Problems with bolts and anchors C. Remy

Bolts fixed in the rock, provided they are sound, are reassuring since each point supports a load of around 2 tons. However, it turns out thatmany anchors have more serious defects than one might imagine. In fact, some bolts manufacturers sometimes supply faulty equipment that rusts quickly and then breaks easily even without the weight of a climber, because it doesn't correspond to UIAA standards or to the one advertised. Let's hope that this report will help raise awareness of the phenomenon, in order to improve safety. In any case, be vigilant, havea look at the equipment in place and if there is any doubt, e.g. due to rust, take safety precautions and report the case (see below)!

Various standards, such as those of the Union Internationale des Associations Alpines (UIAA), are used by manufacturers of alpine and climbing equipment as technical information and references. The guarantee of a flawless product is of paramount importance, since you are entrusting your life to it. Ropes, harnesses and carabiners, for example, are renowned for their strength and reliability, and rightly so. Unfortunately, some bolts, hangers, glue-in bolts, chains or even belay rings, once attached to the rock, reveal serious defects that are most often attributable to specialized manufacturers. Yet these manufacturers claim to comply with the relevant standards. What is surprising about these problems, for most manufacturers, is not only the extent of the defects, but also the fact that they recur regularly over time. This is all the more curious given that the materials used, the manufacturing techniques and the control protocols have long been perfectly known and mastered in industry and shipbuilding, where 316L stainless steel, in constant contact with salty air, performs perfectly under stress and over time. This should rule out any quality problems with climbing anchors, but this is not the case. Before getting to the defects, here's a brief history to help you understand the evolution of such equipment.

After the first compression and expansion pitons, followed by homemade gollots (anchors), the 60s and 70s saw the introduction of screw anchors such as Phillips or Tilca, with DIY hangers, or Petzl's M8 twisted anticorodal anchors for speleology, also used to equip climbing routes, but sparingly as the holes were drilled by hand.

In the early eighties, the diameter was changed to M10 (or even M12), and a variety of steel (1) or stainless steel (2) bolts and hangers, as well as belay rings, became available. From 1985 onwards, the battery-operated drilling machine made it easier to install anchors. As the number of routes increased, so did the use of bolts and anchors, etc. This equipment is also

being used in regions where it was previously uncommon, for example by the sea, where it quickly oxidizes due to the salty air. To remedy this, A2 stainless steel is used. This alloy, then considered excellent, was not sufficient, as its composition was not resistant to corrosion in this corrosive environment. Shortly before 2010, A4 316L stainless steel or HCR stainless steel became the standard for seaside equipment in particular, to avoid corrosion problems.

Alas, over the years, differences in the behavior of the stainless steels used in the walls along the coast have come to light, and worse still, their quality is not always the same as advertised, as we shall see below. The use of non-compliant stainless steel leads to confusion as to the origin of the defects observed, especially along the coasts. According to the UIAA and manufacturers, stress corrosion cracking (SCC) is the main problem in salt air for compliant and properly installed products. However, the source of the main problems mentioned in this article lies upstream: they are linked to the use of a stainless steel other than the one indicated, or to poorly welded rings, or both. Here are just a few known cases.

Shortly before 2008, the undersigned and a number of climbers in Kalymnos, Greece, noticed that anchors very occasionally broke.
Autumn 2011, on the newly equipped Reize route at North Cape, a new anchor broke just as Renée Guerin, belayed by Bruno Fara, was pulling on a quickdraw. At the same time on the same island, on another new route, while an Englishman was taking a rest on an anchor, it broke, as did the next one in the ensuing fall!
It then transpired that it was a former Greek manufacturer who had been supplying non-compliant equipment for two years to the new route setters on Kalymnos. Under an arrangement between the manufacturer and the local municipality, Aris Theodoropoulos and his friends replaced around 500anchors.

