

CHAPTER FOUR
OFFICE OF THE INSPECTOR GENERAL'S ASSESSMENT
OF THE CAUSES OF THE FINGERPRINT MISIDENTIFICATION

In this chapter, the OIG presents its analysis of the causes of the FBI's misidentification of Latent Fingerprint 17 (LFP 17). At the outset, we note that the OIG's investigation was not the only review of these causes. Shortly after the error was discovered, the FBI Laboratory assembled an International Panel of seven latent fingerprint experts to determine how the examination of LFP 17 failed, and to make recommendations for changes in the FBI Laboratory Latent Print Units (LPU). Part I of this chapter summarizes the findings of the Panel and describes the difference in scope and procedure between the Panel's review and the OIG's investigation. Part II of this chapter sets forth the OIG's analysis of the causes of the misidentification of LFP 17.

I. The International Panel Review

A. Findings of the International Panel

The FBI Laboratory recruited five latent fingerprint examiners to serve on the International Panel: Alan McRoberts (Chairman of SWGFAST), C. Lee Fraser (Royal Canadian Mounted Police), Ron Smith (Ron Smith & Associates), Bruce Grant (New Scotland Yard), and Gregoire Michaud (Michigan State Police). In addition, the Laboratory requested that the International Association for Identification (IAI) and the American Society of Crime Laboratory Directors (ASCLD) nominate two other panelists. The IAI selected Ken Smith (U.S. Postal Inspection Service) and ASCLD selected Frank Fitzpatrick (Orange County Sheriff, Coroner Laboratory). The OIG interviewed panel members Ron Smith and Ken Smith for this investigation.

The Panel met at the FBI Laboratory in Quantico, Virginia, on June 17-18, 2004. The Laboratory provided the Panel with two volumes of documentation consisting primarily of numerous images of the latent fingerprints that were transmitted to the Laboratory from the Spanish National Police (SNP) (many of which were not copies of LFP 17 or LFP 20), copies of the known prints of Mayfield and Daoud, and the FBI Laboratory reports regarding the SNP submissions. LPU Unit Chief Wieners also made a PowerPoint presentation to the Panel demonstrating the similarities and dissimilarities with the Mayfield prints observed by the FBI examiners during the examination of LFP 17. The panelists were not permitted to take the documents with them at the end of the meeting for further review. The Panel was permitted to interview LPU personnel Green, Wieners, and Meagher. Following the 2-day meeting, each panel member prepared a separate report. The Laboratory

prepared a synopsis of the comments submitted by the individual panelists, which was published in the *Journal of Forensic Identification*.¹⁰¹ The panelists identified the following as the primary causes of the misidentification:

- Failure to follow properly the Analysis, Comparison, Evaluation and Verification (ACE-V) steps in fingerprint examination. In particular, Green failed to conduct a complete analysis of LFP 17 before conducting the Integrated Automated Fingerprint Identification System (IAFIS) search, which in turn caused him to disregard important differences in appearance between LFP 17 and Mayfield's known prints.
- The power of the IAFIS match and the pressure of working on a high-profile case influenced Green's initial judgment and created a mind-set in which his examination became biased by an expectation that the prints were a match.
- The subsequent examinations by Massey and Wieners were "tainted" by knowledge of Green's conclusion.

The panelists made several recommendations for changes in the procedures utilized by the FBI Laboratory. Chief among these was the adoption of procedures to require more detailed documentation of all steps of the examination process, including documentation of any discrepancies in the prints and explanations for those discrepancies. The panelists also recommended that the Laboratory implement several changes to its verification procedures, including blind verifications (i.e., previous conclusions unknown to the verifier) and second verifications in designated cases.

B. Differences Between the OIG Investigation and the International Panel Review

The scope of the OIG's investigation of the Mayfield matter was much broader than the questions posed by the Laboratory to the International Panel. For example, part of the OIG's investigation involved determining the sequence of events leading up to and following the error. The OIG collected much more information about the identification process than was provided to the Panel. The FBI Laboratory also provided the Panel with many facts as a "given," prior to any detailed investigation of what occurred. In addition, the OIG addressed many non-fingerprint issues raised in connection with the Mayfield matter, issues that were outside the scope of the International Panel Review.

¹⁰¹ Robert B. Stacey, "A Report on the Erroneous Fingerprint Individualization in the Madrid Train Bombing Case," *Journal of Forensic Identification*, Vol. 54, No. 6, 2004, p. 707.

With respect to the question of the causes of the erroneous identification, which both the OIG and the International Panel addressed, the OIG had advantages in preparing this report that were not available to the Panel. The Panel was convened very quickly after the FBI withdrew its identification of Mayfield and met for only two days. At the time the Panel met (June 17-18, 2004), the FBI Laboratory still had not issued its final report identifying Daoud as the source of LFP 17. The Laboratory's determination that the print was of "no value" had not yet been formally withdrawn. Although the Panel was given access to the relevant fingerprint images, Panel members were not permitted to remove those images from the meeting room and could not utilize the images in their individual reports. Probably as a result, the conclusions of the Panel members tended to be expressed in highly generalized terms and did not reference specific features in the prints.

The OIG had access to a far larger collection of materials than did the International Panel and was able to interview a much larger number of witnesses over a longer period of time. The OIG had access to the charted enlargements prepared by the LPU examiners who ultimately identified Daoud, which were not made available to the International Panel – indeed, some of the charted enlargements apparently did not yet exist at the time the Panel met. The availability of these enlargements assisted the OIG and its consultants to conduct a comprehensive, ridge-by-ridge and feature-by-feature assessment of the erroneous identification that included a comparison of the features used in the Mayfield identification with the features later used to identify Daoud. This information provided an opportunity for a detailed examination of the erroneous identification that was informed by access to exemplars from the true source of the latent – information that is often unavailable in the case of erroneous identifications. We believe that the differences in time and information available to the OIG are the primary reasons for the differences between the conclusions reached by the OIG and those of the Panel.

II. OIG Assessment of Causes of the Erroneous Identification

In this section, the OIG describes its assessment of the causes of the misidentification of LFP 17. In the first subsection, the OIG sets forth the factors that it determined to be major contributing causes to the error. In the second subsection, the OIG addresses three additional potential causes of the error. Although we did not find sufficient evidence to conclude that these three additional factors caused the error in this case, we did find that there is potential for these factors to contribute to future errors. We therefore made specific recommendations for action by the Laboratory to address these factors. In the third subsection, we address the specific allegation that the LPU error was the result of discrimination based on Mayfield's Muslim faith. In the fourth subsection, the OIG discusses explanations for the error that have been

suggested previously by the FBI and other sources, but that the OIG specifically found did not contribute to the misidentification.

A. Major Contributing Causes of the Error

1. The unusual similarity of the prints

The OIG concluded that the unusual similarity in the pattern of Level 2 details within the friction ridges on the fingers of Mayfield and Daoud was a significant factor in the misidentification. Although the friction ridges of Mayfield and Daoud were not identical, there was sufficient similarity between them to cause confusion in identifying the source of an imperfectly reproduced latent fingerprint (LFP 17). This unusual similarity confused at least three experienced examiners in the FBI (as well as the expert selected by Mayfield's attorneys), and was an important factor contributing to the erroneous identification. This conclusion was based on interviews of witnesses, consultation with experts, and detailed review of the documentation relating to the identification of Mayfield and Daoud.

This similarity is illustrated by considering the Level 2 features in the latent print that were utilized by different LPU examiners to identify both Mayfield and Daoud. As previously noted, on March 22, 2004, shortly after making the identification of Mayfield, Green prepared charted enlargements for the SNP showing 15 Level 2 details in common between LFP 17 and Mayfield's known fingerprint (Figures 2A and 2B). Of these 15 features in the latent print, 10 were also later used by other examiners in the Laboratory to identify Daoud as the source of the print. These common features are illustrated in Figures 6A-6C. A detailed description of these features is presented in tabular form in Appendix I.

As shown in the Figures, these 10 Level 2 details in the latent print were at least generally consistent with features in the known prints for both Mayfield and Daoud in location, direction, and ridge count, and hence were utilized in both identifications. An appreciation of the consistency can be obtained by working one's way from point to point on all three images. The useful starting point in the comparison of these prints is the distinctive feature in the bottom center of the latent print that Green marked as Point 6 in the March 22 Charted Enlargements. This feature was incorrectly interpreted as a "dot" in the Mayfield exemplar, but it turned out to be the top edge of an incompletely reproduced "enclosure" visible in the Daoud exemplar.¹⁰²

¹⁰² As shown in Figure 4, an "enclosure" is formed by two opposing bifurcations, so that a single ridge splits into two and then rejoins into one over a short distance.

Using Point 6 as a starting point, it appears that the direction from one point to the next is similar in all three prints, and the number of intervening ridges is consistent as well. For example, Point 5 on LFP 17 and on the Mayfield exemplar is an ending ridge three ridges up from Point 6 and to the right. There is an ending ridge three ridges up from the enclosure and to the right on the Daoud exemplar as well. In charting Point 5 (and all the other points shown in Figures 6A-6C, for that matter) as a similarity to Mayfield, the LPU examiners were misled by the fact that there was indeed a Level 2 detail in the friction ridge patterns of Daoud, the true source of LFP 17, bearing a similar relationship in ridge count and location to the other plotted details. What is remarkable is that this relationship in location and ridge count maintains a general consistency among as many as 10 points in the exemplars for both Mayfield and Daoud.

The fact that many features were utilized in both identifications is not in itself surprising. The use of the same features in the correct identification of Daoud confirms, however, that based on his analysis of LFP 17, Green did not err in finding that Level 2 ridge deviations occurred at or very near to these 10 marked locations in the latent print. As to these features at least, the LPU examiners were misled not by distortions in the print, but rather by close similarities in the friction ridge formations on the fingers of Mayfield and Daoud, which complicated the problem of determining the true source of LFP 17.

The OIG confirmed during interviews of Supervisory Fingerprint Specialist Green and Unit Chief Wieners that these 10 points were an important factor in reaching their conclusion that Mayfield was the source of the print.¹⁰³ Kenneth Moses, the court-appointed expert who agreed with the Mayfield identification, described the reasoning that led to his conclusion in presentations at two forensic science conferences. Moses pointed out eight corresponding Level 2 details between the latent print and the Mayfield exemplars that strongly influenced him toward making an identification. Most of the minutiae that Moses identified were among the same 10 features marked in Figures 6A-6C.

In observing the similarity in the location, direction, and ridge count for these features as between the Mayfield and Daoud prints, the OIG is not suggesting that the prints, or these 10 features, are identical. As can be seen

¹⁰³ As noted above, John T. Massey, the examiner who verified the identification, did not consent to be interviewed for this investigation. FBI policies at the time did not require Massey to document the similarities forming the basis for his verification, and there is no written record of whether he also relied on these 10 "common points," although it seems highly likely that he did.

FIGURE 6A

Level 2 Details Used To Identify Mayfield Also Used To Identify Daoud (LFP 17)

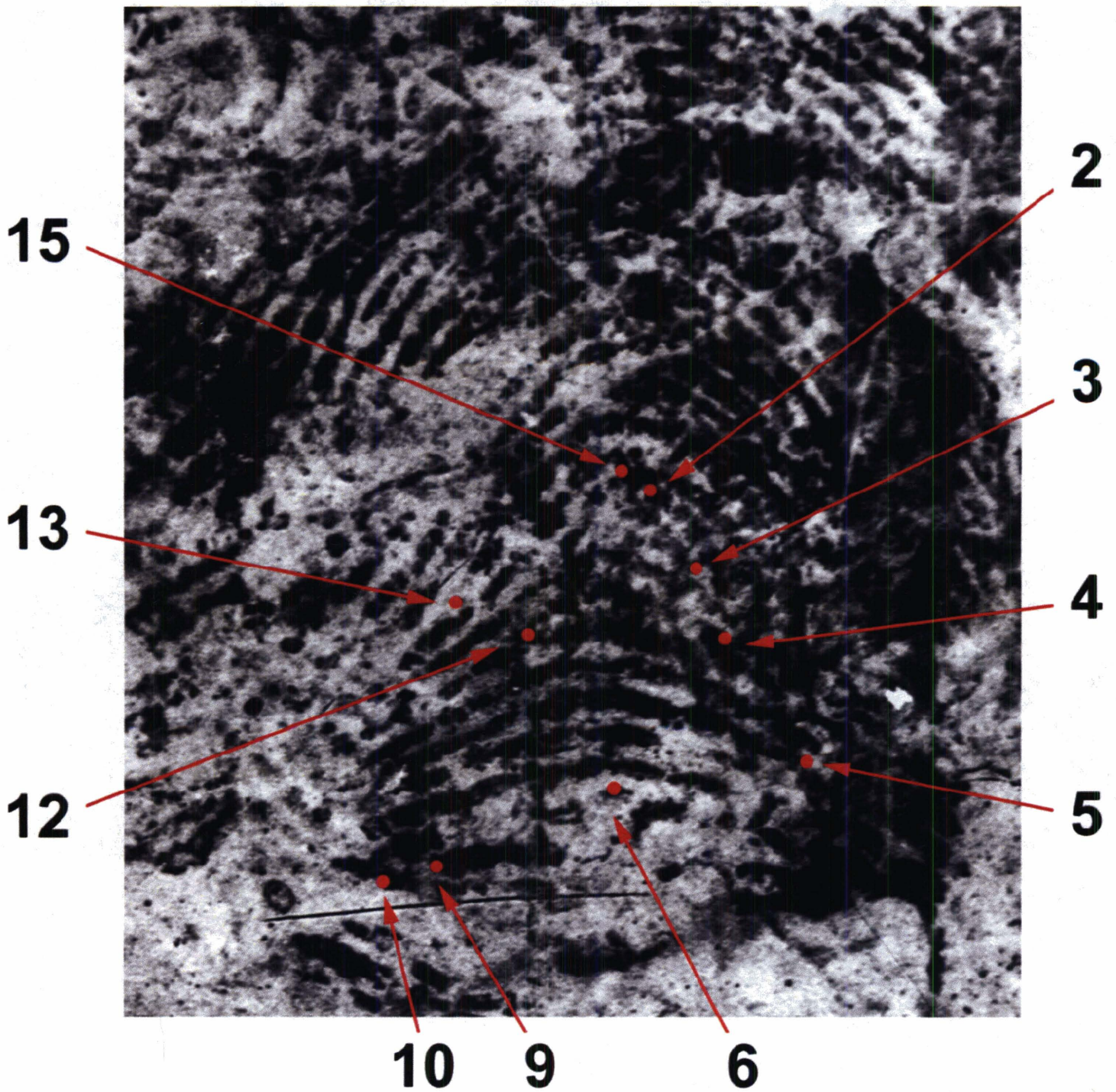


FIGURE 6B

Level 2 Details Used To Identify Mayfield Also Used To Identify Daoud (Mayfield Exemplar)

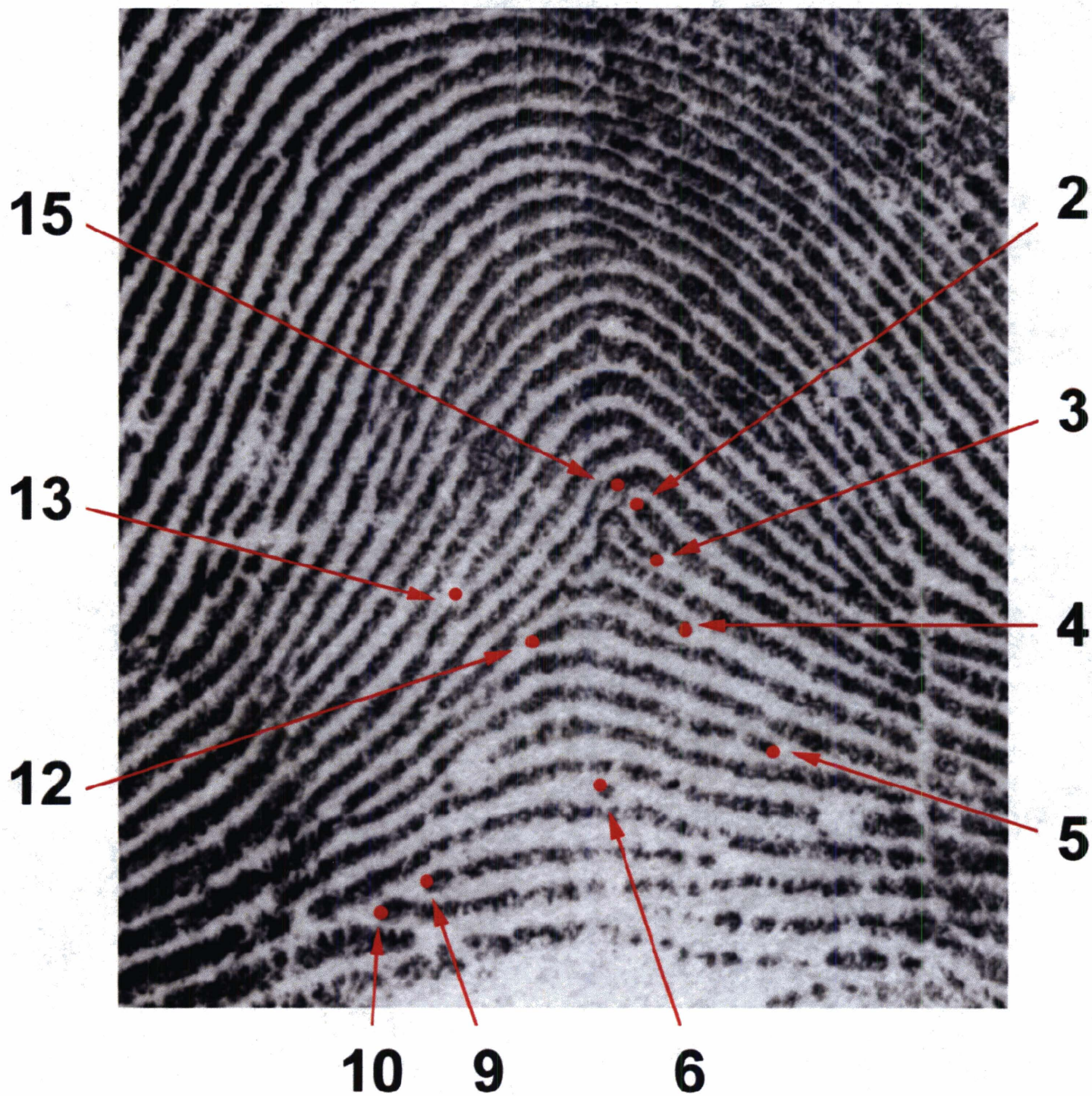


FIGURE 6C

Level 2 Details Used To Identify Mayfield Also Used To Identify Daoud (Daoud Exemplar)



[OPEN]

in Figures 6B and 6C, in many instances the *type* of feature (ending ridge versus bifurcation) turned out to be different on the Mayfield exemplars compared to the Daoud exemplars. As explained in Chapter Three, it can be difficult to distinguish between an ending ridge and a bifurcation in a latent print of imperfect clarity, and it is not extraordinary for an examiner to withhold final determination of the type of feature until the comparison phase. There are also other subtle dissimilarities in the positioning of these 10 features between the prints, and other dissimilarities in appearance between the latent print and the Mayfield exemplars.

