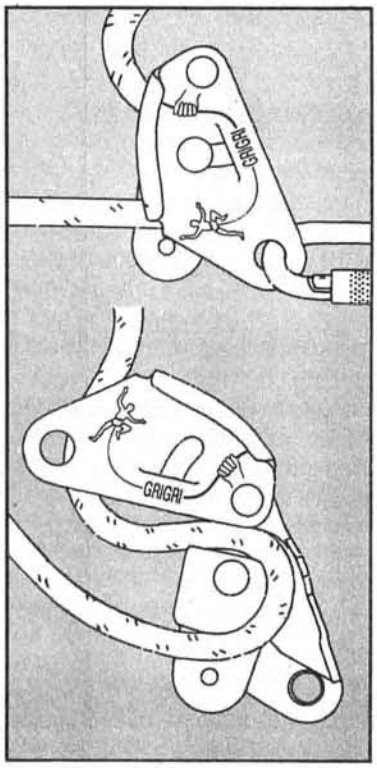
## Slippery Ground and Undercurrents

**By William Storage**

### New Products

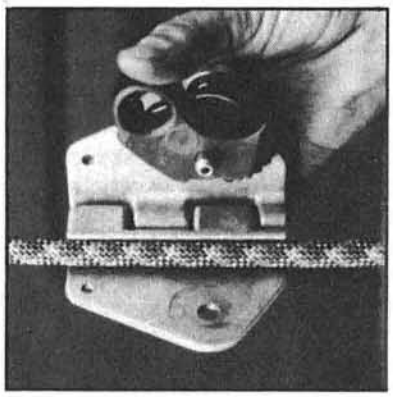
#### Grigri

The Grigri, recently introduced by Petzl, is an autolock belay device that looks somewhat like a small bobbin. It is used by a belayer in the same manner that a figure-8 descender or Sticht plate is used. However, it possesses a locking mechanism, like the autostop bobbin, which grabs the rope in the event of a sudden load. I found it particularly convenient for casual top-rope sport climbing. Its design also seems well suited for aid climbing in caves, where rope runouts are typically short, progress is very slow, the belayer gets bored, and the belay is frequently locked off.




#### Gibbs Quick

The hinged Gibbs ascender has been available since last summer but I have seen little about it in print. It uses the traditional Gibbs hard-anodized cam and a two-piece (hinged) cast aluminum shell. With a little practice, it can be attached to the rope with one hand. This greatly facilitates the type of maneuvers required in more complex ropework, e.g. rebelays. The ascender is supplied in the spring-loaded configuration; removal of a screw converts it to free-running.



#### Tyrolean Terror

A concerned reader sent me a copy of an article from *The Valley Caver,* Spring 1991, recommended a Tyrolean traverse rigging that included a pulley-ascender arrangement to get rid of the sag in a horizontal rope. The reader's concern was that tremendous rope and anchor loads can be generated with such rigging. Indeed they can.

Whenever a vertical load is applied to a horizontal rope, simple physics shows us the relationship between the horizontal and vertical forces in the now-sagging rope. A large horizontal distance with a short vertical sag produces forces proportional to the horizontal and vertical distances. Since the vertical force equals the climbers weight, the horizontal force will equal his weight times the (large) ratio of horizontal to vertical distances. The tension in the rope is a little greater yet. Its a Pythagorean sort of thing.

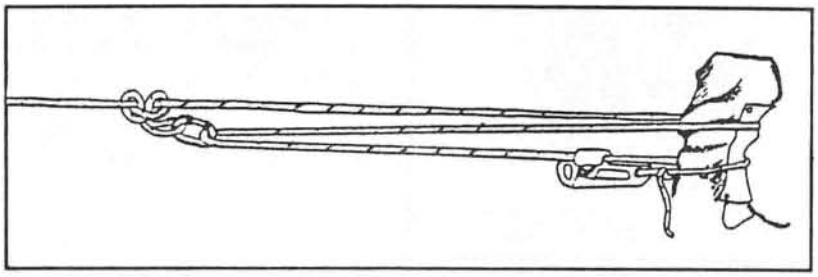
Trigonometry reveals that if a rope is pulled really tight—say with a five degree sag angle—then a 150-lb vertical load will produce a resulting rope tension of about 1700 pounds. Fortunately in actual applications, the high loads generated by this arrangement tend to stretch the rope, thereby increasing the sag angle and thereby decreasing the resultant rope tension. Unfortunately, this benefit can be negated by using a pulley/ratchet arrangement to get the horizontal rope nice and tight before the load is applied to it. With a system having a theoretical pulley advantage of two to one, friction around the rig point and through the carabiner typically negates most of the theoretical advantage.

