Glock Marking Barrels – An Evaluation of Individual and Subclass Characteristics

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ABSTRACT

Glock Inc. recently replaced the Enhanced Bullet Identification System (EBIS) with what Glock refers to as the Glock Marking Barrel. Casts and test fired bullets from thirty-five Glock Marking Barrels were evaluated for subclass and individual characteristics. It was determined that the barrels had subclass carryover from barrel to barrel manufactured using the same mandrel. However, identification of a fired bullet back to the barrel/firearm that fired it was still possible using specific areas of the fired bullet. Due to the fact that this type of barrel will be used in all models of Glock pistols, an examiner should be aware of which areas of a fired bullet may have a high potential for subclass characteristics.

History of the Miami Barrel and EBIS Barrel

In the mid-1990's, the City of Miami Police Department and the Metro-Dade Police Department asked Glock to provide a modified barrel for officer's firearms to facilitate identification of bullets to the correct pistol in multi-officer involved shootings. The result was the "Miami Barrel" in which Glock placed marks in the barrel using "electronic spark reduction method." Carr and Fadul (1997) determined that bullets fired from these Miami Barrels were not readily identifiable [1].

Fadul and Nunez (2003) conducted a study of a different type of Miami Barrel to determine whether or not bullets fired from these barrels were identifiable. During the manufacture of these Miami Barrels, Glock used a single cutter that was pulled through the length of the polygonal rifled barrel. The cutting tool created subclass characteristics and the conclusion was that although initially identifiable, the bullets could not be identified to the barrel that fired them after subsequent firings [2].

Fadul and Nunez (2006) then conducted a follow-up study on bullets fired from Miami Barrels that were manufactured using a new version of the single cutter used in the previous study. Glock labeled this new version of cutter the Enhanced Bullet Identification System (EBIS). This study concluded that the EBIS barrels did create identifiable marks on the bullets; however, the cutter used also created subclass characteristics which examiners should be aware of [3].

Sometime in 2014, Glock discontinued making the EBIS barrel and replaced it with what it calls the Glock Marking Barrel. Pistols equipped with the new Glock Marking Barrels are currently available to the public in the Glock model 42 and the Glock model 43 pistols, as well as in other models for law enforcement. The Glock Marking Barrel will eventually be sold to the public in all Glock models [4, 5]. Glock could not advise when this complete transition from polygonal rifling to the Glock Marking barrel would occur.

In late 2014, the Palm Beach County Sheriff's Office (PBSO) purchased approximately fifty 40 S&W caliber Glock model 22 pistols from Glock Inc. that were equipped with the new Glock Marking Barrels. The Firearms Unit of the PBSO Crime Laboratory decided to conduct a research project to determine how these barrels were manufactured and whether bullets fired from the Glock Marking Barrels could be identified to the source barrel.

Materials/Method

Thirty-five of the fifty pistols purchased by PBSO were randomly selected for this research project. The serial numbers ranged from VDP900 to VDP999. The authors asked Glock representatives if these barrels were manufactured consecutively due to the consecutive serial numbers. Glock did not respond to our emails or phone calls about manufacture dates so the project assumption was made that these barrels were not made consecutively. Each barrel was cast using AccuTrans (Cuyahoga Falls, Ohio) casting material. It was important to cast the entire barrel to evaluate for subclass characteristics. After all of the barrels were cast, ten of the firearms were test fired twice using Federal 40 S&W caliber 155 grain ammunition to obtain samples for comparison. A Leica model Stereo Zoom 6 stereo microscope was used for general observation and a Leeds model LCF-3 comparison microscope was used for microscopic comparisons. The theory and criteria for identification set forth by the Association of Firearm and Tool Mark Examiners was used when evaluating the bullets fired from the Glock Marking Barrels.

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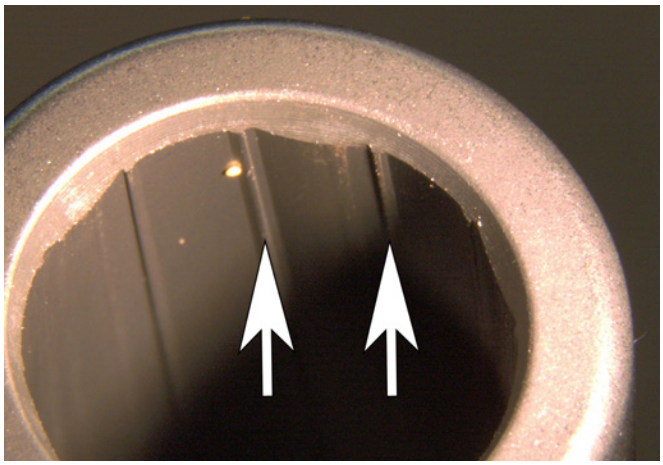