Even taking into account the ambiguity as to whether particular features were ending ridges or bifurcations, the correspondence of 10 Level 2 details in prints from different sources, in sequence and with consistent ridge counts, is an extremely unusual event. Although the OIG found no exhaustive or systematic study of the rarity of such an event, anecdotal reports in the literature of similar fingerprints from different sources suggest that nobody has yet demonstrated more than eight or nine Level 2 details in sequence from different sources, even using prints that were artificially cropped to omit dissimilarities.¹⁰⁴ In describing his error, Moses emphasized the unusual nature of this many minutiae in agreement:

It was at this point that my mind shifted toward agreement with the Bureau's identification. I had never personally seen or read in the literature where two friction ridge images could share eight minutiae and still belong to different persons. Many state, local, and federal labs currently use eight minutiae as their ex officio comfort level for quality assurance purposes.¹⁰⁵

Thus, the OIG concluded that there were as many as 10 Level 2 ridge formations on the fingers of both Daoud and Mayfield, forming a similar constellation with consistent intervening ridge counts on both fingers, which

¹⁰⁴ See, e.g., Thornton (describing spurious comparison of cropped palm prints with nine points of agreement); John D. "Dusty" Clark, "ACE-V – Is it Scientifically Reliable and Accurate?" *Journal of Forensic Identification*, Vol. 52, No. 4, 2002, pp. 401-408 (illustrating cropped impressions with eight matching ridge deviations, with some variance in relative location); Y. Mark and D. Attias, "What is the Minimum Standard of Characteristics for Fingerprint Identification?" *Fingerprint Whorld*, Vol. 22, No. 86, October 1996 (reporting discovery of non-identical prints with seven matching characteristics). The correspondence of features in the Mayfield matter may not be as dramatic as in these other cases due to the ambiguity in the latent as to the types of features (bifurcation versus ending ridge) and the dissimilarities in other parts of the prints.

¹⁰⁵ Kenneth Moses, "The Mayfield Case – Anatomy of an Error," PowerPoint presentation, 2005, p. 6. See also Stoney, p. 381, stating that in the United States, seven or eight corresponding ridge characteristics are generally regarded as sufficient for identification if they satisfy an experienced examiner.

contributed substantially to an erroneous identification made by 4 different experienced examiners. In making this finding, the OIG is not suggesting that the error could not have been avoided, however. Despite the unusual similarities between the fingers of Daoud and Mayfield, there were differences in appearance between LFP 17 and Mayfield's prints that should have alerted the examiners that an identification should not have been made. The Laboratory's treatment of dissimilarities is addressed below in Section II.A.4 of this chapter.

The fact that the FBI examiner found a candidate fingerprint that was so unusually similar to LFP 17 without being an actual match demonstrates a particular hazard associated with the use of IAFIS. IAFIS is designed to select candidates whose prints most closely resemble the subject print. The inclusion of Mayfield's print among the candidates selected by IAFIS reflects IAFIS performing exactly as intended.

The Mayfield case demonstrates the potentially misleading power of IAFIS. Working with databases containing the fingerprints of more than 47 million individuals (i.e., 470 million separate prints), IAFIS is designed to find not only the source of the print (if it is in the database), but also the closest possible non-matches. In other words, although no two people have identical fingerprints, there are some that may be sufficiently close to confuse an examiner dealing with a latent of imperfect clarity. An IAFIS search of a huge database is designed to find those prints most likely to confuse an examiner. The likelihood of encountering a misleadingly close non-match through an IAFIS search is therefore far greater than in a comparison of a latent print with the known prints of a suspect whose connection to a case was developed through an investigation.

The OIG interviewed Ken Smith, a U.S. Postal Inspection Service fingerprint examiner who served on the International Panel. Smith served for 14 years on the IAI Certification Board, which was responsible for investigating complaints of erroneous identifications by IAI-certified examiners. Smith told the OIG that during his tenure on the Board he encountered 25 to 30 erroneous identifications, mostly by local law enforcement agencies. Smith said that all but one of these errors occurred in cases involving candidates selected as a result of automated computer searches. Smith stated that the Mayfield case, like almost all of the other erroneous identifications he has encountered, demonstrates the need for special care in conducting comparisons involving IAFIS candidates because of the elevated danger of encountering a close non-match. We agree with this conclusion.

2. Bias from the exemplar prints (circular reasoning)

We found evidence that the LPU examiners' interpretations of some features in LFP 17 were adjusted or influenced during the comparison phase by reasoning "backward" from features that are visible in the Mayfield exemplars. This bias is sometimes referred to as "circular reasoning" and has been described as "a premature assumption of donorship [that] leads to transplantation of data from the 'original' [the known print] into the latent print."¹⁰⁶

Part of the evidence that circular reasoning infected the Mayfield identification was found in the prints themselves. In this case, knowing the true source of the latent print enabled us to determine which features were charted as part of the identification of Mayfield that in fact were not present in the friction ridges of the true source. We found five examples of features that the LPU interpreted as Level 2 ridge deviations (ending ridges, dots, or bifurcations) in identifying Mayfield as the source of LFP 17, which turned out to correspond to no similar features in the known prints of the true source, Daoud. These features are shown in Figures 7A-7C, which show: (1) where the LPU charted these features in LFP 17, (2) the corresponding features that the LPU charted in the Mayfield exemplar, and (3) the corresponding locations in the Daoud exemplar showing that no such features actually occurred in these locations.¹⁰⁷

The OIG discussed these features in detail with Green and Wieners, and with our three expert consultants. The OIG and its consultants concluded that there was little or no support within LFP 17, considered without reference to any known print, for determining that there were Level 2 ridge deviations at these five locations. There was no evidence that Green identified these five features as Level 2 details in his initial analysis of LFP 17, prior to seeing the Mayfield prints. None of these five features were among the seven features in the latent print that Green encoded for IAFIS prior to the comparison to the Mayfield exemplars.

The Laboratory's error in relying on the five features illustrated in Figures 7A-7C cannot be attributed to unusually confusing distortions in the latent print that gave a strong appearance of true Level 2 detail. Rather, these five features are all at best ambiguous or blurred in the latent print. Two of the

¹⁰⁶ Interpol European Expert Group of Fingerprint Identification II, "Method for Fingerprint Identification, Part 2; Detailing the method using common terminology and through the definition and application of shared principles" ("INTERPOL Method Part 2"), available at <http://www.interpol.int/Public/Forensic/fingerprints/>, § 8.9.1.

¹⁰⁷ Further information on these features is provided in Appendix J.

features that Green interpreted as ending ridges (Points 11 and 8) occur at the outer edge of the latent, which is an area in which a determination that a ridge comes to an end can be particularly dangerous.¹⁰⁸ In reality, Daoud's ridges did not end at these points, but continued beyond the edge of the latent print. Another feature (Point 7) was also interpreted as an ending ridge despite the absence of convergence in the surrounding ridges. Ashbaugh specifically cautions against such an interpretation:

Distinguishing between ridge endings and ridge breaks (incompletely reproduced ridges) requires understanding that in the case of ridge endings, the ridges on either side will fill in any void left by the ending ridge and this directional change will be visible on the ridge path. Unless visible in both prints [the latent and the exemplar], ridge breaks should be treated as if the ridge is continual.¹⁰⁹

The other two features (Points 1 and 14) are at best very unclear and the OIG concluded that they would never have been identified as Level 2 details with confidence unless they had been suggested to the examiner by the exemplar prints during the comparison phase.

Based on these facts and the opinions of its consultants, the OIG concluded that the LPU examiners' reliance on these particular features was influenced by "circular reasoning" that occurred after the Mayfield prints were compared to LFP 17. This reverse reasoning appears to have been an instance of loss of objectivity that Ashbaugh warned against:

During forensic comparison one must maintain an objective state of mind to guard against seeing things that are not there. For example, during the comparison process, examining the clear inked known impression prior to carrying out an analysis of an unknown print could cause the brain to jump to a conclusion and see details in the murky unknown ridge structures that may not actually be there.¹¹⁰

We concluded that the other similarities in the prints, described in the preceding section, which stemmed from the general similarity in the constellation of Level 2 details between Mayfield and Daoud, caused Green to begin to see additional similarities based on features that were not in fact

¹⁰⁸ See, e.g., Interpol Method Part 2 at § 8.4.

¹⁰⁹ Ashbaugh, pp. 132-133.

¹¹⁰ Ashbaugh, p. 105.

FIGURE 7A

Level 2 Features Used To Identify Mayfield Having No Source in the Daoud Exemplars (Do Not Exist) (LFP 17)

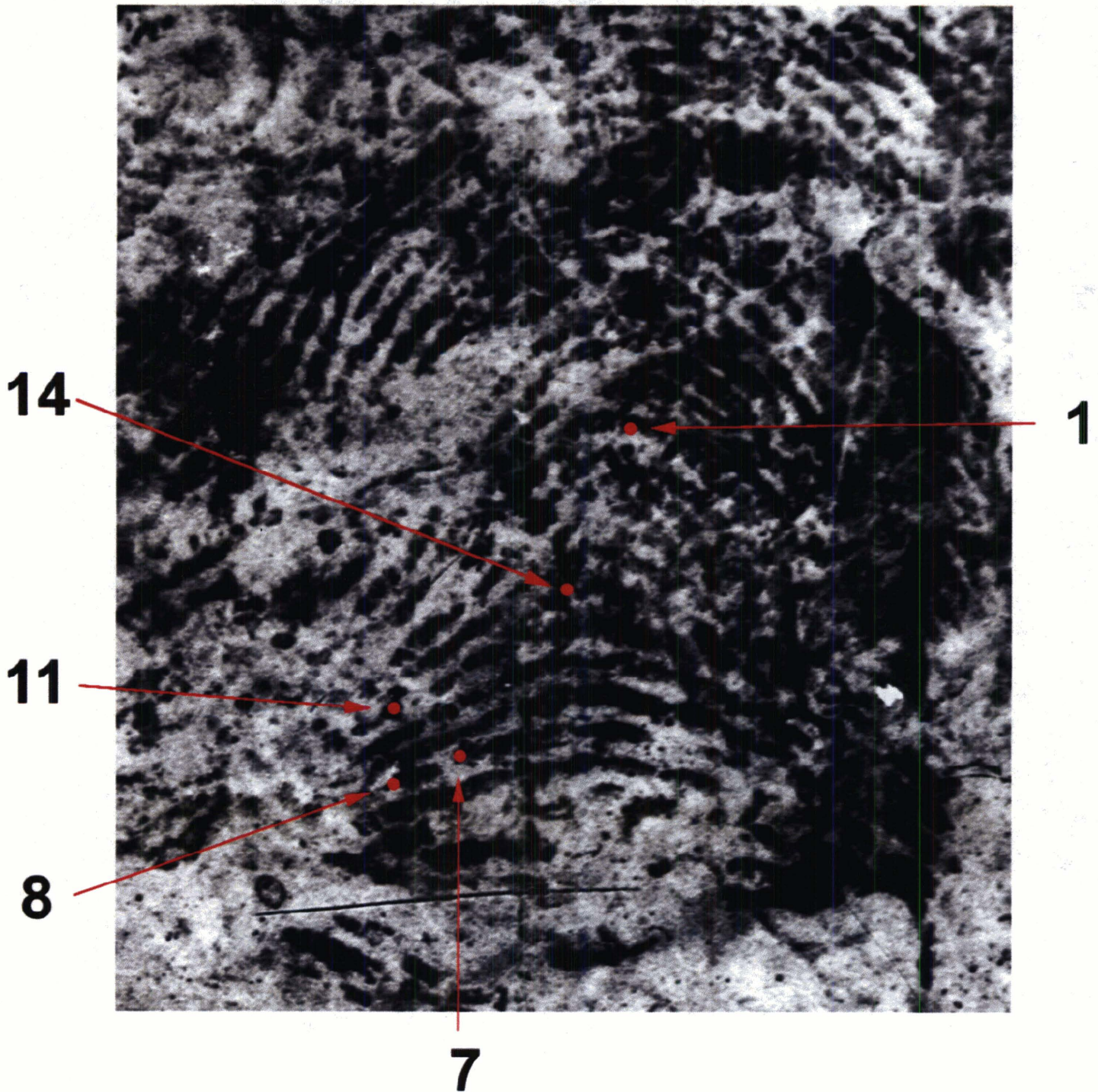


FIGURE 7B

Level 2 Features Used To Identify Mayfield Having No Source in the Daoud Exemplars (Do Not Exist) (Mayfield Exemplar)

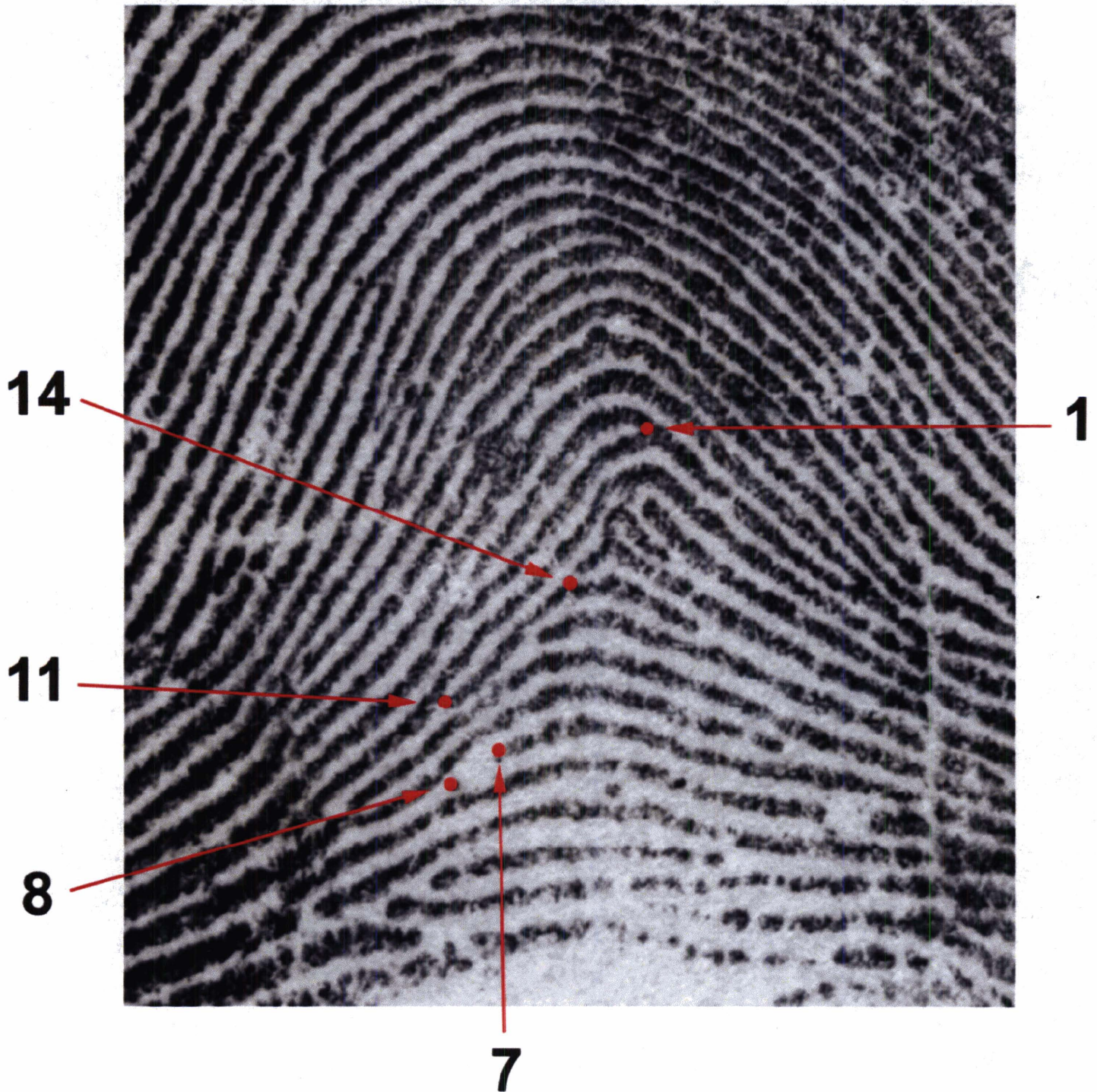


FIGURE 7C

Level 2 Features Used To Identify Mayfield Having No Source in the Daoud Exemplars (Do Not Exist) (Daoud Exemplar)



[OPEN]

present.¹¹¹ In this way, the number of Level 2 similarities that Green was able to chart increased from 10 to 15.¹¹²

There are other, more subtle indications that Green permitted his review of the Mayfield prints to influence his interpretation of LFP 17 in a process of reverse reasoning. The best available contemporaneous evidence of Green's unbiased analysis of the LFP 17 is the way he coded the print for the IAFIS search, as shown in Figure 8A. At that time, he had never seen the Mayfield exemplar and could not be influenced by it. Green encoded seven Level 2 details for the IAFIS search: four points as ending ridges and three points as bifurcations. After comparing the Mayfield exemplar, Green changed his interpretation of three points from bifurcations to ending ridges, as illustrated in Figure 8B. He also changed his interpretation of another point from an ending ridge to a bifurcation, and moved the location of yet another point (an ending ridge) one ridge down. In other words, after seeing the Mayfield prints, Green changed the interpretation of five of his original seven points in type or location, with the result that the five points were reinterpreted to be more consistent with the Mayfield exemplar.

The bias that this reinterpretation introduced can be appreciated by comparing Green's original coding with the Daoud exemplars. For four of the five points that Green changed as to type or location after seeing the Mayfield prints, it turned out that his original interpretation was correct (i.e., was consistent with the Daoud exemplar), as shown in Figure 8C. For those points, Green's original analysis, still unbiased by any comparison to Mayfield, was in fact more accurate than the adjusted interpretation he made after seeing the Mayfield exemplars.¹¹³

¹¹¹ Gregoire Michaud, the Latent Print Unit Program Coordinator for the Michigan State Police, served on the International Panel and described this process as "confirmation bias" or "context effect," resulting from the "unique similarity" between some Level 2 details in LFP 17 and the Mayfield prints that induced the examiner to expect to find additional matching details. See Gregoire Michaud, "Concept Paper for an International Review of the Madrid Bombing Latent Fingerprint" (unpublished), 2004, at 2, citing "Intuitive Judgment and the Evaluation of Evidence," commissioned by the National Academy of Science's Committee on Techniques for the Enhancement of Human Performance, Washington, D.C. 1987, and Saks, et al., "Context Effects in Forensic Science," *Science & Justice*, Vol. 43, No. 2, 2003. Ron Smith, another member of the International Panel, described the same process as a "mindset" in which the initially detected similarities led to an unintentionally incorrect interpretation of additional features as matching. Ron Smith, "Report of Case Review, Madrid, Spain Bombing FBI Latent Print Examination" (unpublished), 2004, p. 2; see also Wertheim, p. 6, describing the same "mind-set" phenomenon.

