Journal of Ancient Fingerprints

Nr 1 2007

Neolithic ceramics, Siretorp, Blekinge, Sweden.

Why the world needs another journal

There are already thousands of magazines out there, so why start a new one?

Well, none of the other magazine publish articles about the exciting subject of ancient fingerprints.

The latest craze in TV and the theatres is forensics. There are several shows where detectives, federal agents and even anthropologists solve crimes with the help of science.

Very few people know that it was a hobby archaeologist who started the science of fingerprints. His name was Henry Faulds and worked as a missionary doctor in Japan in the 1870s. On a visit to a archaeological site he looked at some ceramic sherds and saw imprints from fingers. Later he helped the police to solve a burglary in Tokyo with the fingerpints of the suspect. In 1880 Faulds wrote the article "On the skin-furrows of the hand" in the respected magazine The Nature. In the matter of years fingerprints had become an accepted part of every major crime investigation.

In the field of archaeology however, fingerprints are not an integrated part of the investigation. Of the tens of thousands excavations done every year only a handful are using this technique. One of the major goals of this journal is to expand the knowledge of fingerprints among archaeologist.

In most of archaeology the artefacts tell us much about the ancient people but not much about the persons. When a ceramics sherd or piece of clay has a preserved fingerprint it suddenly becomes personal. It is possible to actually hold the very same object someone held thousands of years ago.

It also gets personal in several other aspects because fingerprints are the only foolproof way to connect two artefacts from two different locations, or cultures. If someone were to find the exact same fingerprint on a piece of ceramics from the 1st century in South America as on a artefact from Rome, the whole world history would have to be rewritten.

In the most recent studies, fingerprints have successfully been used to determine the age of potters and craftsmen, it has also been possible to prove that kids worked with adults both in the Mediterranean Bronze Age and in Scandinavia during the Viking Age, and with the position of fingerprints on artefacts it is possible to know exactly how the objects were manifactured or used.

These studies have been isolated studies made by a handful archaeologists.

The major reason for lack of organized studies and documentation of ancient fingerprints is that it is a multi-disciplinary scientific field. It is a mix of biology, criminal forensics, chemistry and archaeology. This makes it difficult for an individual to master the subject and cooperation is needed.

Hopefully this journal will be help to bring scientists from all these different fields together. We know that we have got a good start. Why? Well You have downloaded and started to read it. And we really hope You will get the "ancient fingerprints"-bug...

MJ, editor

About Journal of Ancient Fingerprints

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The Journal

The Journal of Ancient Fingerprints is published free on the internet by the organisation Ancient Fingerprints Society.

This is a archaeological magazine which is dedicated to the search for, and study of fingerprints on ancient objects.

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The study of ancient fingerprints

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It is very laudable that an international Ancient Fingerprint Society has been established. The study of ancient fingerprints is a neglected field, where much remains to be done. Recording impressions of fingerprint patterns is only in its beginning and it seems that it will take some time before it will be a normal routine in studies of pottery, tablets, sealings and other objects.

Nevertheless, the idea of investigating ancient fingerprints is not new. In 1927, W.F. Badé judged such a study worthwhile. Unfortunately, he did not carry out any systematic researches on the material from Tell en-Nasbeh, where he had noticed fingerprints on lamps[1]. Among others, Charles Walston, Harold Cummins and Kurt Obenhauer reproduced ancient fingerprints on pottery, lamps and figurines in 1925, 1935 and 1965 respectively.[2]

In the early 1960´s and later, Paul Åström observed and recorded fingerprints on potsherds from Kalopsidha and other sites on Cyprus.[3] This gave him the incentive to start with Sven A. Eriksson, head of the Fingerprint Centre in Stockholm, a pioneer study of ancient fingerprints on Mycenaean, Minoan and Cypriote pottery which culminated in a publication entitled Fingerprints and Archaeology in 1980.[4] In Greece and Cyprus, they searched for fingerprints on pottery mainly in museums in Athens, Nauplion, Herakleion, Knossos, Phaistos, Nicosia and Famagusta and in C.F.A. Schaeffer´s store rooms at Enkomi. Regrettably, fingerprints preserved on pottery turned out to be rare. A beginning was, however, made to build up a corpus of ancient papillar lines. They also suggested that population movements may be traced through statistics of fingerprint patterns when sufficient material exists.[5]

In the 1980´s, Karl-Erik Sjöquist – S.A. Eriksson´s successor as Chief Superintendent – and Paul Åström continued these researches by examining the fingerprints and palmprints on Linear B tablets from Pylos and Knossos.[6] The study of Linear B tablets was rewarding, since the fingerprints and palmprints of several scribes or their assistants could be documented. Sjöquist also worked out a method to determine fingerprints of children on the Knossos tablets[7]. Further, he discerned a group of men with strong hands and very rough papillar lines suggesting they had been used to execute very hard manual labour[8]. The palmprints of three persons at Pylos were particularly significant. Based on the way they impressed their palmprints they were given individual names[9].

Dactylographic investigations of Minoan roundels from Chania were first made by Sven A. Eriksson in 1970[10] and later on by W. Nielsen and Erik Hallager who published their results in 1986 and 1996.[11]

Francesco d´Andria recorded about 400 digital impressions on 125 vases from a pottery workshop at Metaponto dating from the fourth century B.C. So far the fingerprints of four individuals working in the workshop have been identified.[12]

It is praiseworthy that the subject has been taken up recently by Keith Branigan and others who have examined fingerprints on Minoan pottery as "a pilot study".[13] Julie Hruby of the Cincinnati University worked on fingerprints on pottery in the Aegean at Midea and Pylos[14], and created on the internet a usable forum, "Daktylos".

For the identification of fingerprints on Mesopotamian tablets much remains to be done[15]. Kimberlee Sue Moran of the Institute of Archaeology, London, has begun to apply modern forensic fingerprinting technique to create a database of ancient fingerprints. Currently, the focus is on fingerprints found in clay sealings and tablets from Mesopotamia. We look forward to the results of this project in progress.

It would probably also be rewarding to search for papillar lines on terracotta moulds. The Italian State Police has, for instance, examined fingerprints on clay plaques inside the Capitoline wolf statue and on sealings from Ayia Triada in Crete[16].

Fingerprints on pottery from Paul Åström´s excavations in the Mycenaean Acropolis of Midea and at the Late Bronze Age harbour town Hala Sultan Tekke in Cyprus have been studied by Karl-Erik Sjöquist and will be published in the final excavation reports. It is also promising to note that fingerprints on Swedish Stone Age material are being documented by Karl-Erik Sjöquist and Mikael Jägerbrand[17].