Figure 1: Rails running from chamber to muzzle

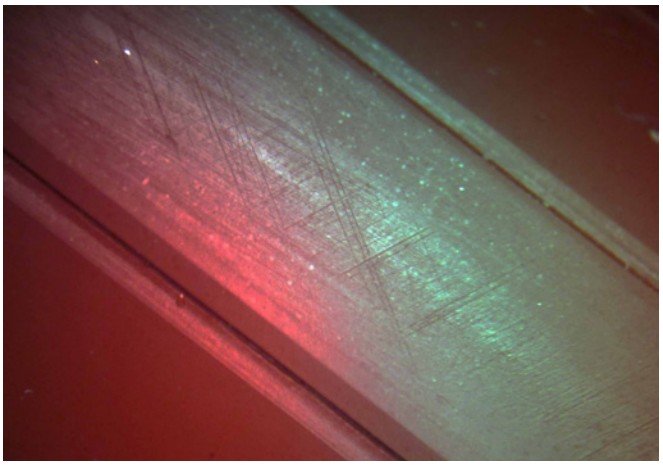

Figure 2: Fine crosshatch visible on land

Results

Upon inspection of the barrels, the first thing noted can be described (and will continue to be referred to in this paper) as rails (**Figure 1**). The rails run along the "shoulders" of each of the lands from the chamber to the muzzle. These rails were created by grooves cut into the mandrel. These were seen on the mandrels shown to the authors during a tour of the Smyrna, Georgia Glock manufacturing facility in September 2015. Photos of the mandrels could not be taken due to Glock factory tour restrictions. It should be noted that the rifling still has the rounded lands and grooves similar to polygonal rifling. Also, the presence of fine crosshatch striae was seen on all of the lands (**Figure 2**). The honing of the barrels prior to rifling creates these random patterns of striations that survive the hammer forging process [4]. Because the striations seen on the lands run perpendicular to the axis of the barrel, the striated pattern created by these lands on the bearing surface of a fired bullet are individual in nature.

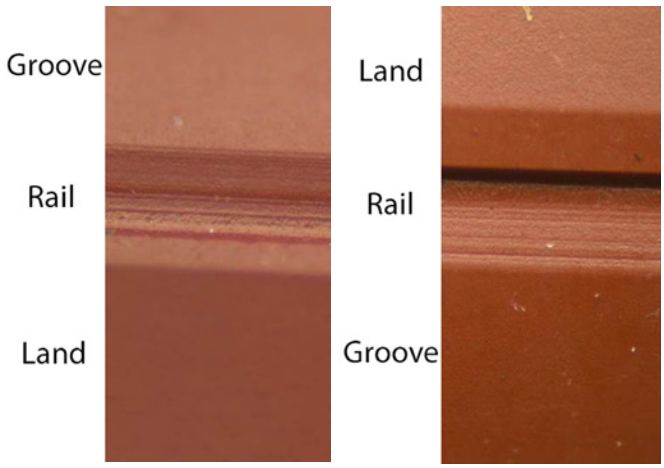

Figure 3: Patterns seen on rails; Pattern A (left) and Pattern B (right)

The next step was the examination of the rails along both sides of the lands. As **Figure 3** shows, the "walls" of the rails displayed a series of parallel striations that ran longitudinal to the barrel. It was clear that these were impressed into the barrel by the mandrel during the hammer forging process. What was also noted was that these parallel striations were continuous (no changes or breaks) from chamber end to muzzle. Upon further analysis of the rails, it was discovered that this same pattern of parallel striations repeated every other rail (**Figures 4 and 5**). Each cast was cut in half to compare each rail within a single barrel. What this revealed were two distinct patterns, Pattern A and Pattern B. This step was repeated with the casts of each barrel. After it was confirmed that each single barrel had two distinct patterns, all of the barrel casts were inter-compared (**Figures 6 and 7**). Patterns A and B were found in 33 of the 35 test barrels. The two remaining barrels (serial number VDP997 and VDP999) had a different set of patterns, Pattern C and D (images not shown). It was determined that the same tool (or tools) made multiple passes on the same mandrel, and that the same mandrel made all but two of the test barrels.

After the comparison of the casts, the test fired bullets were examined. The first obvious difference between the bullets fired from the Glock Marking Barrel and bullets fired from polygonal rifled barrels were sharp cuts that resembled shoulders from conventional rifling (red arrows in **Figure 8**). Caution should be used when examining bullets under low magnification in order to assure proper classification. These cuts seen on the test fired bullets did not display any defined pattern of striations. The area between these cuts

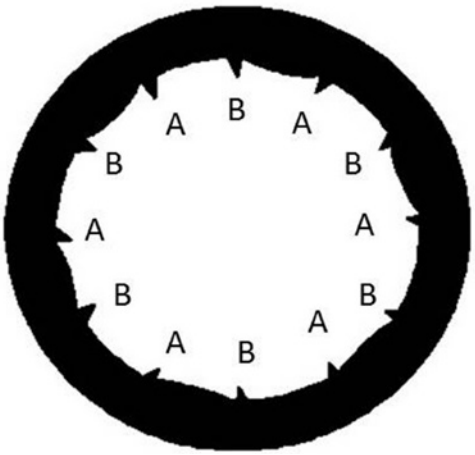

Figure 4: Cross-section of barrel showing pattern repetition

Figure 5: Pattern B on every other rail in a single barrel

created by the rails (white arrow in **Figure 8**) however, did display well defined striae. The two test fired bullets from the same barrel were compared to each other to see if there was any repeatability of potential individual characteristics. There was a pattern of striations that repeated on each of the areas between the sharp cuts created by the rails for each set of bullets. Possible subclass characteristics were not observed on the test fired bullets.

