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Identification Of Authorship Using Lateral Palm Prints By Studying Third Level Details

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ABSTRACT

Writer while writing on paper leaves his lateral palm print (i.e. a portion of little finger/ lower finger and a lateral portion of the palm) on the paper. Since the finger prints have been considered to be one of the best means of identification of a person because of their uniqueness and permanence, so on the basis of finger prints absolute identification can be established. More over Palm prints are commonly found at the crime scene because whenever there is contact between the palm and any object (according to Locard's principle of exchange). Sometimes latent print of the palm are also present which needs to be developed and analyzed to identify author of writing as it is present just below the signatures on the document. In case of partial prints or insufficient samples, the study of shape of edges of ridges i.e. edgeoscopy (which are also permanent feature like any other ridge characteristic) along with poroscopy, can be included for Personal identification.

Since very little work has been done on the use of palm print to determine the author of the document by the analysis of lateral palm prints especially when found close to the signature. Therefore present study was carried out to study partial lateral palm prints. These were then analyzed and compared not only with the help of First and Second level details but also by using Third Level details i.e. Poroscopy as well as Edgeoscopy.

Keywords: Palm Print, Poroscopy, Edgeoscopy

Introduction

Identification of the author of signature has always been a challenge for the document examiner especially in cases of anonymous letters. This challenge has been accepted and solved with many conventional methods by studying its various class and individual characteristics.

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In general, author leaves clues in the form of lateral portion of palm prints near the signature area, which can be positively identified and linked. Writer when writes on paper in most of the cases leaves his latent palm print (i.e. a portion of little finger/ lower part of finger and a lateral portion of the palm) on the paper. The latent image of the palm can be developed and analyzed to identify author of the document as it comes just below the signatures (Chaudhary and Kumar, 2003 and Shimoda and Frank, 1989).

Ridges and furrows present on the palm like finger prints are considered to be one of the best means of identification of a person as they are uniqueness and permanent. Whenever, the finger or palm prints are recovered from scene of crime, they are required to be and developed and compared with the specimen taken from the suspected person. During the comparison process 10-14 points are required at their correlative position to give positive or negative opinion. Requirement of number of characteristics varies from country to country. Various scientists have made an attempt to classify and analyse the prints for personal identification (Amy, 1946; Cummins and Midlo, 1961; Chatterjee, 1963 and 1967; Moenssons and Andre, 1970; Cowger, 1983; Hazen 1986; Bandopadhyay and Sharma, 1995; Graham Hughes 1999; Werthiem, 2000 and Wiseman, 2004). They observed that if pattern type and sufficient number of characteristics are not present at their correlative position then these prints cannot be used for identification. Similarly in many cases the finger prints are partial, smudged, fragmentary or imperfect due to one reason or the other i.e. the required number of ridge characteristics is not available. Then it becomes great handicap for experts to give opinion on identity in such cases. Same is the case with lateral palm prints found close to the signature. The other handicap with these lateral palm prints is the rare occurrence of patterns such as loop, whorl and arch etc.

In this type of situations, there is a need to include third level details like Poroscopy (number, shape and relative position of sweat pores) and Edgeoscopy (shape of edges of ridges) which can be used for individualization purpose (Bridges, 1942; Kuhn, 1994; Czarrnecki, 1995; Ashbaugh, 1999 and Jain, 2007).

In the present study of shape of edges of ridges i.e. Edgeoscopy (which are also permanent feature like any other ridge characteristic) along with Poroscopy, can be included for personal identification along with few Galton details or Minutiae at their correlative positions (Galton, 1892).

Third levels of details are mainly studied to identify and compared the finger and palm prints. But in case of lateral palm prints third level detail is more significant because lateral palm prints has very rare occurrence of any type of pattern and comparatively less proportion of Galton details as compared to the finger prints. Poroscopy was established by Dr. Edmond Locard of Lyons, France in 1912. He is also known as father of Poroscopy. Locard, 1912; studied the various aspects of sweat pore and used it for identification purpose.

According to Locard the sweat pores vary in following ways:

- Size of pores.
- The form of individual pore
- Relative position of pore on the ridge
- Frequency of pores
- Comparison of Relative pore location

Edgeoscopy was originally coined by Salil K. Chatterjee of India. He encountered some characteristics shapes on one or both sides of the friction ridges such as:

- Straight edge
- Convex edge
- Peak
- Table
- Pocket
- Concave
- Angle

He envisioned an identification process where edge characteristics along with ridge can be compared and evaluated for comparison purpose. These characteristics are formed due to alignment and shape of individual ridge units as well as pores close to edge of ridge. The edge characteristics on one side or both sides of ridges grouped together along with few Galton details and pores in relative positions are sufficient to prove identity. When one side of pore is open it looks like a pocket which forms an important characteristic of edges of papillary ridges. The various forms of edge characteristics of papillary ridges depend on the formation of ridges on fusion of the epidermic units containing sweat pores. The relative position of edge characteristics on one side of ridge is very important and their relative position with one another constitutes a unique design for each ridge.

