



Department of Anthropology

REPORT OF SKELETAL DISPERSAL AT SCENE

M.E. DISTRICT IN FLORIDA: 9
ANTHROPOLOGY CASE NUMBER: UCF 2008-12A

M.E. CASE NUMBER: 08-1567

REPORT SUBMITTED TO

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REPORT SUBMITTED FROM

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BACKGROUND INFORMATION OF SCENE PARTICIPATION

For recording purposes at the University of Central Florida, the number UCF 2008-12A was assigned to this case (2008-1567) from the District Nine Office of the Medical Examiner. The remains of Caylee Anthony were located on 11 December 2008 in a heavily wooded area on the south side of the 8900 block of Suburban Drive, Orlando, Orange County. The remains were scattered within a wooded area and were recovered by the Orange County Sheriff's Office (OCSO) Forensic Unit starting on 11 December 2008 and ending on 20 December 2008. As the consulting anthropologist for the District Nine Medical Examiner's Office, Dr. Schultz provided an advisory role to the OCSO Forensic Unit throughout the recovery. On 12 (full day) and 14 (afternoon) December 2008, Dr. Schultz worked with the Forensic Unit during the recovery, and was in contact with Mrs. Susan Mears, Forensic Unit Supervisor, every day during the recovery.

via phone. In addition, Dr. Schultz traveled to the scene on a regular basis (except for 13 and 20 December 2008) to identify human bones, assess the progress of the recovery, and discuss search strategies for locating missing bones with Mrs. Mears.

Dr. Jan Garavaglia (Chief Medical Examiner) requested a scene report that discussed dispersal of the skeleton and time since death.

DISPERSAL PATTERN OF SKELETAL ELEMENTS

In order to interpret the pattern of disarticulation and dispersal of the skeleton, a map of the site was created indicating the areas where the bones were located *in situ*. Bones that were located while sifting were not considered. A Specific Purpose Survey topographic map of the scene located at Suburban Drive, Section 13, Township 23 South, Range 30 East was created by personnel from Allen & Company. A Leica Scan Station 2 with Cyclone software was used in the field for processing the data points collected for the entire site to create the topographic map. Mr. Ronald Murdock, Forensic Unit Supervisor for OCSO, used a Leica TCR307 total station and a Sokkia SDR33 data collector to collect point data for each of the flags that were used to mark the location of either a single bone or bone parts, or a concentration of bones. I then identified nine bone locales or Areas of bones that encompassed the point data collected by Mr. Murdock to show groupings of bones or bone parts that were then incorporated on the topographic Specific Purpose Survey map of the scene as a layer by personnel from Allen & Company (Figure 1 in Appendix).

The shaded Areas in Figure 1 designate nine bone locales starting with Area A and ending with Area I. Below is a brief description of the major bones located within each Area. Refer to Table 1 in the Appendix for a detailed list of the bones that were located in each of the nine Areas.

- Area A included the primary decomposition site and may represent the initial dump site. This is the location where the skull, black plastic bags, canvas bag, and bones were located and recovered on 11 December 2008. Bones that were located in this area during the recovery include teeth, arm bones, wrist and hand bones, lower leg bones, ankle bones, and toe bones.
- Area B only included the left humerus diaphysis.
- Area C only included the left tibia diaphysis.
- Area D only included the right second metatarsal that sustained animal damage.
- Area E only included a small hand bone.
- Area F included both femoral diaphyses with carnivore damage, the right and left unfused ilium segment for both os coxae with carnivore damage to the left ilium, right and left clavicles, two ribs, and a half neural arch of C1.
- Area G included two ribs, L5, and an unfused element of S1.

- Area H included 9 ribs, a left scapula, and a half neural arch of C1
- Area I included four ribs and unfused segments representing 20 vertebrae.

Since the bones of the skeleton were found scattered throughout the site, interpretation of the pattern of dispersal can indicate if the skeleton was dispersed during the early stages of decomposition, prior to complete skeletonization. The pattern of dispersal and disarticulation of the skeletal remains is consistent with dumping the body into the woods prior to significant decay involving disarticulation of major anatomical units. For example, when bones of the same anatomical region, referred to as body units, are discovered in close proximity, they were likely transported as connected body units when soft tissue was still retained and holding the bones together (Haglund, 1997). Conversely, Haglund (1997) asserts that when the scatter pattern consists of single bones or a mix of bones representing different body units, transportation of individual bones occurred after decomposition/disarticulation was complete.

The body most likely was dumped in the woods during the initial stages of decomposition. Postmortem damage to multiple bones indicated that small animals scattered parts of the skeleton. The association of the skull with numerous hand and foot bones, arm bones, lower leg bones, and ankle and foot bones, is consistent with Area A being the primary decomposition site and possibly the dump site. For example, the association of loose maxilla teeth that were recovered in Area A with the skull is consistent with the skull decomposing in the area where it was located.