These and other investigations not mentioned here are not well known. When a ceramics specialist at the Museum of London approached the police for help after discovering fingerprints on ancient Roman pottery it was thought by BBC News (21 May 2003) that this was the first time that criminal fingerprinting techniques were used to assist archaeologists. The establishment of an Ancient Fingerprint Society is therefore of great value to spread knowledge of work on the subject in the past and the future. [19]

Notes

1 W.F. Badé, A Manual of Excavation in the Near East, Berkeley, 1934, 34.

2 A record of early notices of ancient fingerprints is given in P. Åström & S.A. Eriksson, Fingerprints and Archaeology (Studies in Mediterranean Archaeology 28), Gothenburg 1980, 8.

3 P. Åström, Excavations at Kalopsidha and Ayios Iakovos in Cyprus (Studies in Mediterranean Archaeology 2), 142, n. 12, 127-128 (Appendix III by S. A. Eriksson), 214; P. Åström, 'Finger-prints on Cypriote Bronze Age Pottery', Praktikà toû prótou diethnoûs Kyprologikoû synedríou (Leukosía, 14-19 Apriliou 1969) 1, Archaîon tmêma, Nicosia 1972, 1-3. K.-E. Sjöquist has also analysed fingerprints on a Gnathia oinochoe and a Red "Pergamene" jug in P. Åström and E.J. Holmberg, Corpus Vasorum Antiquorum, Sweden 3, Gothenburg 1985, 92, and on a Cypriote White Painted V jug in K. Nys and P. Åström, Corpus of Cypriote Antiquities 23 (Studies in Mediterranean Archaeology 20:23), Sävedalen 2004, 93-94.

4 P. Åström & S.A. Eriksson (above n. 2).

5 See P. Åström & S.A. Eriksson, 'Fingerprints and the Indo-Europeans in Greece', Acta of the 2nd International Colloquium on Aegean Prehistory, Athens 1972, 72-75, and P. Åström, 'Fingerprints on Middle and Late Minoan Pottery', Proceedings of the 3rd International Cretological Congress (in Greek), Athens 1973, 13.

6 K.-E. Sjöquist and P. Åström, Pylos: Palmprints and Palmleaves (Studies in Mediterranean Archaeology Pocket-book 31), Gothenburg 1985; K.-E. Sjöquist and P. Åström, 'The Scribes and their Helpers in the Palace at Pylos', in Hägg & Marinatos (eds), The Function of the Minoan Palaces. Proceedings of the Fourth International Symposium at the Swedish Institute in Athens, 10-16 June 1984 (ActaAth-4o 35), Stockholm 1987, 317-319; K.-E. Sjöquist & P. Åström, Knossos: Keepers and Kneaders (Studies in Mediterranean Archaeology Pocket-book 82), Gothenburg 1991.

7 Op.cit., 25-28. Cf. K.A. Kamp et al., 'Discovering Childhood: Using Fingerprints to Find Children in the Archaeological Record', American Antiquity 64, 1999, 309-315.

8 K.-E. Sjöquist & P. Åström, Knossos: Keepers and Kneaders, 29-30.

9 Energetikós, Dokimastikós and Mikrós, see K.-E. Sjöquist & P. Åström, Pylos: Palmprints and Palmleaves, 47-55.

10 P. Åström and S.A. Eriksson (above n.2), 30.

11 E. Hallager, 'On the Track of Minoan Bureaucrats and their 'Clients'', Eilapíne, Herakleion 1987, 347-353; E. Hallager, 'Roundels among Sealings in Minoan Administration: a Comprehensive Analysis of Function', in Palaima, Th.G. (ed.), Aegean Seals, Sealings and Administration (Aegaeum 5), Liège 1990, 121-147, with interventions by e.g. I. Pini, Th.G. Palaima and M. Marcus (the latter about papillar lines on sealings at Hasanlu in Iran); E. Hallager, The Minoan Roundel and Other Sealed Documents in the Neopalatial Linear A Administration (Aegaeum 14), Liège 1996, 241-242; comments by P. Åström, 'Notes', Journal of Prehistoric Religion 10, 1996, 74, and K.-E. Sjöquist in K.-E. Sjöquist & P. Åström, Knossos: Keepers and Kneaders, 121.

12 F. D'Andria, 'Detectives a Metaponto. L´analisi delle impronte digitali revela l´identità degli antichi vasai', Archeo 13, 5, 1997, 34-39; V. Domenici, 'Il vasaio lasciò l´impronta: scoperto', Corriere della Sera, 9 febbraio 1997; Anonymus, 'Fingering Ancient Greek Potters', Science 275, 7 March 1997, 1425; V. Cracolici, I sostegni di fornace dal Kerameikos di Metaponto (Beni archeologici. Conoscenza e technologie. Quaderni 3), Bari 2004 Apparently the fingerprints of the Dolon Painter have been identified. Sjöquist has identified fingerprints of the Micali Painter, see K.-E. Sjöquist and P. Åström, Pylos: Palmprints and Palmleaves, 89-96.

13 K. Branigan et al., 'Fingerprints on Early Minoan Pottery: a Pilot Study', BSA 97, 2002, 49-53.

14 J. Hruby, Feasting and Ceramics: A View from the Palace of Nestor at Pylos (dissertation in progress).

15 Cf. D. Bonneterre, 'Pour une étude des dermatoglyphes digitaux sur des tablettes cunéiformes', Akkadica 59 (misprint "60"), 1988, 26-29.

16 On the internet: Anonymus, "Sulle tracce del passato, Misteri archelogici" (sic), Il sito ufficiale della Polizia di Stato (http://www.poliziadistato.it/pds/chisiamo/territorio/reparti/scientifica/i_casi.htm).

17 See Fornvännen, forthcoming, and M. Jägerbrand, Forntida fingeravtryck. Dokumentationsmetoder för

Fingerprints on artifacts and historical items: examples and comments

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Abstract

Human fingerprints on archaeological or historical facts have been regarded rare and unimportant from the viewpoint of archaeological methodology. In fact, ancient fingerprints can be found on a variety of different media and among them ceramics is the most prominent.

Advantages and disadvantages of various media of ancient fingerprints are discussed.

