ZARA
ENVIRONMENTAL LLC
118 W. Goforth Road, Buda, Texas 78610
www.zaraenvironmental.com
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Prepared by Jean K. Krejca, Ph.D.

DIVERSION SPRING CAVE

Report prepared for:
Edwards Aquifer Authority
1615 N. St. Mary's St.
San Antonio, TX 78215

Abstract

An examination of Diversion Spring Cave took place on 11 July 2005. The cave was surveyed to a total length of 20.5 feet. A geologic contact was documented within the cave, as well as potential habitat for groundwater taxa. Still images were created and video was taken. Potential for using this site for biological and hydrological research was found to be good, with access to a gravel floored bedding plane that, with excavation, may lead to more conduits connecting various spring outlets.

Introduction

Diversion Spring is an outlet to San Marcos Springs located at 22 feet of depth in the lake behind Spring Lake dam. Historically this spring had a cap over it connected to a pipe diverting the flow into a small pool. When interest in cave salamanders, *Eurycea rathbuni*, began, a section of the pipe was removed so that a net could be placed over the flow to collect specimens. In time, the cap and pipe that diverted flow to the collection net was deteriorating and salamander specimens were found less frequently. Recently the cap was removed with intent to replace it with a cap and pipe that would allow salamanders to be retrieved daily out of nets that are accessible by canoe. When the cap was removed, the divers noticed a cave passage, and this cave is the subject of this report.

Methods

Divers used standard cave SCUBA protocols (Prosser and Grey 1992), with side mounted tanks (Figure 1), surveyed the cave using knotted line and orienteering compass (figures 2 and 3), and searched for organisms by turning rocks and hand collecting. Still images were taken with a high resolution digital camera with on-camera flash in an underwater housing and video images were taken with a digital video camera in an underwater housing using 50 watt dive lights for lighting (Figure 4).

Results

Two divers each logged about 40 minutes during a first dive and 20 minutes during a second dive.

Approximately 60 still images and an hour of video footage were taken in addition to making the observations reported below.

Cave passage morphology

The cave passage was surveyed to a total length of 20.5 feet. The entrance to this feature is located 22 feet below the lake surface and is 3.5 by 1.5 feet in diameter (Figure 1). From the entrance the passage drops down four feet to a cave passage with a general azimuth of 050/230 degrees (Figure 5). From the entrance to the 230 degree direction there is a small alcove with a sand boil in the floor, and this alcove ends in breakdown (Figure 6). In the other direction from the entrance there is some breakdown on the floor to the north, and a bedrock ledge to the south. The floor of this passage in the center and ends is predominantly gravel. At the end of the passage the breakdown on the north that has fallen from the ceiling produces a ceiling channel that is unenterable but extends at least 8 feet from the edge of the surveyed cave passage (Figure 7). On the southern and eastern ends of the cave passage a gravel floored bedding plane can be seen extending for at least 10 feet from the edge of the surveyed cave passage (Figure 8). At one place along this bedding plane several rocks were moved to allow some progress into the bedding plane. Less than 5 minutes were spent at this excavation, and allowed another 4 feet of progress. It is possible with more digging that a diver could pass through the constriction into larger conduit beyond.

Hydrogeology

A geologic contact was found in the cave. The top limestone (at entrance) is a bivalve fossiliferous packstone (Folk classification), the lower "chalky" unit is likely a dolomitic grainstone (Figure 8). The floor is layered in a secondary moderately rounded, well sorted gravel 4-16 cm thick with some coarse, well sorted sand at the southwest end of the cave overlying an additional spring discharge feature. The cave appears to be structurally controlled with the long axis parallel to one fracture plane visible on the surface (azimuth 42 degrees, see Figure 1), and secondary dissolution has occurred preferentially along a 10-20 cm bedding plane between the two previously described limestone beds which discharges approximately 80% of the flowing water from Diversion Spring. At the south and east ends of the cave, the bedding plane extends well beyond the enterable passage. In one area along the south wall some excavation allowed a diver to see into the bedding plane far enough to notice a far wall that appeared mottled in color, had a different morphology (no bedding plane) and may be another contact or fault offset. Finally, there is a second tiny entrance along a joint that leads to the main cave passage (Figure 9).