Bones of the trunk including the ribs, vertebrae, clavicles, parts of both os coxae, and both femora were located away from the body at the secondary decomposition sites (Areas F, G, H, and I). Therefore, it would be expected that the trunk was dragged away from the primary decompositional site (Area A) by animals when the bones of the trunk and femoral diaphyses were still articulated or held together by soft tissues during the early stages of decomposition. The bones were then scattered to a number of secondary decomposition sites (Areas F, G, H, and I). For example, both femora and parts of the pelvis were located in Area F, and both femoral diaphyses were located together lying side-by-side (refer to picture numbers 6137, 6138, 6139, 6141, and 6142 from OCSO dated 12 December 2008). Locating the two femoral diaphyses in close proximity to one another with parts of the pelvis indicated that they were dragged to this area while still articulated, and then were damaged by animal chewing. In addition, unfused segments representing 20 vertebrae were located in the small Area I. This pattern is consistent with a large segment of the vertebral column being transported prior to disarticulation.

Area D only included the right second metatarsal that sustained animal damage and was the only bone from the right foot that was recovered. This Area represented the furthest extent that any bones were located moving away from Area A in a somewhat westerly direction.

TIME SINCE DEATH

Providing an estimate for time since death for the remains of Caylee Anthony included evaluating multiple lines of evidence that were gleaned from the recovery. Many small fibrous roots were located growing in a number of the bones including multiple vertebral bodies. The Botany Report dated 9 February 2009 that Dr. David Hall provided to Detective Yuri Mellich from OCSO, listed periods of time it would take for root growth found in the bones. Dr. Hall indicated that on 23 December 2008 and on 4 February 2009 he examined photographs of roots growing into the bones and determined a minimum period of approximately four months for the largest roots. It is important to note that the bones would first need to be disarticulated, completely skeletonized, and then stabilized for roots to adhere to and grow into the bones.

The taphonomy of the skeleton at the site is consistent with the minimum period of time for the root growth into bone that was provided by Dr. Hall as well as the time needed for skeletonization and stabilization of the bones prior to root growth. The following taphonomic changes will be discussed in more detail:

- Dispersal and burial of the left unfused ilium
- Rate of soft tissue decomposition and bone erosion
- Bones located under seasonal leaf fall

Dispersal and Burial of the Left Unfused Ilium

The association of clusters of anatomical units discussed above is consistent with the body being dispersed when soft tissue was still present and holding articulated bones together at the joints. Furthermore, the association of clusters of anatomical units demonstrates that fluvial transport was not a major factor with scattering of the remains. Although the overgrown nature of the wooded area would most likely have inhibited water from transporting the remains throughout the site, there was most likely some minimal movement of the bones by the water associated with seasonal summer storms. For example, the left unfused ilium of the os coxa was found mostly buried in the muck partially under the trunk of a palmetto bush (refer to picture numbers 6567 through 6572 from OCSO dated 14 December 2008). After the bone had been dispersed by carnivores as part of the trunk and deposited in Area F, the bone was mostly buried in the muck due to the movement of the water associated with seasonal summer storms.

Rate of Soft Tissue Decomposition and Bone Erosion

Overall, the bones were free of soft tissue, odor, and any evidence of recent death. There was no soft tissue remnants adhered to the bones and the bones were not greasy. Many of the skeletal elements exhibited slight soil staining with adhered soil and organic material. Also, slight to

moderate erosion was noted, particularly on elements without thick cortices, including the vertebral bodies, carpals, tarsals, and secondary ossification centers. In addition, minimal adipocere formation that is consistent with a moist environment was noted on the left iliac blade, proximal left femur, a number of hand phalanges, and several vertebral elements.

During the hot and rainy summer months in Florida (June, July and August), bodies will decompose rather quickly and can become skeletonized in less than a month. This estimate is supported through extensive human decomposition research at the Anthropology Research Facility that is located at the University of Tennessee in Knoxville. According to Mann et al. (1990; 105) when referring to warm or hot weather, "it usually takes between two and four weeks for a body to become nearly or completely skeletonized." Bass (1997; 181-182) further stated that "a body in Tennessee in July and August can go from what you and I know to a complete skeleton in two weeks." It is important to note that the decomposition research at the Anthropology Research Facility is primarily with larger adult bodies. Furthermore, Stewart (1979; 71-72) also supports that a body can be completely skeletonized by the end of two weeks when he provides a case involving a 12.5 year old female from Mississippi that was missing for ten days in August and was almost completely skeletonized.