If both these characteristics i.e. poroscopy and edgeoscopy are combined along with few of Galton details then it becomes very easy to reach the conclusion. So, these striking characteristics and ridge details at their relative position can be very helpful for establishing identity when Galton details are very few in numbers.

MATERIALS AND METHODS

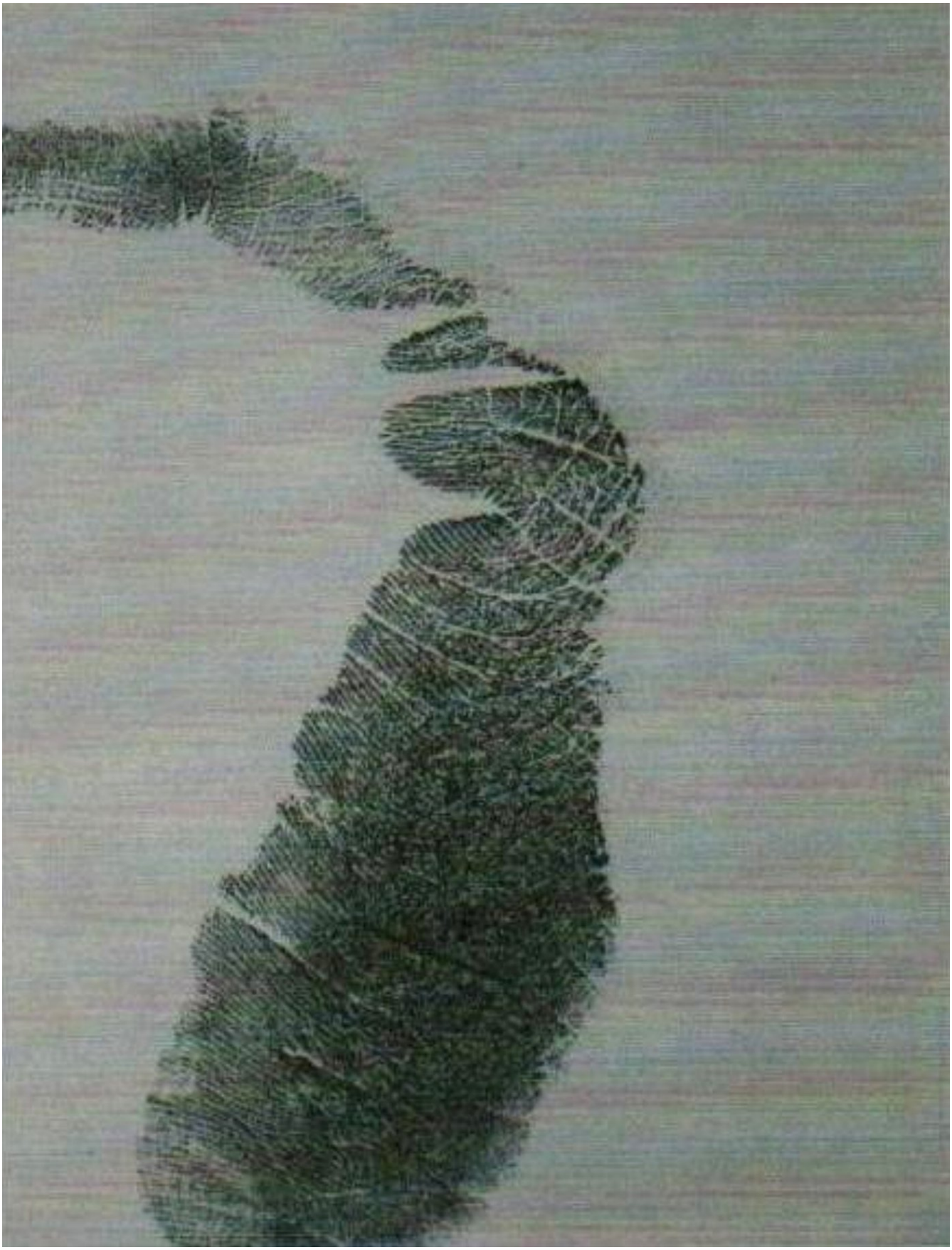
Collection of samples

The present study was conducted on 15 individuals. The lateral palm prints i.e. lower portion of little finger and lower lateral portion of palm of both 8 males and 7 females were collected randomly. The inked prints were taken on paper to study and compare the second and third level details with previously developed latent palm prints. The age, sex and name of each individual were recorded in a separate register along with prints. The latent lateral palm prints were developed with Iodine fuming, Black powder method and Ninhydrin method The hands of each

individual were washed with soap to remove any dust before taking lateral palm prints. A small amount of printer's ink was spread on glass slab and uniformly distributed with the help of roller, so that a uniform layer of ink can be obtained. The subjects were asked to stand at a forearm length from the glass slab while taking the prints. During inking, the palmer portion (i.e. lateral portion) was put on the inked slab with even pressure and then the impressions were taken.

Analysis of fingerprints

All the samples of inked and developed latent palm prints fingerprints and developed latent palm prints were observed under stereomicroscope at magnification 40X then the Grand VCD 2000 camera was attached to the stereomicroscope and photomicrographs (Fig 1-13) were prepared to study the second and third level of details i.e. Edgeoscopy and Poroscopy.