Biology

This site is known to yield Texas Blind Salamanders, *Eurycea rathbuni* (Figure 10). The endangered riffle beetle, *Heterelmis comalensis* (Figure 11) is known from nearby spring orifices. Approximately 10 minutes of searching in this cave yielded no organisms. Due to the high flow of this system, no traps were set. This site is more amenable to drift netting than bottle trapping. The habitat in the cave, consisting of gravel and breakdown blocks, appears suitable for aquifer adapted crustaceans as well as salamanders. In order to collect these crustaceans, typically it is necessary to enter the cave and turn rocks, or to disturb rocks manually as in kick netting to release taxa that adhere to the gravel.

Discussion

Diversion Spring Cave is the downstream most outlet for a large section of the Edwards Aquifer (eg. Ogden et al. 1986, Woodruff and Abbot 1986). For this reason, this cave is a very important feature, even though it lacks extensive enterable passage. There are several reasons to leave this site open, without the proposed cap, for scientific access, and these are enumerated below:

1. Biological Sampling. It has been shown that *Eurycea rathbuni* salamanders can be captured both with and without the cap. Historically they were collected with the cap and could be accessed by boat. Recently they were collected without the cap, using only a drift net, and this net could be accessed by divers (personal communication Ron Coley). With the site open, however, other aquifer taxa could be collected including crustaceans that tend to adhere to rock surfaces and not be captured in drift nets. Also with the site open, the gravel could be disturbed as with kick netting to release organisms that tend to adhere to substrates such as riffle beetles and asellid isopods.
2. Biological Monitoring. Without the cap, divers and biologists can perform in-situ non lethal monitoring. For example it is possible that a population of salamanders occurs in the cave that could be monitored using mark-recapture techniques as in other cave sites where that species occurs. Additionally microhabitat in the cave can be monitored in order to track changes in substrate due to flooding and effects of sediment moving through the aquifer.
3. Hydrogeology. With a cap on the spring, researchers would be limited to placing instruments at the end of the cap. The morphology of the cap would alter some characteristics of the outflow, particularly sediment characteristics. Due to the vertical orientation of the pipe over the cave entrance, heavier sediments would be less likely to flow out of the cap and more likely to accumulate in the cave. Without the cap, instruments could be placed directly in the mouth of the cave or even at the back of the cave where they are truly in the aquifer rather than in a lake.
4. Exploration. This report identifies at least two places in the cave where excavation may yield additional cave passage. It is possible that some digging would result in a connection to a conduit that links other spring outlets in the lake. Considering recent dye tracing work that delineates different characteristics of different outlets (LBG-Guyton 2004), it would be extremely valuable to access and survey that passage.

Literature Cited

LBG-Guyton Associates. 2004. Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas. Report prepared for Edwards Aquifer Authority. 192 pp.

Ogden, Albert E., Ray A. Quick and Samuel R. Rothermel. 1986. Hydrochemistry of the Comal, Hueco, and San Marcos Springs, Edwards Aquifer, Texas. Pages 115-130 *in* Abbott, Patrick L. and Woodruff, C.M., Jr., eds., 1986, The Balcones Escarpment, Central Texas: Geological Society of America.

Prosser, J. and H. V. Grey. 1992. NSS Cave Diving Manual. The Cave Diving Section of the National Speleological Society, Branford, Florida.

Woodruff, C.M. Jr. and Patrick L. Abbott. 1986. Stream Piracy and Evolution of the Edwards Aquifer Along the Balcones Escarpment, Central Texas. Pages 77-90 *in* Abbot, Patrick L. and Woodruff, C. M. Jr., eds., 1986, The Balcones Escarpment, Central Texas: Geological Society of America.

