CANADA'S LONGEST CAVE DIVE
Ottawa River Cave

by

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Introduction

The Ottawa River Cave System has been actively explored, surveyed and mapped for the last 5 years (see articles CC 18/2 and 19/1) and these activities will doubtless continue for years to come. The purpose of this article is to summarize the developments of the last 3 years, present a current map and explain some of the difficulties encountered in exploring and surveying an underwater cave system with large passage, very poor visibility, strong currents and often extreme silt conditions.

Ottawa River Cave is located on a bend in the Ottawa River north of Ottawa, Ontario. The river has taken a very tortuous path, doubling back on itself before going around a peninsula that is almost 1 km across. The water takes shortcuts under the peninsula, under several of the large islands and under the bed of the river itself. A large, complex cave system is developing and exploration is continuously finding new passages. In addition, the survey is revealing that the cave is a maze and the known passage length could double several times as the surveying continues and branch passages are discovered. Sump 1 is only 17 meters long but when the walls were surveyed a branch passage over 300 meters in length was discovered and the walls of that passage have not yet been surveyed! There are currently over 3 km of explored passage under the peninsula itself, over 1 km of explored passage under one of the islands and many unchecked leads.

Passage Details

The cave system is completely flooded (phreatic passage) and the passages are usually shaped like a convex lens, meaning that they are highest in the center of the passage and that the floor and ceiling meet at the sides without any real walls. Thus, the passage is often too low for a diver to pass near the walls. In addition, there are some passages that have developed along faults in the rock and these passages are more rectangular in cross-section. An additional feature is the current which is fastest in the center of the passage and slowest near the walls. Therefore the silt tends to build up on both sides of the passage. There are two main sinks (places where the water leaves the river and enters the cave) in the system so far (at the upstream ends of sumps 8 and 10, see map) and they are both chocked with very large log jams. The logs reduce the current through the cave and have been a major factor in the silt deposition. It is fortunate however that the logs are there as the current is 3 to 5 knots in sumps 8 and 10 at normal water levels, even with the logs, and exploration would be impossible if the logs were not partially obstructing the flow!

Exploration Techniques

Where the cave has enlarged and migrated up too close to the surface (usually at a junction), the roof has collapsed and a pool is formed on the surface. Every pool is therefore a potential entrance into or exit from the system and every dive must start at one of them or at a sink / resurgence in the riverbed. An exploration line is tied off securely and the diver swims upstream into the cave. Visibility is never more that 5 meters (even with a 75 watt light, brighter than a car headlight) and the diver explores upstream whenever possible for two reasons. First, the silt that the diver kicks up is swept behind them so that he always has the best visibility possible going into new passage, of course that means that visibility is near zero coming back out! Second, the current will help him to swim back out. If the diver explores downstream not only is he groping around in zero visibility, the current pushes him into the cave and he has no way to estimate how much air he will use to get back out, assuming that he can even swim against the current! There are few female cave divers (only one has been in this system, my wife Sandra!) but gender free English becomes almost unreadable so male gender words will refer to divers of both sexes in this article.

As the diver swims through the cave, he lays a thin exploration line off a dive reel to mark the way back. Even this seemingly simple task can prove fatal. If the passage is large and the visibility low (typical in Ottawa River Cave), the diver will be unable to see the walls and therefore will maintain his direction by watching the current move silt that he stirs up on the floor with a finger. Unfortunately, if the passage does a large "S" shaped turn, the diver will assume he has gone in a straight line because he always swam straight into the current. The line he is laying will be pulled into the side of the passage. When the diver decides to turn back, he will tie the end of the line off, cut the reel free and follow the line back in zero visibility. If the passage has turned as described above, the line will pass through areas near the sides of the passage that are too small for the diver to get through! Limited time (air) and poor visibility make this a very dangerous situation. The answer is to tie the line off frequently going in and to turn around when there is still lots of air so that the diver can deal with problems like this safely.

After the exploration line has been laid, the next step is to replace it with heavier, permanent line. This line is run down the middle of the passage and securely fastened. In many Ottawa River passages, 1/2 inch nylon rope has been used to enable the diver to pull himself against the current using the rope and to ensure that the line does not get broken from rubbing on the rock (much harder and sharper limestone than in Florida) and/or broken from the drag of debris washing through that will get caught on the line. The exploration line must be removed at the same time the permanent line is installed or soon thereafter to prevent confusion and/or entanglement during subsequent dives.

The permanent line is then surveyed with a compass, tape measure and depth gauge to give the familiar line survey of dry caving. The difference is that in an underwater cave with limited visibility, the line survey team often has no idea where the walls of the passage are! The end result is a general idea of where the cave is located but no passage details. Much of the Ottawa River Cave survey is at this stage.

Next the line survey is plotted to scale on an underwater slate. Using pieces of white plastic with the surfaces roughened by sanding as a slate and ordinary lead pencils works best. The pencil will not wash or rub off but the slate can easily be cleaned on the surface with an eraser. In addition, the markings on the slate can be Xeroxed before they are erased to give a permanent record of the original survey data. Line surveys require the same layout everytime and one slate can be permanently set up to do them by etching the grid into the plastic and filling it with waterproof ink. The actual survey numbers can be written into the spaces with pencil and the slate erased without having to redraw the grid every time.