¹¹² We found further evidence of bias from the exemplar prints influencing the examination in the examiners' utilization of Level 3 detail to support the Mayfield identification, a topic addressed in the next section.

¹¹³ Further detail regarding the way points were originally coded for IAFIS and subsequently reinterpreted may be found in Appendix I.

Green's description of his examination of LFP 17, given during his interview with the OIG, provided further support for the conclusion that Green allowed the Mayfield exemplar prints to color his interpretation of the latent print through a process of circular reasoning. Green stated that during the comparison phase, his practice was to ignore the way he encoded the latent print for IAFIS and to reconsider the latent print from a new perspective. When asked whether it was unusual to change the interpretation of points during the comparison phase, Green stated that he does not even consider the way he originally encoded a latent print at this stage of an examination. This approach appears to be at odds with one of the primary purposes of the analysis phase of ACE-V: to interpret the latent print before the comparison phase in order to avoid reasoning backward from the known print. By discarding at least some of the information developed during the original analysis, Green was able to modify his initial interpretation of the latent print to match the exemplar without ever asking or answering the question of why his initial interpretation was wrong. As discussed above, Green made several such modifications in his interpretation of the location and type of Level 2 details in order to find a similarity to Mayfield, and also apparently added at least five Level 2 details to his interpretation of LFP 17, details that in fact were not present. The OIG concluded that these errors were the result of bias resulting from circular reasoning from the Mayfield exemplars.¹¹⁴

There is nothing in any Standard Operating Procedure (SOP) or other policy or standard applicable to the FBI Laboratory that prohibits an examiner from revising his initial analysis regarding the type or location of a feature in a latent print to match what he finds in an exemplar more closely, but the hazards of such a reversible approach to the analysis phase are well demonstrated in this case. Indeed, in the absence of any requirement to document the initial, pre-comparison analysis of the latent print and to record what is seen at that time, it is impossible to know with certainty which features in the latent were clear to the examiner before the comparison phase and which features only became apparent to the examiner after being suggested by the exemplar prints. The IAFIS encoding, if it occurs, is at best an incomplete record of what features are perceived because the examiner typically will not encode every Level 2 feature in a latent print. Under these circumstances, with

¹¹⁴ Under LPU policy in effect at the time, written supervisory approval was required prior to reporting any identification based on fewer than 12 points of Level 2 detail. By finding 15 Level 2 points of similarity, Green thus potentially eliminated an additional level of review beyond the verification required for all identifications. The OIG recognized, however, that Unit Chief Wieners performed an informal review of the identification after it was declared, and concurred with the result. Unit Chief Wieners likely would have been the supervisor who would have been required to approve the identification under the "12-point rule." Accordingly, the OIG did not conclude that additional review pursuant to the "12-point rule" would have prevented the error.

FIGURE 8A

Original IAFIS Encoding (LFP 17)

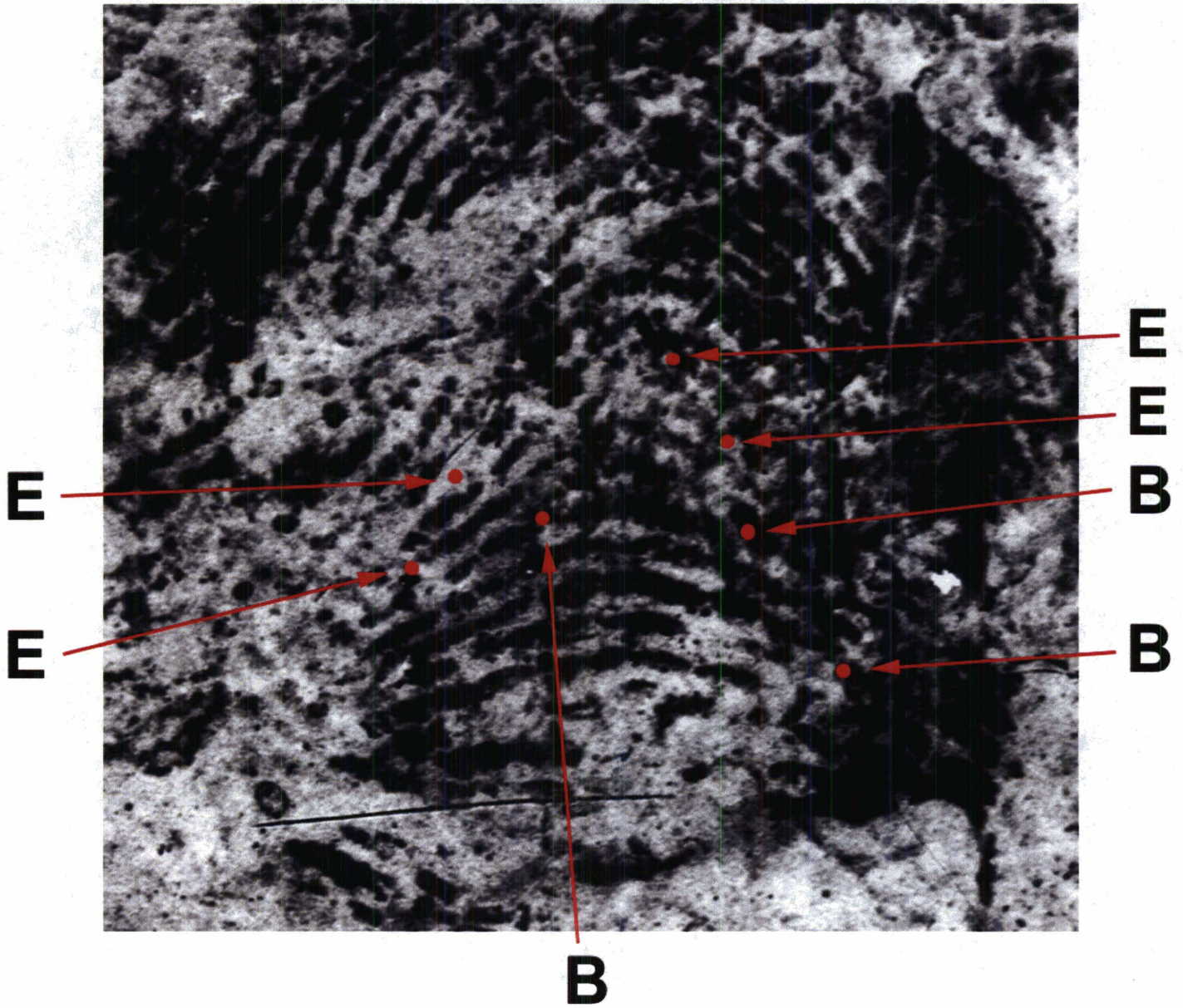
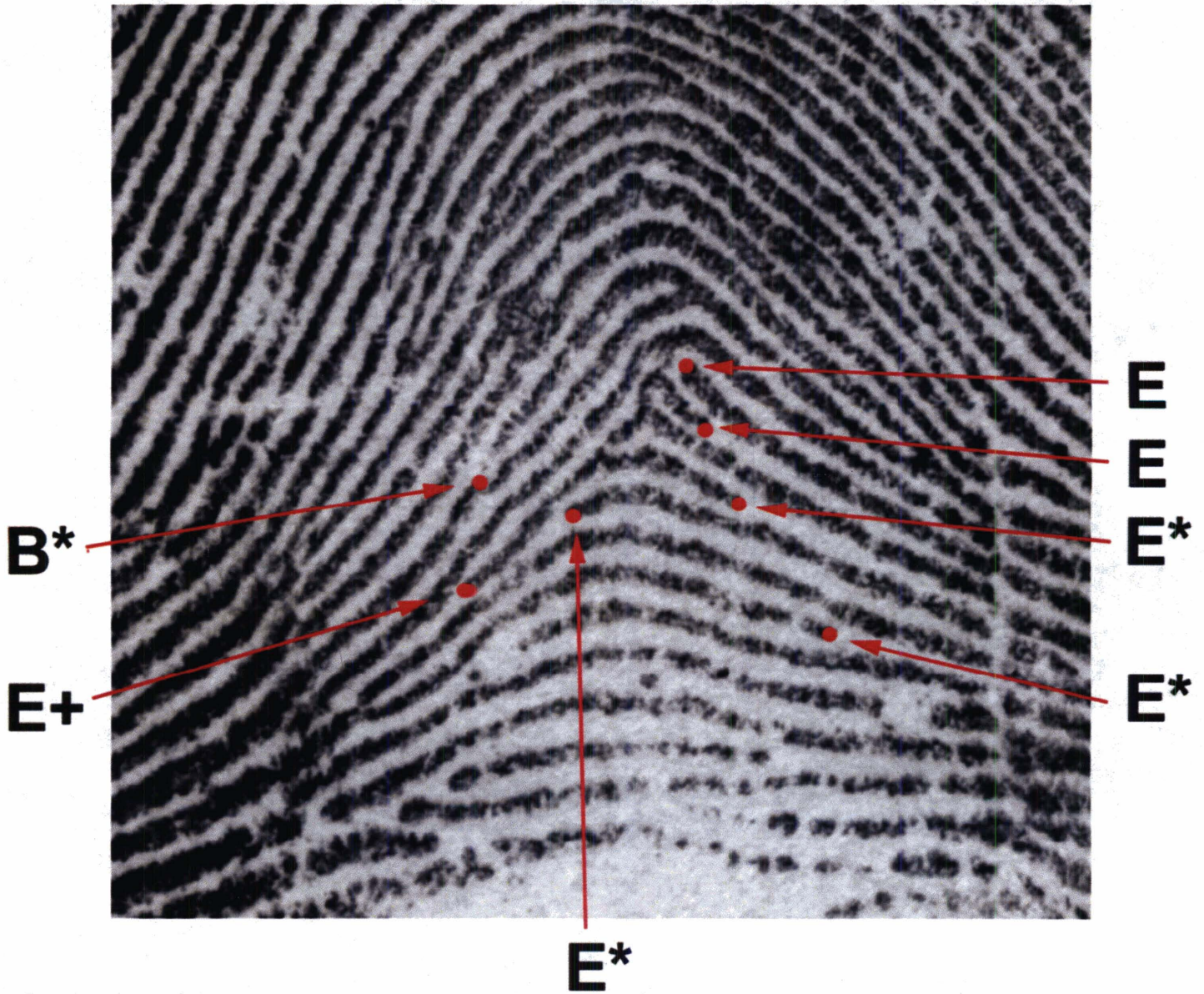


FIGURE 8B

Revised Interpretation of IAFIS Points Following Mayfield Comparison (Mayfield Exemplar)



* = Change in type (e.g., E to B or B to E)

† = Moved one ridge down

FIGURE 8C

Actual Feature Types in Daoud Exemplar



[OPEN]

an incomplete record of the analysis, over time the examiner may lose track of which came first, features he saw in the latent or features suggested by the exemplar.

Of course, Mayfield's print was not the only print selected as a candidate as a result of the IAFIS search. It was only after Mayfield's print became a serious candidate for identification that this process of reverse reasoning began to influence the examiner. The initial interest in the Mayfield print was attributable to close similarities with LFP 17, as described in the preceding section. The OIG concluded that once the similarity was noticed, the process of circular reasoning began to infect the examiner's mental process, particularly in the absence of standards or safeguards to require the examiner to keep distinct which features were seen in the latent during the analysis and which were only suggested during the comparison.

3. Faulty reliance on Level 3 Detail

The OIG found that the purported agreement of Level 3 details (pores, incipient dots, and ridge edge shapes) between LFP 17 and the Mayfield exemplar fingerprint was an important basis for the FBI Laboratory's identification of Mayfield. Supervisor Green and Unit Chief Wieners both described their reliance on Level 3 details in interviews with the OIG. Green marked five areas of Level 3 agreement with yellow ovals in the March 22 Charted Enlargements (Figures 2A and 2B) prepared shortly after the identification was declared. Wieners told the OIG that one of these Level 3 features, interpreted as a pair of incipient dots and marked as the upper rightmost of the five circled features, was a "very persuasive" point within the identification. According to another LPU examiner interviewed by the OIG, Green told him at the time of the identification that it was necessary to consider matching Level 3 details to make the identification.

After the SNP questioned the identification in its April 13 Negative Report, Green prepared new charted enlargements that specifically cited a total of seven different matching Level 3 details in support of the identifications. As noted above, when Wieners made his presentation to the SNP on April 21, he gave great emphasis to the FBI's reliance on Level 3 details. According to AUSA 2's notes regarding a conversation with Wieners after the April 21 meeting, Wieners told her that the SNP's failure to consider Level 3 detail reflected a lower depth of analysis and level of expertise. The FBI's reliance on Level 3 detail was explicitly cited in the Werder Affidavit filed in support of the material witness warrant in connection with explaining the difference of opinion between the FBI and the SNP.

Wieners told the OIG that he now believes that "Level 3 is what betrayed us here." The OIG reviewed the relevant prints with the FBI examiners and the

OIG's consultants, and determined that none of the Level 3 features utilized by the FBI examiners to identify Mayfield has any correspondence to any point in the Daoud exemplar prints. In other words, it appears that the examiners were confused not by any confirmable Level 3 similarity between the fingers of Mayfield and Daoud, but rather by distortions or variations in appearance within the latent print that the examiners found to correlate with features in the Mayfield exemplar. Thus, the error in the Level 3 portion of the examination was fundamentally different from the error that occurred with respect to Level 2. Unlike the case with Level 2 details (in which there were as many as 10 roughly similar minutiae present in *both* the Mayfield print and the Daoud print), none of the Level 3 details cited by the FBI can be attributed to an unusual coincidence of similarity between Mayfield and Daoud.

From a review of the available prints, review of literature regarding Level 3, and consultation with experts, the OIG has determined that there were several indications available to the FBI at the time that the purported Level 3 similarities were not reliable support for the identification. One example is the feature interpreted as a pair of incipient dots in LFP 17 (the upper rightmost yellow-circled feature in Figure 2A), which Wieners described as a very persuasive feature in the comparison. Green and Wieners found a corresponding feature on Mayfield's rolled fingerprint taken in connection with his military service. That exemplar, however, was not the only image of Mayfield's fingerprints available to the FBI. The same set of fingerprints included a "flat" impression of the finger made without rolling. The "incipient dots" do not appear in that version of Mayfield's known prints, made the very same day as the rolled prints. The dots also do not appear in the fingerprints taken from Mayfield in connection with his criminal arrest as a teenager in 1985. Thus, a feature that the FBI Laboratory considered "very persuasive" did not in fact appear in most of the known prints of Mayfield. Moreover, even in the one exemplar print in which the dots do appear, they are significantly further away from the nearest Level 2 feature (Point 5 in Figures 2A and 2B) in the latent print than in the exemplar, calling into question whether the dots are actually in agreement.

Several of the Level 3 details cited by the FBI Laboratory as being in agreement were described as pores or groups of pores. The non-FBI experts that the OIG interviewed, including two members of the International Panel and the OIG's experts, disputed that there was in fact a similarity of appearance in size and shape between these features in the latent print and the relevant exemplars. Moreover, the appearance of a pore along a ridge in a latent print corresponding to another pore in an exemplar has relatively little individualizing power. Every ridge is made up of a sequence of ridge units, each of which contains a pore. Thus, unlike Level 2 minutiae, pores occur on all ridge units throughout the ridge formations in the friction skin. In addition, because of the variability with which pore sizes and shapes are reproduced in

both latent and inked prints, some fingerprint examiners caution against any reliance on the shape or size of pores.¹¹⁵

Several of the examiners interviewed by the OIG, including LPU Unit Chief Meagher, the OIG consultants, and Ron Smith (a member of the International Panel), even questioned whether the clarity of LFP 17 was sufficient to support *any* reliance on Level 3 detail in this image. LFP 17 bears little or no resemblance in clarity to the examples shown in Ashbaugh to illustrate Level 3 detail.¹¹⁶ FBI LPU Unit Chief Meagher, who participated in the May 23-24 reexamination of the print and ultimately identified the print to Daoud in June, told the OIG that the quality of LFP 17 was a 2 or 3 on a scale of 10, and that he did not find usable Level 3 detail in the print.

Another issue raised by the FBI's reliance on selected Level 3 details is the question of "fair reasoning." The INTERPOL "Method for Fingerprint Identification" describes this issue as follows:

As a rule the quality of the difference (e.g. explained by distortion) should not be higher than the quality of the similarities . . . in other words [w]hen a dissimilarity is "explained away," by arguing that the information is too bad and not valid, then similar information with equal quality should also not be regarded as valid. . . .

A good way to practise fair reasoning is to invert the argument or to "play the advocate of the devil"; Or in practise ask: what if it was the other way round? . . .

One finds a similarity in a blurred area and there could be an inclination to mark it; if there appears to be a dissimilarity in the same area would one regard this to be genuine as well?¹¹⁷

It does not appear that FBI examiners applied "fair reasoning" in the comparison of Level 3 detail during the Mayfield identification. There are possible pores, ridge edge shapes, and small between-ridge details in many

¹¹⁵ See, e.g., Doede Rijpkema, unpublished presentation to the IAI Educational Conference in Las Vegas, 2002 (supplied by Dusty Clark).

¹¹⁶ See, e.g., Ashbaugh, p. 151, Figures 5.1 A and B (showing 901 pores with much greater clarity than in LFP 17); p. 155, Figure 5.2A and B (distinguishing bifurcations in the same location in different prints by relative pore positioning); p. 159, Figures 5.4-5.6 (illustrating identification of partial palm print from telephone extension wire having clear impression of ridge edges and numerous pores).

¹¹⁷ INTERPOL Method Part 2 §§ 8.7.1 and 8.8.

locations throughout LFP 17. Some of these shapes arguably correspond with shapes in the Mayfield known prints; they were marked as similarities. Many other shapes in the latent print do *not* correspond to the Mayfield known prints, but there is no evidence that these differences in appearance were treated as important enough to require explanation. They were apparently attributed to the variability in appearance that occurs in any transfer of detail from 3-dimensional friction ridges into a 2-dimensional latent print under uncontrolled conditions. This selective “cherry-picking” of only those Level 3 details that seemed to support the identification, while dismissing all Level 3 differences elsewhere in the print, falls short of “fair reasoning.” Green told the OIG that he did not try to identify usable Level 3 detail in LFP 17 until after he began comparing the print to the Mayfield exemplar. Again, it appears that Green reasoned in a circular manner, using detail in the Mayfield known prints to determine which pores, edge shapes, and incipient dots in the latent print were in fact reliable detail rather than distortion.

In Chapter Three we described the debate within the fingerprint discipline regarding the reliability of Level 3 detail. We believe that the Mayfield error will be an important case study for consideration in that debate. It is beyond the scope of the OIG’s investigation to weigh in on the debate regarding the circumstances under which Level 3 detail should be utilized to effect an identification. The OIG did find, however, that in this case FBI examiners Green and Wieners relied on features in LFP 17 as Level 3 detail that turned out to be details which have no significant correspondence with any features in the known prints of the true source, Daoud.