What does all this mean to cavers? Ropework, and particularly advanced ropework such as tyroleans, requires knowledge of technique. Technique generally should involve established procedures (as discussed in length in the October, 1991 *NSS News* Safety and Techniques column). Tyrolean rigging requires more space than these few paragraphs, or a page in a newsletter, to be covered adequately. Books such as *On Rope* have a good deal of information about this sort of thing, usually with the underlying physics explained in a manner that will help readers to apply the same reasoning to other similar situations. Those who use ropes underground would benefit greatly from reading such books and learning established procedures so the sometimes-fatal lessons of past try-it-and-see events need not be repeated.

Must we reinvent the wheel? Seems to me that rigging techniques should be subjected to peer-review before being published. Technology only advances if we build on the foundation of prior knowledge. How about a bit of literature search before publishing?

#### Stop Using Self-drive Bolts

Two years ago John Ganter and I wrote an article (Artificial Anchors for the Present and the Future, *NSS News,* 48:5, May, 1990, pp. 120-128) discussing requirements for safe anchors, and giving recommenda-



tions for their use. A version adapted for European audiences was published in *Cave Science* (Vol. 18, No. 2 August 1991). Despite a bit of apparent provincialism, we seem to have been well received; our recommendations have been endorsed and quoted (with and without reference, but it's the point that counts). Undoubtedly, Europeans studying the issue have reached the same conclusions independently. In any case stainless steel collar studs and stainless, epoxy-mounted studs are being used extensively.

Aside from analytical justification, recent bolt failures and accidents support this position. Thirty self-drive bolt incidents have been reported since we began our study. There should be a clear message here. **Stop Using Self-drive Bolts.**

Then why do North Americans continue to use them?

A few months ago an organizer of an international expedition contacted me for recommendations on rigging a deep cave. I referred to the bolt article and praised stainless steel, noting that selfdrives cannot be made from stainless. Since the expedition planned to use an electric hammer drill, there would be no reason not to use stainless stud anchors, which require drilling a slightly deeper hole. Placing 3/8'' or 10 mm studs with a Hilti is a trivial task. Self-drives, in addition to being weaker, susceptible to thread damage, and horribly corrosion-prone, are difficult to place with an electric drill.

I was astounded to later learn that the expedition had placed about 100 self-drives. Could it really be that they were simply too cheap to pay the additional buck for a stainless anchor? Whatever the reason, we can thank them for another batch of permanent defacements to the cave: and we can look forward to replacing them all in a decade or so. John and I are planning to revisit the bolt issue in more detail later this year. One thing for certain will appear: **Stop Using Self-drive bolts.**

## Helmets and Testing

We have recently received questions regarding selection and testing of caving helmets. Recent testing by British cavers has helped to confuse the issue. They are measuring loads imparted to the neck of a dummy during vertical impact with a falling weight. Thus they are measuring dynamic loads. On this basis they have pronounced some helmets acceptable while others have fallen from grace.

Is neck loads in a vertical rockfall really the only consideration for determining what makes a helmet good or bad? I don't think so—otherwise I'd wear a six-inch coil-spring under my helmet.

Helmet manufacturers do a little more analysis and a little better testing. Edelrid, for example, evaluates load value and duration during impacts. Frontal shock absorption is tested. They perform repeated load testing as well, demonstrating that a helmet rapidly looses its ability to mitigate dynamic loads after successive high-load applications. Moral: if your helmet suffers a severe blow, trash it and get a new one.

Helmets must be strong (to resist crushing), hard and tough (to resist penetration by sharp objects), and light (to avoid neck strain). Depending on where we go caving, we might trade off full coverage (greater protection but hotter) against cooler, more open models. In most caves, it is important to make sure the helmet stays on, particularly since we desire protection from caver falls, where the blow to the helmet comes at odd angles. A multi-point suspension, found on ''caving'' and climbing helmets (not miners' safety caps) fills this need.

It may be desirable to get the helmet off quickly, thus Fastex buckles might be preferred over D-rings. One caving death and several accidents have involved cavers hanging from their helmet suspension after wedging the helmet in a narrow space. Thus some prefer to reduce the strength of the buckle junction by filing away the edges of the connector (as described by Paul Kirchman in the *York Grotto Newsletter,* Vol. 26, No. 3). They prefer to take their chances against helmet loss rather than strangulation. Heated debates have arisen. (*NSS News,* January 1991, Philip Moss letter to the editor; reply by Paul Kirchman, *NSS News,* May, 1991).

Obviously your choice (and the debate) revolves around the perception of which risk is largest, strangulation or impact after loss of helmet. And that, of course, depends on the cave and the type of caving.