In 2011, the undersigned and other climbers noticed a recurring fault with a bolt from a well-known brand: around one in ten was turning in the void when being tightened. In 2014, on the seaside of the Sperlonga region of Italy, where the Grotta dell'Arenauta is located, Federico D'Isep, Enrico Mazzoli and other climbers also noticed, sometimes with quite a scare, that anchors and chains from well-known brands were breaking easily, as in Kalymnos! It took a while to explain the problem: it wasn't the sulphur or the sea air as first thought, but stainless steel equipment that wasn't of the

advertised quality. This was demonstrated by analyses carried out later, by the Laboratory of Diagnostics and Materials Science at Tuscia University in Viterbo, Italy, on broken material that had been preserved. Similar problems have been encountered with many seaside anchors in several countries. On the other hand, at San Vito lo Capo, Sicily, despite the presence of sulphur and sea spray from strong westerly winds, Daniele Arena, who closely monitors the corrosion of anchors, found no attack on the stainless steel installed in the 80s, nor on the 316L used for retrofitting.

A few years ago, various manufacturers sold a new type of bolt, the PLX. Once the nut had been tightened, it was no longer possible to unscrew it to change the hanger. What's more, many of these bolts could not be placed correctly, so it was necessary to re-drill a hole to fix another bolt.
Several setters have noticed that manufacturers sometimes mix steels, which the UIAA recommend not to do: for example, steel rings have been welded onto 316L stainless steel ihangers, and this is still the case today!
As mentioned above, our setters regularly discover that bolts don’t fit correctly in the rock: it is then impossible to tighten them properly, as they rotate in the void or half protrude out of their hole. You then have to re-drill and fit another bolt. In this case, it's hard to say whether the problem is related to the rock or to a defect in the bolt, but it's curious to notice that this is a recurring problem for some manufacturers, whereas it isn't for others.

On February 23, 2024, a photo shows a split ring from a top anchor installed in 2022, from a new (Greek) manufacturer, in Leonidio, Greece... After on-the-spot verification, the municipality and the manufacturer were informed by the undersigned that ALL the rings of this brand observed in several sectors, even though they were recent, showed rust at the weld and that many were cracked or even split open! It should be pointed out that rings from other companies, not far from this area , were found to be faultless, even though they had been installed several years earlier. Shortly afterwards, the same defective equipment from this manufacturer was found in Kalymnos! At the beginning of April 2024, the manufacturer concerned by the rings came to Leonidio and made commitments (see below). Shortly afterwards, official analyses carried out by Professor Ulderico Santamaria, Director of the "Michele Cordaro" Laboratory of Diagnostics and Materials Science at Tuscia University in Viterbo, Italy, established that the welds, rings and hangers made by this manufacturer, who claims to meet UIAA standards for his equipment, were not of the advertised quality. It should be noted, however, that this manufacturer's

hangers were not analyzed, as it initially appeared that only certain welds had problems.

Observations and measures
The manufacturer has promised the municipality of Leonidio and the undersigned that he will replace all his faulty equipment himself, as well as the equipment abroad, and will cover the shipping costs. Others, however, are slow to take a stand, or even fail to respond or even visit the sites. Any manufacturer concerned by proven defects in their products should come immediately to the site to recognize the problem, inform the people concerned and take charge of replacing defective or non-compliant parts, as all responsible companies do.

UIAA
It is to be hoped that the UIAA will opt for strict rules guaranteeing the quality to which manufacturers must adhere. In addition to laboratory validations, it is essential to have field tests of the product. It should also be possible to expect
guarantee for these products over time: at least ten years under normal aging conditions. Some industry regulations require materials, including bolts, to last up to 25 years. It will cost extra money to achieve this quality, but it's worth it to ensure greater safety.
To optimize quality, we must not forget the imperatives that the setters must respect when setting the equipment in the rock, so that here too every precaution is taken to prevent any problems, but to date this type of defect is considerably rarer than those of the manufacturers.