Developed Latent Palm Print.

RESULTS AND DISCUSSION

Latent Palm prints developed with three different methods namely Iodine fuming, Powder and ninhydrin and found that prints developed with black powder were found to be the best to study the third level details.

All the inked and developed prints were analyzed to find out the presence of any particular pattern type such as loop, whorl, arch etc. but these patterns were rarely present. Then the prints were analysed further to find out the ridge characteristics such as bifurcation, dot, lake, enclosure, spur, ridge ending etc. (Second Level Details) at their correlative position. As the minimum requirement of ridge characteristics to establish identity varies from 10 -14 points. In case sufficient number of Galton's details or ridge characteristics was not available, then third level details was added to establish the identity of the lateral palm print.

In the third level details, two types of characteristics were studied in detail i.e. Poroscopy and Edgeoscopy.

The following observations were made on inked prints and latent palm prints developed by powder method, which are given and discussed as follows:

Observations of Poroscopy

Poroscopy is a study of characteristics present in the form of pores on the papillary ridges.

1) **Number of Pores Per Unit Area**: Average number of pores per unit (in 1 cm of ridge on magnified photomicrograph) area was found to be vary from 8 to 11.

2) **Interspacing between the pores** (i.e. the space present between the two pores) was observed and can be classified as follows (Fig-1, 2&3) (Bindra et. al., 2000)

- Chain like appearance (Fig-1)
- Less space but Uniform space (Fig-2)
- Very less space

3) **Position of Pores**

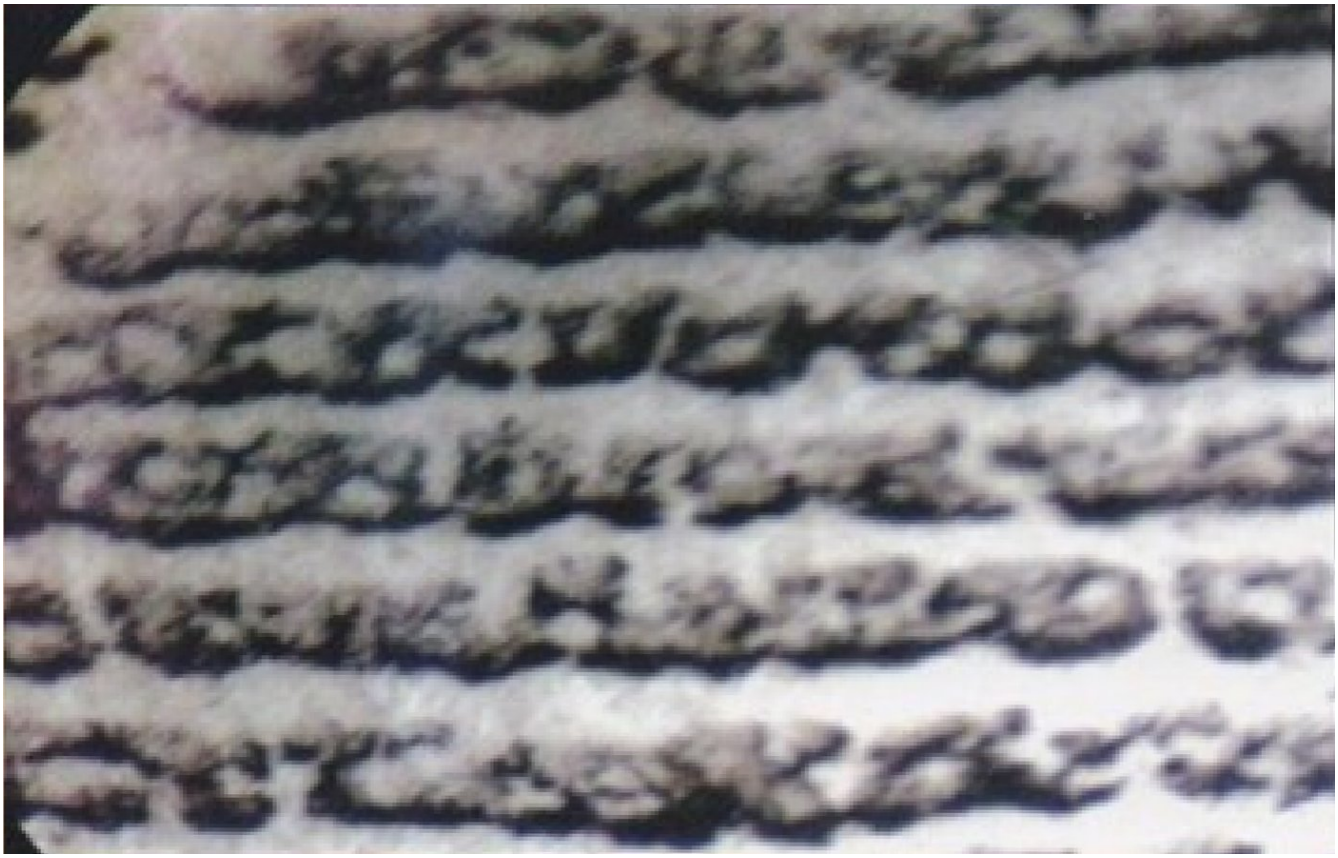


Fig. 1. Pores with Chain like Formation.