4. Inadequate explanations for differences in appearance

Several members of the International Panel found that the FBI examiners had ignored, overlooked, or disregarded a significant number of differences in appearance between LFP 17 and the Mayfield prints.¹¹⁸ The individual members of the Panel did not explain these findings in more than a summary fashion in their reports. During their interviews with the OIG, Green and Wieners disputed this finding, stating that they did notice several differences in appearance but believed them all to be explainable. In this section, the OIG examines, in detail, the differences in appearance and the explanations that the FBI Laboratory posited for them. The primary Level 1 and Level 2 differences in appearance that the OIG was able to identify with the help of its

¹¹⁸ See, e.g., Michaud, p. 3; Ron Smith, p. 3; Kenneth O. Smith, “International Expert Review of the Madrid Bombing Latent Fingerprint Examination by the FBI Latent Print Unit,” (unpublished), 2004, p. 1.

consultants and other examiners who were interviewed are described in Table 1 and illustrated in Figures 9A-9F.¹¹⁹

In reviewing the questions of differences of appearance and explanations, the OIG's investigation was hampered by the fact that there was no contemporaneous written record of what differences the examiners perceived and what explanations, if any, were posited for them in March 2004 when the identification was made. As previously noted, no FBI policies or procedures required the documentation of this aspect of the comparison. Consequently, the OIG was required to rely solely on the recollection of the participants, which were by that time informed of the fact that an error had occurred.

In reviewing the adequacy of the explanations posited by the Laboratory examiners, the OIG took into account the degree of certainty which the FBI Laboratory and other forensic laboratories require for their identifications. As previously explained, latent fingerprint identifications are not declared unless the examiner has crossed a threshold of certainty that the latent and known prints originated from the same source, to the exclusion of all others. The SWGFAST Methodology is unequivocal in rejecting "possible" or "probable" identifications as outside the acceptable limits of the discipline. Consistent with this philosophy, Green approved of language in the affidavit supporting the material witness warrant for Mayfield describing his conclusion as a "100% identification."

As previously explained, the FBI and other forensic laboratories utilize a "one discrepancy rule" in which a single difference in appearance that cannot be explained must preclude the examiner from declaring an identification. Although the SWGFAST Standards that governed the FBI's identification in this case are not explicit regarding the degree of certainty that the examiner must have in a proposed explanation, the certainty that the discipline requires for its identifications cannot be provided unless the examiner has achieved equivalent certainty with respect to the validity of the explanations offered for differences in appearance between a latent and a known fingerprint.

¹¹⁹ The discussion in this section does not address dissimilarities in Level 3 detail. As previously noted, there can be substantial variability of appearance in Level 3 detail from one impression to another, even when the prints are made by the same person. Examiners are generally tolerant of many differences in appearance in Level 3 details and are more willing to explicitly or implicitly explain them as distortions. Although it is possible to imagine circumstances under which there would be adequate clarity in both the latent and exemplar prints for an examiner to rely on Level 3 differences to declare an exclusion, this is apparently an extremely unusual situation. In the Mayfield case, there were so many unexplained differences in Level 1 and Level 2 details that a discussion of Level 3 differences would be superfluous.

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FIGURE 9A

Differences in Appearance Between LFP 17 and Mayfield Exemplar
(See Table 1)

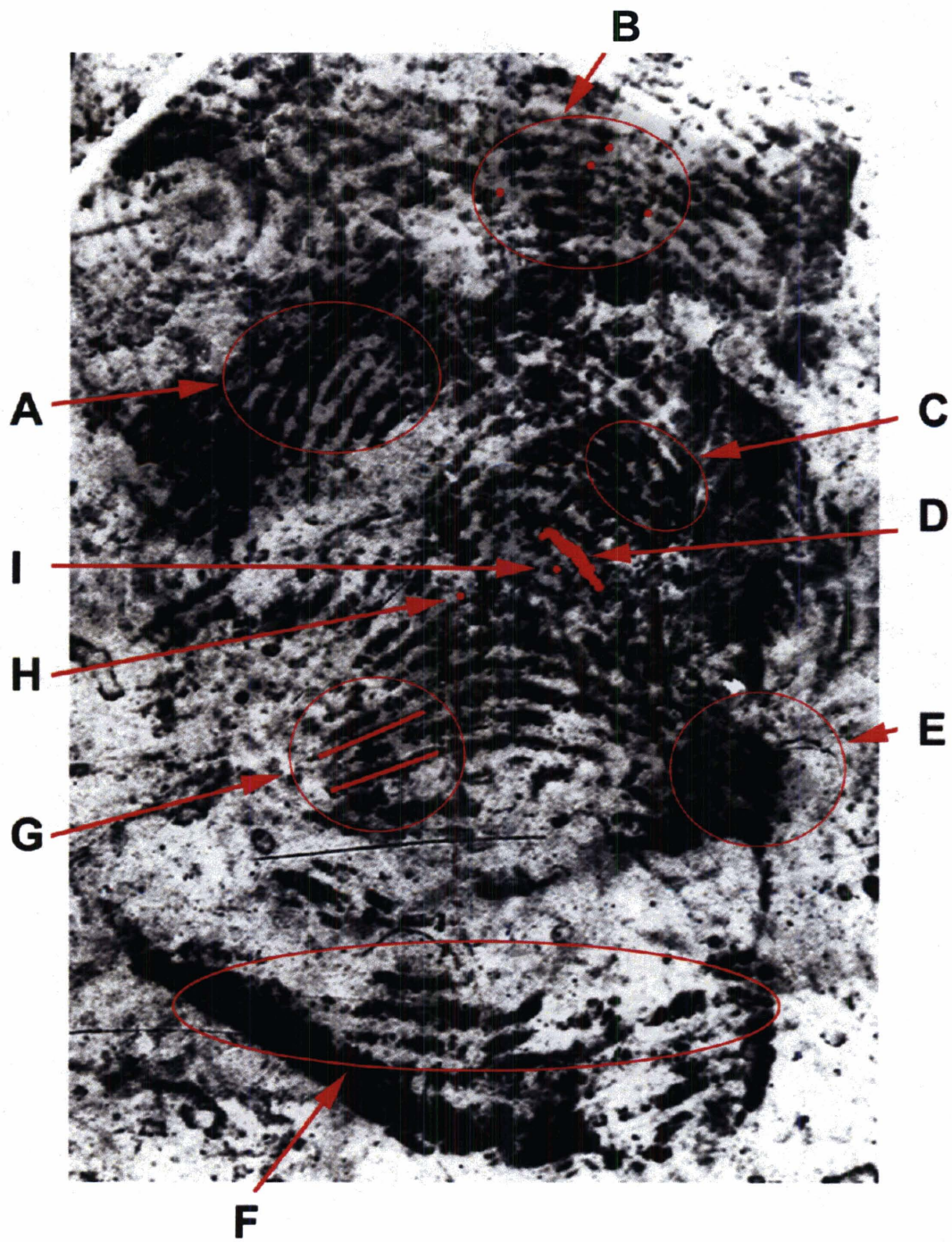


FIGURE 9B

Differences In Appearance Between LFP 17 and Mayfield Exemplar
(See Table 1)

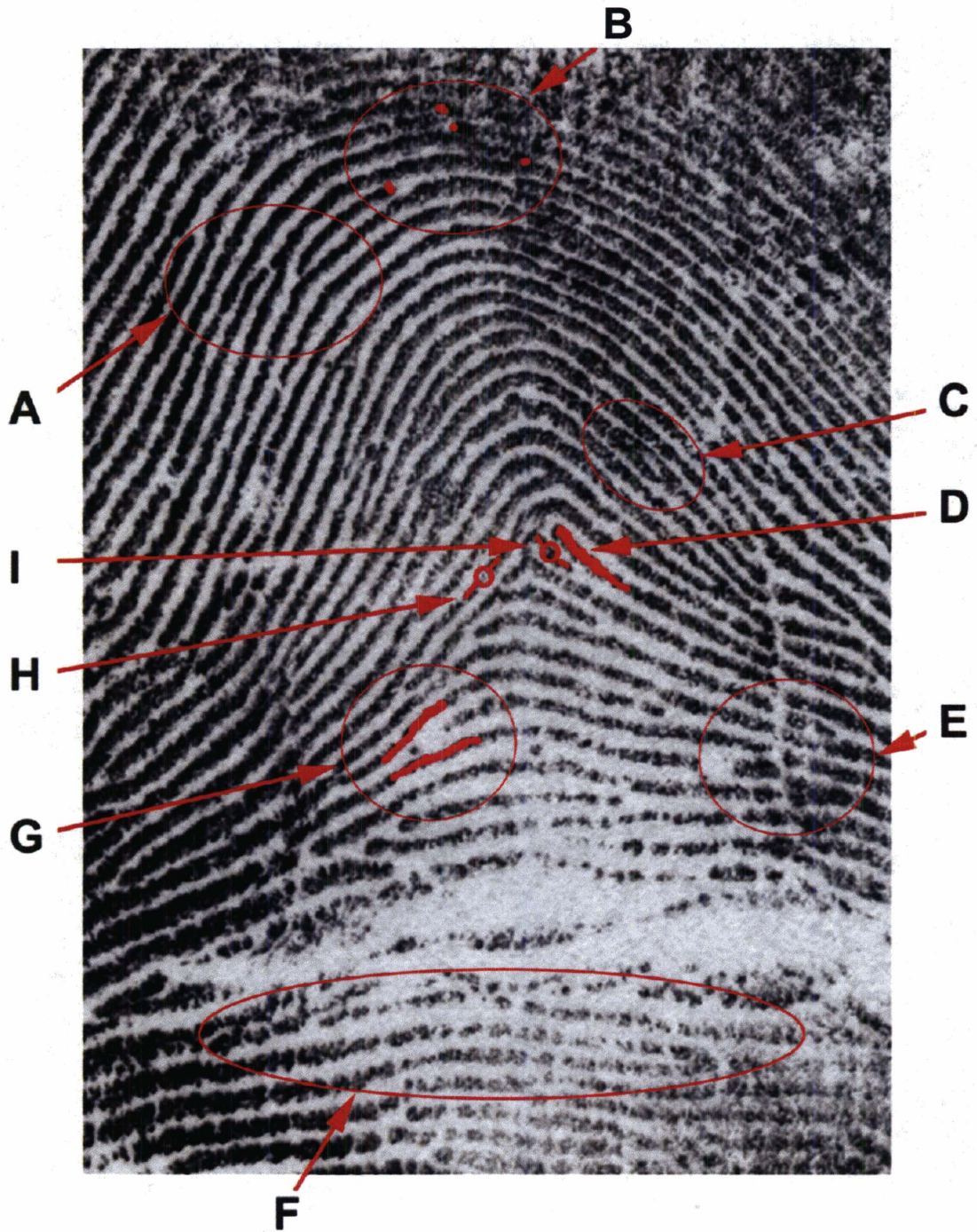


FIGURE 9C

Differences in Appearance Between LFP 17 and Mayfield Exemplar
(See Table 1)

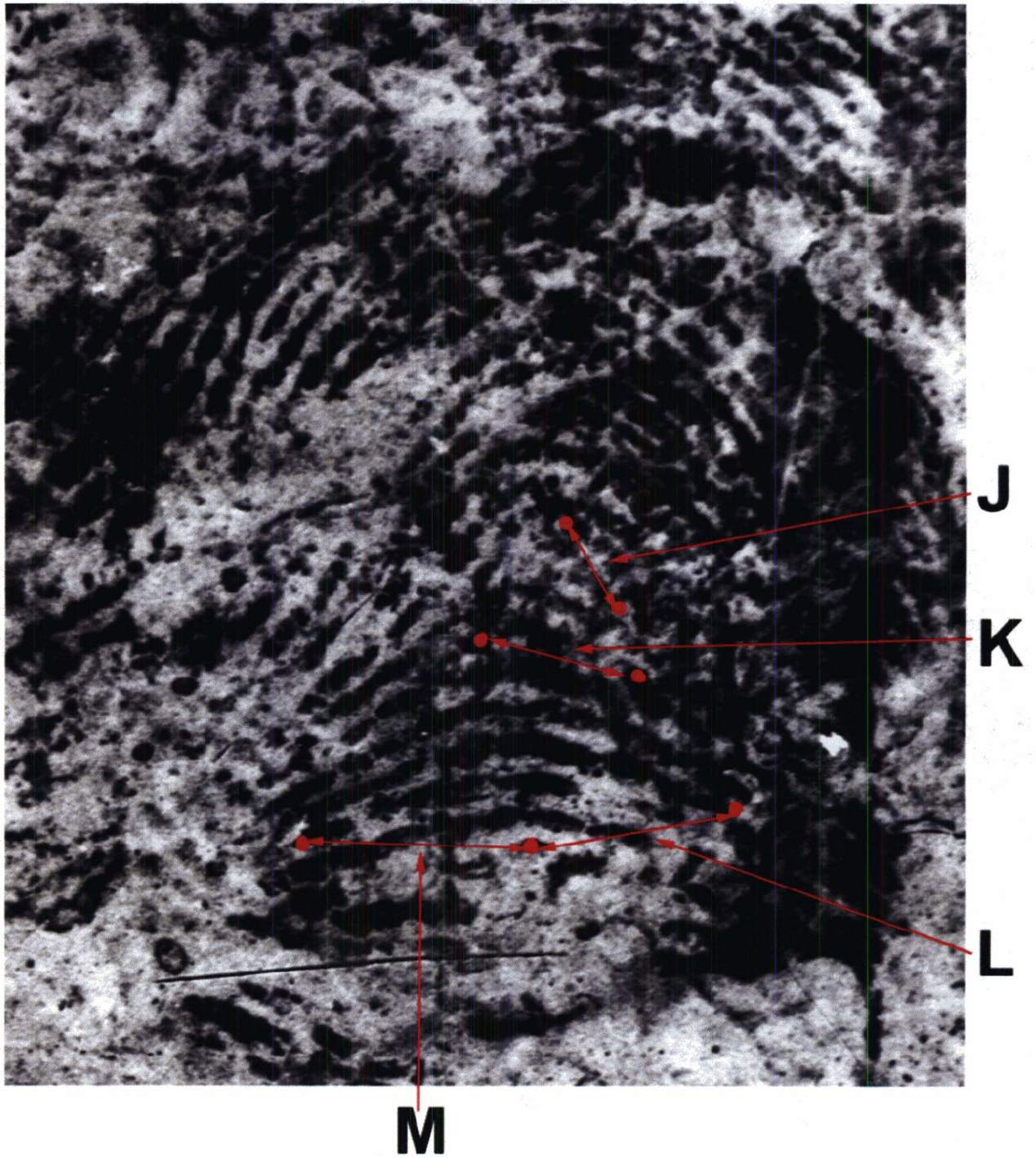


FIGURE 9D

Differences in Appearance Between LFP 17 and Mayfield Exemplar
(See Table 1)

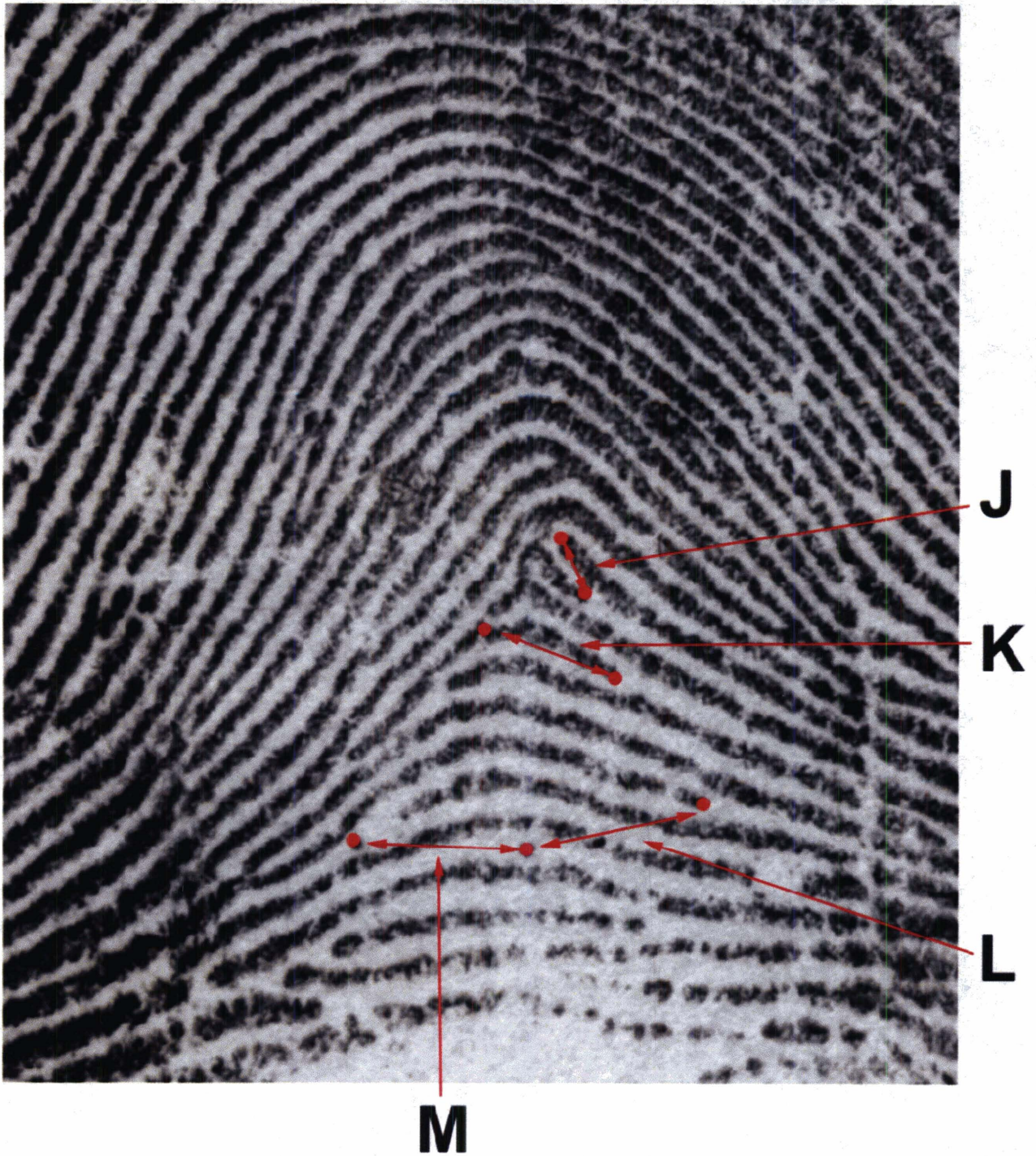


FIGURE 9E

Differences in Appearance Between LFP 17 and Mayfield Exemplar
(See Table 1)