Stainless steel
Iron is a pure metal. Steel is iron alloyed with carbon. Steel containing elements such as Ni, Cr and many others is also referred to as alloy steel. Stainless steel 316 is 304 with a higher chromium content and 2 to 2.5% more molybdenum, to improve corrosion resistance. 316L is 316 with a significantly lower carbon content, to improve weld corrosion resistance. It is suitable for seaside applications, although the UIAA states that 316L does not offer sufficient SCC (Stress corrosion cracking) resistance in seaside applications. All other indications for 316L stainless steel have no official value. 904L and 926 HCR steels are even better, but they are more expensive.
A simple basic test, although not valid, can give you a clue: the magnet is not attracted by 316L stainless steel.

Information on hangers
These usually include the company name, strength, metal type and other letters and numbers. It would be desirable to unify and simplify this information, while indicating the date of manufacture. They should be engraved, not laser-marked, which disappears over time.

Top anchors with unconnected rings
Such top anchors are less expensive, less energy-intensive and less material-intensive. They are also stronger, simpler to manufacture and install, and last longer.

Titanium
Particularly resistant to corrosion, but much more expensive and energy-intensive to manufacture. Titanium or HCR-type steels seem a good compromise for the most corrosive environments combining salty air and high humidity. But has it been properly tested for climbing? Could it solve the problem of those who misuse stainless steel? Is there a need for such an expensive product (which is said to have a 100-year lifespan) when climbing routes are often patinated after just a few years and considering that both equipment and activities evolve?

Faulty equipment
- Professor Ulderico Santamaria is available to test anchor devices.
- Anyone who has had incidents with anchors or seen faulty equipment can report them on the UIAA online form: https://theuiaa.typeform.com/to/rlBZyc

Thanks
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1. The cheapest, but rusts in damp conditions.
2. More expensive, stainless steels are alloy steels; in everyday language, they're called stainless steels.

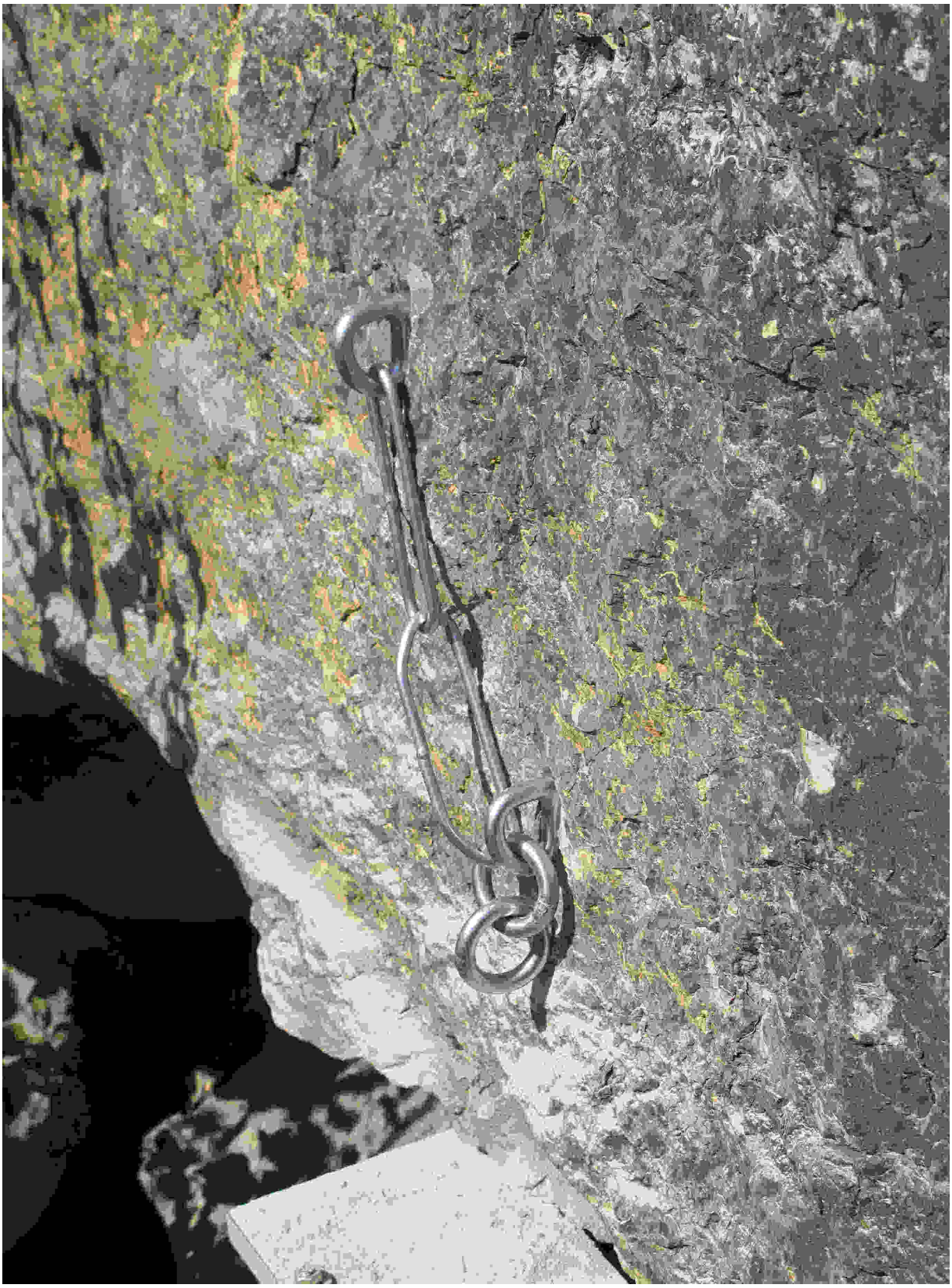
Further information: UIAA website and https://cragchemistry.com/2020/10/05/austenite-stability-are-we-missing-something-here/

