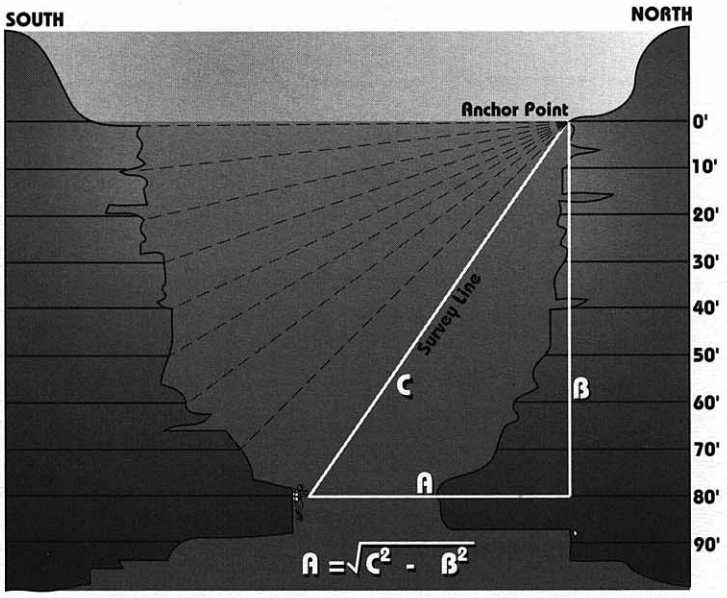
Underwater Surveys

A How To Guide for the Apprentice Cartographer

You have probably seen drawings of ship wrecks or cave systems hanging on the wall in your dive shop and may have wondered how they were created. Did someone with a photographic memory and a high tolerance to nitrogen narcosis simply draw a sketch after a dive? Probably not. Those drawings are created by divers who have surveyed the wreck or cave and taken many detailed measurements, depth readings, and compass headings. This data is then analyzed, processed and a drawing is created either by hand or, more commonly, by computer.



Triangulation from a fixed anchor point is an excellent method for surveying sinks. The length of the survey line and the depth, read from the divers depth gauge are used to calculate wall contours using simple trigonometry.

Some underwater surveys can be relatively simple taking only one dive to complete the data collection. Others can be very complex requiring many dives and coordination of many divers with lots of equipment. The difference lies mainly in what is being surveyed. There are many factors that contribute to survey complexity including size, depth, visibility, currents, and site access.

Each site is unique and requires ingenuity and planning to efficiently

collect survey data. Deep surveys (130ft+) and long penetration cave surveys (2,500ft+) require the most planning and the greatest level of training.

Survey equipment usually consist of measured survey lines, compass, slates, and video equipment. Survey reels commonly hold over 400 feet of #24 nylon line. This line is knotted every 10 feet for accurate measurements.

