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How did some of the advanced technologies we use as divers today come to be? Simon Pridmore takes an intriguing look into the early days of rebreathers with an excerpt from his new book, *Technically Speaking—Talks on Technical Diving, Volume 1: Genesis and Exodus*.

It took a while for sport divers to start using rebreathers, although if you look back far enough, you can see that people were using them to go underwater for sport well before the Aqua-Lung came along. In his excellent book, *The Darkness Beckons*, Martyn Farr wrote that UK amateur cavers were using ex-government/military oxygen rebreathers in 1945. Farr also reported that the first sport diving rebreather fatality took place on a British sump dive in 1949.

However, generally speaking, up until the late 1960s, rebreathers were the tools of professional divers, and the flourishing new sport of scuba was all about air diving on open circuit.



The Early Days

Rebreathers in Sport Diving

ANDREY BIZYUKIN

The marine biologists

Then, as the 1970s loomed, *Skin Diver* magazine—the Bible of US sport diving at the time—started getting interested in closed-circuit technology. An article in July 1970 about a

“cryogenic” rebreather using frozen oxygen as the breathing medium was followed up the following month by a short article announcing a new machine called the Electrolung.

This was a mixed gas rebreather

designed and built by two marine biologists, Walter Starck and John Kanwisher, both of whom had significant skills beyond their primary field of work. Starck was an inventor—he developed dome ports for camera

housings, among other things—while Kanwisher was a wizard with electronics. They met on an expedition in the mid-1960s and discovered that they had a shared dream of constructing a machine that would allow them





OLGA TORREY

to go deeper and spend more time underwater doing their research. Alone, they did not have the wherewithal to turn this dream into reality, but together, they did. They combined their resources, sold the concept to the Beckman Instruments Company, and began development in 1968.

By the time *Skin Diver* revealed the Electrolung to the sport diving world, there were 30 units in use and in the subsequent issue of the magazine, editor Paul Tzimoulis showed he had done more than just regurgitate a press release, he had actually gone diving on an Electrolung. His story was entitled, "300 Feet on Computerized

Scuba," and described in detail a course he had taken with Starck that had culminated in a dive to that depth off Andros Island in the Bahamas. Tzimoulis was completely enthralled by the experience and declared that the Electrolung "will undoubtedly revolutionise deep diving technique."

At that time, if you had wanted to buy an Electrolung, it would have cost you US\$2,975, which was about the same price as a new Chevrolet pick-up truck.

Tzimoulis was right about the technology, but his prediction would take 30 years to materialise, and it would not

be the Electrolung that led sport diving into the future. In 1969, a diver died using an early version of the unit and, over the following three years, there were three more deaths, including a diver who was harvesting black coral in May 1972. This was the last straw. Scuba diving is an adventure sport and accidents are inevitable, but with so few units in use, even one death a year was commercially intolerable.

Beckman pulled the plug, and the production plant was closed. In fact, the company shut down its entire marine division. The rights to the Electrolung reverted to Starck. He headed off to live in the South

A New Dive Book from Simon Pridmore

"Simon Pridmore's new book, 'Technically Speaking' is an outstanding tour de force from one of modern diving's most accomplished practitioners and best-selling authors."

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"Simon has completed a complex task with consummate skill and has accurately unravelled the when's, the who's and some of the why's, much of which would have been unjustifiably lost in the mists of time if not for this work."

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"It will take some doing to better this account of tech's first steps...

as no matter how much you know or think you know; you will still find many obscure historical gems..."

— Kevin Denlay, Early Adopter & Wreck Finder

Technically Speaking is the latest book from best-selling Scuba series author Simon Pridmore. It is a selection of themed talks telling the early history of technical diving—where it came from, how it developed, how it expanded across

the world, who the important movers were and how, in the decade from 1989 to 1999, the efforts of a few determined people changed scuba diving forever.

These ten years saw the greatest shake-up the sport has ever seen but technical diving's road to universal acceptance was anything but smooth, many obstacles had to be overcome and there were times when even viewed in retrospect, it seemed that its advocates might fail in their mission. Ultimately, success came down to perseverance, people power, good timing and more than a little luck.