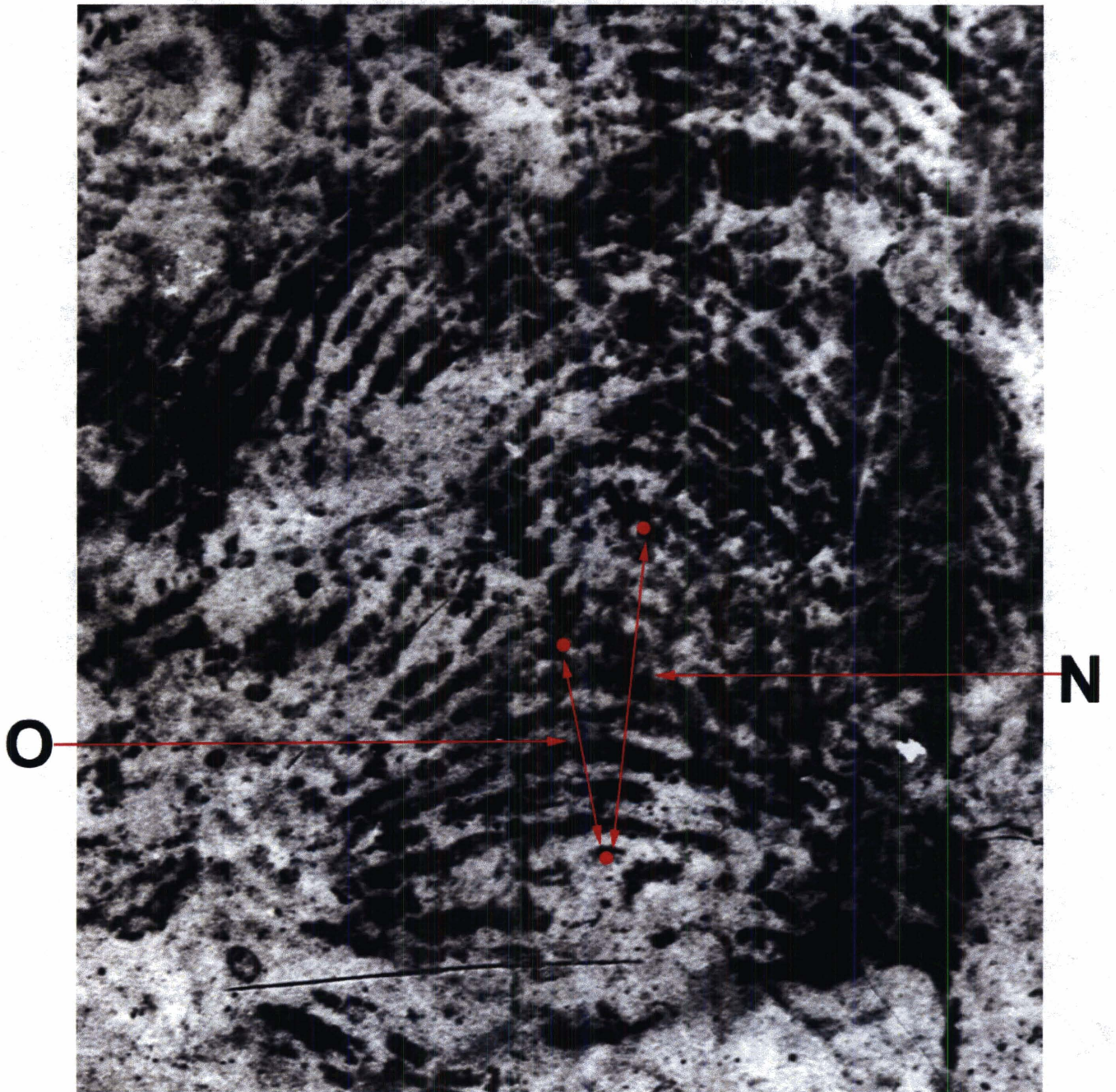


FIGURE 9F

Differences in Appearance Between LFP 17 and Mayfield Exemplar
(See Table 1)

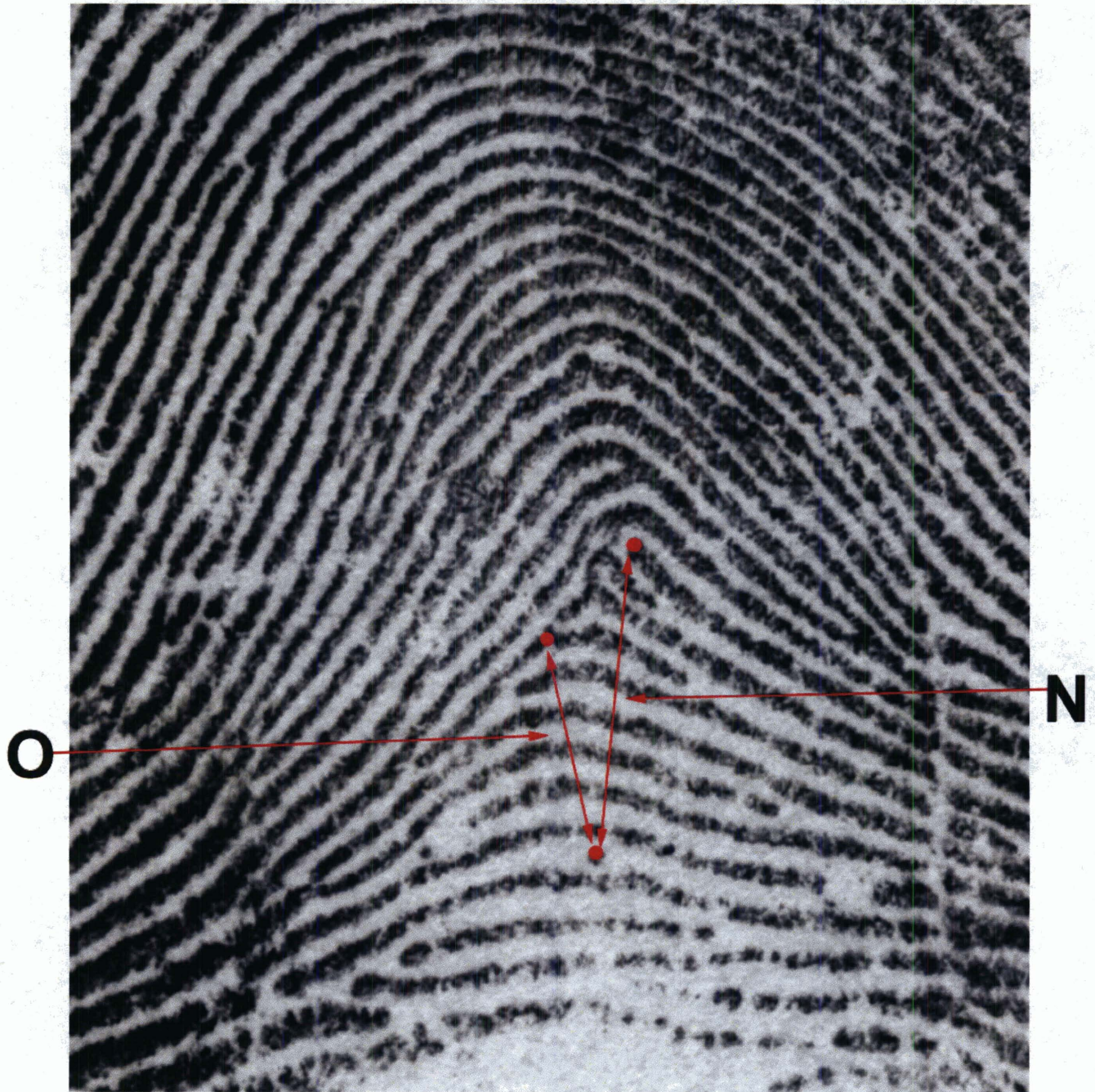


TABLE 1

DIFFERENCES IN APPEARANCE BETWEEN LFP 17 AND THE MAYFIELD PRINT

(SEE FIGURES 9A-9F)

A	Level 2 details in upper left portion of print cannot be correlated to Mayfield exemplars.
B	Level 2 details in upper right/center are not in agreement in alignment and spacing and are off by one ridge count from core.
C	Enclosure in Mayfield exemplar cannot be seen in latent.
D	Ridge ending at point 2 is downward curving in latent, upward in Mayfield exemplar.
E	Ridge flow in SE portion of center of LFP is flatter in Mayfield exemplar than in LFP 17.
F	Ridge flow in lower joint is cupped in LFP 17, mounded in Mayfield exemplar.
G	Ridges around point 8 are parallel in LFP 17, taper together in Mayfield exemplar.
H	Level 2 detail in latent on ridge above Point 14, not present in Mayfield exemplar.
I	Level 2 detail NW of Point 3 in latent, not present in Mayfield exemplar.
J	Distance from Point 2 to Point 3 is much greater on latent (1.52 mm) than on Mayfield exemplar (1.09 mm).
K	Distance from Point 14 to Point 4 is much greater on latent (2.74 mm) than on Mayfield exemplar (2.34 mm).
L	Distance from Point 5 to Point 6 is much greater on latent (3.28 mm) than on Mayfield exemplar (3.02 mm).
M	Distance from Point 8 to Point 6 is much greater in latent (3.56 mm) than in Mayfield exemplar (3.0 mm).

N	Distance from Point 2 to Point 6 (on N-S axis) is larger on LFP 17 (5.28 mm) than on the Mayfield exemplar (5.13 mm). Compare Difference O – opposite distortion along similar axis.
O	Distance from Point 2 to Point 14 (on N-S axis) is smaller on LFP 17 (3.61 mm) than on the Mayfield exemplar (3.78 mm). Compare Difference N – opposite distortion along similar axis.

Numbered point references correspond to points marked in March 22 Charted Enlargements (Figures 2A-2B)

However, the information available to the examiners regarding the validity of their explanation for this difference was contradictory. Although the gap in detail between the main body of the print and the upper left could be consistent with a separate touch, other information suggested that both portions were part of the same print. To begin with, the Level 1 ridge flow was consistent across the gap and over the top of the print, suggesting that the detail in the upper left was part of a single print. Another FBI examiner who looked at LFP 17 informally at the time of the original identification in March 2004 told the OIG that he was surprised to hear the "double touch" explanation because the print looked like a single print, with consistent ridge flow on both sides of the gap. Ken Smith, a U.S. Postal Inspection Service examiner who served as a member of the International Panel, showed the OIG how the upper left area of the print could be connected to the main body of the print by following the sequence of ridges up from the center of the print to the upper right, and then following the flow of the ridges leftward into the problem area. Smith said that this analysis of LFP 17, together with recognition of other dissimilarities, should have led the FBI Laboratory to declare an exclusion of Mayfield within a short time after beginning a side-by-side comparison. OIG consultant Dusty Clark stated that it is also possible to trace the sequence of ridges from the main body of the print into the upper left area along the left edge of the print, giving more basis to suspect that the upper left area was not a separate touch.

Ashbaugh devotes considerable discussion to the problem of double taps:

Double taps are a very common distortion with flexible substrates [such as plastic bags]. A double tap happens when a single print is deposited with two distinct and separate applications of pressure. The time between the applications or touches of pressure can be as little as a split second. The most common result is two areas of friction ridge print separated by a smear or smudge. At times the two separate areas of ridge structure may overlap a few millimeters and, if the ridge ends align, the print will appear normal but will actually be distorted in size and/or shape. The telltale sign for this type of distortion is where the two prints meet. All the ridges in the transition area usually do not join smoothly and thick areas of friction ridge will be evident, possibly with the occasional ridge end protruding from the side of a ridge. Another obvious indicator would be finding the relative position of the major ridge path deviations to be out of spatial sync or even missing when compared to a known exemplar print.

* * *

Crossovers, misaligned ridges, extra thick ridges, and protruding ridge ends are common features in double taps. These types of features are called *red flags*. . . .¹²⁰

[D]eposition pressure becomes important . . . when there is confusion as to whether one or more prints is involved, possibly a double tap, in the overall makeup of the developed print. It is very difficult to deposit two prints with the same deposition pressure. An analysis of deposition pressure along all the friction ridge paths of this type of print may assist an identification specialist in separating the two prints, even when they are from the same donor and were deposited a split second apart.¹²¹

In light of this discussion, it is clear that the information supporting the FBI's double touch explanation was limited and required the examiners to believe a remarkable set of coincidences. The only "red flag" that any examiner could identify for the OIG indicating that a separate touch had occurred was the "gap" in detail between the upper left portion of the print and the center. The examiners did not describe any crossovers, misaligned ridges, or protruding ridge ends in LFP 17 that would signal a double touch. The FBI examiners also did not identify any difference in deposition pressure between the upper left and the rest of the print to suggest a second touch. An SNP Laboratory Supervisor told the OIG that the consistency in deposition pressure between the upper left portion of the print and the rest of LFP 17 caused one team of SNP examiners to reject the FBI's "double touch" explanation.

We are not suggesting that the "double touch" explanation was impossible, but rather that there was, at best, conflicting evidence for and against it. Acceptance of the double touch explanation required the FBI to believe that Mayfield touched the bag a second time with a portion of his finger (such as the extreme tip) that was not recorded in any inked print but that lined up consistently in ridge flow and deposition pressure with the image left in the other touch. Alternatively, to accept the hypothesis of a touch by a second person, the FBI had to believe that the second donor coincidentally left a fragment of a print having a ridge flow consistent with the main part of the print made by Mayfield, with no detectable difference in deposition pressure, no crossover ridges, no protruding ridge ends, and no extra thick ridges. Either scenario assumes an extraordinary set of coincidences. There was no basis for the examiners to be certain that these coincidences, in fact, occurred in light of the alternate explanation that Mayfield was not the source of LFP 17.

¹²⁰ Ashbaugh, p. 114.

¹²¹ *Id.*, p. 125.

Moreover, the extremely stringent standard of certainty that the FBI Laboratory and others in the latent print identification discipline claim for their identifications must, by implication, apply to any explanation that the examiner relies upon to justify a difference in appearance, particularly a difference as obvious and significant as occurred in the upper left portion of LFP 17. The OIG found that this threshold of certainty was not satisfied in the Mayfield case. In light of the conflicting information regarding whether a double touch occurred, an “inconclusive” determination would have been more appropriate.¹²²

b. Other differences

There were many other differences in appearance between LFP 17 and the Mayfield exemplars identified to the OIG by its consultants and by other examiners interviewed by the OIG. These differences were generally more subtle than the obvious inconsistency between the upper left portions of the prints as discussed above. The consultants and other examiners attached varying significance to each individual difference in appearance between LFP 17 and the Mayfield exemplars, but they agreed that the cumulative impact of the differences should have been sufficient to preclude the identification of Mayfield. A few of these differences are discussed in detail in this section.

During his interview, the only difference in appearance that Green initially remembered being concerned with at the time he identified LFP 17 to Mayfield was the upper left area discussed in the previous section. When the OIG shared a list of other differences with Green, his recollection was generally vague as to (1) whether he perceived the differences in appearance at the time of the initial identification; (2) if so, what explanation he adopted at the time to justify the difference; and (3) what, if anything, he did at the time to attempt to confirm the validity of any such explanation. Wieners’ recollection of the differences and the explanations adopted for them also was incomplete. As noted above, FBI policies required no documentation of perceived differences and explanations as part of the identification. As a result, we are unable to

¹²² The FBI examiners were not alone in this error. The court-appointed examiner, Kenneth Moses, perceived a break in the ridge flow between the upper left area and the main body of LFP 17 during the analysis phase of his examination, and stated he “could not immediately determine if [these areas] were from the same finger.” Moses, *Anatomy of an Error*, p. 5. Later, during the comparison phase, Moses found “two prominent minutiae [in the upper left of LFP 17] that were nowhere to be found in the known prints [of Mayfield]. I concluded that this patch of ridges might belong to a different finger or another person.” *Id.* at 6. Moses thus appears to have jumped from an admission that he was unsure of whether the upper left was a separate fingerprint to a conclusion that it was, solely on the basis that it was not in agreement with Mayfield’s known prints. Again, absent *certainty* that the upper left was a separate print made by a different finger or person, Moses should have been precluded by the one discrepancy rule from declaring an identification.

determine with certainty whether the potential explanations for differences that were provided during the interviews of Green and Wieners were in fact those utilized at the time of the Mayfield identification, or whether some had been reconstructed in hindsight.

i. Differences in ridge flow

The OIG consultants identified several differences in the shape of ridges between LFP 17 and the Mayfield exemplars that they concluded should have alerted the FBI examiners to a problem with the identification.

For example, there is a difference in appearance in the ridges at the very bottom of the print (Difference F in Table 1 and Figures 9A-9B). These ridges appear to be associated with the second joint of the finger, below the crease. In LFP 17, these ridges curve upward forming a “cupped” shape, while in the Mayfield exemplar these ridges are flat or slightly mounded. This difference was a major focus of the SNP in questioning the FBI’s identification of Mayfield. Green and Wieners stated that the large gap between the lower portion and the main body of the latent print made it difficult to be certain whether that area could be matched to any part of Mayfield’s finger and that the quality of detail in this portion of the latent print was poor.

The consultants utilized by the OIG had varying opinions regarding whether this difference should have precluded the FBI from identifying Mayfield. Clark and Grimm found the difference in ridge flow in this area to be an important dissimilarity, although Grimm observed that when the finger is bent, the reproduction of ridges from a joint below the crease will be greatly affected and the examiner may not be sure what part of the finger he is seeing. Vanderkolk did not consider this area of the latent to be an unexplainable dissimilarity due to the lack of clarity in the latent, and pointed out that this portion of LFP 17 also lacked any strong details supporting the identification of Daoud.

Another difference in ridge flow occurs in the southwest portion of the main body of the latent print (Difference G on Table 1 and Figures 9A-9B). This difference relates to the behavior of adjacent ridges on either side of the ending ridge that Green originally marked as Point 8 on his March 22 Charted Enlargements (Figures 2A and 2B). In the latent print, the adjacent ridges continue in paths parallel to the ridge that ends. In the Mayfield exemplar, the adjacent ridges converge sharply together to fill the space vacated by the ending ridge. The consultants considered this to be a significant unexplained

difference. Green told the OIG, however, that he considered the adjacent ridges to be sufficiently similar to support the identification.¹²³

ii. Differences in distances between points

The OIG consultants and other examiners interviewed by the OIG pointed out several differences in appearance that related to the distance between Level 2 minutiae originally marked as similarities by Green. These differences are shown graphically as Differences J-O on Figures 9C-9F, and are described in detail on Table 1. For example, Dusty Clark measured distance J on LFP 17 as 1.52 millimeters; he measured the distance between the corresponding points in the Mayfield known prints as 1.09 millimeters, or 28 percent less. Clark reported similar inconsistencies in distance between several other points that Green marked as similarities. (See Figures 9E and 9F and Table 1).

Green told the OIG that he noticed some of these differences in distance at the time of the identification, but that he attributed them to slippage or twisting that occurred when the print was deposited. Green pointed out smudging along the right side of the print that he stated could have been an indication of slippage during deposition.

The examiners who served as consultants to the OIG stated that these differences in distance between points constituted important inconsistencies between the prints that should have alerted the FBI examiners of problems with the identification. The consultants agreed that friction skin does not stretch or flex over the small distances between these points to a degree sufficient to explain these differences in distance. More significantly, the differences in distance were not consistent across the print. For example, the distance was larger in the latent in one set of north-south points (Difference N in Figures 9E and F), and smaller in the latent for another set of points oriented in the same general north-south direction (Difference O in Figures 9E and 9F). The OIG consultants stated that such differences could not be adequately explained by slippage or twisting. In particular, John Vanderkolk stated that he found no "red flags" to indicate significant twisting or slippage during the deposition of the print and that the consistent spacing of furrows throughout the latent print suggested the absence of such twisting or slippage.