INTRODUCTION AND TERM DEFINITIONS

Touching, grasping and manipulating objects are fundamental ways in which humans interact with the surrounding environment. The hands (and legs) have suitably equipped contact surfaces for protective, sensory and friction functions (cf. friction skin). Fingers, palms, soles and toes are creased in sets of parallel running ridges – epidermal ridges and the furrows between them. Deeper in the skin, each epidermal ridge is underset by two rows of papillae of corium that project into the epidermis. Therefore, epidermal ridges (on the fingerprint) are frequently called "papillary lines" and the whole setting as "papillary terrain" (Fig. 1). For more detailed view of friction skin development and morphology see Babler (1979). The papillary terrain has a number of properties, which include characteristic dermatoglyphic patterns. The word dermatoglyphics is used for the papillary terrain itself and the study of the papillary terrain (the variability of its properties, and the biological connections between them). The word dermatoglyphics has a Greek origin (derma means skin and glyphé means furrow) (Cummins, Midlo 1926). Fingerprints are used in police daktyloskopy for identification of individuals (daktylos means finger and skopein means to see, to explore, also from Greek).

With every physical touch we leave behind a copy of our epidermal ridges, mainly fingerprints. The human world is literally covered with them. Under suitable conditions the prints become preserved, sometimes for millennia, so today we can study the negative impressions of fingers and palms of people who lived hundreds or thousands of years ago. During the International Conference on Dermatoglyphics, Athens, Greece, September 20–30, 1981, Bartsocas suggested the term paleodermatoglyphics "to be used for the study of dermatoglyphics through antiquity in archeological and anthropological material (mummies), as well as in the ancient texts" (Bartsocas 1982). There is a widespread notion that finger and palm imprints are so rare on archeological artifacts that studying them is not viable. It is said that they occur sporadically and cannot reveal useful information in the scientific "world of statistical testing", so there is no reason to give fingerprints any special attention. In reality, the opposite is true: fingerprints do not attract adequate attention, they are not a standard item on the documentation lists of archeologists, art historians or conservators (restorers). This is the reason why so few imprints have been documented. Ancient fingerprints do exist but there is a great lack of awareness of this fact.

It is clear that fingerprints are not found on all archeological artifacts. Their occurrence depends on many circumstances. These include favorable technical properties of materials, i.e. media – the transfer vehicle for fingerprints, which make the

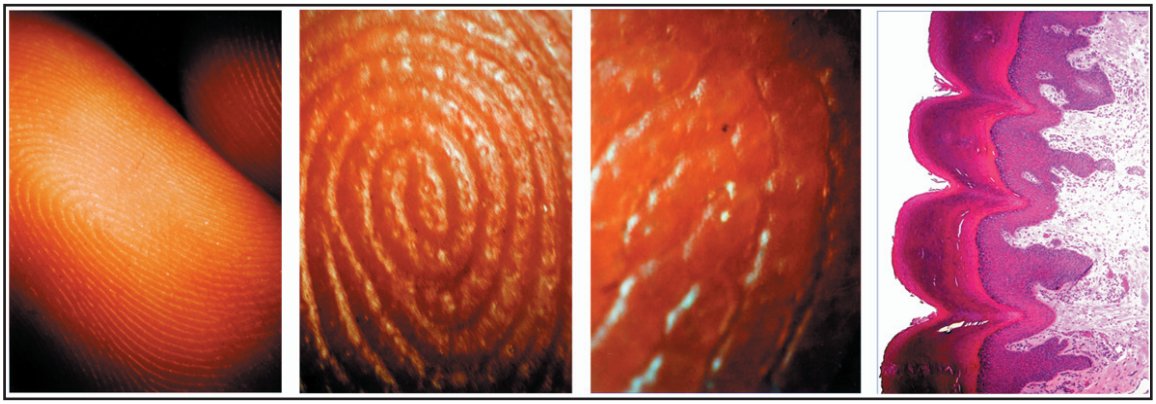

Fig. 1 Various magnifications of the papillary terrain of inner surfaces of fingers and in a histological cross-section (far right).

formation of such an imprint possible. The probability of fingerprint occurrence increases with the everyday interaction of the human hand with such transfer media. To enable an ancient imprint to become preserved, the material must be durable. Fingerprints can be found on various archeological artifacts and objects in historical collections. If we examine suitable objects and the 'typical' locations on these objects, we will often find imprints of the papillary terrain.

In English, the term "fingerprint" predominantly means an impression of the epidermal ridges of the fleshy distal portion of a finger formed by applying ink and pressing the finger on paper, that is used as means of establishing identification (in biochemistry, molecular genetics and other sciences, "fingerprint" is used, in transferred meaning, as a characteristic combination of particular features). The presence of distinctive epidermal ridges is of fundamental importance. In archeology, however, we can find human fingerprints with visible epidermal ridges and prints without ridges. In such cases, although they are still fingerprints (i.e. imprints of fingers), it is not possible to study dermatoglyphic features and to proceed with daktyloskopic comparisons. However, such finger traces (concavities made by finger balls) could be useful for anthropometric analysis. On the other hand, we also have to take into account epidermal ridges which do not come from fingers. Palm imprints, (foot) soles and toes, which can be used in the same way as fingerprints: for evaluating dermatoglyphics and for anthropometric analysis (Fig. 2).

Apart from the abovementioned dermatoglyphics, imprints (and more generally traces) of other body parts are also occasionally found, which can be evaluated anthropometrically (channels from traction by fingers, nail-marks, imprints of finger-knuckles, imprints of the whole hand (hand contours or stencils), casts of the whole human body (Pompeii) etc.). In this paper, however, we are interested in imprints of fingers, palms and soles with distinguishable epidermal ridges.

FORMATION OF THE FINGERPRINT (IMPRINT OF EPIDERMAL RIDGES)

The imprint of the papillary terrain is formed when the skin comes into contact with the object. (Fig. 3). In this instant, the shape and setting of the epidermal ridges become recorded on the object. The imprints form in various ways. One way is the imprinting of the epidermal ridge surfaces smeared with a colored liquid or powder – a dye (ink, wash, grime) onto a hard surface (paper, rock, hard ceramic surface). The dye on the papillary terrain imprint forms a contrast in relation to the underlying surface. A variant of this type of imprint is the latent imprint, where the medium is human sweat, loose surface epidermal cells and fats. The second type of imprint is the three-dimensional imprint of epidermal ridges into a plastic material (ceramic clay, wax, resin). The negative imprints form due to the contrast (under lateral light) between lighter and darker sections. The third type of imprint is somewhere in-between the first two – the epidermal ridges come into contact with a dye-covered surface and smudge off the dye (analogous to the human hand coming into contact with a freshly painted surface). Thus, finger imprints can be divided into two-dimensional and three-dimensional. Transitional imprints also exist. For example, the imprint can be partly three-dimensional and partly two-dimensional, depending on the thickness of the adhering paint.