Figure 1. Diver using side mounted 40 ft.^{3} tanks to enter spring. Spring orifice is at center of image, camera view is looking straight down. The azimuth of the prominent joint from the top to the bottom of the image is 042 degrees.

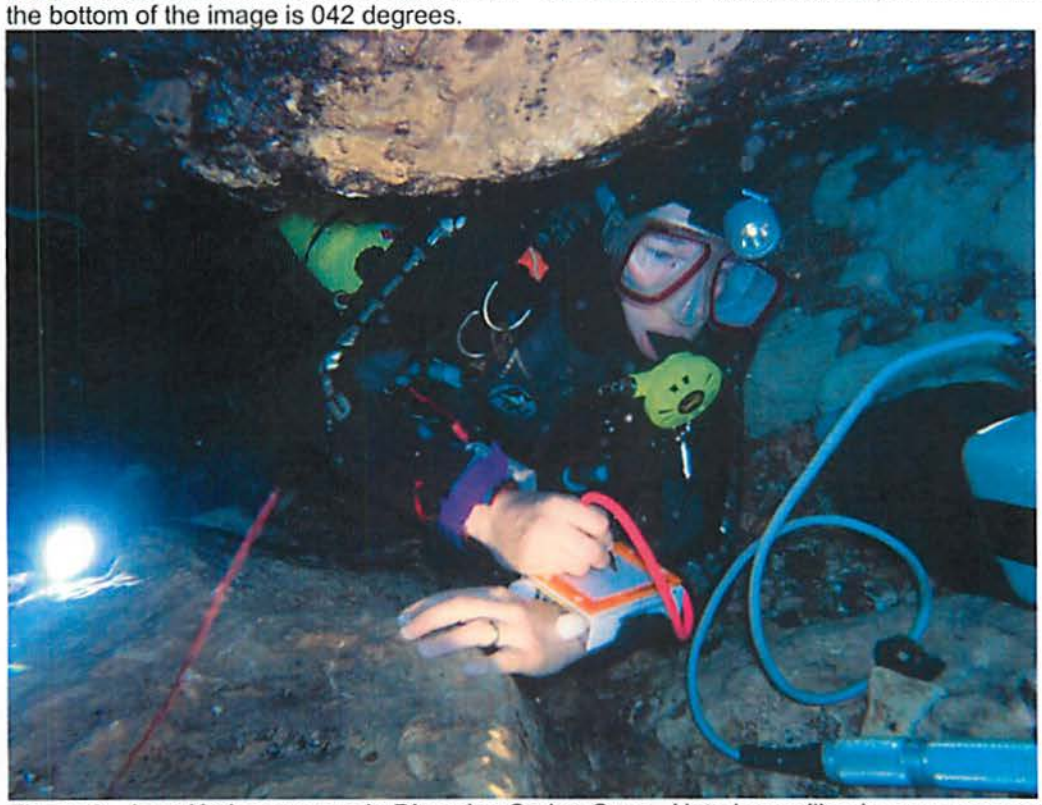

Figure 2. Jean Krejca surveys in Diversion Spring Cave. Note low ceiling in cave passage.

