The use of rebreathers in caves is nothing new. Decades ago, Hans and Lotte Hass used them to venture into marine caves. Profiles like Rob Palmer in the UK, Bill Stone, George Irvine and Jarrod Jablonski in the USA, or Olivier Isler in Europe, are also strongly linked to rebreathers and cave diving. Recreational cave divers discovered Oxygen CCR in the Navy surplus, then experimented with Draeger Dolphins, and more recently, APD Inspiration. Nowadays, there are many different brands and models, and they become even more popular within the cave diving community worldwide.

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Rebreather for Cave Diving

Why?

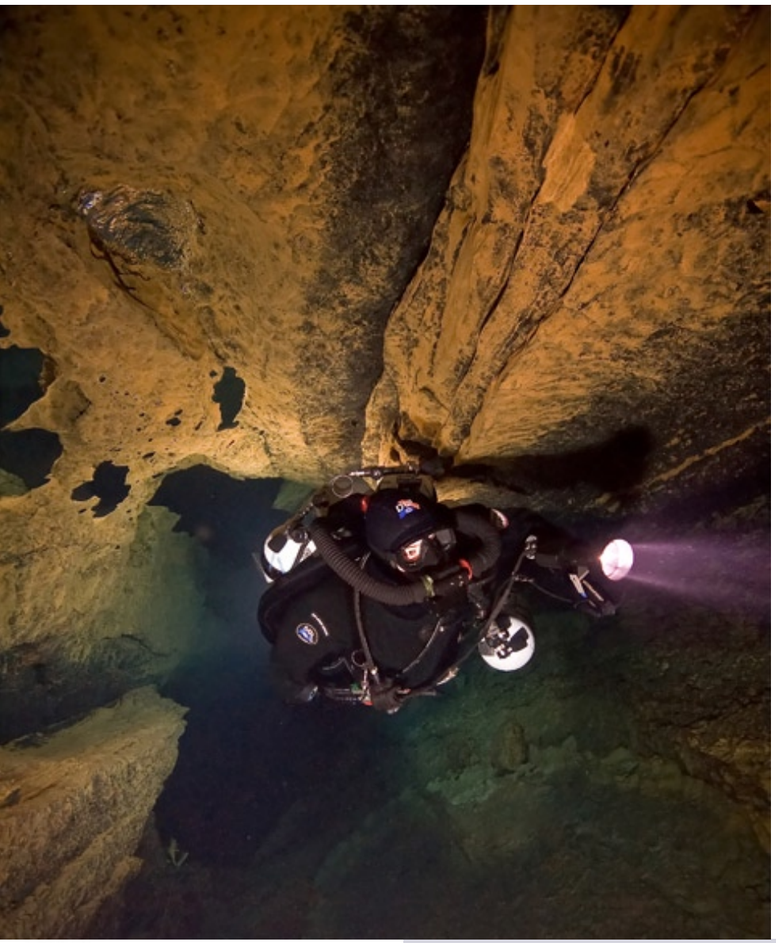
So, why use a rebreather for cave diving, and what kind of benefits does this type of equipment have compared to the highly reliable conventional Open Circuit scuba?

Extended dive time. One of main advantages of a rebreather is that it makes longer dives possible. In a cave, that translates into extended explorations and the ability to do penetration dives much longer and further than what would be possible with conventional open circuit scuba. But the rebreather also gives an additional safety margin, as it provides the cave diver with more time to handle emergencies. It could be a lost line scenario, where the way to the exit is unknown, or a situation when a team member is lost, and extra time is required to look for them. A light failure or a complete silt-out is also a situation where extra time is needed, as the progression to the exit is very often drastically slowed down.

Good buoyancy characteristics. In cave diving, buoyancy control is obviously one of the most important skills, as it prevents silt from lifting up off the bottom. With a rebreather, the buoyancy of the tanks remain almost constant throughout the dive. Therefore, it is not necessary with extra weights to compensate for the added buoyancy of tanks going empty towards the end of the dive. Less weight also means a better trim and less energy spent when moving underwater.

Lack of bubbles. A constant problem cave divers face with OC scuba is called percolation. Bubbles make their way to the walls and the ceiling of the cave and dislodge some silt. This is not an issue when diving with a rebreather. It also helps improving communication (it's possible to talk in the mouthpiece) and maintains the silence that most people are looking for in a cave.

Mixed-gas flexibility. A mixed-gas CCR offers quite a lot of benefits for the exploration of unknown cave systems. Dive planning is easier when it comes to gas mix selection, even if one doesn't know exactly how deep the cave is; the same diluent can be used for a larger depth range than the same mix used on OC. A mixed-gas CCR also gives the best decompression mix when it's time to ascend—and it could be quite often during a cave dive—ending up with a perfect yo-yo profile.



