

TRACE TESTIMONIALS

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ABSTRACT

Anecdotal casework is presented in which trace evidence, in some instances unusual types of materials, provided critical and probative information in the investigation and/or prosecution of homicide cases. For each of four cases, the overall case scenarios are presented in abbreviated form, and emphasis is centered on the value of the trace evidence:

Case I. the identification of transferred natural dental enamel/dentin and dental porcelain crown material, and unburned smokeless gun powder used to reconstruct the position of a gun at the time of discharge;

Case II. the species specific identification and natural history of goose-neck barnacles settled on a gunshot wound victim found floating in coastal oceanic waters used to estimate the amount of time the victim was in the water;

Case III. reconstruction, identification and observations of deteriorating clothing and hair recovered a year after the victim's disappearance (including differential fiber decomposition and weathering apparently due to fiber-type as well as microclimate differences, identification of sharp force damage to various fabrics as distinguished from weathering and tearing, and hair putrid root banding, decompositional shaft changes and fungal infiltration) used to identify the victim and partially reconstruct the events surrounding her death;

Case IV. the physical matching of small and extremely fragile automotive paint chips (some hanging by a single fiber glass thread) from a substantially repaired vehicle to a painted

fiberglass automotive panel recovered at the scene of a double homicide illustrating a technique used to prepare a court display when the chips could not be moved, placed in a planar manner or brought into proximity to each other.

CASE I

Histologically, the human body is composed of seven basic tissues: blood, epithelium, connective tissue, muscle, nerve, bone, and cartilage. These basic tissues are organized morphologically and anatomically into organs, and organs into organ systems. DNA typing can be used to determine or confirm the identity of the tissue donor. It is the identification and/or discrimination of the tissue type and tissue source in terms of the body site from which it originated that provides the probative information in many case situations. This type of source determination can not be provided by DNA typing, however, and must be accomplished by an adequately trained histologist or microscopist.

In many instances the basic tissue types are identifiable by polarized light microscopy using methyl salicylate (aka oil of wintergreen, $n = 1.535\sim 1.538$) as a temporary mounting medium. Methyl salicylate does not interfere with subsequent DNA typing as can some of the traditional cellular fixing and staining techniques. Beyond light microscopy, SEM/EDX provides a non-destructive method for obtaining morphological and chemical compositional data from possible body tissues.

The useful application of these techniques can be found in this illustrative case in which a female nightclub hostess accompanied a male patron home on one evening in 2003. The hired driver of the male patron heard a gunshot several hours after arriving at the male patron's residence and summoned authorities by calling 911. Upon entry into the residence, the female

was found dead slumped in a foyer chair, a 2 inch barrel .38 revolver under her left leg. At autopsy it was determined that she was the victim of a single GSW entering the mouth and no exit, her right acrylic thumb nail was broken and missing, her two front incisors had broken and partially missing full crowns, and one lateral incisor had broken but not missing veneer. Appearing as a fairly simple case in that it was known who was present and when the shot occurred, the true investigative questions were for incident reconstructive purposes: Where was the female GSW victim, where was the gun, and where was the male subject at the time of the gun discharge?

Identification of trace materials associated with this case demonstrated that the material embedded in the bullet lead was compact bone, material embedded on the rearward slope of the revolver's front site was natural tooth enamel and/or dentin, and a white particle on her torso/abdomen was fabricated tooth porcelain crown. This information, in part, situated the female in a seated position, with the barrel of the gun in her mouth such that the forward gun site was upright and behind her upper front teeth, at the time of gun discharge.

CASE II

Associative trace evidence in terrestrial systems is encountered in the form of local flora and fauna. The invasion and succession of various species (including the ecological decomposers), usually insects, has been used in various cases and with varying degrees of success to determine an individual's time of death and/or deposition in a particular environment. Similar associative trace evidence in aquatic systems (both limnetic and marine) is rarely reported on in the forensic literature except for the use of diatoms.

In May, 2006, a fully clad male was found floating in marine waters about 20 miles from the Los Angeles area coast. The autopsy revealed him to be the victim of a single gunshot wound and no useful estimate of the time of death could be provided based on the experience of the medical examiners. This examiner first became aware of the case five days after the autopsy when a lab technician was attempting to determine how to “preserve” the clothing.

Upon viewing the victim’s clothes, it was noted that every surface of the clothing, regardless of the fabric composition and texture (including leather shoes) had adhering marine organisms commonly known as goose-neck barnacles. At this time all of the barnacles themselves were dead and starting to decompose. A sampling of the barnacles was removed selecting for the largest specimens to represent the oldest individuals and, hence, provide the longest estimate of the victim’s time of death.

The barnacles were identified using a standard dichotomous key for local southern California marine fauna as *Lepas anatifera*. This species is a small to medium size barnacle found almost exclusively attached to floating objects (an indiscriminate settler) and is cosmopolitan in distribution along the western coast of the Americas. This organism has an open water, floating larval stage that must attach to a substrate before it metamorphoses into the adult growth form of the stalked barnacle. The identification of the species was useful in that it indicated the body was most likely always floating in open waters (a different species populates harbor, piers and fixed objects). But the cosmopolitan distribution of this species could not aid in discriminating a location or area of the coast from which the body originated. The height of the capitulum (body), and the length and width of the peduncle (stalk) were compared to available literature giving an estimated maximum barnacle age or duration of 15 days. Once the victim was identified by fingerprints, the barnacle age/duration estimate allowed the investigators

to immediately focus their attention on events surrounding the victim's life some three weeks prior to him being found.