The Petzl Ecrin, Joe Brown, and Edelrid Ultralites seem to be the favorites of vertically-inclined U.S. cavers. These all meet the basic requirements above as well as the UIAA standards. My personal favorite is a variant of the Edelrid, sold by Caving Supplies in the U.K. It has a simpler suspension, sits slightly closer to the head, and is a little lighter and cheaper than the basic Edelrid. My reason for this choice is comfort. If you have similar priorities, trying the helmets on for fit is essential—since heads vary so greatly in shape. As mentioned above, I think much of the testing being undertaken by the Brits is too narrowly focused. But in the interest of fairness and thoroughness, the following articles are noted for those who wish more details:


Barker, Giles et.al. (1991) ''Testing Caving Helmets'' (in report on BCRA Conference '90) *Descent* 97 Dec./Jan. 1990/91 p. 23.

Proudlove, Graham S. (1986) ''Caving Helmets.'' *Caves and Caving* 21, Feb. 1986, p. 24.

Proudlove, Graham S. and Dave Brook. ''Tests on Used Caving Helmets'' (in Equipment Column), *Caves and Caving,* 48, pp. 31-32.


## Knot Strength

Several of our recent articles have discussed the reduction in strength of rope due to knots. PMI recently tested strength of knotted 7/16-inch PMI caving rope. Bowlines, Figure 8's, and Butterfly knots were tied in one end of the rope to provide a six-inch loop. The loop was then attached to a 12 mm pin in a Dillon Universal Tester. Load was applied at six inches per minute until the rope broke. In each case the rope broke right at the knot and not at the pin. Results as reported by PMI are shown below.

**Knot Strength**
**7/16'' PMI—6,800 LbF Minimum Tensile**

| | *Bowline* | *Figure 8* | *Butterfly* |
|---|---|---|---|
| Test 1 | 5100 | 5200 | 5400 |
| Test 2 | 5050 | 5400 | 5250 |
| Test 3 | 5200 | 5200 | 5150 |
| Test 4 | 4900 | 5425 | 5275 |
| Average Observed | 5062 Lbf | 5306 LbF | 5268 LbF |
| Standard Deviation | 108 LbF | 107 LbF | 89 LbF |
| Percent of Original Strength Retained | 74% | 78% | 77% |

## Clinical Concerns

Leptospirosis in Costa Rica: We have heard of an increasing number of cases of leptospirosis among river guides in Costa Rica. Cavers heading to that part of the world may want to take note, as well as the prophylaxis recommended by their physicians.

Leptospirosis seems to occur worldwide, although U.S. cases are rare. The vector of transmission is urine, potentially in contaminated water. Initial symptoms include severe frontal headache, photophobia, muscle pains in thighs and lumbar area, chills, and very high fever. A second phase, after several days, may involve return of fever and itchy rash. Entreated, advanced infection includes jaundice and kidney disfunction. Often misdiagnosed as hepatitis or meningitis, leptospirosis mortality averages 7%.

Friends in the medical world tell me that doxycycline is commonly used as a prophylactic. General tetracyclines and erythromycin are reported to be effective treatments. (*Wilderness Medicine Newsletter,* Jan./Feb. 1991)

Travellers Diarrhea and Ciprofloxacin (Cipro): Several cavers have reported being prescribed Cipro as a preventive measure when travelling to Mexico. My pharmacist

(as well as a number of medical journals: *JAMA* 1990; 264; 1438, *American Journal of Medicine*, 1989; 87:49S) tell me that this drug is being horribly over-prescribed. Its use as a prophylactic will lead to its being rendered ineffective in a few years. Prescribing doctors should be encouraged to use more traditional drugs (Bactrim, etc.) and to save Cipro for serious cases. And by the way, Cipro is reported to be less effective than doxycycline against chlamydia (*JAMA*, 1990; 264; 1413).

### Short History of Peer-destructive Behavior in California

That's "peer-destructive," not "pier-destructive." I have received several complaints from east-coast cavers that I have become "over-Californiafied." Their evidence is the appearance of the term "peer-destructive behavior" in recent Safety and Techniques columns. I think this complaint shows a lack of sensitivity to our real needs. Wake up. Hyphens are in. If you don't believe it, just pick up a copy of *Time* or *Newsweek*. Our micro-cultures are abandoning hard-line positions; we seek New-Age Awareness through the Positive Caver-Energy of Self-Realization.

Peer-destructive behavior—call it what you like—is serious business. Many caving accidents involve a strange competitiveness at their roots. Look at the histories of project caving—Organ, Lilburn vs. Bigfoot, Roppel, Lechuguilla—and you will see it in action. Bill Steele's book, *Yochib, The River Cave* is an amazing testimony to peer-destructive behavior, nationalistic competition and risking death to impress chicks. Lessons for everyone.