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Pacific, and his machine became a historical footnote. He had shown what was possible, but also what the risks were. The echoes of the Electrolung story would resound through US sport diving over the following decades and any inventors and investors thinking of following in Starck and Kanwisher's footsteps would always keep their cautionary tale in mind.

The 1980s covers

Several years later, when sport divers started toying with the idea of mixed gas rebreathers again, it was those dwelling in the outer reaches of the

sport diving universe who started the ball rolling. In the 1980s, cave divers in both Europe and the United States found they needed to go farther underwater underground than conventional sport diving equipment could take them. They concluded that a rebreather was the answer, and, in the absence of a viable, readily available and affordable commercial option, they decided to make their own.

Record-breaking German Jochen Hasenmayer was the first. In 1980, he built a machine that consisted of not one but two rebreathers side by side and called it the Speleo Twin





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Rebreather 80 (STR-80). His thinking was that if the rebreather he was using were to fail deep inside a cave he would need a second rebreather to get him to safety. Hasenmayer was an engineer and he saw this as his “technical advantage” over other cave divers. In a rare interview with an Icelandic radio station, he explained: “...using the equipment available until then, I could stay underwater for several hours depend-

ing on the depth—the deeper, the shorter—but with the new ‘double-circulation’ equipment I was able to stay up to 48 hours underwater irrespective of the depth.”

His achievements with both the STR-80 as well as with open-circuit mixed gas extended the concept of what was possible and opened minds elsewhere in the sport.

Hasenmayer was notoriously secretive. He told very few people about the

STR-80 and what he had achieved with it. He was the “lone-est” of lone wolves in a field of activity where lone wolves were very common. On 9 September 1982, at Fontaine-de-Vaucluse in France, he became the first sport diver to reach a depth of 200m, descending alone after dark with no dive team or surface support; the only person who knew about this was his wife, who stayed in their lodgings in a nearby village, no doubt sitting sleepless through

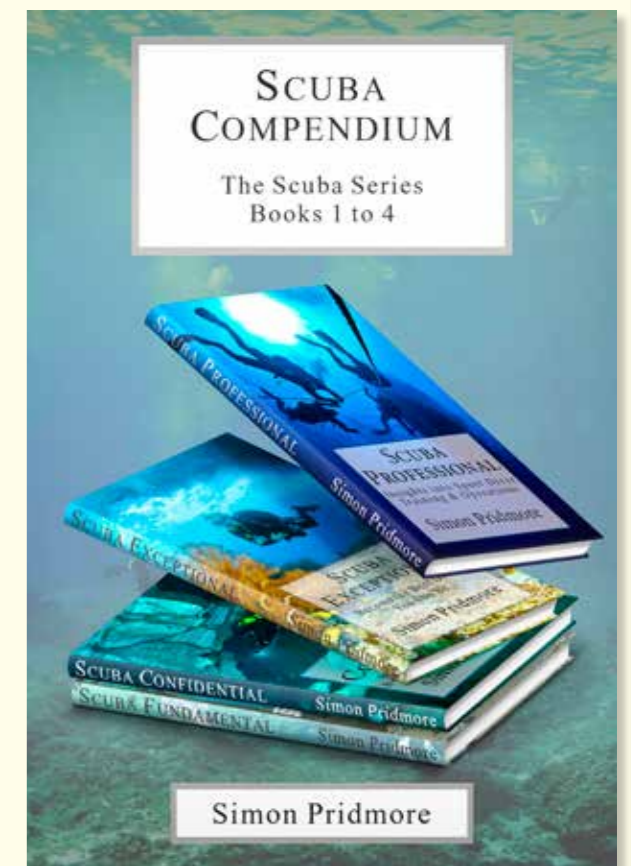
NEW 4 in 1!