Fig. 2. Pores with less Spacing In between.

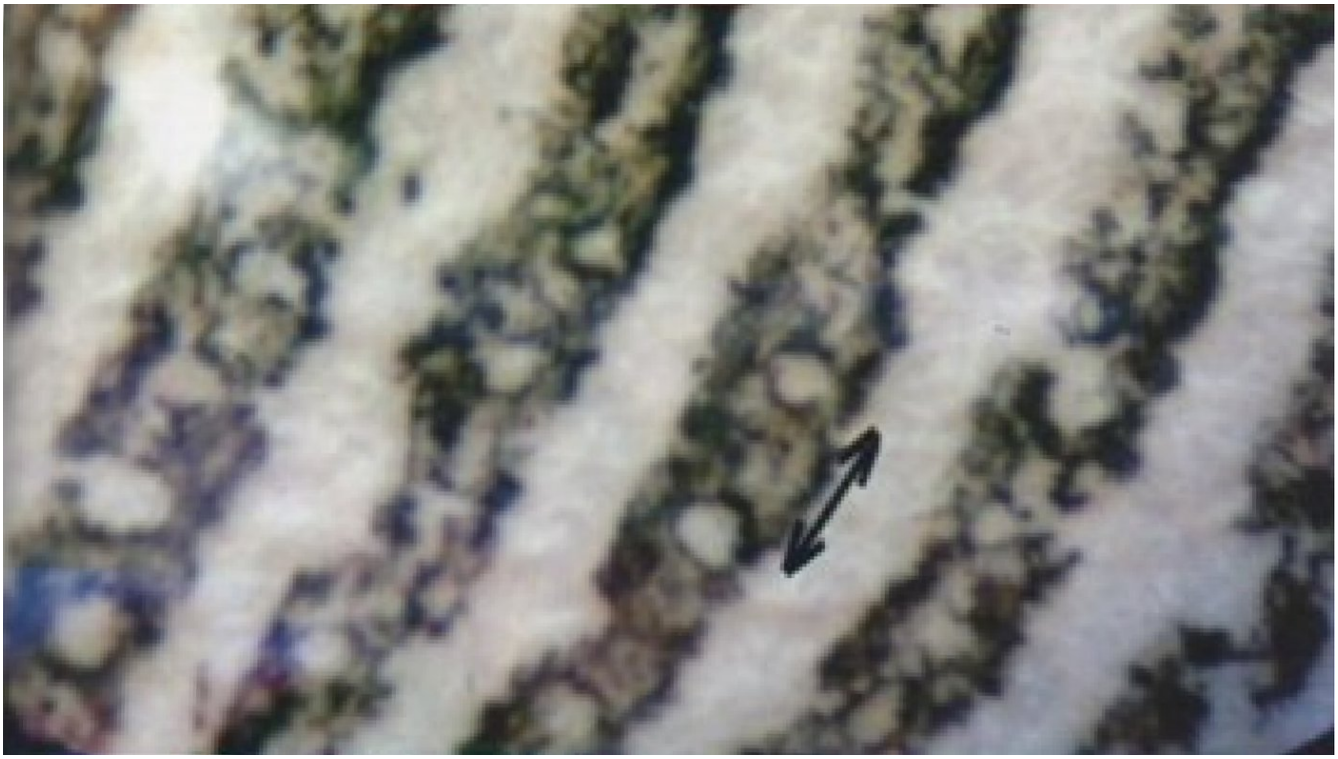


Fig. 3. Pores with Distant Spacing Lying towards Periphery.

Pores were found to be either of the following main positions (Fig3&4):

- Towards periphery of the ridge or (Fig-3)
- In the middle of the ridge (Fig-4)

4) **Size of Pores**



Fig. 4. Pores Lying in the Middle of the Ridge.

Pores were found to be of different size, even though present on the same ridge. The following three types of pores were observed (Fig-5, 6, 7):

- Large size (Fig-5)
- Medium Size (Fig-6)
- Small size (Fig-7)