Translation : Stéphane Rouvinez. La version originale en français fait foi.

A. Theodoropoulos_Matériel usagé, Kalymnos, Grèce

A. Theodoropoulos :Tampon dangereux, en très mauvais état, Kalymnos, Grèce

Corpo dei vigili del Fuoco di Gaeta_Broche cassée, Italie,



Broches et chaînes neuves, cours CAS 2023

Chaîne et plaquette inox A4 316L et boucles non A4

Différentes pièces endommagées par le temps et l'écrasement

Matériel artisanal de C. Remy fait en 1970

Piton à expansion et à compression et diverses plaquettes

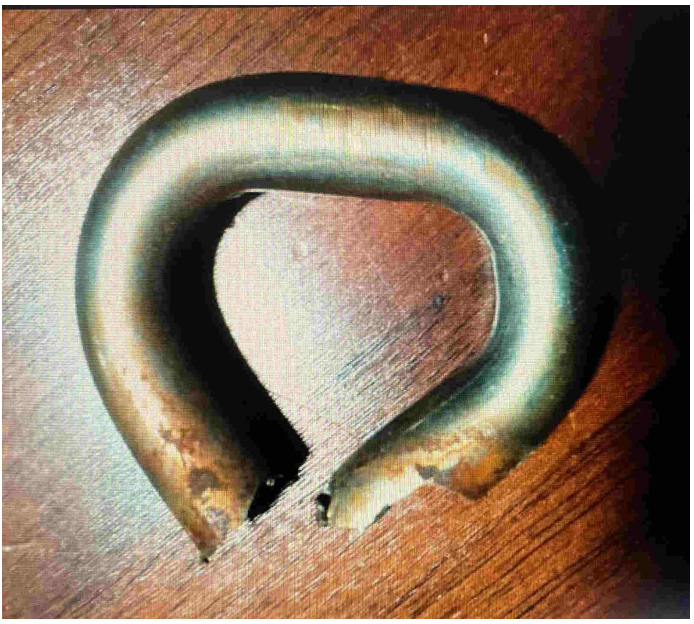
Plaquette à boucle artisanale restée plus de 30 ans en paroi, voie classique au Dar, Diablerets, Suisse

Plaquette et boucle A4 316L posée en 2022, boucle déjà fendue en 2024, Leonidio, Grèce

Plaquette et boucle A4 316L, posée en 2022, boucle déjà rouillée et fissurée en 2024, Leonidio, Grèce