Simon Pridmore has released a new single-volume e-book, bringing together four books in his bestselling Scuba series:

- *Scuba Fundamental – Start Diving the Right Way*
- *Scuba Confidential – An Insider’s Guide to Becoming a Better Diver*
- *Scuba Exceptional – Become the Best Diver You Can Be, and*
- *Scuba Professional – Insights into Sport Diver Training & Operations*

As Simon puts it, this is “a remastering and repackaging of the original albums rather than a greatest hits.” Nothing is missing. *Scuba Compendium* gives e-book readers the advantage of being able to access all the knowledge contained in the four books in one place, making this a unique and easily searchable work of reference for divers at every level.

Simon has always promoted the idea of safer diving through the acquisition of knowledge, which is why he has chosen to release this highly accessible version. If you have read his work before, you will know that he provides divers with extremely useful advice and information, much



of it unavailable elsewhere; his points often illustrated by real life experiences and cautionary tales. He examines familiar issues from new angles, looks at the wider picture and borrows techniques and procedures from other areas of human activity.

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the long night, awaiting his return.

So, it is unlikely that US extreme caver Bill Stone had heard of Hasenmayer’s STR-80 when he started building the first version of his Cis-Lunar rebreather in 1984, but in drawing up his design, he followed a similar thought process, prioritising safety and, like Hasenmayer, built a unit that consisted of two complete and separate rebreathers. At this point, Stone was unconcerned about considera-

tions of size or weight. His machine also needed to be as indestructible as he could make it. He would not be putting it on in the open air by the side of a French river. Its primary purpose was to enable him to negotiate a sump, which lay at the end of several miles of very difficult dry cave in Huautla, Mexico, and it would have to arrive at the sump still functioning.

Three years later, in 1987, Stone’s prototype, the Mark I—nicknamed



LARRY COHEN

FRED (Failsafe Rebreather for Exploration Diving) and weighing in at 93kg—was finally ready for testing. Stone carried out a 24-hour dive on it at Florida's Wakulla Springs, breaking a number of records in the process and managing

the entire dive using only one of the unit's two rebreather systems. The other one remained unneeded and untouched.

The previous year, British caver Rob Palmer had asked if he could use Stone's Cis-Lunar to explore the Blue Holes of Andros

Island in the Bahamas, but it was not yet ready. So, instead, he used mixed gas rebreathers provided by Stuart Clough's Carmellan Research in the United Kingdom. These were modified biomarine military units that Clough called CR155s.

Around the same time, Swiss cave diver Olivier Isler and French electronics engineer Alain Ronjat were busy designing a triple semi-closed rebreather to extend the penetration of La Doux de Coly in the Dordogne, France. Earlier, in 1984, Isler had completed a 3,100m dive there on open circuit, but he knew the cave went on much farther. He just lacked the means to get there.

"[The 1984 dive was] accomplished with an enormous back mounted aqualung [five 20 litre cylinders, or 23 cubic metres of gas—about 812 cf.], along with many more cylinders for backup and emergency. I could have continued the push, but it would have required a massive investment of energy. Very long dives would be necessary to place and retrieve the necessary stage cylinders before and after the main exploration push. These would have called for a formidable team of assistants serving a single exploration diver, much like the early Himalayas expeditions.

"Instead, I wanted to bring a measure of elegance to the way La Doux De Coly and other underwater caves are explored. La Doux De Coly provided the needed impetus to develop a unique type of self-contained aqualung. I had



LARRY COHEN

Rebreathers

the good fortune to meet Alain Ronjat, an electronics engineer who was fascinated by the intricacies of breathing apparatus. Between us, with just over 5,000 hours of hard labour, we designed the Ronjat Isler semiclosed system, which we named the RI2000."

On 31 December 1989, Isler completed a major dive in La Doux de Coly using the RI2000 and announced it as a technological breakthrough, only to learn that Hasenmayer had accomplished similar dives nine years earlier using his STR-80. Despite the fact that he and Hasenmayer were two of very, very few people doing this sort of diving, Isler had no idea.

Such was the world before

the Internet.

Isler did not care. Being first with the technology was not his goal and the RI2000 would turn out to be everything he wanted. In 1991, he reached 4,055m in La Doux de Coly, which gave the cave the status of being the longest siphon in the world—at least the longest one anybody knew about at that time. In 1998, his RI2000 took him even farther—4,250m into the cave—on a 12-hour dive at an average depth of 45m, just using the box on his back.