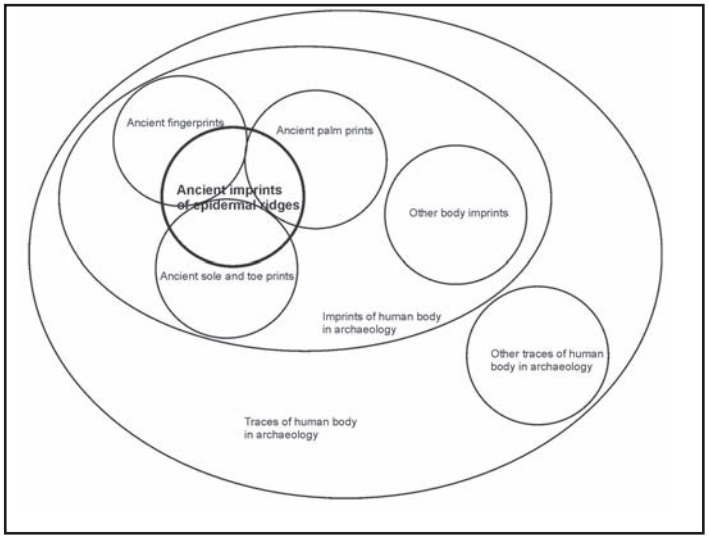

Fig. 2 The division of traces of the human body in archeology.

All imprints are the negatives of the original papillary terrain and deformed by pressure (in comparison to a cast). There is no such thing as an "undeformed" imprint.

EXAMPLES OF TRANSFER MEDIA OF ANCIENT FINGERPRINTS

CERAMICS

Ceramics have suitable properties to act as a recording medium for fingerprints. Ceramic clay is sufficiently plastic for imprinting, and finger molding is a necessary part of many ceramic molding techniques. Due to the nature of ceramics manufacture, any ceramic piece may have been in contact with the human hand and is therefore a potential imprint transfer medium. After drying and firing, the ceramic material becomes hard and chemically stable. This allows any imprints on its surface to last for a long time. At the same time, the finished ceramic object is fragile. Objects made of clay break easily and often have to be replaced.

Fingerprints have been found even on the world's oldest ceramics – on pellets and figurines from Dolní Věstonice and Pavlov in South Moravia. They were fired in the Upper Paleolithic period about 25 000 years ago (Králík et al. 2002; Králík, Novotný 2005; Sládek 1994; Szilvássy 1983; Vlček 1951, 1952). From the Neolithic to the present, ceramics often form a substantial proportion of archeological collections. That is why ceramics research in archeology is so advanced not only in the area of practical management of finds i.e. inventory, cleaning, but also in the context of ceramic material analysis, production technology, function, degradation following their discard, and finally, post-depositional processes (reviewed by Orton et al. 1993). Amorphous pellets with fingerprints are common in the vicinity of ceramic workshops. Fingerprints can be found on ceramic materials of varying quality (Fig. 4), different production technology and function, and on objects such as small figurines, utilitarian pots, roof tiles, floor tiles, bricks and daub (for example Einwögerer 2000, 121–133; Pavelčík 1958; Šefčáková 1998; Šikulová 1956).

The formation of an imprint on a ceramic object depends on the technology of production. Its preservation also depends on changes on the ceramic surface during deposition. Fingerprints are most often found on those ceramic materials which have not undergone surface modifications such as polishing, glazing and other surface modifications. In other cases, the paint may have actually protected the imprint, which only became visible on the surface after the paint was partially removed. Depositional and post-depositional processes can significantly affect the preservation of imprints. Well preserved imprints are also commonly found on ceramic objects from surface sites where exposure to weathering agents can be expected. Fingerprints on ceramics can last for centuries even in seawater (Corey 2002). Most publications on fingerprints in archeology are in fact concerned with fingerprints on ceramics (for example Basilidade, Rişcuţia 1974; Cseplák 1982; Kamp et al. 1999; Králík, Hložek 2007; Králík, Novotný 2003; Lička, Musil 1975; Sjöquist, Åström 1985; Sjöquist, Åström 1991).

ORGANIC SUBSTANCES

The oldest known fingerprint was imprinted on an organic substance originally described as a resin (Mania, Toepfer 1973). From recent chemical analyses we know that this material is an artificial adhesive (glue) made from birch bark (Koller et al. 2001), which was used by a Paleolithic inhabitant of the Königsaue region (Halle, Germany) to glue a flint artifact to a wooden haft. The dating of this item to the Middle Paleolithic suggests that the fingerprint belongs to a Neanderthal (Homo neanderthalensis). This object proves that fingerprints can remain preserved for tens of thousands of years on the surfaces of organic substances. They are more often found on much younger artifacts. For example, imprints of epidermal ridges were found on a wax seal depicting the Brno coat-of-arms emblem from the 15th century (Strouhal 1999) (Fig. 5). Traces of fingers without distinguishable dermatoglyphics were also found on the surface of a Roman artifact - solidified cream in a metal box discovered in London (Elisabeth Barham, The Museum of London – personal communication; cf. Evershed et al. 2004). Fingerprints may also be found on various putties (carpentry, picture framing), on objects made of resin, asphalt, wax and other organic and inorganic plastic materials.

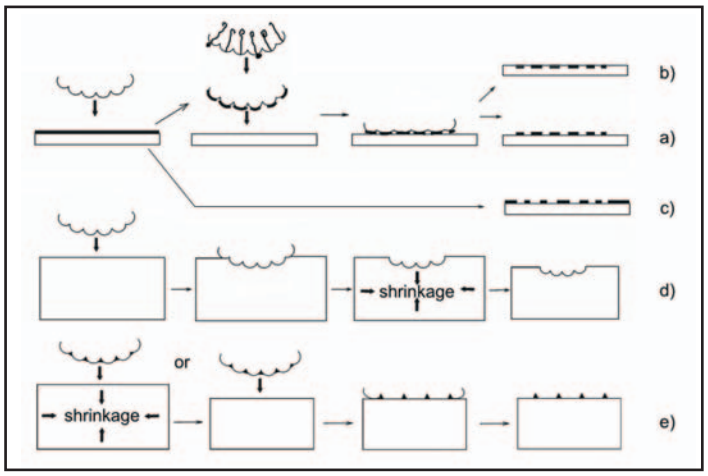

Fig. 3 The principle of fingerprint formation on various media. A two-dimensional imprint of a finger dipped in a dye on the surface of an object (a), a variant of dye absorption (in latent imprints of sweat) into a transfer medium (paper) (b), imprint formed by extracting dye from a fresh layer of dye (c), a plastic molded (d) and additive imprint (e) e.g. on ceramics.