5) **Shape of Pores**

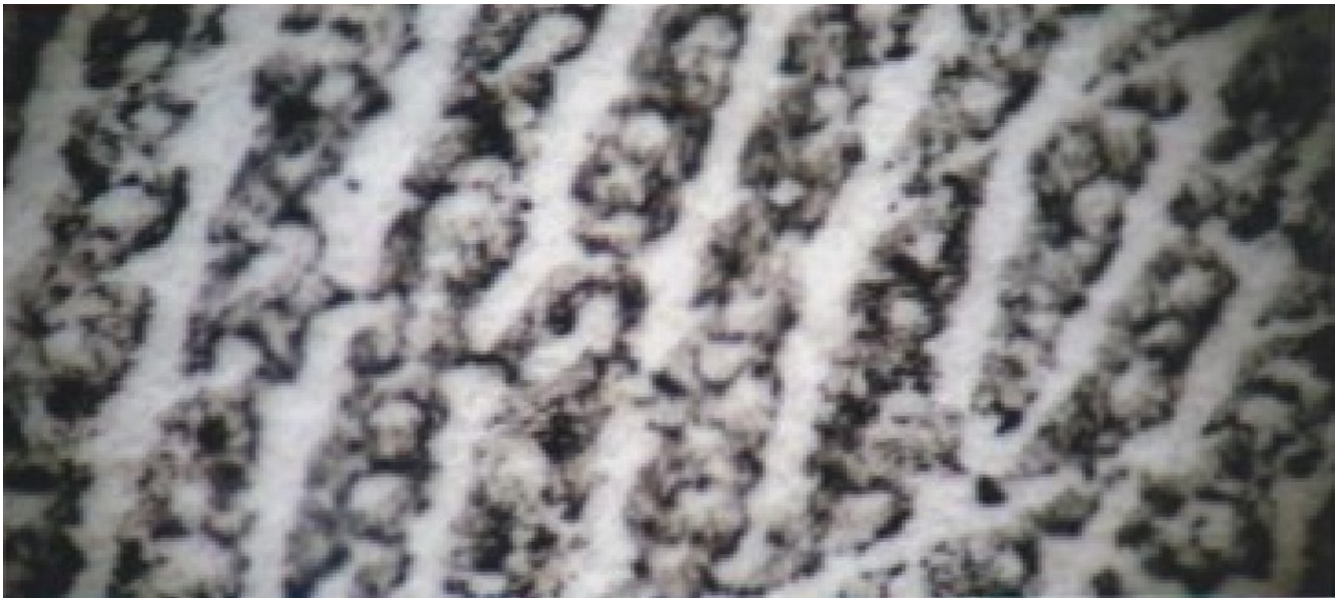


Fig. 5. Large Size of Pores.



Fig. 6. Medium Size of Pores.



Fig. 7. Minute Size of Pores.

The following different types of shapes were observed in the same print and even on same ridge. But the shapes are expected to change with the change in pressure applied while obtaining the prints (Fig-8, 9 and 10):

- Square Rhomboid (Fig-8)
- Rectangular (Fig-9)
- Round (Fig-10)

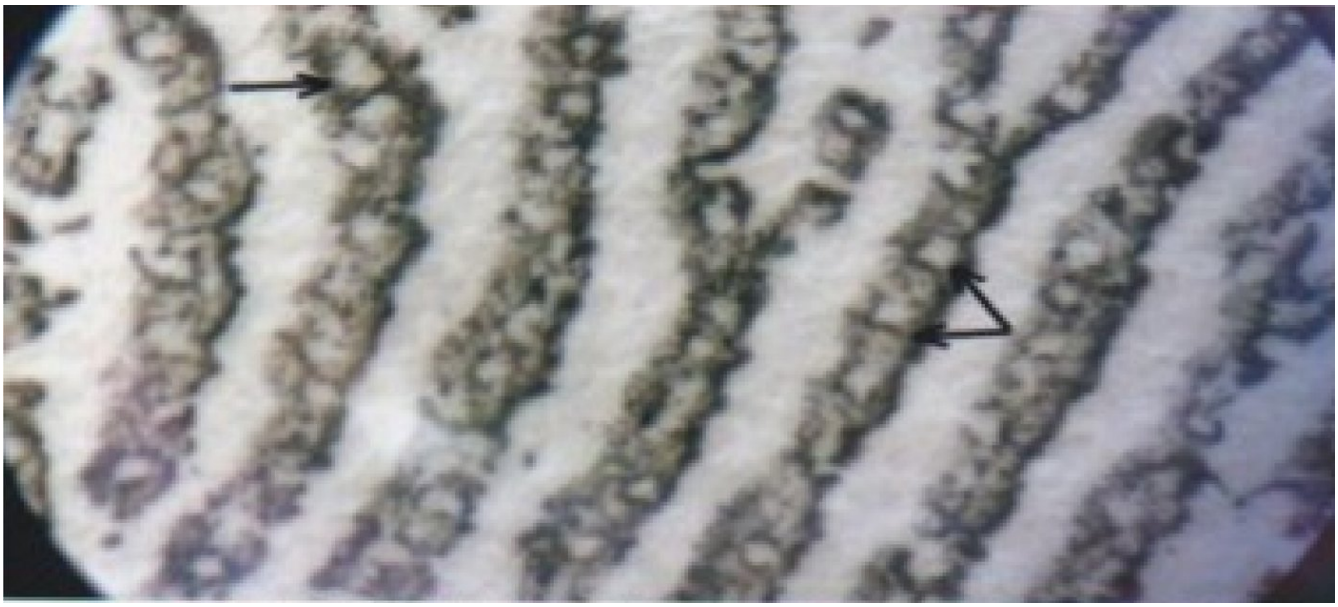


Fig. 8. Squarish and Rhomboid Shapes of Pores.



Fig. 9. Rectangular Shape of Pores.



Fig. 10. Round Shape of Pores.