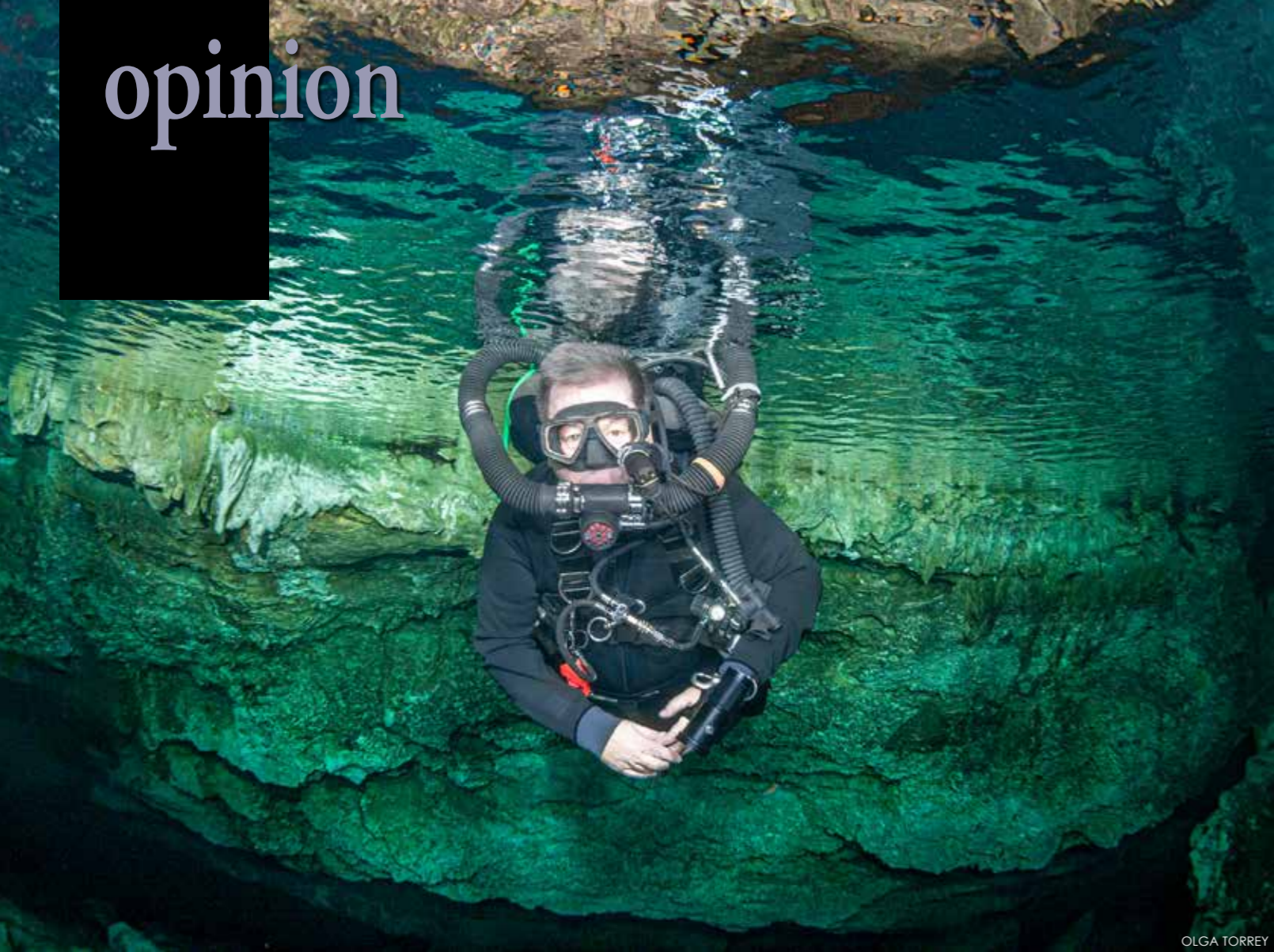
Isler was the inspiration for German cave explorers Dr Reinhard Buchaly and Michael Waldbrenner of the European Karst Plains Project (EKPP) to build a semi-closed rebreather

called the RB2000 for further Doux de Coly pushes. The RB2000 subsequently became the exploration rebreather of choice for the Woodville Karst Plain Project (WKPP), replacing its unwieldy PVR-BASR unit, which was nicknamed "The Fridge."