¹²³ Two other differences in ridge flow are described in Table 1 and shown in Figures 9A-9B (Differences D and E).

iii. Cumulative impact of differences

LPU Unit Chief Meagher told the OIG that when he reviewed the identification, he found more areas of disagreement that required explanation than high-quality characteristics in agreement, and that the examiners' failure to recognize the cumulative impact of these differences was a major cause of the error. In an e-mail written a few months after the error was discovered, Meagher wrote:

Every comparison . . . will have a varying degree of qualitative issues. Each examiner must assess when too much compensation is being given for too many dissimilarities. Most examiners err on the side of caution and will not make the call as soon as three or more dissimilarities exist.

This "rule of thumb" is not formalized in any FBI SOP or SWGFAST standard. Other examiners we interviewed were not familiar with such a rule. Nevertheless, Meagher's e-mail highlights the failure of the examiners in the Mayfield matter to consider the cumulative impact of the differences between the prints.¹²⁴

The OIG concluded that the FBI examiners did not exercise this level of caution with respect to their treatment of the differences between LFP 17 and the Mayfield exemplars. The explanations posited for the differences, while individually plausible, cumulatively required too many rationalizations. These explanations did not have sufficient known support within the print, the substrate, or the crime scene to support the degree of certainty demanded for a latent fingerprint identification.

¹²⁴ Ashbaugh makes the following observation relevant to this point:

[I]f each area of friction ridge detail being compared requires justification for why the formation appears slightly different or why it is not spatially correct, be cautious, one may be talking oneself into agreement that is not really there. Small discrepancies appear in all prints. Most have a rational explanation based on a distortion during deposition, in the substrate, or in the development medium. However, when discrepancies appear at each turn in the ridge path, ensure the explanation for the differences is rational and based in physical fact. One should be able to point to something physical in the print, substrate or crime scene to defend one's position, otherwise the explanation may be that the print is from another donor.

Ashbaugh, pp. 146-147.

5. Failure to assess the poor quality of similarities

All of the latent fingerprint experts consulted by the OIG agreed that the FBI Laboratory examiners failed to assess the poor quality of the similarities that were used to justify the Mayfield identification. As noted above, “quality” is equated with “clarity” in the SWGFAST Methodology that the Laboratory LPU incorporated into its Examination SOPs. Clarity is sometimes equated with the ability to discern and utilize Level 3 detail in declaring a match, but clarity can affect the examiner’s assessment of agreement at all three levels of detail. In this case, the imperfect clarity of LFP 17 limited the ability of the examiners to find strong agreement in both Level 2 and Level 3 details.

As previously explained, agreement among Level 2 ridge deviations is assessed according to several dimensions, including the type, location, orientation of the points, and their relationship to other features. In this case, the examiners were, in many cases, unable to determine the correct type (e.g., bifurcation versus ending ridge) of most Level 2 features accurately. Shortly after making the original identification, Green charted 15 Level 2 minutiae as similarities in the March 22 Charted Enlargements (Figures 2A and 2B). He also described his interpretations of these points in a memorandum he prepared for use by Wieners at the April 21 meeting with the SNP in Madrid (Appendix B). The subsequent identification of Daoud enabled the OIG to check the accuracy of the Laboratory’s initial interpretation of the “type” of these 15 minutiae. Table 2 summarizes the results of this review.

Of the 15 Level 2 minutiae initially used to identify Mayfield, 5 did not, in fact, exist at all, but rather were distortions misinterpreted as ridge deviations (see Section II.A.2 of this chapter). Of the remaining 10 minutiae, comparison with the Daoud exemplars shows that the LPU correctly identified only 3 of them as to type (bifurcation versus ending ridge) when it declared the Mayfield identification. Indeed, as shown in Table 2, Green changed his interpretation of some of these points between the time he encoded the print for IAFIS and the time he compared the print with Mayfield’s exemplar. Green was able to make such a change because the lack of clarity in the latent print permitted either interpretation of these points.

Thus, even assuming the 10 minutiae were in agreement as to location, orientation, and relative positioning (including intervening ridge counts), Green was unable to accurately establish agreement between most of them as to type. The examiners consulted by the OIG stated that agreement of points in which the type of point is unknown has less individualizing power than an agreement of features that are unequivocally of the same type. These consultants also agreed that many of the points utilized by Green to support the identification suffered from this shortcoming (ambiguity as to feature type), and that

TABLE 2 – Point “Types” in Mayfield Misidentification

Feature No.	“Type” encoded for IAFIS	“Type” identified in Mayfield ID(1)	True “type” (Daoud ID)(2)
1	Not encoded	Bifurcation	No ridge deviation at this location
2	Ending Ridge	Ending Ridge	Bifurcation
3	Ending Ridge	Ending Ridge	Bifurcation
4	Bifurcation	Ending Ridge	Bifurcation
5	Bifurcation	Ending Ridge	Ending Ridge
6	Not encoded	Dot	Top part of enclosure
7	Not encoded	Ending Ridge	No ridge deviation at this location
8	Not encoded	Dot or Short Ridge	No ridge deviation at this location
9	Not encoded	Ending Ridge	Bifurcation
10	Not encoded	Ending Ridge	Ending Ridge
11	Not encoded	Ending Ridge	No ridge deviation at this location
12	Bifurcation	Ending Ridge	Bifurcation
13	Ending Ridge	Bifurcation	Ending Ridge
14	Not encoded	Bifurcation	No ridge deviation at this location
15	Not encoded	Bifurcation	Bifurcation

(1) Derived from written descriptions presented by FBI to SNP on April 21 [App.B].

(2) Derived from examination of Daoud exemplars.

accordingly, the "quality" of the agreement was inadequate to support the conclusion of identification.

6. Failure to reexamine LFP 17 following the April 13 Negative Report

The April 13 Negative Report provided an early warning to the FBI Laboratory that it had erred in identifying Mayfield and a corresponding opportunity to take a fresh look at the Mayfield identification. Although the meaning of the term "negativo" in the report was unclear to the FBI Laboratory, it was clear that the SNP Forensic Laboratory had at least preliminarily disagreed with the FBI's conclusions. The OIG found no evidence, however, that the FBI Laboratory adequately explored the possibility that it had erred in identifying Mayfield. Although Green and Wieners stated they took another look at the identification, they did not attempt to find out the basis of the SNP's doubts before reiterating their conclusions. Instead, Laboratory personnel told the Counterterrorism Division (CTD) on April 15 that they were "absolutely confident" in the identification. The demand for the April 21 meeting in Madrid between Wieners and the SNP came not from the Laboratory, but rather from the CTD, the FBI Portland Division, and the United States Attorney's Office (U.S. Attorney's Office). Wieners told the OIG that his purpose in making the trip to Madrid was to explain the FBI's position, and he did not expect the SNP to make its own presentation. If so, it appears that Wieners did not view the meeting as an opportunity to learn more about the SNP's position in order to inform the Laboratory's own reconsideration of the identification.

The OIG believes that the Laboratory's overconfidence in the skill and superiority of its examiners prevented it from taking the April 13 Negative Report as seriously as it should have. A better response to a conflicting determination by another forensic laboratory would have been, first, to determine the complete basis for the other laboratory's disagreement *before* committing anew to the validity of the original determination and, second, to arrange for a fresh examination of the relevant prints by a new examiner who had not previously committed himself to a particular conclusion. The FBI failed to take both these steps.

B. OIG Assessment of Other Potential Sources of Error

In this section, the OIG addresses three additional factors that potentially affected the erroneous identification of LFP 17. The OIG did not find sufficient evidence to conclude with certainty that these factors specifically contributed to the error in this case. We determined, however, that the possibility that these factors could contribute to erroneous identifications in future cases merited specific discussion in this report and recommendations for action by the LPU.

1. Ridgeology versus Numerical Standards

In light of the ongoing debate regarding Ridgeology versus Numerical Standards, the OIG addressed two questions. First, was the erroneous identification attributable to the application of the Ridgeology standard, as required under the Examination SOPs and the SWGFAST Methodology and Standards? Second, would the error have been prevented by the application of a more objective Numerical Standard requiring a minimum number of Level 2 details in agreement?

Many advocates of a Numerical Standard consider 12 points in agreement to provide an adequate margin of safety.¹²⁵ A 12-point standard has been advocated at least since 1914, when it was proposed by Dr. Edmond Locard.¹²⁶ In the Mayfield case, the FBI Laboratory claimed that it found at least 15 Level 2 details in agreement, and charted these points in enlargements for the SNP within a week of the identification. It therefore seems likely that even if the FBI had formally adopted a 12-point standard rather than the Ridgeology qualitative-quantitative approach, the FBI examiners would likely have made the erroneous identification anyway. Indeed, one might conclude that the Laboratory in effect *did* apply a Numerical Standard by citing 15 Level 2 details as the basis for its conclusion in the affidavit submitted in support of the material witness warrant.

The difficulty with this assessment is that there were not, in fact, 15 Level 2 minutiae in agreement. As previously demonstrated, comparison of the latent print with the known print of the true source, Daoud, reveals that only 10 of the features originally plotted by Green were in fact attributable to ridge deviations on the fingers of the true donor. The other five were, at most, distortions or breaks in the reproduction of ridges that the examiner appears to have identified as matching details as a result of a faulty process of circular reasoning. Moreover, of the 10 remaining points, the examiners were unable to accurately identify the type of point (e.g., bifurcation versus ridge ending) in 7 cases. Due to the ambiguity as to the type of minutiae being observed in the latent print, most of these points should only have been counted as being in "partial" agreement with Mayfield's prints. Further, although these 10 points were in general agreement as to relative positioning and intervening ridge count, there were subtle differences in ridge flow and the distance between the points which further undermined the quality of the agreement. Thus, OIG

¹²⁵ See, e.g., Stoney, § 27-2.1.2[5] and note 20.

¹²⁶ Christophe Champod, "Edmond Locard – Numerical Standards & "Probable" Identification," *Journal of Forensic Identification*, Vol. 45, No. 2, March/April 1995, p. 136. Locard proposed permitting identification on as few as eight points in special circumstances involving particularly clear prints and other factors. *Id.*

consultant Dusty Clark, who is a well known advocate of the Numerical Standard approach, gave his opinion that, properly applied, a 12-point standard would have prevented the Mayfield error because in reality there were not 12 points in adequate agreement.

The Mayfield error also offers support for the argument that the error was not a failure to apply an objective numerical standard, but rather a failure to apply Ridgeology. The Ridgeology approach, as described by Ashbaugh, stresses consideration not only of Level 2 minutiae but also of the more subtle considerations of ridge paths and measurement *between* ridge deviations.¹²⁷ As shown in Section II.A.4 above, there were many subtle differences of this type between LFP 17 and the Mayfield prints that the examiners either overlooked or rationalized. The FBI examiners appear to have been heavily influenced by the similarity in the relative location of Level 2 ridge deviations and the ridge counts between them, to the detriment of giving adequate weight to the more subtle differences occurring in the portions of the prints lying between the ostensibly similar points. An adherent of Ridgeology might well attribute this failure to appreciate subtle differences to an excessive focus on the accumulation of points. OIG consultant John Vanderkolk, who is a prominent advocate of the Ridgeology Standard who consulted with the OIG, agreed with this assessment.

The OIG concluded that the source of this error was not the failure of the examiners to apply one standard or another (Ridgeology versus Numerical). We believe that the errors committed by the examiners would have led to an incorrect result no matter which standard was incorporated into the Examination SOPs. The process of circular reasoning that contributed to the error in this case was not a function of either of these standards. Further, the choice of standard would not affect the “one discrepancy rule,” which should have precluded the identification of Mayfield. Neither standard would permit the examiner to adopt rationalizations for numerous dissimilarities that required the acceptance of extraordinary coincidences. In addition, either approach would permit the consideration of Level 3 detail under circumstances of a high-clarity latent print, but neither approach would have explicitly permitted the examiners to rely on a few selected Level 3 details in a print so lacking in clarity.

That being said, the OIG believes that a more objectively defined criteria for declaring an identification could help prevent future misidentifications. The Ridgeology Standard embodied in the SWGFAST Standards for Conclusions states only that “the standard for individualization is agreement of sufficient friction ridge details in sequence.” The OIG believes that the absence of any

¹²⁷ See, e.g., Ashbaugh 1999 at p. 141.

further objective definition or guidelines for determining sufficiency, in terms of both quantity and quality, heightens the danger that an examiner will be unduly swayed by an initial or “gut” reaction, or will fail to factor in an adequate margin of safety in a close case. The OIG’s recommendation regarding the development of such criteria is discussed in Chapter Five.

2. Independence of FBI verification procedures

Several members of the International Panel suggested that the verifications of Green’s identification by Massey and Wieners were “tainted” by a mindset in which “[t]o disagree was not an expected response.”¹²⁸ Several panel members also called into question the “independent nature of the verification employed by the LPU.”¹²⁹ This appears to be a reference to the fact that verifiers are made aware that an identification has already been made by a prior FBI examiner at the time they are requested to conduct the verification, contributing to the expectation that the second examiner will concur with his colleague. Several members of the Panel recommended that the FBI Laboratory do more to foster independent verifications in which the second examiner feels free to challenge an identification. At least one expressed concern that a “bench-level” verifier might not feel comfortable disagreeing with a supervisor’s identification.¹³⁰

It was difficult for the OIG to assess whether the FBI’s verification procedures contributed to the Mayfield error, primarily because the verifier, John T. Massey, declined to be interviewed for this investigation, and because he created no documentation reflecting the mental processes that led to his conclusion of individualization. (The International Panel faced the same obstacle.) Information provided by other witnesses, however, does not show that Massey conducted a superficial examination or that he merely “rubber stamped” Green’s identification. To begin with, the OIG found no evidence that Massey’s verification was hasty or based on a superficial examination. Wieners told the OIG that Massey waited to see Mayfield’s original inked prints from the FBI’s Criminal Justice Information Services Division (CJIS) rather than rely on

¹²⁸ Stacey, 2004 at 714; Alan McRoberts, “International Expert Review of the FBI-LPU Madrid Bombing Latent Fingerprint Examination” (unpublished), 2004, p. 2; Ron Smith, pp. 2-3.

¹²⁹ Frank Fitzpatrick, untitled report regarding Madrid case (unpublished) (2004) p. 1; C. Lee Fraser, “FBI Erroneous Identification – Committee Assessment” (unpublished), p. 4; Ron Smith, pp. 2-3; Bruce Grant, “International Latent Print Panel Review of the FBI Laboratory Latent Print Unit fingerprint examination in the Madrid Bombing Case” (unpublished), 2004, p. 3.

¹³⁰ Fitzpatrick, p. 2.

the digital printouts or screen images available at the Laboratory before making his decision.

Massey was a retired examiner from the FBI Laboratory, but was serving as a contract examiner. Wieners selected Massey to act as the verifier because of Massey's extensive experience and skill. Massey did not depend on Green for assignments, reviews, or promotions. Several examiners interviewed by the OIG said that Massey would not allow his examination of the prints to be influenced by the fact that another FBI examiner had made the identification.

However, LPU Unit Chief Wieners told the OIG that his knowledge of the conclusions reached by Green and Massey *did* bias his own review of the print, because of his high regard for the skills of Green and Massey. At the time of the original identification, Wieners did not perform a complete ACE-V examination of the prints, but rather reviewed the results reported by Green and Massey and concurred with them. Wieners' admission reveals little about the impact of the FBI's verification procedures, however, because he was not required by any policy to perform a verification and was not acting as a formal verifier.

In considering whether the FBI's verification procedures contributed to the error, the OIG found it significant that the court-appointed expert, Kenneth Moses, reached the same conclusion as the FBI examiners regarding the identification. The pressures that might cause an FBI Laboratory examiner to hesitate to dispute an identification by one of his colleagues in the LPU obviously should not have impacted Moses' impartiality. Moses was specifically appointed to conduct an independent review of the identification.

Thus, the OIG did not find sufficient evidence to conclude that the FBI's verification procedures introduced a bias that prevented or discouraged Massey from challenging Green's conclusions with respect to the identification of LFP 17.

Nevertheless, other information made available to the OIG raises the possibility that the existing verification procedures may provide insufficient assurance that complete, independent, and unbiased second examinations are conducted in connection with every identification.

First, all of the FBI examiners interviewed by the OIG indicated that it is an extremely unusual event for a second examiner to decline to verify an identification. The verifier begins his examination with the knowledge that another FBI examiner has already made the identification. We believe that this information could consciously or subconsciously influence the verifier in favor of identification.

In addition, under the LPU Quality Manual, Procedures for Reviewing a Report of Examination, any difference in conclusion between an examiner and a verifier must be referred to a supervisor or Unit Chief for resolution. The resolution of such a dispute could implicitly involve a determination that one of the examiners committed an error. This may create an additional disincentive for a verifier to decline. LPU Unit Chief Wieners told the OIG that since he became Unit Chief in 2001 he has never had to resolve such a dispute, although his unit had completed thousands of identifications in that time. This may reflect the exercise of caution by initial examiners who know their work will always be checked, but it may also reflect that the verification phase of ACE-V is not serving as a significant screen.

As described in Chapter Five, the LPU is making major changes to its verification procedures. The OIG's assessment of these changes, and recommendations for further changes to the LPU verification procedures, are discussed in Chapter Five as well.

3. Pressures of a terrorism investigation

Several members of the International Panel suggested that the pressure of working on a high-profile terrorism case created an atmosphere which contributed to the misidentification.¹³¹ In considering this possibility, the OIG recognized that the FBI Laboratory works on many high-profile matters without committing errors. The pressure to identify LFP 17 was no greater than the pressure to identify the other seven latent prints submitted by the SNP for which Green conducted unsuccessful IAFIS searches. Again, it was the unusual similarity of up to 10 Level 2 details in the prints that initially misled Green and led to the other errors.

Yet, there is one respect in which the OIG believes the nature of the crime could contribute to an error of this type. As noted in Chapter Three, the FBI Laboratory's criteria for reaching an "inconclusive" result apparently precludes such a result in cases such as this one in which both the latent print at issue and the known prints of the subject are deemed to be of sufficient quality for comparison. According to the FBI examiners interviewed by the OIG, when an FBI Laboratory examiner is unable to effect an identification or an exclusion, the usual practice is to declare the latent print to be of "no value." As noted in footnote 85 above, the LPU primarily uses the "inconclusive" result when there is an absence of relevant detail in the exemplar print. The LPU typically does *not* alert the submitting agency or the investigating unit of the FBI that there was a potential suspect who could not

¹³¹ See, e.g., McRoberts, pp. 1-2; Fraser, p. 2.

be identified due to the insufficiency of unique detail, but who also could not be excluded.

The OIG consultants agreed that, in the case of a particularly heinous crime and a comparison of a single print in which there are ambiguities such that the examiner has insufficient confidence to reach a conclusion of identification, this circumstance could create pressure on the examiner to declare an identification when he should not. Fear of failing to identify a terrorist could push an examiner to make a false identification in a close case.