COLOR IMPRINTS

Black ink imprints of the papillary terrain on white paper are the main transfer medium in dermatoglyphics. Many depositories in anthropology departments store large quantities of complete impressions of the papillary terrain of various populations (dermatoglyphic cards). Many of these populations can be considered historical (19th and 20th century peasants). For archeological purposes, these collections are better comparative material than imprints of contemporary people. The same can be said for fingerprints of deceased criminals from police daktyloskopy databases. These databases include anthropometric records (body

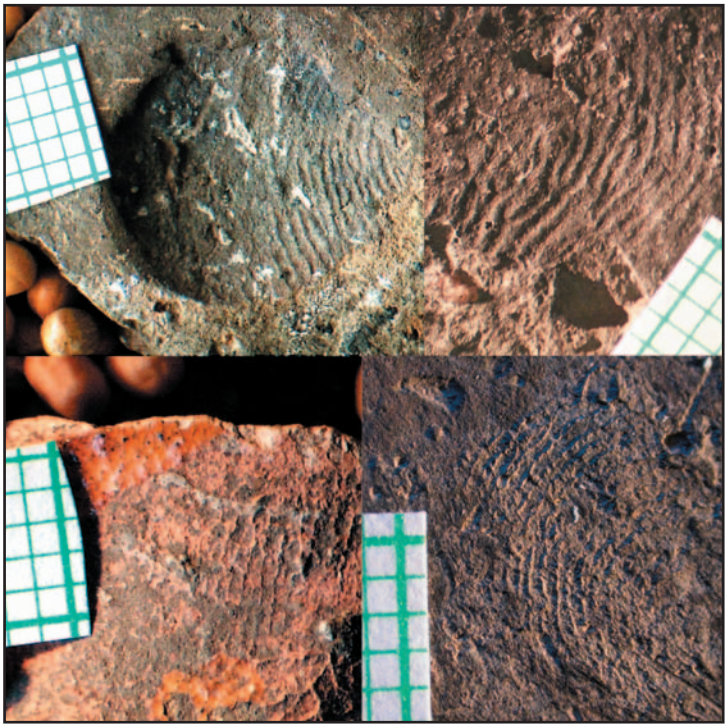

Fig. 4 Examples of imprints common on ceramic pots from various periods (discovered by Martin Hložek).

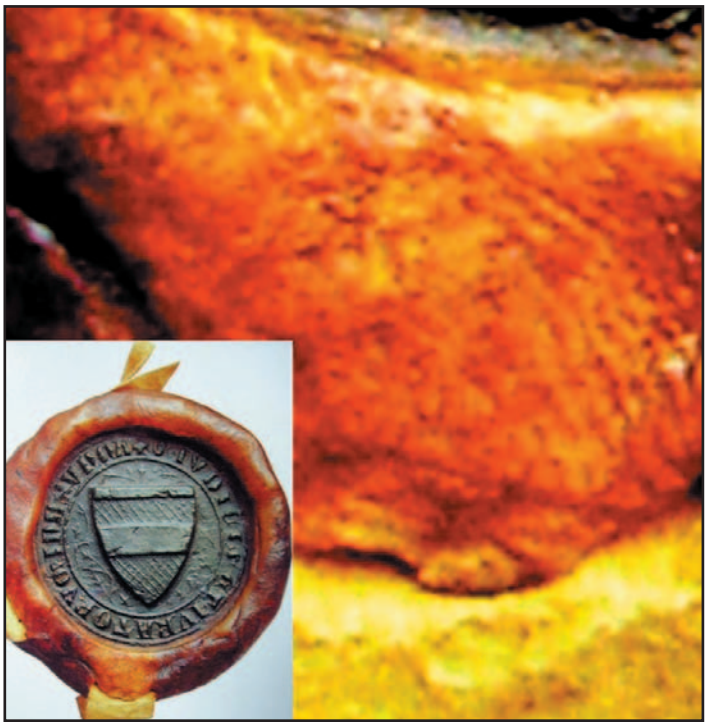

Fig. 5 Epidermal ridge imprints on a seal depicting 15th century Brno coat-of-arms (Strouhal 1999).

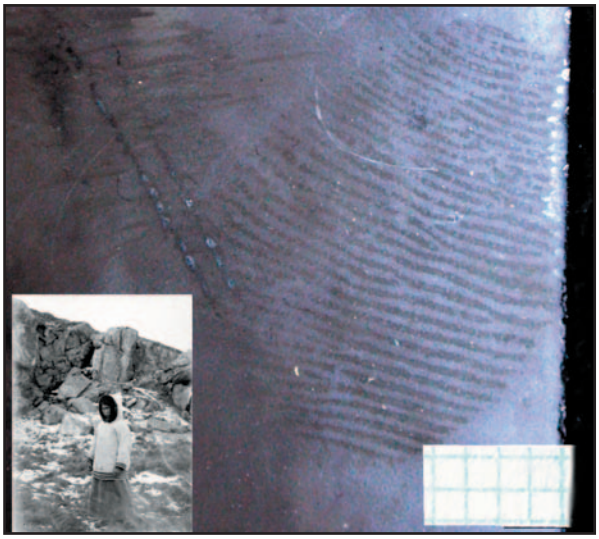

Fig. 6 Fingerprint on a light-sensitive layer of a glass photographic plate (below left is the photograph - positive image), (Professor Vojtěch Suk's collection, 1879–1967, Department of Anthropology, Faculty of Science, Masaryk University, Brno, Czech Republic).

Fig. 7 Kerosene lamp, later converted to run on electricity (Brno, Czech Republic). A larger number of fingerprints is present on the polished brass outer surface of the cylinder holder, which formed by a chemical reaction of sweat and the metal surface.

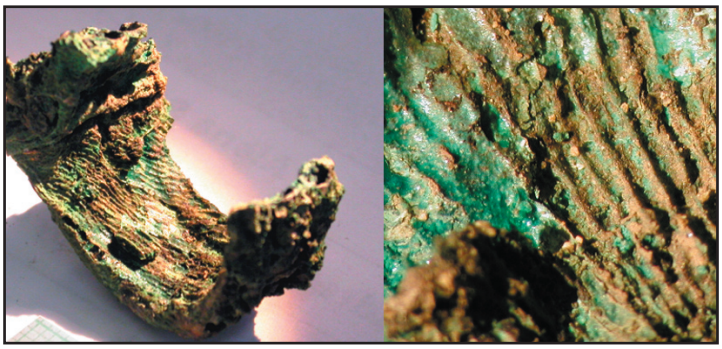

Fig. 8 View of epidermal ridges in a corroded bronze ring from a burial of a male from Early Bronze Age (site Hulín – U Isidórka, Archeological Center Olomouc, Czech Republic, 2004); ring in a block of sediment with the phalanx and the negative of the papillary terrain in corroded material on the outer side of the ring (left), image of the negative of epidermal ridges inside another ring from the same site (right).

height, eye color and so on) and criminals´ life trajectories. It would be worthwhile declassifying them and collecting these records for ancient fingerprints studies.

