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LEWIS N. WOOD

Innovation and Methodological Approaches to Deep Water Excavation; Warm Mineral Springs (8So19): A Case Study

With the focus of underwater archaeology beginning to shift towards the examination of submerged cultural resources in deeper waters on the Outer Continental Shelf and in lakes, springs, and sinkholes, it is essential that professional archaeologists begin to recognize the need for a continuing program of research and innovation in terms of diving technology (Cockrell 1973). Since the earliest stages of the research at Warm Mineral Springs in 1972, such a program has existed under the direction of Wilburn A. Cockrell. Cockrell was quick to realize that the archaeologically rich waters of Warm Mineral Springs presented a challenge in terms of developing new techniques to meet the ever increasing demands of his research design and the harsh diving environment. Beginning in 1972, Cockrell, assisted by his colleague, Larry Murphy, instituted a multi-disciplinary effort that has gained worldwide recognition as having remained on the cutting edge of innovation and adaptation.

Research efforts during Phase I (1972-1977) were directed by Cockrell and administered by the Florida Department of State's Division of Archives, History and Records Management. During six consecutive field seasons, he mobilized large crews and launched successful, large-scale archaeological field projects. The emphasis was then, and continues to be, three basic elements; preservation of the site and its archaeological materials; education of the public through information dissemination; and archaeological research. With those elements to guide them, Cockrell and his crews set out to explore and map the upper, shallow portion of the Springs and to excavate the remains of an intentional 10,300 year-old Native American burial on the 13 m ledge as well as the articulated remains of extinct Pleistocene megafauna (Cockrell & Murphy 1978). Although some exploratory dives were made to depths of up to 70 m, the principle research focus was the upper 19 m of the Springs.

In 1978, the Phase I portion of the research was phased out due to funding cuts and a lack of support in the Florida Department of State. A subsequent elimination of the Underwater Archaeological Research Section of the Division of Archives forced Cockrell to seek alternate funding sources. Phase II began in March 1984, and continues to date under the auspices of the Warm Mineral Springs Archaeological Research Project and is funded by the Florida State Legislature.

Initial underwater efforts during Phase II were directed towards cleaning accumulated sand from the 13 m ledge and re-establishing mapping points. Although hampered by limited funding, a small over-worked staff, and "hand-me-down" diving equipment, the projected goals for the 1984-1985 fiscal year were accomplished and staff members were able to begin working towards more ambitious goals for forthcoming field seasons, namely the establishment of deep excavation units in the debris cone at the bottom of the springs (Cockrell 1986).

Concurrent with the ever increasing demands of the Project's research design have come increasing demands upon new technology to insure diver safety in a harsh diving environment, notable for its extreme depth, partial overhead environment, and lack of ambient light. Therefore, research into increasingly more technologically advanced diving and data gathering techniques has been ongoing since the start of Phase II. The final stage of this research resembles the evolutionary process in that new equipment configurations and techniques are tested and evaluated on-site with safety and job-specific tasks in mind. Pieces of equipment or techniques which prove to be effective are retained and those that fail to produce positive results are discarded.

Initial excavations in Phase I were carried out utilizing what was then considered to be "state-of-the-art" sport diving equipment. Early recognition of the need for innovation and adaptation took the form of modifications to the individual gear of dive team members. Murphy, then functioning as Project Dive Officer, was an early proponent of techniques developed through the efforts of the membership of the National Association for Cave Diving. He recognized the value of their specialized diving equipment in terms of increased diver safety and the increased buoyancy control it afforded in the overhead diving environment. Keying on this, Murphy began by modifying his "horse-collar" Buoyancy Compensator to facilitate a more exaggerated "head down-feet up" swimming position which has proven to be extremely effective in working in close proximity to the fragile sediments found in Warm Mineral Springs. While a seemingly obvious and simple modification, Murphy's adoption of this technique marked the beginning of a relationship with the cave diving community which has continued to date. The close of Phase I in 1977, saw the application of other equipment attributable to the NACD, such as dual high pressure orifice tank valves and the use of redundant SCUBA regulators (Exley 1981).

Phase II saw the aforementioned extension of work areas into the depths between 36 m and 50 m. With diver safety in mind, the principle of redundancy of equipment was carried further to include redundant buoyancy control devices, redundant primary light sources, and alternate air supplies. Working at depth, well beyond the reach of ambient light from the surface and often with limited visibility due to suspended particulates in the water, the added safety factor provided to the diver by these redundancies cannot be underestimated. Short of a primary air supply failure, each diver is capable of self-rescue and the handling of most immediate equipment-related emergencies independently (Exley 1984).

During early efforts to establish an excavation unit in the 46 m area of the debris cone at the bottom of the Springs, it became obvious that staff divers were pushing open-circuit SCUBA to its maximum potential. Bottom times were limited by the amount of air that the divers could carry for use during the dive, as well as during the lengthy periods of decompression which resulted from working at depth.

Feeling somewhat like Mary Norton's "Borrower Family" in her book *The Borrowers*, staff members began to evaluate alternate life support equipment and technology. Where once the staff members borrowed heavily from the cave diving community, they now found that the most obvious progression technologically was to begin by looking at the time-tested equipment developed for the Commercial Diving Industry and the oil fields of the Gulf of Mexico and the North Sea.

Following a literature search by the staff, numerous inquiries were sent out to a wide spectrum of diving experts and consultants, seeking baseline data on what kind of equipment was available and who was available to provide the necessary training to bring the staff up to a safe, acceptable level of performance in its use.

Based upon research performed by the Project Manager, Barbara O'Horo, and the author, a firm commitment was made to purchase surface-air-supplied diving equipment. A compact, diving control console, manufactured by Diving Systems International was purchased following in-water testing and evaluation by staff members. This equipment, coupled with 300 foot hoses and two different configurations of diver headgear, allows the divers to have an unlimited air supply and direct contact with their sur-