One possible means of preventing this kind of pressure from pushing an examiner to make a borderline identification would be for the examiner and the Laboratory to recognize the option of utilizing the “inconclusive” category in such cases. This conclusion would alert the relevant investigating authorities that there was a particular subject who could neither be included nor excluded as the donor of the print. It would be different from a “no value” determination, which suggests that the print itself was not suitable for comparison to any subject. The investigating authorities could then make an informed decision regarding whether to take additional investigatory steps with regard to the potential subject. According to the OIG’s consulting examiners, all of whom are members of SWGFAST, the SWGFAST Method and the SWGFAST Standards would permit this use of the “inconclusive” result. The conclusion would not have to be couched as a “probable or possible identification” (which is prohibited under the SWGFAST Method and Standards), but merely as “unable to identify or exclude.” This recommendation is discussed further in Chapter Five.

C. The Role of Mayfield’s Religion in the Identification

The OIG examined the allegation made by some individuals, and in Mayfield’s civil action, that knowledge of Mayfield’s Muslim faith may have influenced the LPU’s examination of LFP 17 and the Mayfield exemplar prints. The OIG determined that Mayfield’s religion was unknown to the FBI Laboratory on March 19, when the Laboratory made the initial identification. The FBI identification records available to Green, Massey, and Wieners at that time only revealed the candidate’s name, arrest record, and the fact that he had been fingerprinted at a military installation. Nothing on the FBI identification record indicated Mayfield’s religion, current employment, or whereabouts, or the fact that he was married to an Egyptian immigrant. The OIG found no evidence that the FBI had knowledge of Mayfield’s religion until the Portland Division learned this fact in the early stages of the field investigation, after the identification had been made and verified in the LPU.

The question of whether Mayfield's religion was a factor in the Laboratory's failure to revisit the identification and discover the error in the weeks following March 19 is more difficult. By the time the SNP issued its April 13 Negative Report, the Laboratory examiners had become aware of information about Mayfield obtained in the course of the Portland Division's investigation, including the fact that Mayfield had acted as an attorney for a convicted terrorist, had associations with other subjects of FBI terrorism investigations, and was himself a Muslim. Wieners candidly admitted that if the person identified had been someone without these circumstances, like the "Maytag Repairman," the Laboratory might have revisited the identification with more skepticism and caught the error.

The OIG concluded that Mayfield's religion was not the sole or primary cause of the FBI's failure to question the original misidentification and catch its error. We concluded that the primary factors in the FBI's failure to revisit the identification before the SNP identified Daoud were the unusual similarity between LFP 17 and Mayfield's prints and the FBI Laboratory's faith in the expertise and infallibility of its examiners and methods. However, we believe that Mayfield's representation of a convicted terrorist and other facts developed during the field investigation, including his Muslim religion, also likely contributed to the examiners' failure to sufficiently reconsider the identification after legitimate questions about it were raised.

D. Explanations Found by the OIG Not To Have Contributed to the Error

The OIG found that several explanations for the error proposed by various sources were not persuasive. Several of these explanations were offered by the FBI during the time shortly after the misidentification was discovered. Others were suggested by the International Panel or in the press.

1. Lack of access to the original evidence

At various times beginning shortly after the discovery of the error, FBI officials have stated that the error was caused in part by the fact that the Laboratory did not have access to the original evidence (the plastic bag on which LFP 17 was found). The New York Times reported that, according to a congressional aide, FBI "senior officials" emphasized that the FBI made repeated unsuccessful requests to the SNP for the best possible evidence. This theme was also reflected in several versions of draft talking points prepared for the Director of the Laboratory for use in Congressional briefings.

LPU Unit Chiefs Meagher and Wieners told the OIG that if the FBI examiners had obtained access to the plastic bag on which the fingerprint was

found, they would have determined from the positioning of three latent prints (LFPs 17, 19 and 20) that LFP 17 was deposited simultaneously with two other latent prints in a single grasp of the bag. Wieners and Meagher claimed that from this information the Laboratory would have determined that LFP 17 was in fact made by a right middle finger and therefore would not have been matched to Mayfield's left index finger. Moreover, the Laboratory determined in March that LFP 20 was not made by Mayfield. Seeing the bag, the argument goes, would have enabled the examiners to determine that the same person made both LFP 17 and LFP 20. Since Mayfield did not make LFP 20, he would not have been identified as the source of LFP 17.

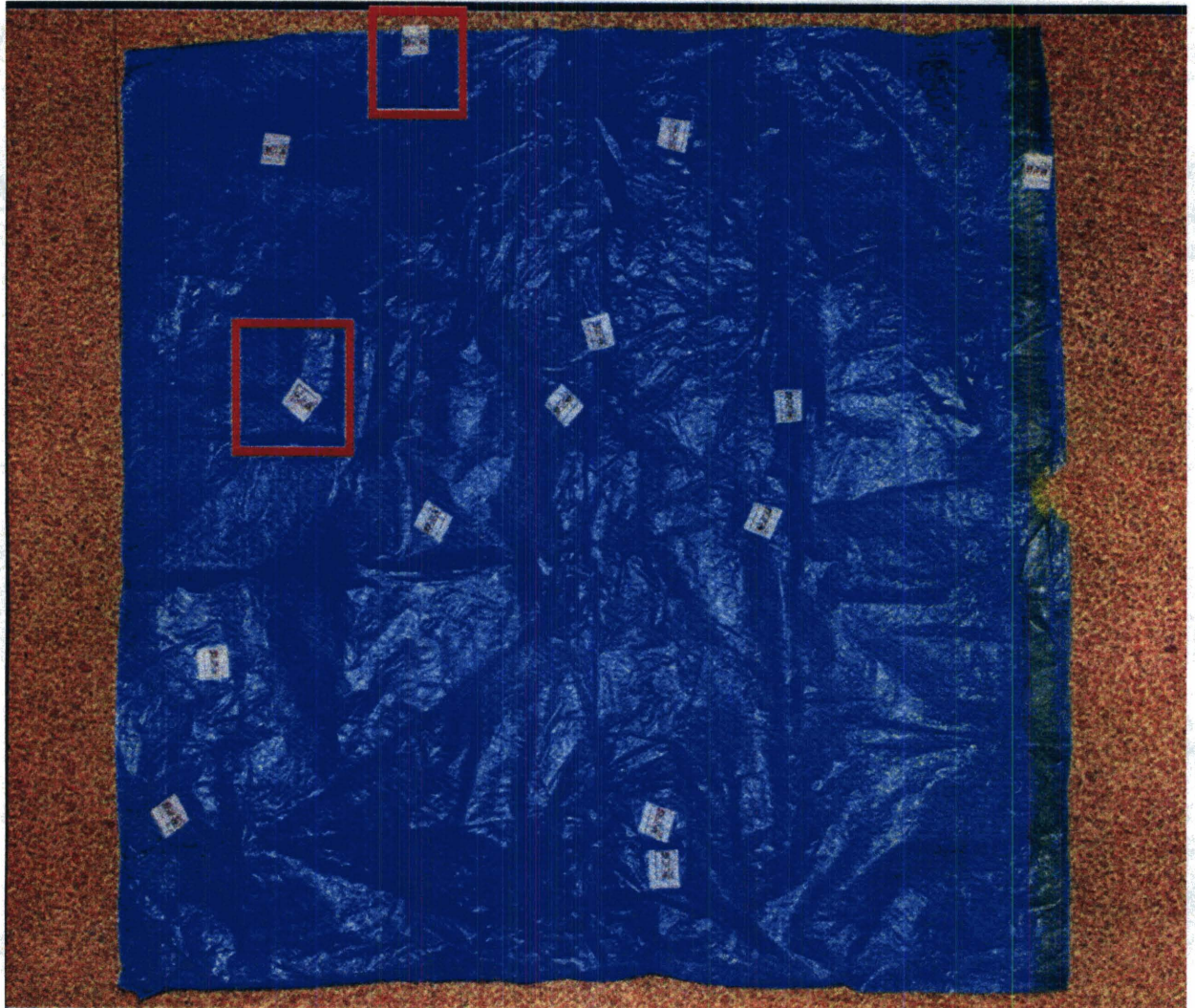
The OIG reviewed the evidence and concluded that, contrary to these claims, having access to the bag would not necessarily have prevented the LPU from identifying Mayfield. Photographs of the bag demonstrate that the three latent prints in question were located spaced apart on the flattened bag, not immediately adjacent to one another. (See Figure 10.) Green told the OIG that in the case of a plastic bag that is laid out for processing, it is difficult to determine with certainty whether prints deposited at different locations on the bag were simultaneous prints of a single individual. SNP representatives acknowledged that there was no way to reconstruct the configuration of the bag as it was found in the van.

The OIG did not find convincing evidence that a conclusive finding of simultaneity could be made from the positioning or appearance of the latent prints on the plastic bag. The OIG found that no such conclusion was ever reached by any FBI examiner in this case. LPU Unit Chief Wieners reported that another LPU examiner made a determination that the prints were deposited simultaneously during his May 22 trip to Madrid, when he inspected the bag (which had been marked to show the location of the prints). This examiner told the OIG that he never made his own analysis of the simultaneity issue and merely concluded that the SNP's hypothesis of simultaneity was plausible. The OIG consultants were in agreement that the arrangement of fingerprints on the bag did not compel a conclusion that the prints were deposited by a single person. The hypothesis that they were deposited in a single grasp of a rolled or crumpled plastic bag was certainly plausible, but there were also other plausible ways that three latent prints could have been deposited on a plastic bag in that pattern at different times or by different persons.

The SNP apparently made a determination of simultaneity only in conjunction with the comparison of LFPs 17 and 20 with the known prints of Daoud. An SNP Laboratory Section Chief told the OIG that the positioning of the prints alone, without identification of the prints to Daoud, would not have provided a sufficient basis for a finding of simultaneity. In other words, the

FIGURE 10

Photograph of Blue Plastic Bag, Showing Locations of LFP 17 (Near Top Edge) and LFP 20



hypothesis of simultaneity resulted from the identification of both prints to Daoud rather than the other way around.

Assuming that the examiner had initially adopted the hypothesis that LFP 17 was deposited simultaneously with LFPs 19 and 20, this theoretically could have led an examiner to specify a particular digit (right middle) as part of the initial IAFIS search. Green told the OIG, however, that if he had had any doubt about whether the prints were simultaneous, he would *not* have limited his IAFIS search to a single digit. There is no SOP requiring that the examiner use such a limitation. Because LFP 17 was a relatively rare arch pattern, Green was able to conduct a search of the Criminal Master File without limiting his search parameters to a particular digit.

Even assuming that Green would have initially specified a right middle finger for the IAFIS search, no identification would have been made. At that stage, the examiner would be faced with either abandoning the effort to identify this print or broadening the IAFIS search to include other digits. The latter course was the more likely in light of the gravity of the investigation and the uncertainty of the simultaneity hypothesis. In that event, IAFIS would have retrieved the Mayfield known prints and the same chain of events that ultimately led to Mayfield's identification could have been triggered.¹³²

The OIG also found it significant that at the time of the original identification of Mayfield, the FBI examiners did not consider access to the bag to be a necessary prerequisite to making an identification. Although at least one request was transmitted by LPU Unit Chief Wieners to INTERPOL for access to the "original evidence," Wieners told the OIG that he did not expect the SNP to give up custody of a key piece of evidence, and he was not surprised when it did not. Had the Laboratory considered such access to be essential to completing the identification, it could have informed the SNP that it had a potential match but that a final determination required access to the evidence. When Wieners traveled to Madrid in April to meet with the SNP, he did not request to examine the original evidence.¹³³

¹³² Wieners told the OIG that LFP 17 and LFP 20 were similar in tone and ridge width, further supporting the hypothesis of simultaneity. The same can be said of the two portions of LFP 17 (the center and the upper left) that the Laboratory concluded were made by separate touches, possibly by different persons, in order to explain a dissimilarity in the upper left part of the same print. Assuming the Laboratory would apply the same logic with regard to the simultaneity question that it applied to the dissimilarity in the upper left portion of LFP 17, the Laboratory would have readily attributed LFP 20 to a separate, non-simultaneous touch by a different person once it found that LFP 20 did not match Mayfield.

¹³³ According to the Laboratory, the Madrid Legat advised Wieners to make his presentation to the SNP without making any requests. In addition, Wieners told the OIG that he did not wish to irritate the SNP and that he did not consider access to the evidence to be necessary at that time because the Laboratory had already reached its conclusion.

Within a few weeks after the Laboratory's error was discovered, Laboratory spokespersons began emphasizing that the FBI Laboratory was solely responsible for the error and that no blame should be assigned to the SNP. The FBI witnesses interviewed by the OIG did not fault the SNP for declining to provide the plastic bag to the FBI Laboratory. Nevertheless, Unit Chiefs Meagher and Wieners continued to assert in their interviews with the OIG that access to the bag would have prevented the error. For the reasons stated in this section, the OIG did not find this explanation to be persuasive. We recognize that as a general rule it is better for the FBI Laboratory to have access to the evidence on which an original fingerprint is deposited when making a latent fingerprint examination. But we believe that the question of access to the evidence should not distract the Laboratory from the methodological errors that were the ultimate cause of the misidentification.

2. Image quality

In a press release issued on May 24, the FBI attributed the erroneous identification to an "image of substandard quality." Laboratory Director Adams stated in a conference call with U.S. Attorney Immergut and Assistant Attorney General Wray that day that the problem was caused by the FBI's use of a third-generation image. Consistent with this explanation, on May 25 Wieners drafted a Concept Paper for the International Panel that included, among the proposed topics for consideration, "[t]he effects of digital capture and transmission on friction ridge detail." On May 27, Green signed a memorandum to the Acting Section Chief in charge of the LPU attributing his error in part to "the quality of the image," which Green told the OIG was a reference to the potential for distortion resulting from the use of a digital image that had been compressed for transmission.¹³⁴

However, this explanation was not supported by the evidence. The digital image used to identify Mayfield had a resolution in excess of 1,000 pixels per inch. This degree of resolution satisfied the threshold provided in the SWGFAST Friction Ridge Digital Imaging Guidelines. LPU Unit Chief Meagher described 1,000 pixels per inch as the resolution threshold preferred by the LPU.

The question remains whether there was degradation of the image in the process of digitizing it that contributed to the error. The OIG consultants agreed that, although there is a modest difference in clarity between the digital

¹³⁴ One difficulty with the "image quality" explanations is that at the time they were proposed, the FBI did not know whether the digital image was materially different from the original photographic image used by the SNP. As previously noted, the FBI did not see a copy of the print from the original negative until June 9.

image of LFP 17 used to identify Mayfield and the photographic print that was later made available by the SNP, this difference was not decisive because there was ample quantity and quality of detail in the digital version to permit the examiner to avoid the error. All of the members of the International Panel concurred in the finding that “the quality of the images that were used to make the erroneous identification was not a factor.”¹³⁵

The FBI examiners interviewed by the OIG also agreed that the Mayfield error was not attributable to the use of a digital image of LFP 17. Green told the OIG that he did not believe that it would have changed his examination to have had access to the photographic version of LFP 17 that the SNP later provided. LPU Unit Chief Wieners stated that the increased clarity of the photographic image made it easier to track the ridges from the center of the print into the upper left portion, and thus to see that the upper left was not a separate touch.¹³⁶ Although Wieners stated that the photographic image was superior, he stated that he did not think that the use of digital media was a major factor in the error.

In light of the virtual unanimity of opinion among examiners inside and outside of the FBI Laboratory, including the International Panel and the OIG consultants, the OIG concluded that the quality of the digital image used by the Laboratory to identify Mayfield was not a cause of the error.

We also concluded that the reason the FBI offered this flawed explanation in the period immediately after the error was discovered was that there was a misunderstanding or miscommunication between the LPU examiners and Laboratory management regarding what the LPU examiners told them early on May 24. Although Unit Chief Meagher expressed concern during the overnight review that the Laboratory had not seen the original fingerprint on the plastic bag, the FBI examiners had not yet determined whether the image available to the SNP was significantly better than the image used to identify Mayfield. Adams also apparently misunderstood what the LPU examiners saw in Madrid on May 22. As noted in Chapter Three, they only saw better quality exemplar prints for Daoud during that trip, not a better quality image of the latent fingerprint.

We found that the LPU examiners who could have corrected this misunderstanding (Meagher, Wieners, Green, and the examiners who traveled to Madrid) were not involved in subsequent briefings of senior FBI management

¹³⁵ Stacey, p. 714.

¹³⁶ The OIG consultants and International Panelist Ken Smith demonstrated to the OIG how the ridges could also be tracked continuously from the center of the print to the upper left using the digital image.

or in the preparation of the FBI's press release or Director Adams' statements for Congress regarding the causes of the error. The suggestion that the FBI was using an inferior quality image to that available to the SNP was an easily understandable explanation, and an attractive one for the FBI to disseminate immediately after the error was discovered, but it was not supported by the evidence in this case. By May 26, the matter was clarified and the FBI stopped using the "image quality" explanation for the error. As noted above, after obtaining the best available quality photographic image of LFP 17 from the SNP in June, the FBI did not revive the "image quality" explanation for the error.

However, we believe that the foregoing explanations for how FBI spokespersons misunderstood the "image quality" issue do not apply with respect to Green's May 27 memorandum to the Acting Section Chief, which also referenced "the quality of the image" as a source of the error. Green should have been aware, as a result of the May 23-24 overnight review, that the FBI Laboratory had never seen a better image of LFP 17 than the one used to identify Mayfield and that there was no basis for his speculation that the error was caused by image distortion.

