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I welcome this opportunity to address the issues raised by Selvaggio regarding my analysis of FLK 22 (Capaldo, 1997). A discussion of these issues will hopefully encourage the use of experimental data by paleoanthropologists trying to infer the order in which hominids and carnivores processed carcasses, the foods each acquired, and the degree of competition between these actors.

Selvaggio assumes that I scraped flesh from carcasses because one in two to three long bone specimens from my two hominid to carnivore experimental samples bear at least one scrape mark on recovery. This is not the case, as flesh and skin were cut from long bones while periosteum was scraped from long bones using a metal knife in the first phase of bone modification. The remaining scraps of flesh were minuscule in comparison to the amount of flesh originally present. Consequently, I did not bother to remove flesh scraps from long bones, nor did I observe carnivores to pay any particular attention to them in the second phase of bone modification (Capaldo, 1995, 1998).

Selvaggio is concerned that scraping may have reduced the number of cut marks present on long bone specimens. I calculated cut mark percentages by counting the number of long bone specimens bearing at least one cut mark in each of 69 experiments. While I did not specifically record damage to cut marks resulting from scraping, I do not recall that any cut marks were so damaged by scraping as to be unrecogniz-

able as cut marks. It is also highly unlikely that scraping would have damaged or removed all cut marks from a given specimen as bone surfaces were only partly covered with scrape marks. Since my counting methods are not based on the number of marks present, I do not see how scraping could have had any effect on my cut mark percentages.

Selvaggio also maintains that her method of counting specimens that only bear cut marks, and no other marks, is more appropriate than mine. I do not agree with this contention for several reasons. First, Selvaggio's statement that she only "grouped like specimens together" she is, in fact, removing cut-marked specimens from her sample based on the presence of tooth marks and percussion marks, thus making cut mark percentages dependent on the presence of these other marks. This methodology is not warranted because all of these marks are *functionally unrelated to each other*. For example, in a three-stage model marks were produced by different actors for different reasons in each stage (defleshing by felids vs. demarrowing by hominids vs. degreasing by hyaenids), or by the same actor engaged in different activities in a single stage (cut marks from defleshing and skinning, scrape marks from the removal of periosteum, and percussion marks from demarrowing all inflicted by hominids in stage two).

Second, Selvaggio's counting methodology is difficult to replicate because she did

**Table 1** Surface mark comparisons between two experimental samples

Portion	Carnivore to hominid Selvaggio (1994b, Table 2) Mark assemblage means (with one standard deviation)			Whole-bone (hominid) to carnivore Capaldo (1997, Table 9) Mark assemblage means (with 95% confidence intervals)		
	CM	TM	PM	CM	TM	PM
EPH	37.0 (28.0)	75.0 (25.0)	45.0 (35.0)	—	—	**
PX	—	—	—	50.0 (0.0–100)	100	**
DS	—	—	—	50.0 (0.0–100)	100	**
NEF	30.0 (32.0)	63.0 (41.0)	53.0 (41.0)	47.0 (19.4–74.6)	72.6 (30.8–100)	**
MSH	17.4 (22.1)	47.0 (27.0)	35.0 (28.2)	22.4 (6.9–37.9)	57.4 (41.7–73.1)	**
Sum	34.1 (22.0)	65.0 (20.0)	46.0 (24.0)	24.8 (11.1–38.5)	63.7 (50.9–76.5)	**

Abbreviations: CM, cut marks; TM, tooth marks; PM, percussion marks; EPH, long bone epiphyses; PX, proximal long bone epiphyses; DS, distal long bone epiphyses; NEF, near-epiphyseal fragment; MSH, midshaft fragment; Sum, all long bone specimens; —, surface mark data not calculated for this portion; \*\*, surface mark not present.