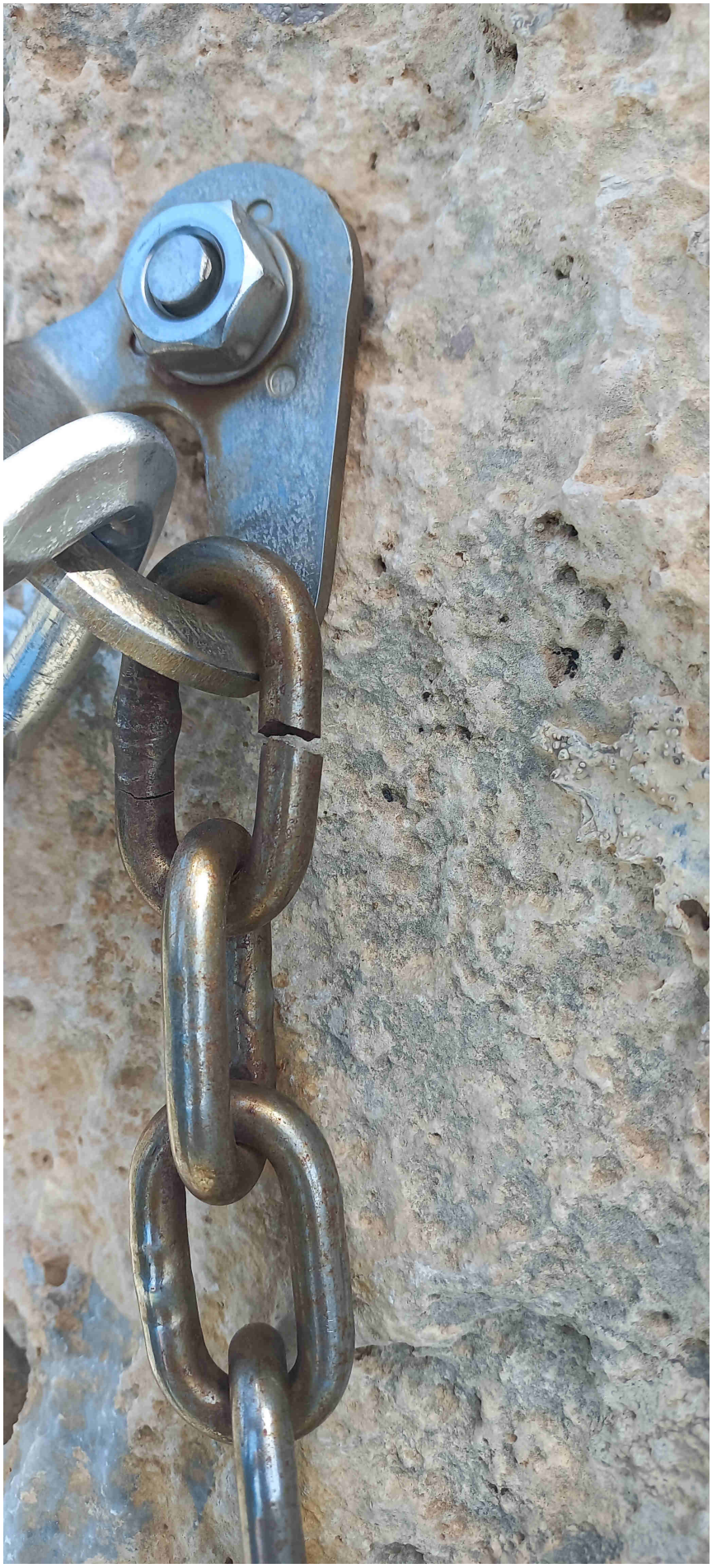
Tampon Phillips des années 1960-70 et début 80

Tampons cassés en 2010, Kalymnos, Grèce



F. D'Isep : Broche cassée, Italie

L. Salsotto : Chaîne fendue, Kalymnos, Grèce



Municipalité Leonidio : Plaquette et boucle A4 316L posée en 2022, boucle déjà fendue en 2024, Leonidio, Grèce

S. Equy : Boucle fendue, Kalymnos, Grèce