Color fingerprints are also found on 'paper objects' (e.g. manuscripts and documents). Old finger imprints on paper and similar materials cannot be preserved for long periods (compared to ceramics) because of reduced durability of the transfer media. Imprints on a parchment are mentioned by Bartsocas (1982). Among color fingerprints on paper from historical or archeological contexts, we should also mention records from chiromancy and palamoscopy (Bartsocas 1982). Latent (hidden) imprints, which rely on human sweat, epitelia and skin fat components, are commonly used in everyday police procedures. Discovering and visualizing latent imprints on historical documents is an open question. The presence of inorganic substances in sweat (Bramble, Brennan 2000) enables (theoretically) unlimited preservation of latent fingerprints under favorable conditions (dry environment in a closed book). An example of a criminological study of fingerprints on incunabula (theft of historical objects), is the work of Bialek and fellow workers (Bialek et al. 2003). The authors obtained relatively well-preserved, and in some cases daktyloskopically useful fingerprints. Because they succeeded in making the prints visible using 1,2-indanedion (chemical reaction with amino acids), the fingerprints were probably not ancient.

Imprints in paint on painted ceramics are reported by Primas (1975), color imprints on ceramics were also reported by Åström and Eriksson (1980). These authors also suggest the possibility of enhancing the visibility of faded bloody fingerprints using chemical agents based on reactions of iron compounds originating from blood hem (Åström, Eriksson 1980, 17–19).

PHOTOGRAPHIC FILM

Fingerprints from the early days of photography can be found in the photosensitive layer of 'negative' photographic material, for example photographic glass plates (Fig. 6). Chemical compounds in sweat (chloride ions) react with chemicals from the photosensitive layer (silver ions) and/or epidermal ridges imprint themselves plastically (three-dimensionally) into the photosensitive layer of gel. In both cases, fingerprints can then (but usually not) appear on the developed positive image – fingerprints however are magnified according to the degree of magnification of the actual photograph. In case of contact copying (development) from glass plates, the ratio is 1:1. Imprints captured during the development of the negative are also visible on the 'positive' image (i.e. the photograph). It is the same as if we were looking at the papillary terrain of the original finger (re-positive), except it is magnified to the same extent as the magnification of the positive image. Imprints, however, can adhere to the developing photographic paper and these are then negatives of actual size.

BRASS OBJECTS, BRONZE SCULPTURES

Glossy brass objects (doorknobs, house signs, brass containers, and so on) often carry fingerprints that formed by sweat reacting with the brass surface. It is possible that a slightly sweaty finger can affect the touched surface for a period of time (Fig. 7). Such a fingerprint usually consists of rows of dots corresponding to the sweat around the sweat pores (pori sudoriferi). These traces probably disappear even after a slight build-up of corrosion.

Fingerprints on cast bronze and brass objects have a good chance of being preserved. The form for the metal cast is often a scale model made from clay or wax. Fingerprints of the maker or his assistants can remain in the cast form and subsequently transfer to the cast. These imprints are ubiquitous on recent bronze sculptures. They can also be found on protected and less corroded sections of older bronze sculptures, or on other casted objects that were made using wax models (cf. Beneteau 2005).

CORRODED METALS WITH COPPER CONTENT

Negatives of dermatoglyphs on corroded copper and bronze objects (copper corrosion) represent a different category of fingerprints associated with metals. Imprints of proximal members of fingers and the palm were found on corroded Old Bronze Age rings which were found by Tomáš Berkovec (Archeology Center, Olomouc) during a rescue archeological excavation at Hulín – U Isidórka (Czech Republic) (Peška et al. 2005). The rings found on the fingers of the buried individual started to corrode after deposition due to moisture in the soil and the decaying body. A temporary barrier against the advancing corrosion was presented by the epidermal cortical layer of skin (stratum corneum epidermidis) on fingers and palm of the deceased. This part of skin has some resistance against decay because of a high keratin content. The skin surface then absorbs the compounds which formed during the process of metal corrosion. When the skin eventually decayed, the negative remained on the corroded object due to the presence of copper carbonates and a stable environment prevailed until present (Fig. 8). Strictly speaking, these are not imprints but casts and when the papillary terrain is deformed, it is caused by taphonomic processes, not pressure. Negatives are found both on the inside and outside of rings. The negatives inside the rings partially consist of a skin imprint with dermatoglyphics of the palm side of the proximal member of the respective finger, and partially of skin of the dorsal section of the finger. Negatives on the outer side of rings are imprints of skin from the adjoining palm. The negatives are of sufficiently high quality that sweat pores are clearly recognizable. Epidermis is sometimes preserved repleted with copper salts.

The presence of skin negatives on corroded metal objects containing copper has been demonstrated (in collaboration with archeologists Jaroslav Peška and Martin Hložek) on other bronze objects (not only from the Bronze Age) from collections and new discoveries. Imprints of fingers and palms on corroded copper or bronze objects that were put on fingers (or placed in the hands) of the deceased are likely to be found more often in the future.

SKIN OF MUMMIES

Dermatoglyphic research in archeology is not necessarily confined to fingerprints; in some cases, dermatoglyphic research can be conducted on the skin of mummified bodies (Fig. 9). Important mummy finds have been well investigated anthropologically, but dermatoglyphic analyses are still an exception. Most well-known mummies are Egyptian. Fingerprints of pharaohs (Ramses II, Seti II and Siptah) imprinted in silicon materials were subject to research (Prominska et al. 1986). Mummies from South American burial grounds (Peru) or mummies from church crypts (e.g. Capuchin crypt in Brno) can be investigated in a similar manner. The best preserved (for dermatoglyphic purposes) are mummies from Scandinavian moors (the so-called "bog bodies"). Grauball man's hand and foot skin imprinted in silicon was studied by Vogelius Andersen (1956). Ice mummies are another example, i.e. "Ötzi" (Ötztal man from the Alps). Bloody fingerprints have been noted on Ötzi's arrows but they have not been dermatoglyphically analyzed as yet (Spindler 1998, 117). Mummies are extraordinarily important for fingerprint studies because dermatoglyphic characters on mummies can be investigated in relation to other biological properties of the human body from an ancient population. This is still only a theoretical possibility. Mummified skin is often not preserved to such an extent which would allow the implementation of common procedures used in forensic science to treat and reconstruct papillary terrain of mummified tissues (Schmidt et al. 2000), and consequently allow a dermatoglyphic analysis. Mummies are also very rare and the research has been quite limited.