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Warmth. Most of the cave systems are located in cold/cool water (with the exception of places like Mexico and Cuba). A rebreather provides divers with some additional warmth, as they are breathing warm circulated air rather inhaling cold air from a tank—a definite benefit when the total dive time is a matter of hours.

Weight. Many caves are in remote areas. When a cave diving team wants to explore some deep caves, the amount of gas to be carried is sometimes unrealistic if the dives have to be done on conventional scuba equipment. Regardless of the bailout gas to be used, rebreathers help to have smaller and more flexible logistics. A booster pump and a few tubs of sodalime give the opportunity to explore virtually any cave system.

Obviously rebreathers are very useful tools for the cave explorer.

But simply having a rebreather is not enough to go cave diving. There are some necessary features and safety components that need to be there.

A Head-Up Display. An HUD is a key piece of equipment for safe cave diving. It tells you if you are breathing the right mix and can even inform you about other potential problems (O_2 sensors, battery power, decompression requirements, etc). All this information is normally displayed on the handset(s), but in a cave, you need your hands free to perform other tasks like reeling in and out the guideline, setting up a jump, squeezing through a restriction, riding a scooter, mapping, etc. In an emergency situation (complete light failure), one can even use the small amount of light made by the HUD to keep a visual contact with the line while looking for a back-up light.

Trim. Some rebreathers have a tendency to make the diver bottom heavy. It could be because of their different components (tanks and scrubber, OTS or back-mounted Counter-Lungs, etc) or because of the diver him/herself and the dive gear (dry/wet suit, heavy fins, canister light, etc). Before venturing into a cave, it's essential to make sure that the trim is appropriate (horizontal position, slightly head-down feet up), thanks to some adjustments and maybe some trim weights. It's also important that the configuration is streamlined and free of danglies (LP hoses, handset cables, etc).

Off-board gas switching capability. For cave diving, this is a very important feature. It gives you the possibility to use different off-board cylinders and to plug them into the loop. In case of gas depletion, electronics failure, equipment failure, scrubber failure, the diver can still stay on the loop while manually flying the unit, (Closed, Semi-Closed or open loop mode). The additional cylinders significantly increasing the possible duration and range of the diver, it would then be nice to make sure that all the fittings are the same and that all additional tanks (sling or staged) have an LP hose fitted.

A safe way to the exit. All cave divers have to make sure that they can safely come back to the exit (and the surface!) if they have to go off the loop for any reason (mainly Total Loop Flooding

or severe hypercapnia). In most of the cases, it means carrying enough Open Circuit gas for a complete bail-out exit, but it could also be a Bail-out Rebreather when the amount of gas needed is simply too big.

A Bail-Out Valve. A BOV is very useful to have on a rebreather when cave diving to avoid task loading in case of emergency. When something goes wrong with the rebreather, it is safer and easier to quickly switch to Open Circuit, sort the buoyancy out, lock off the reel, etc, then check out what happens and what to do. Furthermore, a diver suffering from CO_2 toxicity might have a hard time removing their mouthpiece and replacing it with a regulator because their breathing action is involuntary. It they try, there is a real risk that they will breathe in water. When using a rebreather in a cave, CO_2 toxicity is a very real possibility when one has to fight against a current or go through a restriction. A BOV is a quick and safe solution, at least for some sanity breaths, time to calm down and switch to the OC bailout tank.

Potential problems

Obviously rebreathers are very useful tools for the cave explorer. Nevertheless, the two main problems that could occur are:

Improper time management. As a rebreather gives additional dive time for cave diving, one can easily extend their oxygen exposure or deplete one tank. Going beyond the scrubber duration could also be a concern.

Task-loading. Never forget that cave diving is a very demanding activity. There are simply so many things to do and to think about. Situation awareness is an important component of every cave dive. Therefore, adding another task loading equipment like a rebreather doesn't help to deal with the normal flow of a cave dive, and even less when dealing with an emergency situation.

Discipline

As we often say when teaching cave diving courses, "Cave diving is not for everyone!" Add rebreathers to the equation, and we would say, "Cave diving with a rebreather is definitely not for everyone!" One has to be a very experienced CCR diver before starting any dive in an overhead environment. The main attribute of a CCR Cave diver is *discipline*. One needs discipline not to exceed the so-easily-exceeded limits. If one exceeds their limits and gets away with it very often, it could seem safe to do so.... until the day something goes wrong, which could take years to happen.

A rebreather is a very convenient tool to further explore a cave system. It's also a good solution for some of the emergency situations that can occur in a cave. Nevertheless, despite all of the benefits listed above, it's not an easy-to-use tool that can be immediately adapted to one's needs. An experienced OC cave diver or an experienced rebreather diver needs time to be able to safely combine both techniques. When they reach this state, they get the best of both worlds! ■

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