After this, the test fired bullets from the different barrels were inter-compared. Only bullets fired from the same barrel could be identified to each other (**Figure 9**).

Figure 6: Subclass characteristics from two different barrels – Pattern B
R1 (VDP913) (left) R1 (VDP968) (right)

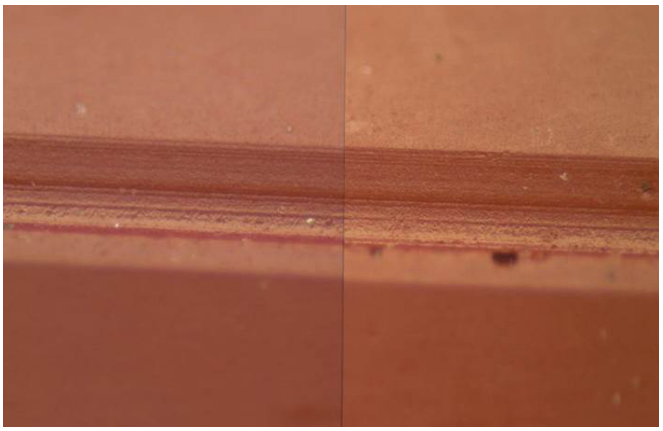

Figure 7: Subclass characteristics from two different barrels – Pattern A
R2 (VDP913) (left) R2 (VDP968) (right)

Conclusion

It was determined that there were subclass characteristics present on each of the rails. This could only mean that the cutting surface of the tool making the rail grooves on the mandrel did not change. Furthermore, the same tool made multiple passes on the same mandrel which is why the same pattern was seen more than once on a single barrel. Glock would not specify how their mandrels are made; however, it is the only explanation for what was observed. According to Glock representatives, the mandrels are designed to produce approximately 40,000 barrels before being replaced, however they frequently don't last this long [4,5].

The identification back to the source barrel was made using the areas between the sharp cuts made by the rails on the bearing surface of the land impression. Again, the striae in the land impressions were created by the fine cross hatch marks left by the honing stage of the manufacturing process at the factory. The cuts on the bullet created by the rails did not leave a striated pattern on any of the test fired bullets from

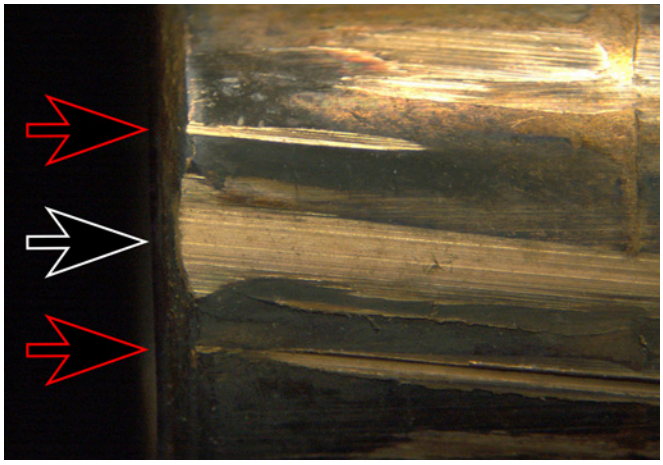

Figure 8: Land impression and cuts created by the rails (14X)

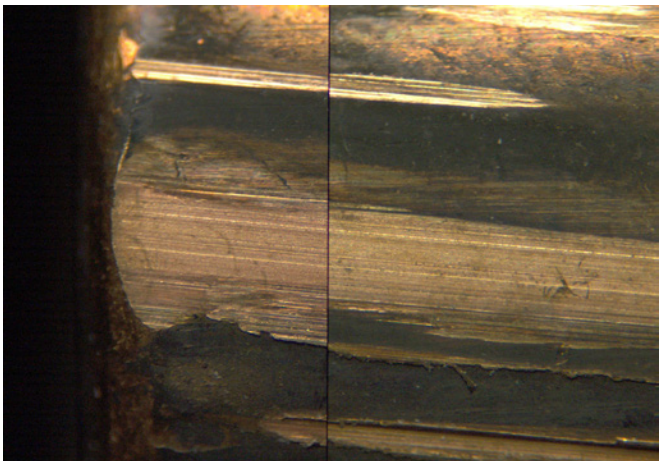

Figure 9: Photo showing individual characteristics on land impression (22X)

our research project; however this area should still be avoided when making an evaluation of individuality due to the subclass characteristics seen in the barrels. Without excluding the possibility of subclass characteristics the examiner cannot satisfy the AFTE criteria for identification.

Limitation

Observing the manufacture of the mandrels that Glock uses to make its pistols was not feasible. Glock not only manufacturers its own mandrels, it also sends the used mandrels back to Austria for recycling or re-tooling [4]. In addition, this study only used 40 S&W caliber Glock model 22. Future projects could include a study of subclass carryover in other models/ calibers.

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