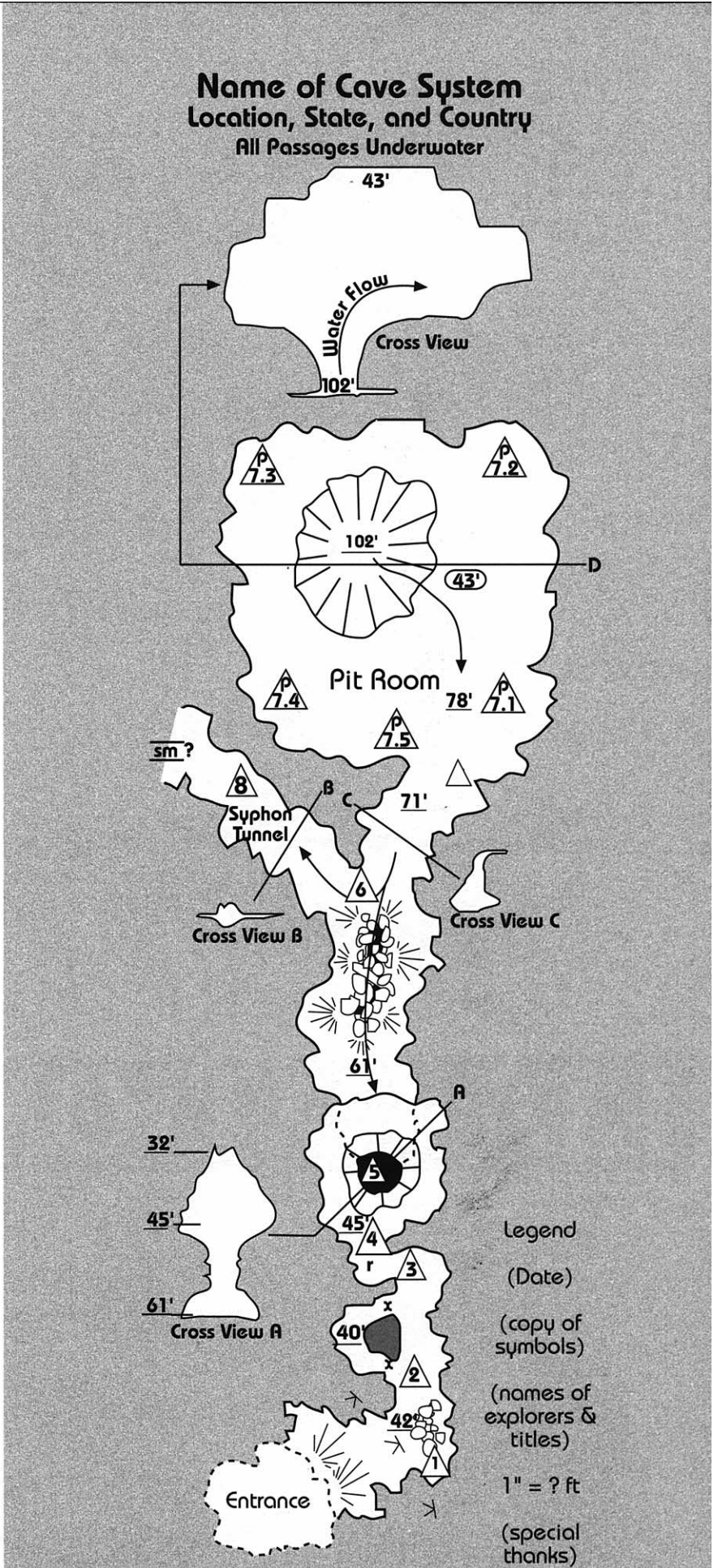
A cave survey is typically begun by running a pre-measured survey line through the cave system and recording information at various stations. Stations are the locations where the survey line makes a direction change such as turning a corner in the cave. These stations are numbered on a slate and data such as distance from previous station, depth, and compass heading are recorded. Other information including the distance from floor to ceiling, wall to wall, breakdowns (rock piles), pits, wall contours, silt conditions, floor composition, etc. are also recorded.

In cave systems with extremely large rooms, perimeter survey lines must be installed. A perimeter line is a pre-measured survey line that follows the outer walls until it returns to the starting point, completely encircling the room. Station data is collected at each station and recorded on a slate. This process accurately represents the size and shape of the room.

Common map symbols and terminology are shown on page 10. These symbols have been illustrated in the sample cave map to the right.

Side view cutouts are used at important or interesting places to give a more three dimensional understanding of the cave. Example, cross view D illustrates what the Pit Room looks like from top to bottom.

Survey maps should also include information such as the name of the system, location, a legend (all symbols used in the map), date, names of the explorers, scale, and special thanks. (continued page 10)



Sample cave map showing a variety of geologic constructions. The symbols used are critical to giving the reader a proper understanding of the three dimensional nature of the system. See index of symbols on page 10.

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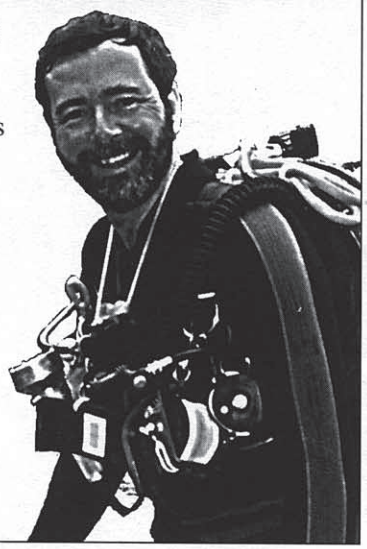
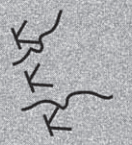
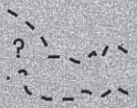