Surveying the walls is a complex task. First, the mainline is marked every 5 meters, usually by tying a small chord around the rope using a tape measure to place the ties. The next step is to survey one wall. Two divers have to work in concert and the task loading is very high when you consider that the divers are already keeping track of up to three tanks, regulators, pressure gauges, depth gauges, lights, watches, knives, mask, fins, buoyancy compensator, etc. *and* trying to survey in very poor visibility, with current, all underwater! One diver takes the end of a tape measure and places it on the first knot on the mainline. The second diver takes the tape reel and proceeds out to the wall, ensuring that he is downstream of the knot. He then pulls the tape tight and slowly moves up the wall until the diver on the line sees that the tape is perpendicular to the knot. It is the responsibility of the diver on the line to ensure that the tape runs straight to the diver on the wall and does not get caught on projections or rocks on the floor. The diver on the line then signals the diver on the wall via tugs on the tape to tell him that he is perpendicular to the knot. A complete set of signals have been worked out to tell the diver to move forward, backwards, etc. and must be memorized before the divers enter the water. The diver on the wall reads the tape and marks the wall location on the underwater slate with a ruler. He then signals the diver on the line to move to the next knot (5 m) and then he proceeds up the wall until the diver on the line signals him that he is perpendicular to the next knot. He marks the new wall location on the slate and draws in the intervening 5 meters of wall that he inspected as he moved upstream. This system works very well and is surprisingly fast once the divers are well trained but it becomes even more complex when side passages are encountered, the mainline makes a sharp change of direction and when the side wall is more than 10 meters from the mainline. The other wall is done with the same technique via a second sweep of the cave passage from the downstream end after the silt from the first dive has cleared. Underwater hand held sonar has been used to survey some caves. When visibility is excellent, there is little silt and there are true walls, you only require a distance to the wall and sonar works quite well. In the Ottawa River Cave however, the walls are out of sight, the passage lens shaped and the silt banks usually found by the walls make sonar useless (it was tried).

As is apparent from the above description, it takes a minimum of 5 dives through one length of passage to do a survey with passage details and most cave divers do not yet have the experience and skills necessary to do a wall survey accurately and safely under these conditions. This is why the survey is proceeding so slowly and why the map is still very incomplete after 5 years of diving and surveying (the author has spent over 100 hours surveying in this system!). In addition, surveying in the cave is only feasible from late June until early October and, it is a 5 hour drive from Toronto.

Map Production

Most computer programs available to convert line survey data to x,y,z coordinates demand clinometer readings and are therefore useless for underwater surveys. SMAPS fortunately will handle depth gauge readings and it was used to do the conversions for this map. SMAPS is an IBM compatible program but it can be run on Macintosh computers if you also run a program called SoftPC. SoftPC is an MS DOS emulator for the Macintosh and allows you to run any IBM program. Version 1.0 will not handle IBM graphics but apparently the most recent version will.

For this map, there were several kilometers of surface survey done to locate the shoreline, the pools, the roads, the trails through the bush and the houses (not all drawn on the map). This data was then converted to x,y,z coordinates and plotted with a Macintosh program called MacDraw II at a scale of 1/1700. An air photograph of the peninsula was enlarged to a 2 by 3 foot print so that it was also at a scale of 1/1700. The surface survey was printed, superimposed on the photograph and the obvious survey errors corrected. After all of the major errors had been removed, the multiple loops were closed using SMAPS. The islands and shoreline were drawn in as approximations and then adjusted to correspond to the air photograph. This resulted in a very accurate surface survey and all of the surface survey stations where then considered “fixed” and were not moved again (ie. the entire surface survey was considered a “benchmark” to which the cave survey was tied). The cave survey was done in the field at a scale of 1/500 and therefore the surface survey in the computer was expanded to this scale (takes two minutes with MacDraw II).

The cave survey was then drawn in the computer and each leg was adjusted to close to the the surface survey at every entrance and exit (closures done with SMAPS). When entering the survey locations, the map was expanded to a scale of 1/125, which allowed them to be located to the nearest 10 centimeters! Another advantage of using a computer program to draw the map was that it was possible to put the surface survey on one “layer”, the surface features on a second layer, the cave survey on a third layer and the cave walls and features on a fourth layer. The program allows the order of the layers to be changed with a click of the mouse and any number of layers can be viewed or printed as wished.

The cave wall details were drawn in by eye, the map scaled back to 1/500, each section printed and the printout held over a Xerox of the original survey slate. The walls were adjusted until the match was perfect. Other features of the program are that it will smooth lines and correcting mistakes or adding items is unbelievably fast and simple. Artistic skills are no longer required to produce quality maps! When the map was complete at a scale of 1/500, the layers containing the surface and cave features where copied to another file and compressed to a scale of 1/2500 (at a scale of 1/500 the map would cover 50, 8 1/2 by 11 inch pages!). The title, lettering, north arrow, current arrows, etc. were added and the map printed using a HP inkjet printer (300 dot per inch). As the survey is continued, the map will be updated and a current version can be printed at any time.

Anyone with cave diving or extensive advanced open water diving experience who is interested in helping with the survey and exploration is encouraged to contact the author at #41 Wild Gingerway, Downsview, Ontario, M3H 5W9, ph. 416-638-2058(h), 635-2079(w).

Warning: Do *not* attempt to find the cave and go cave diving by yourself! This is not only very dangerous, the cave is a maze and many of the lines go in circles, but illegal, the cave is on private property and the owners do not want people unknown to them diving in the cave.