It is important to mention that the elliptical shape of the pore is not found in the prints shown in Fig-8, 9 and 10.

Prints developed with black powder were found to be the best for the analysis purpose among all the three methods to study the third level details.

6) **Comparison of Relative Pore Location**

The inked lateral palm prints were compared with latent prints developed with black powder. The comparison was performed on the basis of pore location around ridge characteristics (bifurcation in this case) which was used as a key point and shape of the pores present on the surrounding ridges and distance between the pores was compared (Fig. 11 A and B).

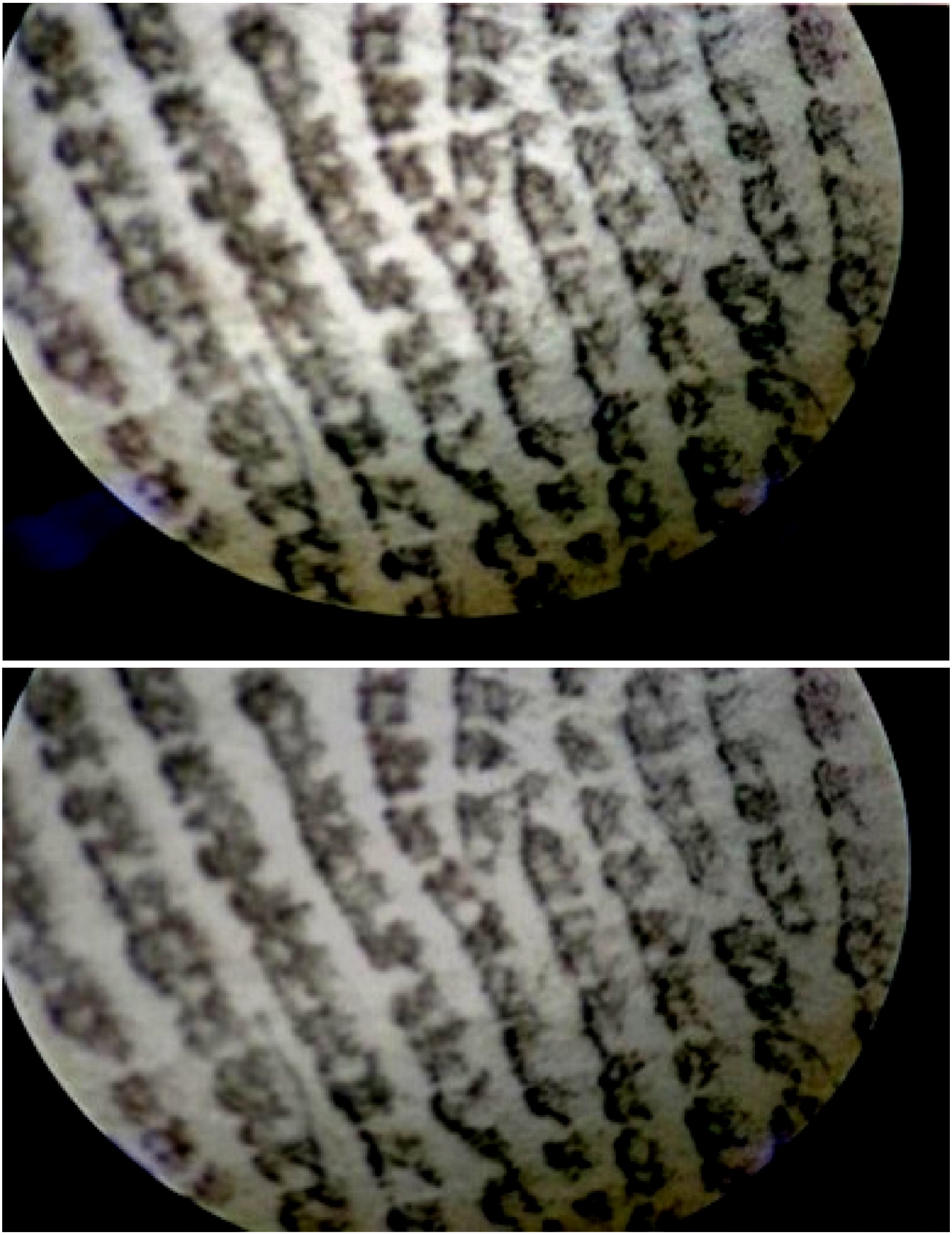


Fig. 11A and B. Comparison of relative pore location.

Observations of Edgeoscopy

If on the basis of pattern types, ridge characteristics and poroscopy, sufficient points are not present then the edge characteristics can also be added. The edge characteristics (edgeoscopy) have certain advantage over the poroscopy i.e. the shape of the pore changes with the pressure, but edges of ridges are less affected by pressure. Various edge characteristics studied and classified according to observations made by Chatterjee, 1962 and are given in Table (1&II).

