

Microscopic Analysis of Machete Toolmarks on Bone¹

James A. Bailey, PhD, Professor Emeritus, Minnesota State University Mankato, Department of Law Enforcement, Mankato, Department of Political Science and Law Enforcement, 109 Morris Hall, Mankato MN 56001

In some dismemberment cases, cut marks on bone from axes, hatchets, and machetes have been reported. The purpose of this paper is to present the principles of toolmark identification and the results of a study analyzing machete cut marks on bone. When a material is cut using these cutting tools, random imperfections on the leading edge of the cutting tool may be transferred to some substrates. When imperfections are transferred, they leave a series of fine lines referred to as striations. A comparison of two samples juxtaposed allows an examiner to observe each striation and determine if there is sufficient alignment for an identification.

For this study, 50 machete cut marks on bovine bone were evaluated to determine if the individual characteristics or striations could be used to identify a specific weapon. A machete measuring 59.05 cm (23.25 in) in length with a 45.72 cm (18 in) blade was used to produce the cut marks on bone. Paraffin wax was melted at 64°C (147.2°F) and poured into a mold to produce 4 cm x 4 cm x 1 cm thick (1.57 in x 1.57 in x 1 in) blocks. The blocks were used to record the toolmark characteristics from the machete blade. Each section of the machete blade was used to cut a thin section across the top of a wax block transferring the imperfection from the blade to the wax block. Twenty-five bovine rib bones and 25 long bones were struck with the machete blade at different angles to produce the cuts. Various amounts of force were used to produce each of the cuts.

A stereoscopic microscope at 7X to 30X was used to examine the cut marks on bone and wax block sections. A moticam digital camera using a 3500K light source was used for overhead illumination to photograph each image through the microscope. The bone images and wax sections were juxtaposed on a computer using Jasc Paint Shop Pro software for sample comparisons. Also, the Jasc software was used to enhance the images by splitting the color channels of the original image into percentages of black, yellow, magenta and cyan. The color separation feature does not alter the image but changes the contrast for each of the colors based on the original image.

In conclusion, 60% (30) of the cut marks did not contain individual characteristics; however, 40% (20) of the cut marks did contain individual characteristics that could be used in identifications. None of the rib bones contained individual characteristics possibly due to the condition of the bone samples. Five of the long bones did not contain individual characteristics possibly due to the amount of force or the angle of the machete when making a cut. Nevertheless, in some cases, it is possible to match a machete to a bone cut mark.

¹Abstract for paper presented at the 19th Mediterranean International Congress of Legal Medicine, Tozeur, Tunisia, April 2010.