The mean monthly temperature of the three summer months for June, July, and August in Orlando is 82°, which is hotter than the mean monthly temperature for Knoxville, TN and similar to Hattiesburg, MS (Table 2). It can be inferred that decay rates in the Orlando area should be faster than Knoxville, TN and similar to Hattiesburg, MS. It would be expected that decomposition of a small child in Florida that is deposited in an outdoor environment during the summer months would have occurred in less than a month and most likely within two weeks. Therefore, the body must have been dumped at the site during the early stages of decay prior to disarticulation of anatomical units.

Table 2. The average monthly temperature for the three summer months of 2008 from Weather Underground (<http://www.wunderground.com>)

Month	Knoxville, TN	Orlando, FL	Hattiesburg*, MS
June	77	82	82
July	78	82	84
August	77	82	81

*Since the Mississippi city for the case was not provided by Stewart (1979), the inland city of Hattiesburg was arbitrarily chosen to make a comparison with Orlando.

Seasonal Leaf Fall

Other than a number of bones that were located when the bags were removed, the majority of the bones were located under the leaf layer and many were in contact with the muck. In other words, the bones had to have been decomposed and scattered prior to the leaves falling and covering up

the bones during the fall season of 2008. According to Dr. David Hall (personal communication 12 January 2009; approximately 12:00-12:30 p.m.) there were a number of red maples in the area which would have produced a high leaf fall during autumn. Dr. Hall stated that the leaf fall would definitely occur by November and possibly as early as October depending on the temperature.

CONCLUSION/OPINION

The overall pattern of skeletal dispersal is consistent with the body of Caylee Anthony being dumped into the woods at the scene located on Suburban Drive during the early stages of decay, before significant disarticulation of anatomical units occurred. Animals then scattered the remains, including moving the trunk with the femora attached as a unit. The taphonomy of the skeleton at the site such as complete skeletonization with slightly eroded bone, minimal adipocere development on a number of bones, bones dispersed as anatomical units, bones located under leaf fall, adhered roots growing into a number of bones, and a left unfused ilium located almost completely buried in the muck is consistent with a time since death of multiple months. However, considering the environment where the remains were located, a time since death of approximately six months would not be inconsistent with the taphonomy of the skeleton.

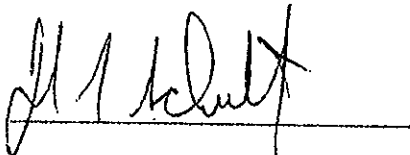
APPENDED MATERIAL

Literature Cited, page 7

Table 1, pages 8-9

Figure 1, Specific Purpose Survey map created by Allen & Company, page 10

Respectfully completed and submitted on this 15th day of May, 2009.



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Mann RW, Bass WM, Meadows L. 1990. Time since death and decomposition of the human body: variables and observation in case and experimental field studies. Journal of Forensic Sciences 35:103-111.

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Table 1. Bone and bone parts located within each of the nine areas (flag numbers provided by Mr. Ronald Murdock)

Area	Flag Number	Bone or Part of Bone
A	None	mass of black bags, canvas bag, tibial diaphysis, right scapula, five finger bones, proximal humeral epiphysis, primary ossification center, proximal tibial epiphysis, and two small ossification centers
A	None	skull
A	1*	ulna diaphysis
A	1A**	ulna diaphysis, radius diaphysis, 8 small hand and wrist bones
A	2*	right fibula diaphysis
A	2A**	small hand bone
A	3*	right humerus diaphysis
A	3A**	two small hand bones
A	4*	small hand bone
A	4A**	two maxilla teeth
A	5*	small hand bone
A	5A**	small hand bone
A	6*	radius diaphysis
A	6A**	seven small hand bones
A	7	epiphysis
A	25	small hand bone
A	26	left fibula diaphysis and 11 left ankle and foot bones
A	29	two maxilla teeth
A	38	small hand bone
B	24	left humerus diaphysis
C	41	left tibia diaphysis
D	46	right second metatarsal
E	45	small hand bone
F	8	right unfused ilium
F	16	clavicle
F	17	rib
F	18	right and left femoral diaphysis with carnivore damage
F	22	clavicle
F	27	rib
F	28	½ neural arch of C1
F	42	left unfused ilium
G	19	rib
G	20	L5, sacral S1 unfused lateral element
G	21	rib

*Collected on 11 December 2008

** Collected on 12 December 2008

Table 1 (continued)

H	9	rib
H	10	2 ribs, ½ neural arch of C1
H	11	rib
H	12	rib
H	13	2 ribs, left scapula
H	14	rib
H	15	rib
I	30	rib, rib fragment with carnivore damage
I	35	2 ribs, unfused portions representing 7 vertebrae
I	36	unfused portions representing 10 vertebrae including C2 (½ neural arch, dens, and centrum present)
I	37	2 vertebrae
I	39	½ neural arch of C2
I	40	vertebra