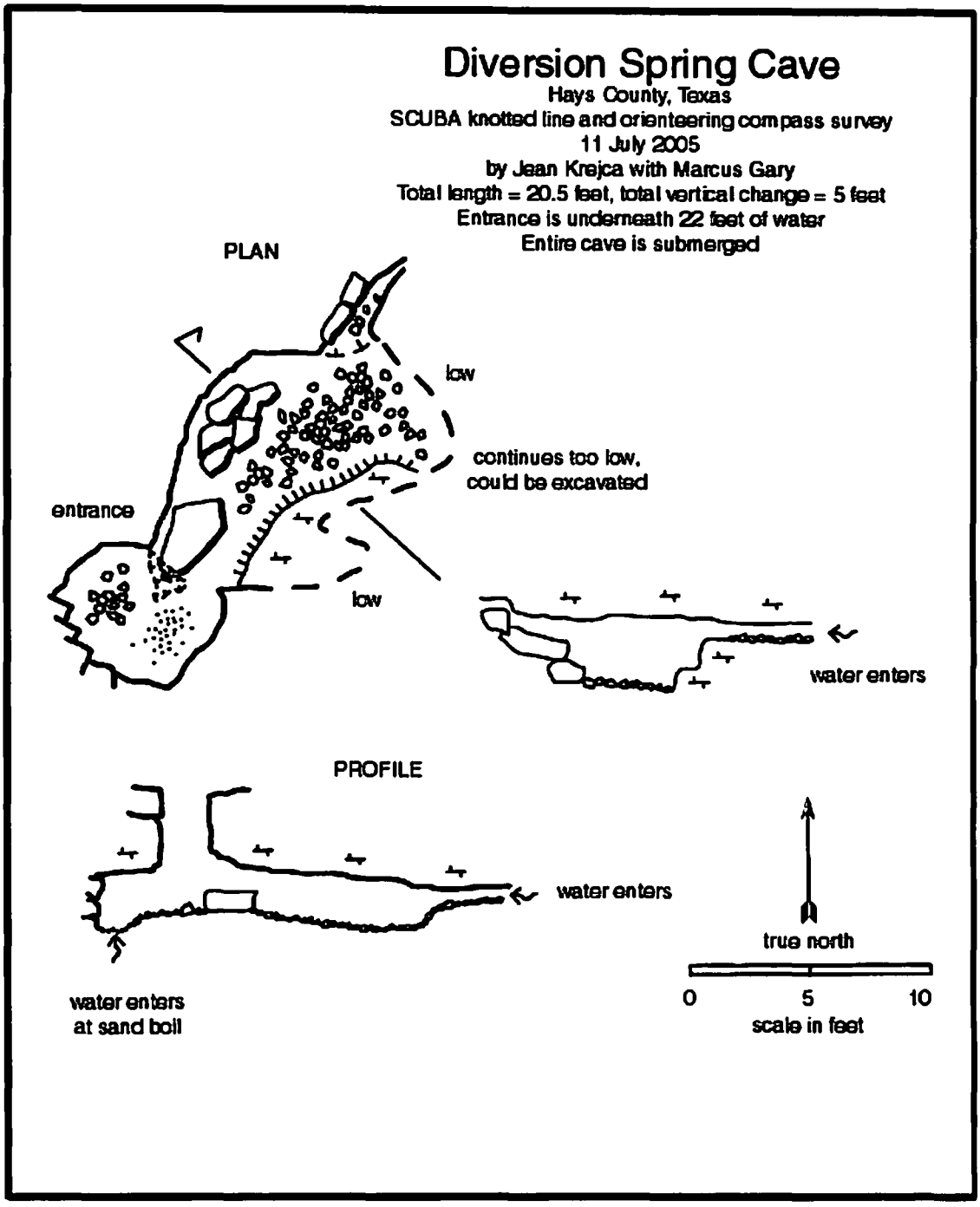

Figure 3. Map of Diversion Spring Cave.

Figure 4. Jean Krejca operates a digital video camera in Diversion Spring Cave.

Figure 5. Marcus Gary enters the vertical entrance.

Figure 6. Sand Boil at the southwest end of the cave passage.

Figure 7. Ceiling breakdown along north wall of cave.

Figure 8. Bedrock ledge showing bedding contact between floor limestone (white and chalky) and ceiling limestone (dark and fossiliferous).