In retrospect this case may have been better served with better attention and forethought to the proper preservation of the aquatic fauna and flora ala the concepts of forensic entomology for the terrestrial systems. Given that the clothing languished for five days an unknown number of other species of marine organisms (including the more mobile or unattached, the more fragile, and the smaller) may have been present and may have been more discriminatory information about the time of death and location of the decedent during his time in the waters. Proper preservation of aquatic species includes immediate sampling of the populations present and inactivation of specimens in alcohol.

CASE III

In late 1993 a partial skeleton (a skull and several long bones) was recovered from the mountainous area north of Los Angeles. Nearby, as well as somewhat more distant but still nearby, deteriorated clothing items and costume jewelry were also recovered, but none with skeletal remains directly associated with them. The partial skeletal remains were considered identified as that of a woman that had been missing for almost a year, based on a picture of the woman indicating a rotated lateral incisor and a similar appearing pair of earrings. An aspiring model, in 1992 she had failed to return home to her husband and child after reportedly going to the hair dresser and a modeling shoot. Her car was found burning on a mountain highway the day after she failed to return home in 1992. Autopsy of the partial skeletal remains failed to determine a cause of death. Initially, several persons of interest were interviewed but no arrest(s) was made. The immediate examination of recovered items centered on biological stain

information only. In the absence of significant suspect information the case became cold and no further laboratory examinations were done at the time. The skeletal remains were given to the family and cremated.

Twelve years later interest in the case was rekindled as a cold case. It wasn't until this time that the clothing items were first examined in the trace physical evidence section of our laboratory due to the absence of any initial information provided by biological/serological examinations in 1993. Mounds of deteriorating fabric, fibers, hair, and associated dirt and debris were examined macroscopically, microscopically and by FTIR as appropriate for the type of item. Like fabric and fiber items were compared to each other for physical match reconstructions and examined for the nature of fabric damage. These very basic examinations resulted in some significant case incident reconstructive information.

Wads of human head hair found with some of the clothing items were found to have cosmetically bleached shafts (a cosmetic habit of the missing woman) and putrid root bands (an indication that this hair was associated with decomposing skin tissue at one time). The hair shafts had significant fungal infections, and heavy soiled contaminated and weathered shafts and roots making them unsuitable for nuclear DNA typing. Mitochondrial DNA typing was successfully completed confirming a link to the maternal line of the missing aspiring model.

Reconstruction of some of the clothing items sufficiently demonstrated them to be of the type she was wearing when last seen at the hair dresser. It further demonstrated some significant non-manufacturer's sharp force cuts of some of the clothing including the bra straps, jacket lapels, panty-hose panties and skirt. Some of the cuts must have occurred when the fabrics were bunched or folded, and some of the fabric damage was in the configuration of sharp force stabs to bunched fabric.

Two of the clothing items were composed of synthetic and natural fiber combinations: a body-suit style blouse composed of a nylon knit frame covered by interwoven cotton, and an apparent jacket composed of acetate and cotton 1:1 weave. In both of these clothing fabrics the cotton had, in many instances, completely or nearly completely decomposed thus leaving the synthetic fibers in tact. But, also, in both of these clothing fabrics some fabric remnants of each were found in which the cotton fibers were completely in tact. Typically these were smaller fabric remnants recovered nearby a larger mass of fabric and examples were found to physically match some portion of a nearby larger mass of fabric. This indicates that a microclimate effect on the weathering and decomposition of fibers and fabrics can be significant. In view of this significant differential effect it is recommended that all items be thoroughly examined for fabric damage and that any generalizations or assumptions about the fabric condition or damage sources in which “proximity” is a factor be made cautiously.

CASE IV

A shooting occurred in which an apparently bronze colored vehicle violently rear-ended another vehicle, subjects from the rear car ran up to the front car to fatally shoot two of the three occupants (the third occupant survived), returned to their car and fled the scene. Numerous car parts including grille, headlamp, headlamp housing, chrome trim and fiberglass substrate painted panels were recovered from the street at the shooting location.

More than three weeks later a suspect vehicle was impounded for examination. If this was the suspect vehicle, then it had undergone extensive repair and/or removal of damaged parts as evidenced by the complete absence of any grille or grille parts, replacement of chrome trim with apparently weather similar chrome trim laying inside the car, etc. Of all the material

recovered at the shooting scene there remained on the suspect vehicle only one small area of a radiator bracket bearing a piece of fiberglass with bronze paint fragments literally hanging by a thread. These bronze paint fragments were observed with side-by-side comparison to be a physical match to a fiberglass substrate painted panel from the shooting scene in which the match was a hole in the center of the panel.

The fractured paint chips from either item could not be moved, placed in a planar manner or brought into reasonable proximity for the purposes of a court display. Life-sized (1:1 scale) 35 mm photographs of each item were scanned into a version of a photoshop-type software, color selected to remove the background fiberglass substrate and then superimposed on each other to illustrate what the eye could see as a side-by-side physical reconstruction. In an interesting twist of legal perspectives about forensic science testimony, the defense did not challenge the concept of a “physical match” being objective or being science or being experienced-based, but rather extensively challenged the concept of digital imaging being used to create a court display.

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