In 1999, Halcyon began marketing the RB80, a US version of the RB2000.

A sport diving revolution

In developing and deploying various applications of closed-circuit rebreather technology, these cave explorers all had specific personal ambitions in mind. They certainly did not see themselves as leading a sport diving revolution.



OLGA TORREY

In Hasenmayer's case, it probably never crossed his mind, any more than he ever considered advertising his achievements and becoming famous. As for Isler, this was what he thought: "With regard to the future prospects of rebreathers for sport diving applications, I believe their widespread adoption is unlikely. Indeed, it seems that only extreme situations fully justify their use."

Stone and Clough were certainly well aware of the potential for commercial development, but in Stone's case, his primary focus was always on the cave and, by the time he and his company got around to producing rebreathers to sell

to the public towards the end of the 1990s, it was too late. By then, other firms had developed models targeted specifically at sport divers and were well ahead in terms of marketing and production. They were also selling machines that cost much less to buy than the Cis-Lunar.

Clough built a whole series of rebreathers in the 1980s and 1990s, both on his own and together with other companies—one of which was Oceanic, a major mainstream US dive equipment manufacturing company led by Bob Hollis—but he and his various partners never succeeded in coming up with a viable production unit.

Although none achieved commercial success with their inventions, this small band of deep cave pioneers succeeded in firing imaginations nevertheless, igniting dreams and keeping rebreathers in the spotlight—as far as technical divers were concerned anyway. The mainstream diving world remained oblivious. During much of this period, it was still trying to decide whether open-circuit single-cylinder nitrox diving was a good thing or not.

Nothing did more to generate excitement about the enormous potential of rebreathers than a report that came over the wire from Mexico in early

May 1994. The US caving world had just lost its patron saint, Sheck Exley, and was sorely in need of some positive news. In a last gasp "Hail Mary" move right at the tail end of a project that had begun with massive sponsorship and a raft of publicity, but had almost ended in tragedy and total failure, Bill Stone and Barbara am Ende pushed Huautla, the deepest cave in the Americas, beyond all expectations.