OTHER MEDIA

From our own and our colleagues' (let us mention at least Martin Hložek) experience we know that fingerprints can also be found in paint on artistic paintings, and on sculptures, on ethnographic collections of painted Easter eggs from Moravia, and in inedible dough used in folklore production of Moravian decorative items (the so-called Vizovice pastry). It is very probable that with increasing interest in old fingerprints, the variety of objects on which fingerprints can be found will increase as well. However, it can be said without exaggeration that none of the materials or objects will ever reach the importance of ceramics in archeological fingerprint studies; ceramics have apt properties for the creation and preservation of fingerprints, and large quantities of pottery are often found during archeological excavations.

THE FINGERPRINT – A SPECIFIC WITNESS OF THE PAST

The ancient fingerprint represents a specific record of human body, which differs in various ways from the dominant source of paleoanthropological data – skeletal remains. Different types of fingerprints differ in the way they formed and in the relationship of the fingerprint maker to the transfer medium, in the technical properties of the media and the imprints, and in the degree of preservation and legibility of dermatoglyphic characters of various levels of differentiation. For this reason, it is useful to have knowledge of not only dermatoglyphics and daktyloskopy, but also of the technical parameters of the transfer media, and the processes which affect the imprint during its "life". In order to emphasize the specific qualities of imprints as biological traces, we will list the basic differences between finger imprints and human skeletal remains. We will compare the different finger imprints which occur on various transfer media, and then we will attempt to uncover their main advantages and disadvantages (Tab. 1).

PROPERTIES OF ANCIENT FINGERPRINTS

On a basic level, we can classify prints into flat (analogous imprints on paper, in 2D, material is solid, deformation of soft tissue) and plastic (3D, ceramics and other plastic materials, deformation of soft tissue and material) (Fig. 3). Based on the bending of the overall surface of the print we can classify prints into concave – usually imprinted by the finger ball, next are planar imprints – straight and flat where the print copies the surface of the finished artifact, an extreme example being convex prints. Based on the manner of inception of the relief of epidermal ridges, on ceramics we distinguish between the molded print – formed in a plastic environment where the epidermis becomes imprinted into a soft but non-adhesive ceramic matter (it is softer than the flesh of the finger), next is the additive print which forms by adherence of the less viscous ceramic matter from the surface of the epidermis on the prepared surface of a ceramic artifact (Fig. 3). An actual imprint on ceramics can even be a combination of these idealized types. Additive imprints are most often found on the lower parts of the outer surface of pots and they form when the pot is being removed from the pottery wheel with a wet hand. Molding imprints are more common on hand-molded figurines. The placement of imprints into categories based on different criteria enables us to specify the circumstances of their origin and modify the analysis procedure.

Visibility of the epidermal ridges depends on the material grain-size; the larger the grains, the easier it is for the imprint to 'disappear' in the structure. Sweat pores on imprints on ceramics are often difficult to distinguish, but they are easier to distinguish in wax, and regularly found on casts (plaster, corroded copper). Other prints are blurred due to the huge amount of water on the clay.

Taphonomic processes can alter the appearance, as well as the size, of the prints. The skin of mummies desiccates, deforms, and shrinks. Metric analysis of fingerprints on ceramics must take in account ceramics shrinkage during the drying and burning process. Thus, accurate data about ceramics shrinkage is of great advantage. Other media can similarly shrink and/or expand when they are being used. The shape of plastic materials is not fixed as it is in fired ceramics, so it can be secondarily deformed. A layer of calcium carbonate (calcite, sinter) which can form on ceramics very quickly and can completely cover the whole surface has the greatest influence on the visibility of fingerprints on ceramics. Inadequate burning of ceramics often leads to a abrasion of surface layers and a gradual abrasion of the fingerprint.

Fig 9 Skin with epidermal ridges from the inner surface of second toe of the left leg – found on a mummy of a young female from Pompei (Professor Vojtěch Suk's collection, 1879–1967, Department of Anthropology, Faculty of Science, Masaryk University, Brno, Czech Republic).

INTENTIONALITY

Based on intention of the print maker, prints are classified into intentional, most often thumbprints being the maker's signature, and unintentional or accidental prints, where their owner did not intend to leave them behind and/or was not aware of them (cf. Cummins 1941). Intentional prints are usually more complex and represent an interesting cultural phenomenon (i.e. a signature).

The largest proportion of unintentional prints are small, fragmentary prints. These prints are in a different category to the prints usually studied in dermatoglyphics. They are also (usually) of insufficient quality for daktyloskopic purposes. Most fingerprints, however, can be identified with little experience based on the characteristic patterns (or its components) of epidermal ridges. Studying such small prints is, however, more limited by the fragmentation and incompleteness of natural biological units (hand, finger, inner surface of finger), than skeletal remains.

Because most prints on ceramics and other transfer media are accidental, the development of analytical methods should focus mainly on them. Intentional and unintentional prints vary not only in size and completeness, but also in the sections of fingers and palms which become imprinted. During the molding process (ceramic clay or wax) we use fingers as tools so we usually imprint different areas of the papillary terrain than when we use the hand for locomotion (in tree branches), grasping objects (drinking from a cup) or touching a surface (pressing a doorbell, imprinting a thumbprint as a signature). During grasping, we often leave a trace of the center of finger balls (pads), during touching - the fingertip, and during molding of a plastic material „from free hand" – the peripheral areas of the papillary terrain of the finger and the palm papillary terrain. Hand biomechanics and the method of use during the inception of the imprint affects which particular part of the hand becomes imprinted, and the size of the imprint.

THE FREQUENCY OF IMPRINT OCCURENCE ON TRANSFER MEDIA

The discovery of the imprint on an archeological artifact is often in itself an interesting phenomenon. It can also be interesting to look at the processes where imprints become preserved on some media but not others, and also how on the same media, imprints will be preserved in one archaeological culture, but not in another. This can be important when studying ancient technologies, taphonomy or during cross-checking of some archeological procedures (e.g. sampling). If we want to proceed further, we need a larger number of imprints. The total number of fingerprints (the probability of finding fingerprints) is important for any statistical evaluation, for instance, when comparing dermatoglyphic features. With an increasing number of imprints, there

is a higher chance of finding larger imprints which hold more information for dermatoglyphic and daktyloskopic studies. Thus, frequently occurring media which also tend to record fingerprints are the best. This criterion favors ceramics over other media. Even though ceramics are the most common media in archeological collections (so the largest number of fingerprints are found on ceramics), other media should not be overlooked. The properties of fingerprints on minor transfer media offer an opportunity for examining connections and comparisons which are nor present on fingerprints found on ceramics.