As for the effects of California, I think such a complaint is totally bogus. Yo, cave dudes and babes, just 'cause a guy wears neon day-glo wetsuits and chows on nouveau southwestern macrobiotic tofu sushi doesn't mean he's, like, totally dialed-out of the caving scene. I'm way stoked, here. Don't gag me with retrohash, man. Open your righteous cranium to ideas of new. Out with meganeck droids, pit posers and wannabees. We, like, need to bag a new consciousness of human error and other wall-to-wall big-time mess-ups. Totally triumphant concept, huh, dude?

Party on.

# Down Through the Decades

By Peri Frantz

**Exploration:** With war-time rationing reducing caver's mobility, the NSS sponsored only two trips in May, 1942. Dr. Frost was scheduled to lead a trip to **Aitken Cave,** in central Pennsylvania. The cave was noted for its large bat population. Further south, Jack Preeble and George Dare were planning a trip to **Indian Caves** on the Moorefield River in West Virginia. The National Museum was planning on sending an archeologist along.

The May, 1952, *NSS News* had a number of short exploration articles. Bill Halliday reported on three caves north of Canon City, Colorado, which although close together, were dramatically different in character. **Marble** consisted of two long, narrow rooms with high ceilings formed along parallel joints. **Fly** was a combination of bedding planes and joints in tiled (sic) strata, and **Wilson** was a typical bedding plane anastomosis. Meanwhile, on Eluthra Island in the Bahamas, Frederic Cuff was investigating **Cockroach Cave,** named for the thousands of LARGE cockoaches, apparently thriving on garbage tossed down one of its sinkhole entrances. Several hundred feet of gradually descending passage, festooned with stalactites, stalagmites and flowstone, terminated in a mud floor, apparently below sea level. Back in the States, Captain Michael Buoncore of the U.S. Army and a former MET Grotto member, produced a picture of a crystal pool in a newly discovered cave in Kentucky. Neither a name nor a location were provided, but the picture bore out his claim that the cave abounded with formations. Buoncore also claimed that its streams were loaded with aquatic life and that much remained unexplored.

The May, 1962, *NSS News* reprinted an article from the *Soviet Weekly* about three Soviet cavers who spent 92 hours in **Krasnaya Cave,**near Yalta in the Crimea. Using a subterranean camp, they surveyed over a mile and a half of recently discovered passage. The cave contained numerous waterfalls, and waterproof suits were needed in order to work in 15° C water. Krasnaya, at that time the longest in the Soviet Union, was estimated at over 4½ miles. In the same issue, John Holsinger reported an interesting observation made in **Boundless Cave,** Virginia. During the initial exploration and mapping of the cave in 1959, Bill Buckingham and Bill Plummer had observed continuous strong air currents. They also encountered a passage filled almost to the ceiling with light, dry sand, most likely a composite of gypsum and quartz particles. They excavated the sand plug and continued another 150 ft until the passage terminated in clay fill. Two and a half years later, Holsinger again found the passage blocked by the dry sand. Obviously, the air currents were strong enough that they were creating sand dunes within the cave.

David Schnute's cover photograph of a recently discovered crystal-coated stalactite accompanied Herb and Jan Conn's "Report from **Jewel Cave"** (South Dakota) in the May, 1972, *NSS News*. A year earlier, while tracing a noticeable breeze in a section of cave previously thought to end, the Conns had opened up a new section, adding 3800 ft to the previous survey. The multi-level maze contained numerous bottle brushes, draperies, and two large columns. It also led them to a 500-ft walking passage, crossing back over the top of the maze, and connecting into known cave. The connection, "well enough concealed so that we were sure to check everything else first" bypassed all the up-and-down chimneys which had plagued the original route.

Excitement, Mystery. Danger. And, unfortunately, death. The May 1982 *NSS News* had them all in Blane Colton's riveting tale of the exploration and mapping of **Vanishing River** and **Rising River Caves** in the Guadalupe Mountains of New Mexico. During infrequent Guadalupe gully washers, water cascaded into the eight-foot diameter Vanishing River entrance and disappeared. Where did it go? The initial explorations of Vanishing River, discovered in 1966, came to a halt less than a year later when Doug Evans fell to his death at the entrance drop. The party, which consisted of Evans, Loren Bolinger, Rich Breisch and Ells Rolfs, had been turned back by bad air more than 300 ft below the entrance. Following Evans death, 12 years elapsed before the cave was reentered. In the meantime, Donald Davis had located a possible resurgence, dubbed Rising River, in an adjacent canyon. Between 1979 and 1981 Davis, Colton, Tom Taylor and others completed the exploration and mapping of the two caves and tied them together with an overland survey. The Rising River Survey was particularly arduous, as much of it was conducted on ropes in a 175-ft fissure, where "precariously perched slabs, bridges of loose rock. . .that spanned the fissure, as well as loose rock and dirt clinging tenuously to the irregularities on the wall," made the work exceedingly dangerous.