Note: Long bones in Selvaggio's sample were defleshed by carnivores prior to the removal of remaining flesh and/or flesh scraps with stone flakes, and hammerstone breakage. Long bones in Capaldo's sample were defleshed with a metal knife prior to being broken by spotted hyena. In both samples, cut mark percentages are calculated from the number of specimens bearing at least one cut mark on recovery.

not qualify it by stating that scrape marks should, if present, be ignored. I followed her counting methodology as she outlined and used it herself, and consequently replicated her cut mark results. This replication is not an isolated incident as the cut mark means from my whole-bone to carnivore model fall within one standard deviation of the means from Selvaggio's carnivore to hominid model (Table 1). This most recent test is arguably the best which can currently be made, as our respective experimental samples are two-stage mirror images of each other, and we both used the same method for counting cut marks. As with my previous test (Capaldo, 1995), this test falsifies the hypothesis that cut mark percentages reflect the amount of flesh on long bones. Since the experimental samples being compared used stone flakes or metal knives to deflesh and skin long bones, while only mine included scraping, the fact that cut mark percentages

generated by them are largely replicated also suggests that the use of a metal knife to deflesh, skin, and scrape long bones in my samples had no measurable effect on the production or counting of cut marks as Selvaggio suggests.

Lastly, Selvaggio contends that only a three-stage experimental model can be used to infer a three-stage model of site formation for FLK 22. I do not share this contention. My original intention in conducting two different two-stage experimental models was to control for variation in the carcass processing behavior of both hominids and carnivores, and to test the two-stage models of site formation proposed by Bunn (1982, Bunn & Kroll, 1986) and Binford (e.g., 1981) for FLK 22. Once I compared FLK 22 to my experimental control samples it was apparent that FLK 22 was not explained by either of them. This finding was consistent with earlier work

conducted by both [Selvaggio \(1994a\)](#) and [Blumenschine \(1995\)](#), and demonstrates the importance of replication. Like [Selvaggio](#) and [Blumenschine](#), I also inferred a three-stage model of site formation for FLK 22, but did so based on results obtained from my two-stage experiments. Regardless of the models used to reach these inferences, all of them are *hypotheses which require further testing and refinement*. Consequently, it is not a contradiction to infer a three-stage model of site formation for FLK 22 from two-stage experiments. Rather, it is a way of controlling for a large number of possible one, two, and three-stage site formation scenarios because some of the data generated by these experimental studies overlap ([Capaldo, 1995, 1998](#)). Data that separate these models can only be identified when the models are compared to each other using consistent reporting conventions. The relative strengths and weaknesses of experimental data can also be identified via comparison. For example, tooth mark results from my whole-bone to carnivore model also replicate those produced by [Selvaggio](#) in her carnivore to hominid model ([Table 1](#)). The only reliable data for separating these two experimental models from each other are the percussion mark data.

At this point, it would be premature to assume that the replication of results between different experimental control samples invalidates the results themselves. In many other instances tooth and cut mark percentages are not replicated and remain distinctive enough to infer behavior from archaeofaunal assemblages (e.g., [Selvaggio, 1994a](#); [Blumenschine, 1995](#); [Capaldo, 1995, 1997](#)). When data do overlap the issue becomes one of finding an unambiguous way of separating them out. With regard to cut marks, this can be done by conducting new experiments that control for the use of metal vs. stone, and the experience of the butcher, in defleshing and skinning, as I am currently doing. With regard to tooth marks,

[Selvaggio \(1994a\)](#) has already noted some differences in the morphology of tooth marks produced by different carnivore families. The continuation of this work is critical because all of the three stage models hypothesized for FLK 22 infer that felids were active in stage one while hyaenids were active in stage three. A better understanding of tooth mark morphology and/or the conditions under which tooth marks and cut marks are produced may also permit us to resolve three-stage models with greater clarity regarding the particular felid inflicting tooth marks in stage one (e.g., lion or leopard).

Experimental zooarchaeology has made an important contribution to our understanding of site formation in the last ten years. However, its advocates must remain cautious because some of their findings are ambiguous. Currently, cut mark percentages are the most ambiguous of these findings, yet the methods which helped to identify and quantify cut marks in the first place will help reduce this ambiguity with further careful work and patience.

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