H57 The Use of an Alternate Light Source for Detecting Skeletal Material Under Water

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After attending this presentation, attendees will understand how a submersible Alternate Light Source (ALS) can be used to locate skeletal material underwater.

This presentation will impact the forensic science community by improving the search methods used by forensic divers and increasing the quantity and efficiency of evidence recovered.

When searching underwater crime scenes or disaster scenes for human remains, it may be advantageous for forensic divers to be able to detect the presence of skeletal material among other non-skeletal marine materials (such as shells and rocks). In terrestrial environments, this can typically be accomplished by visual and instrumental methods, but underwater conditions make it difficult to employ segregation techniques in these environments. This study investigates fluorescence of skeletal and non-skeletal materials using a submersible ALS and concludes that an ALS can be a useful tool for detecting skeletal remains in underwater searches.

Tests were carried out using a hand-held, integrated-battery light source advertised as submersible to 100 meters and saltwater resistant. Skeletal material examined included human bones, burned human bone, non-human bones (pig, deer, turtle, and fish), and non-human teeth (pig and dog). Other non-skeletal marine material examined included gastropod shells, bivalve shells, echinoderm shells, coral, rocks, and beach glass. The first stage of testing involved an investigation of whether skeletal material (including both bones and teeth) could be differentiated from non-skeletal marine materials using the selected ALS in a terrestrial environment. This phase was performed using ultraviolet and 450nm wavelength settings and filters in red, orange, and yellow. The second testing stage involved deployment of the ALS underwater to examine the ability to differentiate skeletal material underwater, and also to evaluate the practicality of using an ALS system (including light source and filter) underwater. The ALS was deployed in a freshwater lake where the water depth was approximately 15ft, and the device was tested at a depth of approximately 4ft. Test specimens were placed in a mesh bag, and observations were made using a diving mask fitted with a yellow filter.

In terrestrial tests, skeletal material could be easily differentiated from the other materials using the 450nm setting and a yellow filter on the basis of the intensity of fluorescence. Under these conditions, skeletal samples fluoresce yellow to orange, while all other materials failed to fluoresce, appearing dark purple/blue or simply dark. In underwater tests, the device functioned well, proving to be water resistant and effectively projecting light at a distance of up to several feet. Because the test was conducted in the daytime in shallow water, the light was found to be difficult to detect in bright areas near the surface. When the device was used in a dark crevice, however, the skeletal material could be seen to fluoresce. These results suggest that the technique is likely to be most effective at greater depths or during nighttime investigations.

While this technique can distinguish skeletal material from other materials, it does not distinguish human skeletal material from that of other animals that may be encountered in an underwater environment. In cases where bones or teeth are identified by divers using the ALS, the specimens will still need to be brought to the surface to determine their ultimate forensic significance. Nonetheless, the technique may be useful in eliminating the unnecessary collection and transportation of non-skeletal material to the surface. Although examined for its utility underwater, the ability to distinguish skeletal from non-skeletal material in a laboratory environment may also be useful in forensic anthropological segregating exercises.

Further studies aimed at how long skeletal material underwater retains its fluorescent properties would be useful, as would additional tests of the depth and visibility limitations (if any) of the device. It is concluded that the use of ALS under the conditions described may be very useful in forensic diving for detecting the presence of skeletal material in underwater environments.

Alternate Light Source (ALS), Forensic Diving, Forensic Anthropology

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