Table 1. Showing Edge Characteristics in the Sample

S. No	Number given to the Points	Name of the edge Characteristics
1.	1	Peak
2.	2	Convexity
3.	3	Peak
4.	4	Peak
5.	5	Table
6.	6	Peak
7.	7	Pocket
8.	8	Peak
9.	9	Convexity
1O.	10	Peak
11.	11	Peak
12.	12	Table
13.	13	Convexity
14.	14	Convexity
15.	15	Convexity
16.	16	Convexity
17.	17	Convexity
18.	18	Convexity
19.	19	Convexity

Comparison of Edge Characteristics

Edge characteristics of inked prints (Fig 13-Aj were compared on the basis of edge characteristics of latent prints, Fig. 13(B) developed with black powder and are given in Table-2. Red markings in photomicrograph are showing corresponding points at their correlated positions.

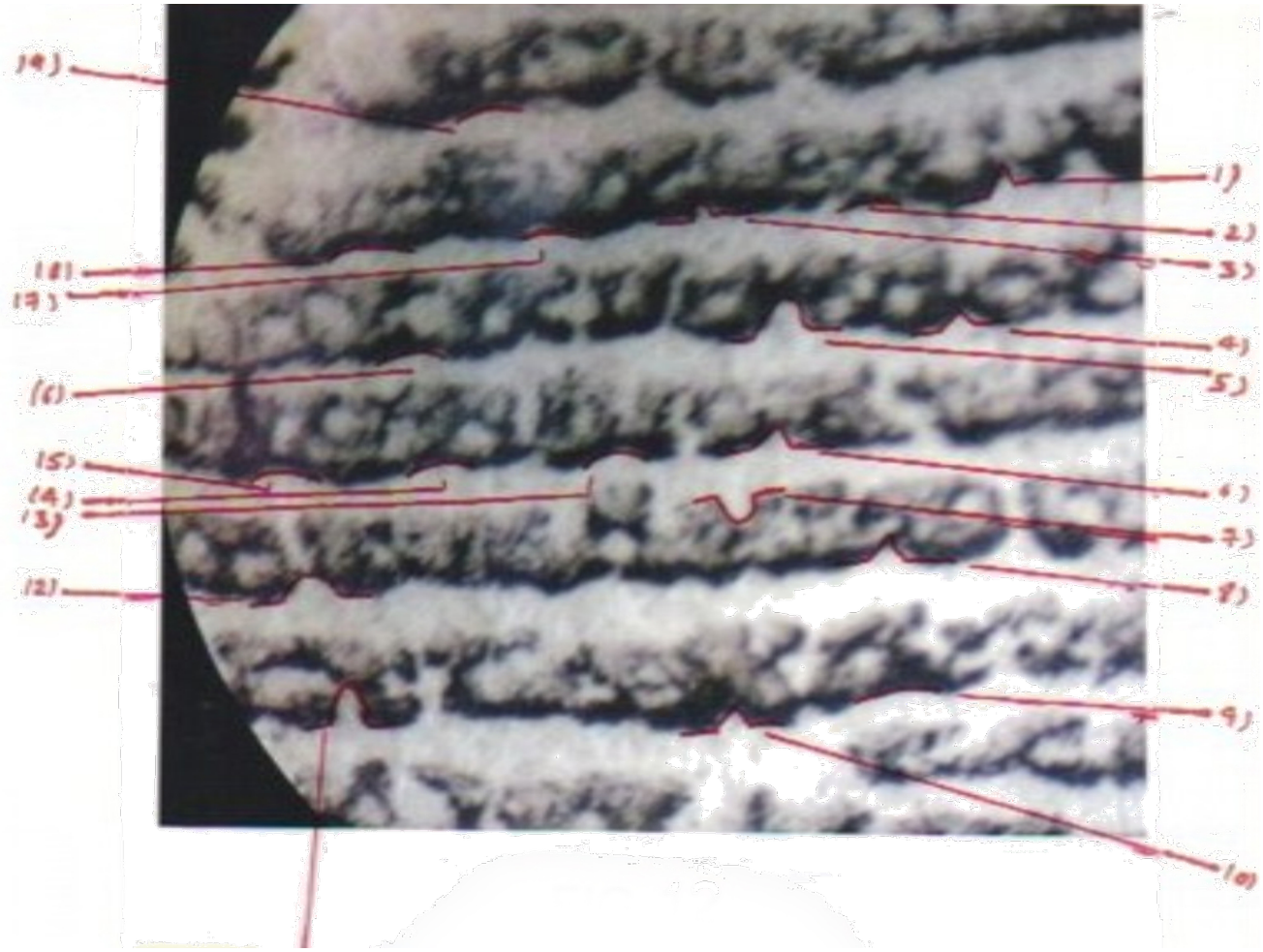


Fig. 12. Photomicrographs showing various edge characteristics.