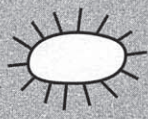
Cave Mapping Symbols and Terminology


Outline of surface pool


Limit of daylight at optimum conditions (cavern zone)


Explored but unmeasured passage


Direction of water flow


Dome in ceiling


Pit in floor


Pit in floor connecting two levels


Rocks or breakdown


Slope in floor

(120') Depth at ceiling

145' Depth at floor


Survey station number at which data was collected


Survey station number for perimeter lines for large rooms

p.4,765 ft Maximum penetration to the nearest exit

r Minor restriction 3' x 3'

x Major restriction 2' x 2'

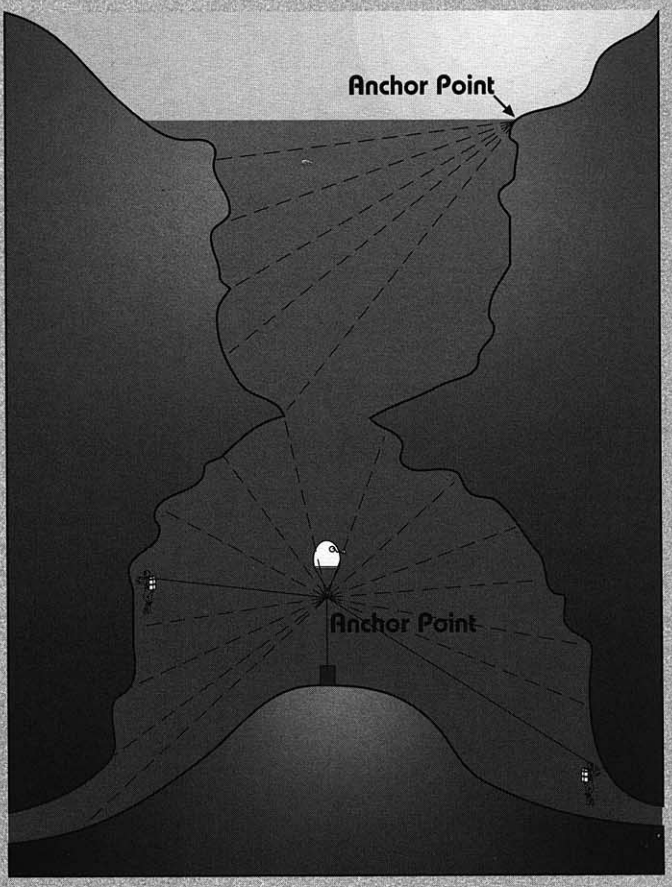
? Unexplored passage

SM Passage requiring side mounted tanks

▲ **Standard cartography symbols used in cave maps. Measurements taken at survey stations plus video or slate sketches are used to develop the cave maps.**

Triangulation Method

Several methods can be used to take station measurements for underwater surveys. The triangulation method is ideal for large rooms, sinks, and open-water wrecks, especially those wrecks with large debris fields. The only two requirements are a stationary anchor point and a straight line between the anchor point and the area being surveyed. No bends in the survey line are allowed or the survey data will be incorrect. A minimal amount of equipment can be used for this method. A survey reel with marked distances, compass, slates, and a digital depth gauge. A 200 ft. cloth measuring tape works well.



Sink and Cave Surveys

An anchor point must first be determined. Usually the best location for cave surveys is the center of the area being surveyed or on an outer wall. The diver should first circle the room taking compass, depth, and distance readings on the east, west, north and south walls as well as points of special interest (i.e., pits, breakdowns, artifacts, etc.). When surveying deep sinks only one or two walls may be surveyed per dive due to dive time restrictions.

Wreck Surveys

When surveying wrecks, first locate a recognizable structure as close to the center of the wreck as possible, tie off a 25 foot piece of rope with a 50+ pound lift bag. Inflate the lift bag so that it rises above the wreck. Tie the survey reel off just below the bag. This will keep your survey line from becoming tangled in wreckage. Swim around the wreck taking line distances, depths, and azimuth readings. Slate sketches and video will help when piecing the information together afterwards. When drawing wreck maps, all significant items of interest can be labeled either by numbering the sites and creating a legend, or by labeling each component individually on the map.

A lift bag provides the fixed anchor point on wrecks required for accurate measurements. Divers with survey lines swim around to the various points of interest on the wreck measuring distance, compass heading, and depth.