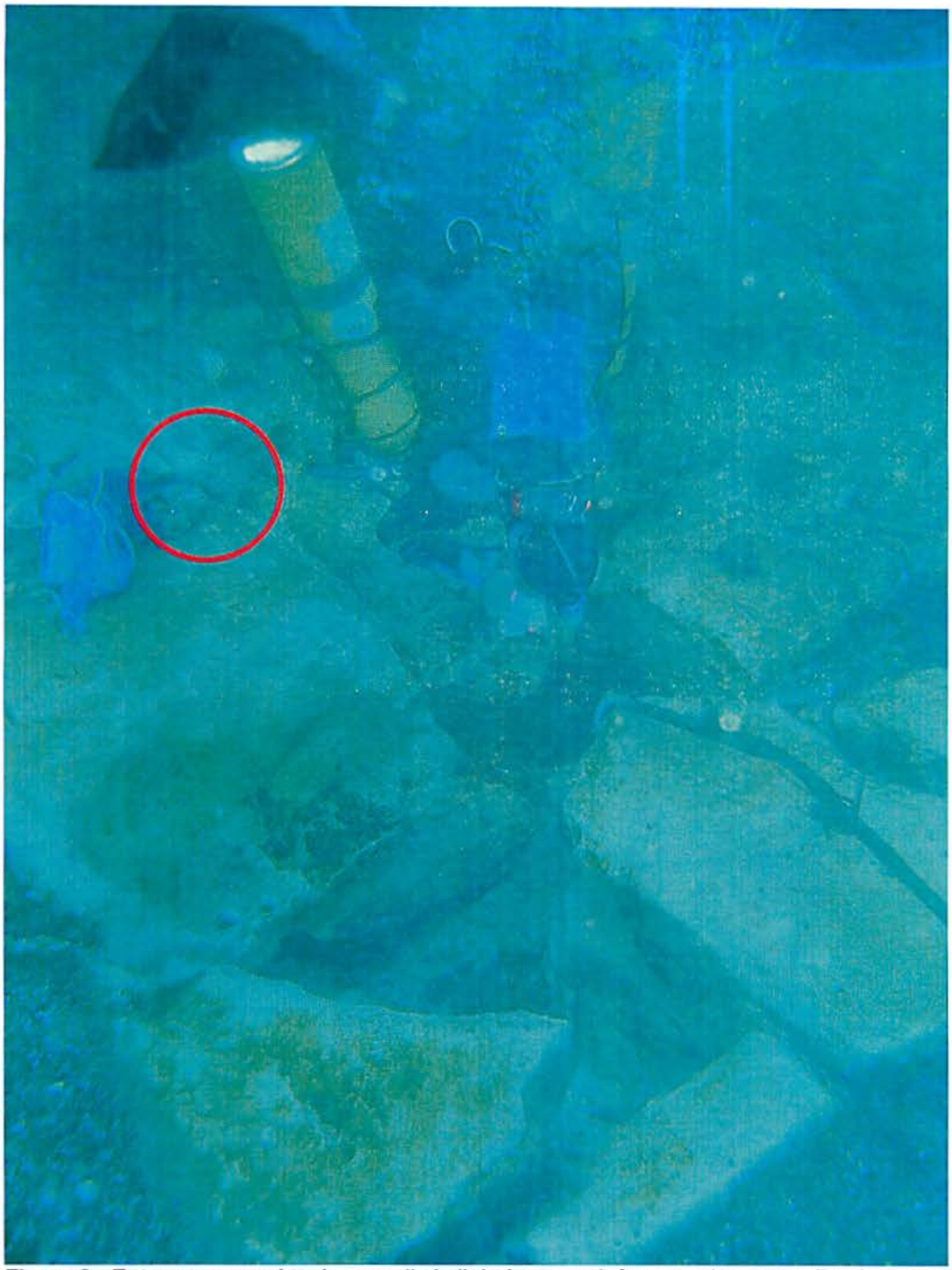

Figure 9. Entrance area showing small skylight in upper left corner between diver's tank and bags.

Figure 10. *Eurycea rathbuni* from San Marcos Fish Hatchery. These specimens are taken from Diversion Spring for captive breeding in the Fish Hatchery.

Figure 11. *Heterelmis comalensis* from San Marcos Fish Hatchery.