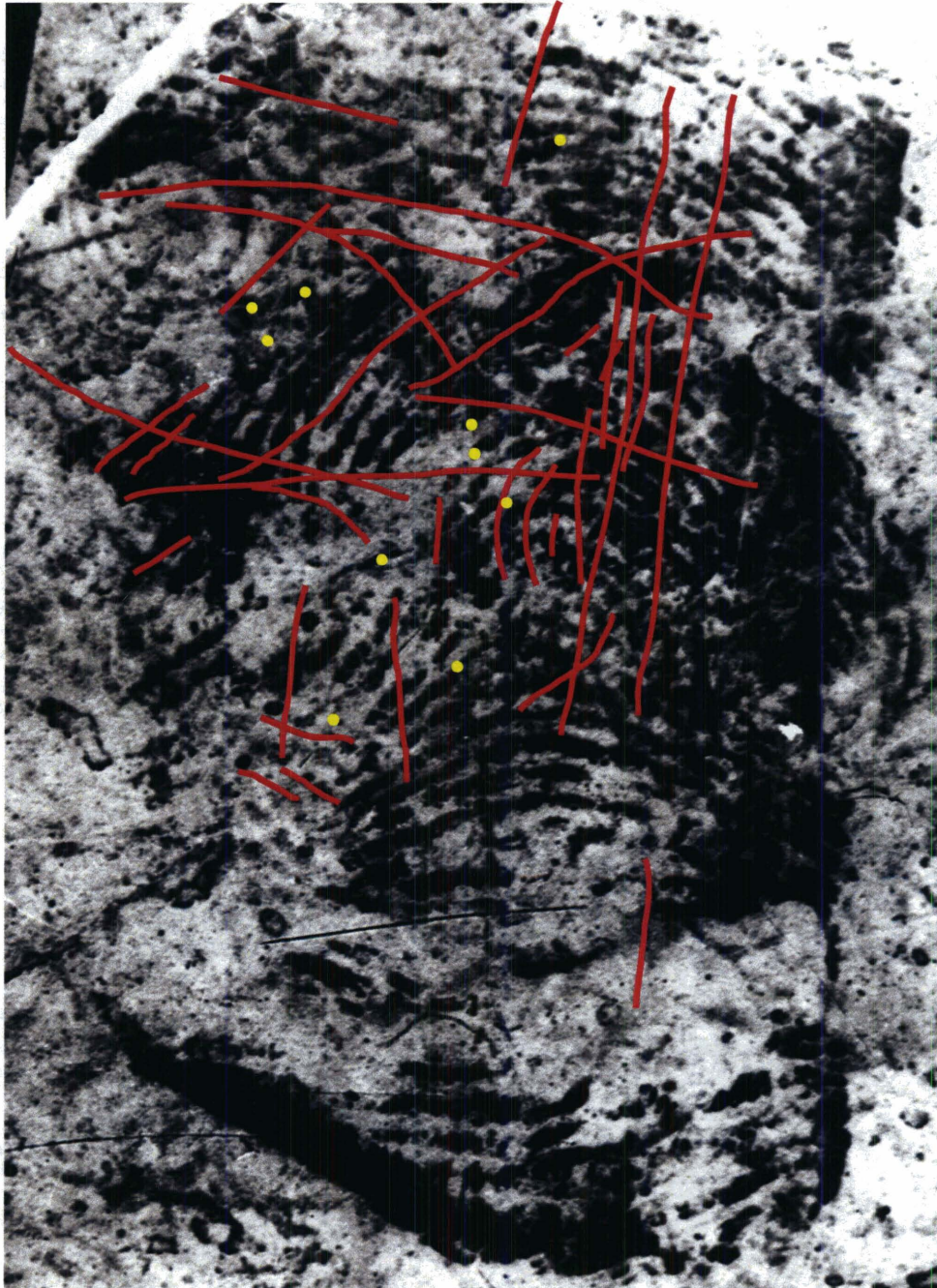
3. Failure to detect interruptions in ridge flow

Another explanation offered by Laboratory officials for the misidentification was that LFP 17 was so divided by creases and separations that the contiguous areas of the print had too few details to support an identification. Following the May 23-24 overnight review of LFP 17, LPU Unit Chiefs Meagher and Wieners prepared an explanation for the Laboratory's "no value" determination stating that "the latent print was divided by many lines of demarcation possibly caused by creases in the plastic bag, multiple touches by one or more fingers, or both. Based on the lack of sufficient quality and/or quantity of ridge detail in any one area of the latent print, a no value determination was made." This explanation was cited in the government's Motion To Dismiss the Material Witness Proceeding filed on May 24.

Laboratory Director Adams elaborated on this explanation in an interview with the OIG. Adams stated that because of these separations and interferences in the print, there were not enough points within any contiguous area within the print to effect an identification. He stated that Green's error was in failing to realize this when he was analyzing the latent print to determine if it was of sufficient quality for further processing. Similar issues were raised in the PowerPoint presentation made to the International Panel. Figure 11 is an illustration used in the PowerPoint presentation. It shows over 30 different lines drawn to indicate interruptions in the ridge flow.

FIGURE 11

Interruptions to Ridge Flow



The difficulty with this explanation for the error and with the Laboratory's "no value" determination was that the Laboratory was forced to rescind it a few weeks later when it identified Daoud as the source of the print. This change in conclusions cannot fully be explained by the photographic image used to identify Daoud that the SNP provided to the Laboratory in June. As discussed in the previous section, the difference in clarity between the digital image used to identify Mayfield and the photographic image later provided to the Laboratory was not a cause of the error. The FBI has never claimed that the interruptions to ridge flow that appeared in the digital image were caused by the digital photography or that they disappeared once a photographic image became available. Three different examiners later identified Daoud as the source of LFP 17 and were each able to chart approximately 20 points of similarity in locations throughout the print despite the interruptions to ridge flow.

Wieners and Meagher both suggested that the event that made it possible for the LPU to revise its "no value" determination to an identification of Daoud was information obtained from the SNP during a meeting in Madrid on June 9. But Meagher and Wieners did not identify any specific information that was provided by the SNP at the June 9 meeting that eliminated the problem of interruptions to ridge flow. Indeed, the LPU examiner who verified the identification of Daoud in late June did not attend the meeting in Madrid and told the OIG that the only thing he recalled that Meagher told him as background information was the processing method (superglue and dye) and the possibility that LFP 17 and LFP 20 were deposited simultaneously. The verifying examiner also told us he made his identification decision without assuming simultaneity. It is therefore apparent that he did not need any information about the print that was not already available to the LPU before the June 9 meeting to make the identification of Daoud, and that the separations and interferences in the print were not an obstacle to the identification.

The OIG reviewed Figure 11 and the "no value" determination with its expert consultants. The OIG consultants all stated that the identification of Daoud was possible based on the same digital image that the LPU used to identify Mayfield, notwithstanding the interruptions to ridge flow. John Vanderkolk told the OIG that he was disturbed by Figure 11 and the suggestion that discontinuities within the print contributed to the error by limiting the continuous areas in the print to small areas. In many cases the ridges continue on both sides of the marked discontinuities or interferences. Vanderkolk stated that this latent print did not have an unusual number of these kinds of "red flags," and that he felt that Figure 11 was misleading. If the discontinuities should have precluded the identification of Mayfield, they should also have prevented the identification of Daoud. But the OIG consultants all stated that the Daoud identification was not difficult.

In short, the OIG concluded that the interruptions and separations in the print did not make it “unsuitable for comparison” and the failure to recognize these separations and interruptions was not a significant cause of the error.

4. Whether LFP 17 was of “no value” because it could “work with” two different people

Another suggestion discussed within the FBI during the immediate aftermath of discovering the mistake was that LFP 17 should have been declared of “no value” because it could be matched to two different candidates, Mayfield or Daoud. Green told the OIG this was the basis of the statement in his May 27 memorandum that he should have declared the print to be of “no value.” Wieners told the OIG that during the May 23-24 overnight review, Meagher stated LFP 17 should be declared to be of “no value” because it could be “made to work” with *either* Mayfield or Daoud. Contemporaneous documents indicate that this reasoning was also provided by the Laboratory during one or more internal government briefings regarding the error.

This explanation, if accurate, would raise difficult a question about latent fingerprint identification. If LFP 17 could be “made to work” with the known prints of two different people using accepted fingerprint identification methods and standards, the question arises: are such methods and standards preventing false identifications in other cases? In the Mayfield case, by good fortune, the known prints of both subjects eventually came to the attention of the FBI. There is no way for the Laboratory to determine from an initial analysis of a latent that it might “work with” more than one person’s fingerprints in this scenario. If the known fingerprint from only one potential subject is available for comparison, the potential for an erroneous identification is apparent.

We identified in the previous sections of this report several causes for the error. One of these causes – the unusual similarity of the prints – was outside the control of the examiners. The other causes involved mental processes, such as circular reasoning and rationalizing differences in appearance, that have been cited as potential causes of error in the literature on latent print identification, and that could have been avoided through the application of a more rigorous approach. The OIG found that LFP 17 could not “work with” both Mayfield and Daoud because, among other things, there were many differences in appearance between LFP 17 and the Mayfield print that could not be adequately explained.

The OIG recognizes that the Laboratory’s “no value” determination was made early in the morning on May 24 under circumstances of extraordinary stress and pressure. The examiners involved in the overnight review had been

instructed to provide a definitive answer first thing in the morning for a Director's briefing but had been unable to reach consensus on the result. The examiners were justifiably concerned with avoiding making another error in haste and compounding the problem that the Mayfield case was likely to cause for the Laboratory and the discipline.

The differences between the Mayfield prints and LFP 17 that seemed apparent to the International Panel and the OIG's consultants in a retrospective review conducted without time pressure were not so obvious to FBI examiners working under very different circumstances. The OIG also believes that at the time of the "no value" determination, the examiners involved in the reexamination had not yet fully accepted that the Laboratory could have identified the wrong person as the donor of a latent fingerprint, and the "no value" determination was in a sense an intermediate point in the process of correcting the error. The "no value" result was a means for the Laboratory to provide a conclusion under the pressure of time consistent with conventional latent fingerprint identification terminology. It was a highly unsatisfactory result, however, in that it left Mayfield under an unfair continuing cloud of suspicion because he had not formally been excluded as the donor of the print. It also left the SNP in the position of having its identification of Daoud undermined by the FBI's public declaration that LFP 17 was of no value for identification.

5. Excessive faith in IAFIS technology

Some members of the International Panel suggested that the FBI's faulty examination of LFP 17 stemmed from the suggestive power of the IAFIS results. For example, panel member Alan McRoberts stated that "the AFIS suggestion of a candidate with some similarities to the evidence print" contributed to a "mind-set" of identification.¹³⁷ Panel member Ron Smith likewise suggested that the examiners' "strong belief in the discriminating power of AFIS technology" affected the examiners' subsequent examination.¹³⁸

The OIG found these explanations to be unsatisfactory (or perhaps imperfectly worded) because IAFIS did not "suggest" a single candidate to the FBI examiners. Mayfield's print was the fourth-highest scoring candidate among the 20 candidate prints selected by IAFIS from the Criminal Master File. The examiner (Terry Green) had apparently already declined to declare an identification from among the candidates generated by IAFIS during searches of the Civil File and the Special Latent Cognizant File. Green conducted IAFIS

¹³⁷ McRoberts, p. 2.

¹³⁸ Ron Smith, p. 2; see also Stacey, pp. 712-713 ("[t]he power of the IAFIS match, was thought to have influenced the examiner's initial judgment and subsequent examination").

searches of at least seven other latent prints from the SNP without declaring an identification. As all three FBI examiners were well aware, most IAFIS searches do not result in identifications. The OIG concluded that the examiners were initially misled not by a belief in the discriminating power of IAFIS but rather by the unusual similarity of the Mayfield print to LFP 17. This similarity led Green to the other errors in his examination, including the process of circular reasoning and the adoption of inadequately supported explanations for differences.

6. The LPU verifier's prior errors

Within a few weeks after the misidentification of LFP 17 was discovered, media reports began to appear that John T. Massey, the contract examiner who verified the identification of Mayfield, had previously been reprimanded for erroneous fingerprint identifications. Mayfield's attorneys included this information in the complaint filed in Mayfield's civil action, alleging that Massey was selected to verify the identification because this history of discipline for poor performance would motivate Massey to agree and verify the prior identification.

The OIG obtained the following information from the FBI Laboratory regarding this allegation. Prior to becoming a latent print examiner in 1975, Massey worked as a Fingerprint Clerk in the FBI Identification Division. In this capacity, Massey's job involved comparisons of inked 10-print cards from a person, such as might be obtained pursuant to an arrest or job application, in order to determine whether the individual had a prior arrest record, possibly under a different name. This was in the era before computerized IAFIS searches, and Massey's function involved extremely rapid comparisons of the subject 10-print card with a large number of inked cards already on file. The comparison process for this job bears only superficial resemblance to a latent print examination utilizing the ACE-V process. According to the FBI, this function involved making approximately 60 identification decisions per hour. The function did not involve evidence in criminal prosecutions or courtroom testimony. LPU Unit Chief Wieners, who performed the same kind of work in the Identification Division prior to joining the Latent Print Unit, told the OIG that errors performing this function were "very commonplace."

According to the FBI Laboratory, Massey made three erroneous fingerprint identifications while working for the Identification Division in 1969, 1970, and 1974. The FBI Laboratory did not consider errors of this type to disqualify Massey from selection into the latent fingerprint identification program, which was a competitive process.

Massey's personnel file also indicates that after he transferred into the latent fingerprint training program, his promotion from that program to be an

examiner was delayed in 1976 because of two missed identifications during training. According to the Laboratory, there are no records of any other errors made by Massey during the many years he served as a latent print examiner prior to the Mayfield matter. Massey's performance as a latent fingerprint examiner and his reputation for good work within the LPU were reasons that the Laboratory hired him on a contract basis following his retirement as a full-time LPU examiner.

The OIG concluded that the errors made by Massey more than 30 years ago while performing a substantially different function, as well as the 2 identifications that Massey missed during his training as a latent print examiner nearly 30 years ago, do not indicate that Massey was unqualified to serve as a verifier in the identification of LFP 17. At the time of the Mayfield identification, Massey was performing more casework in his capacity as a contract examiner than either Green or Wieners (who were supervisors), and Massey was selected because of his reputation as a skilled latent print examiner. The OIG concluded that the selection of Massey for this function was not inappropriate or based on any improper motive.

E. Summary of Causes

We determined that the unusual similarity of details on the fingers of Mayfield and the true source of the print, Ouhane Daoud, confused the FBI Laboratory examiners, and was an important factor contributing to the erroneous identification. Ten of the "points" in LFP 17 that the examiners used to identify Mayfield were also later used by different FBI examiners to identify Daoud as the source of the print. These features formed a constellation of points in LFP 17 that was generally consistent with the known fingerprints of *both* Mayfield and Daoud in location, orientation, and intervening ridge counts. This degree of similarity between prints from two different people is an extremely unusual circumstance within the latent fingerprint discipline, and it misled not only the FBI examiners, but also an independent court-appointed latent fingerprint expert.

However, we also found that the FBI examiners committed several methodological errors that compounded the confusion caused by the unusual similarity of the different prints and resulted in the misidentification. First, the initial examiner (Green) applied circular reasoning. Having found as many as 10 points of unusual similarity, he began to reason backward and "find" additional features in LFP 17 that were not really there, but rather were suggested to him by features in the Mayfield exemplar prints. As a result, he erroneously interpreted murky or ambiguous details in LFP 17 as points of similarity with Mayfield's prints. This process of circular reasoning infected the process, particularly in the absence of standards or safeguards requiring the examiner to keep distinct which features were seen in the latent fingerprint

during the analysis and which were only suggested during the comparison. This error likely would have been avoided had the examiner firmly established and documented which features were clearly discernible in the latent fingerprint in the “analysis” phase, before conducting a comprehensive side-by-side comparison. Once Green identified these features as similarities, Wieners accepted them without adequate skepticism.

Second, the examiners relied on Level 3 details under circumstances that did not support the reliability of these features. Although several different examples of Mayfield’s known fingerprints were available to the FBI, some of the details that the FBI examiners considered to be important were only visible on one version of those fingerprints, suggesting the possibility that these details were not reliable characteristics for identification. In addition, the examiners who made the identification appear to have relied on selected Level 3 similarities while dismissing or discounting other apparent pores, ridge edge shapes, and small between-ridge details in LFP 17 that were not in agreement with the known Mayfield fingerprints. We found that the examiners should have had serious doubts whether the clarity of LFP 17 was sufficient to support any reliance on Level 3 detail.

Third, the FBI examiners overlooked or excused a significant number of differences in appearance between LFP 17 and Mayfield’s fingerprints, and they did not apply the “one discrepancy rule” with sufficient stringency to support the degree of certainty required for a conclusion of identification. The upper left portion of LFP 17 was plainly inconsistent with Mayfield’s prints. The examiners accepted a “double touch” explanation for this difference, for which the evidence was mixed at best. This explanation required the examiners to accept an extraordinary set of coincidences. The examiners also had to adopt explanations for numerous other, more subtle differences that may have been individually plausible but that cumulatively required too much rationalization.

Fourth, the FBI examiners failed to assess the poor quality of the similarities that were used to justify the Mayfield identification and give adequate consideration to the incomplete nature of the agreement in points between LFP 17 and Mayfield’s fingerprint. Although there were as many as 10 “points” in LFP 17 that bore an unusual similarity to points in the Mayfield fingerprint in location and ridge count, the limited clarity of LFP 17 prevented the examiners from making an accurate determination of the type of many of these points (whether they were ending ridges or bifurcations). We found that the examiners should have recognized that these 10 similarities had less individualizing power than they would if the type of point had been unambiguously in agreement, and, hence, that they were inadequate to support an identification.

The FBI Laboratory also did not adequately explore the possibility that it had erred when the SNP reported in mid-April that its comparison of the Mayfield prints was “negative.” The FBI examiners did not attempt to find out the basis of the SNP’s doubts before reiterating that they were “absolutely confident” in the identification on April 15, a full week before the FBI Laboratory met with the SNP. We found that the FBI Laboratory’s overconfidence in the skill and superiority of its examiners prevented it from taking the April 13 Negativo Report as seriously as it should have.

We did not find sufficient evidentiary support to conclude that several other potential sources of error were major factors in this case. We found that particular standard utilized by the FBI examiners for identification (the Ridgeology Standard versus a more objective Numerical Standard) was not a root cause of the error; the Laboratory’s methodological errors could occur under either standard. We also found insufficient evidence to conclude that the Laboratory’s verification procedures contributed to the misidentification of LFP 17, or that the particular pressures of a high-profile terrorism investigation led to the erroneous conclusion. Nevertheless, we found that the potential for future errors arising from these factors was sufficient to support recommendations for research and changes in Laboratory procedures, which we discuss in detail in Chapter Five.

We also examined the allegation that the FBI Laboratory’s identification of Mayfield was improperly influenced by knowledge of Mayfield’s religion. We found that the Laboratory had no knowledge of Mayfield’s Muslim faith at the time that it made the initial identification. In the days or weeks following the identification, however, information acquired in the field investigation regarding Mayfield’s religion became known to the examiners. We believe that the primary factors in the FBI’s failure to revisit the identification were the unusual similarity between Mayfield’s fingerprint and LFP 17, and the FBI’s overconfidence in the superiority and infallibility of its examiners and methods. However, we believe that Mayfield’s representation of a convicted terrorist and other facts developed during the field investigation, including his Muslim religion, also likely contributed to the examiners’ failure to sufficiently reconsider the identification after legitimate questions about it were raised.

Finally, we reviewed several other potential causes of the error that have been suggested by the FBI and others following the discovery of the misidentification, and found them to be unpersuasive. We found that the chain of events leading to the error would likely have occurred even if the FBI had been given access to the original evidence on which LFP 17 was found. We found that the quality of the digital image used by the FBI Laboratory to make the original identification was adequate and was not a factor in the error. We found that the separations and interruptions in ridge flow within LFP 17 did not prevent the SNP or the FBI from correctly identifying Daoud and, hence,

did not cause the misidentification of Mayfield. We found no support for the suggestion that LFP 17 was of “no value” because it could “work with” the known fingerprints of two different people. We also found no reason to believe that the FBI Laboratory was misled by an excessive faith in IAFIS technology.

In summary, we believe that the unusual similarity between Mayfield’s fingerprint and LFP 17 was a major factor in the misidentification. However, we believe that the FBI examiners could have prevented the error by a more rigorous application of several principles of latent fingerprint examination methodology.