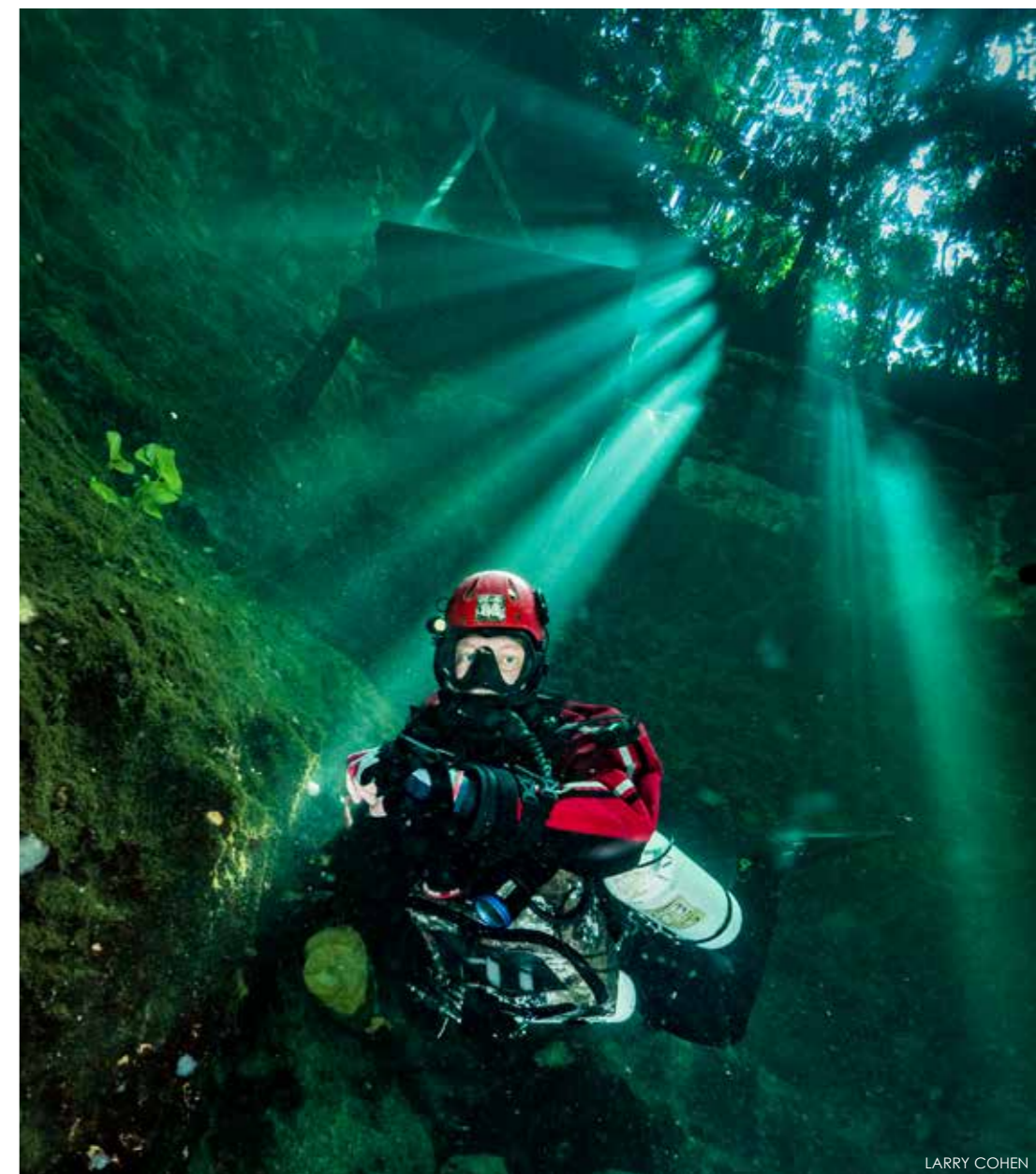
After ten years of research and a development budget of over US\$100,000, the Cis-Lunar rebreather (in its fourth manifestation) did what it had been designed to do. It took the two divers beyond the San Agustín sump that had held Stone and others up on previous explorations. Stone and am Ende's final excursion—the culmination of 44 days underground—required a complex traverse of three kilometres of air-filled cave and 655m of flooded tunnel and extended human exploration of the Huautla cave system to over 56km and a depth of 1,475m.

Coming so soon after Exley's death had placed an exclamation mark on the limitations of open-circuit scuba; this was a closed-circuit line marker that pointed the way forward. Now, it was up to some new personalities to enter the field and bring rebreather diving to the wider sport diving community...

(The story continues in Chapter 10, "Closing the Loop," in *Technically Speaking—Talks on Technical Diving, Volume 1: Genesis and Exodus.*) ■

Simon Pridmore is the author of the international bestsellers Scuba Fundamental: Start Diving the Right Way, Scuba Confidential: An Insider's Guide to Becoming a Better Diver, Scuba Exceptional: Become the Best Diver You Can Be, and Scuba Professional: Insights into Sport Diver Training & Operations, which are now available in a compendium. He is also the co-author of the Diving & Snorkeling Guide to Bali and the Diving & Snorkeling

Guide to Raja Ampat & Northeast Indonesia. His recent books include The Diver Who Fell From The Sky, Dive into Taiwan, Scuba Physiological: Think You Know All About Scuba Medicine? Think Again! and the Dining with Divers series of cookbooks. New in 2023 is the book, Technically Speaking: Talks on Technical Diving Volume 1: Genesis and Exodus. For more information, please see his website at: SimonPridmore.com.



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Rebreathers