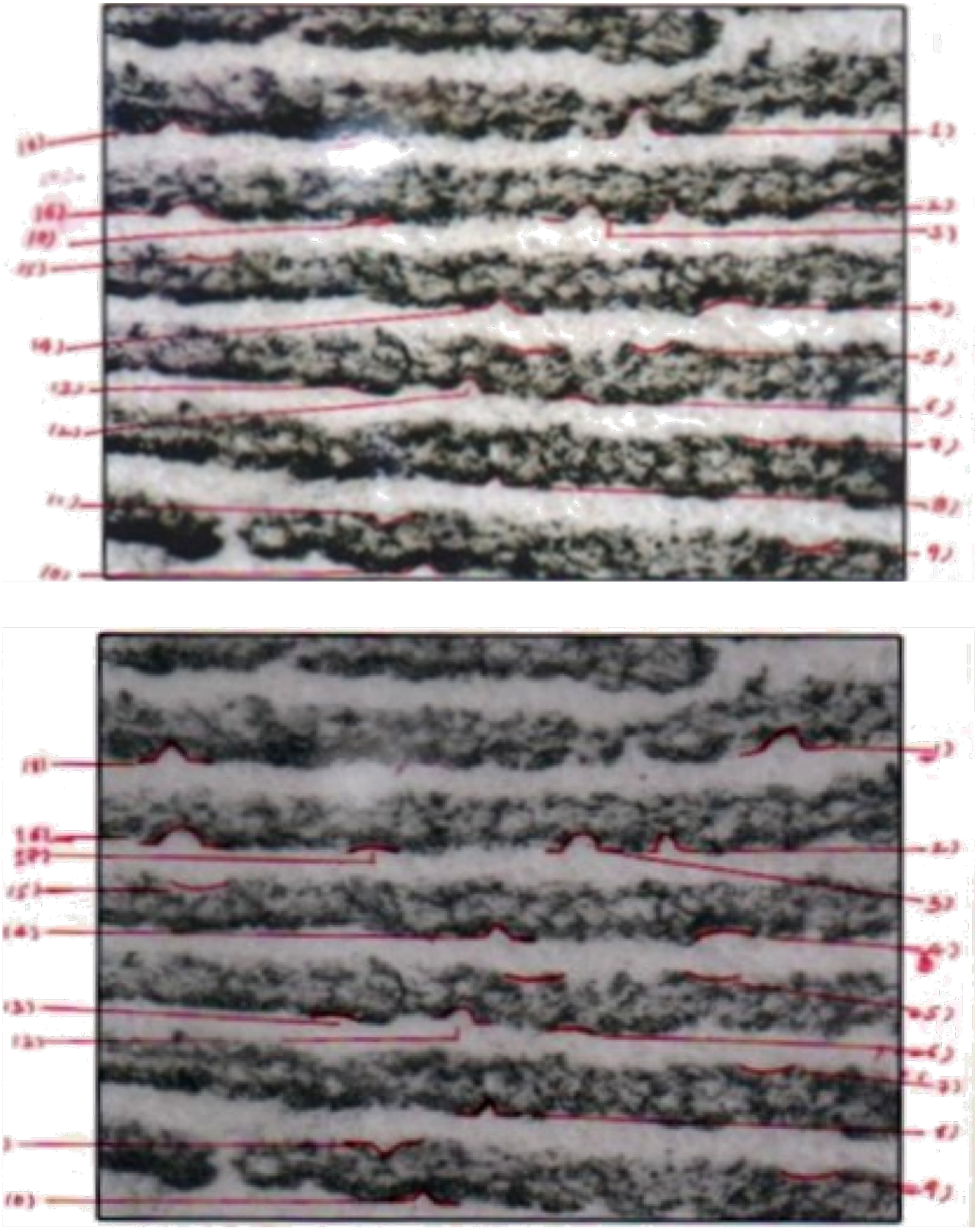


Fig. 13A. Inked Prints. **Fig. 13B.** Latent Prints Developed with Powder Method.

Table 2. Showing corresponding points with inked print

S.No	Number given to the points	Name of the edge characteristics Inked print	Name of the edge characteristics in Latent print developed with Powder method
1.	1	Table	peak
2.	2	peak	Table
3.	3	Table	Convexity
4.	4	Convexity	Concavity
5.	5	Concavity	Convexity
6.	6	Convexity	Concavity
7.	7	Concavity	Concavity
8.	8	Peak	Peak
9.	9	Concavity	Concavity
10.	10	Peak	Peak
11.	11	Angle	Angle
12.	12	Table	Table
13.	13	Concavity	Concavity
14.	14	Concavity	Concavity
15.	15	Convexity	Convexity
16,	16	Table	Table
17.	17	Convexity	Convexity
18.	18	Peak	Peak

Summary and Conclusion

In certain questioned document cases the writing is not positively identified writer's palm prints can sometimes be developed below the questioned signature. The analysis of a writer's lateral palm print can be used to infer that both the palm prints arid the handwriting originate from the same hand. Writer's palm print evidence is a logical concept and may be an important link between a subject and the authorship of anonymous letters, forger, or suicide notes etc. besides handwriting. Evidential value of such palm prints along with signature or handwriting examination in court of law could be right on the top of all other scientific evidences. In few cases court may not give importance to signatures, but if it is accompanied with such palm print which can be developed. The court would definitely give importance or acceptance to it.

Sometimes certain features such as loop, arch, whorls and delta can be observed in such lateral palm prints. But if sufficient numbers of characteristics are not available, the third level details can play very important role to determine authorship of the document.

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