THE TIMING AND THE CONTEXT OF FINGERPRINT FORMATION

A wide range of fingerprint transfer media also widens the range of interpretations of fingerprint origin, i.e. the time period when the imprint formed, the identity of the maker and the time when it formed. In general, fingerprints speak of the moment when the owner of the friction skin was in direct physical contact with the medium, when the recording of a print was possible: the ceramic clay was plastic, the dye was liquid, etc. The number, placing and the arrangement of fingerprints, their size, legibility and other properties related to the traceological event in which the prints are found, are generally traces of activity of a human, who left the prints. This certainly cannot be said about the placing and the mutual relationships in skeletal remains (at least in a standard burial). Compared to skeletal remains, the fingerprint has a unique property that it combines human biology and culture. In other words, the print is a record and thus an absolute proof of the temporal-spatial unity of the concrete biological human form (dermatoglyphics, hand morphology ….) and concrete cultural form (dye, ceramics …). With studying skeletal remains, this is usually completely out of question, except maybe for an arrow lodged inside a skull, but that too belongs to an enemy and not the person killed. (Known exceptions are negatives in corroded metals containing copper and mummies. In these cases, the imprints belong to deceased individuals and their preservation was possible through natural or artificial processes which, strictly speaking, are not related to the activities of the people we are studying.) Due to the differences among the various types of media, the likelihood of the contemporaneity of the objects under study, and the imprints on them, is uncertain. For instance, we can say: "A particular human with these biological characteristics was touching this pot during the time of its inception". Without reservation, we relate a single pot from the thousands present to a single person from the thousands of possible people, to an exact time, regardless of how much time has passed since. Without a doubt, a plastic imprint on ceramics originated during the process of making a ceramic object from a soft material, while a color fingerprint on the edge of a medieval book page is not necessarily connected either to the parchment maker, the bookbinder or the scribe; it could have been created at any later time. Close interdisciplinary collaboration of various sciences and technical fields can provide the solution.

THE ANCIENT FINGERPRINTS PARADOX

Skeletal remains from human burials speak of people who did not continue to age because they died. There is a great variability in the causes of death, burial treatment and preservation of skeletons. We do not have control over these factors and investigating an ancient population based on skeletal remains (e.g. using mortality tables) gives us a skewed, distorted image of the life ways and the biological properties of the living population; living people of certain ages are those that are not available for study (the so-called osteological paradox, Wood et al. 1992).

Unlike in skeletal remains, fingerprints belong to people who were still alive (apart from the two mentioned above: negatives in corroded copper and mummies), and there is no information about their death in the imprints. The fingerprints of living people also give a distorted, selective view but in a different sense to skeletal remains. This "ancient-fingerprints paradox" is analogous to the osteological paradox. The imprints allow us to study only those individuals who came into contact with the transfer media. Thus, finger imprints on various media come from heterogeneous groups of people. Fingerprints on the photosensitive layer of glass photographic plates most likely belong to people who were developing the photographs in the dark room. The corrosion of bronze rings captures negatives of dermatoglyphics of people who were buried – individuals who were either wealthy and/or of high social status, and also only in cultures where the placing of rings in graves was practiced. Fingerprints on written documents usually belong to people who were either literate or who were present in educated circles. In most historical cultures this involved a very small, selected segment of the population. Fingerprints on ceramics belong mostly to those who were concerned with the manufacture of the ceramic objects. However, in some archeological cultures it could be all able individuals (domestic handicraft), in other cultures only a selected few specialized craftsmen (cf. Primas 1975), who may have themselves been related by marriage or birth. As a result of various political changes and ethnic movements, the craftsmen may be a separate ethnic group with respect to the majority of the population (cf. Åström, Eriksson 1980).

The print does not necessarily have to belong to the creator of the ceramic artifact. The manufacture of ceramic items and the craft character of pottery permits the assumption that the product was likely to have been physically touched only by its creator, or a limited number of creators, regardless of the number of prints present. However, as various people may have been present in the workshop during the manufacturing process, including assistants and sometimes people present by chance, we can never be absolutely certain that the fingerprint belongs to the object maker. Furthermore, many various types of ceramic objects did not originate in the classic workshops: ritual ceramic artifacts, kiln brick clay, etc. Therefore, we are concerned with the owner of the print, not necessarily the manufacturer or creator of the artifact.

Material	Ceramics	Organic plastic substances	Dye on paper, parchment, papyrus	Dye on ceramics	Photographic plates	Copper corrosion	Mummified skin
Process of imprint formation	Soft clay imprint.	Imprint in a plastic material.	Imprint of dye-smeared hand.	Imprint into paint or with dye-smeared hand.	Imprint in light-sensitive gel.	Skin covered by copper corrosion products.	Mummified skin.
Time of imprint formation	When the ceramic material was soft.	When the material was plastic.	?	When the dye was liquid.	When the light-sensitive material plastic/sensitive to sweat compounds, ie. during the development of photographic images.	Soon after burial.	
Dimensionality	3D	3D	2D	2D/3D	2D/3D	3D	3D
Frequency of imprint occurrence on transfer medium	Frequent.	?	?	Based on dye characteristics.	Frequent.	?	Regular, but differential preservation.
Occurrence of medium	Frequent.	Rare.	?	Based on type of ceramic technology and preservation.	Particular historical period of limited duration.	Rare.	Rare.
Effect of medium on the nature of imprint	Mineral grains, dampness/stiffness of the ceramic material, volume changes.	Stiffness/stickiness, volumetric changes during solidification.	Surface unevenness.	Surface unevenness, dye viscosity.	2D imprints only visible in good light and at a particular angle.	Details also captured.	
Possible subsequent changes	Abrasion from use, fragmentation, clay fill.	Chemical and volumetric changes of the transfer medium.	Degradation of medium, fading and abrasion of paint.	Fading and abrasion of paint.	Scratches.	Unknown taphonomic processes (moisture, body decomposition, recystallization of copper salts.	Dessication, skin degradation.
Who is the originator?	Individuals associated with ceramics manufacture, originator/maker or his assistants.	? (Dependent on use of material).	Writers and readers. *1*	Individuals associated with ceramics manufacture, probably painter/assistant.	Photographer or his assistant, finger contact during development.	Burial object associated with the buried person, who had the object placed in or on the hand.	Mummified human body.
Is the originator of the print related to craftsman?	Usually yes *2*	? *3*	? *4*	Usually yes.	No. *5*	?	
Which part of the papillary terrain does the imprint come from?	Various based on the type of ceramic. *6*	Varies depending on the function of material.	Most frequently on finger balls.	Most frequently on finger balls.	Finger balls.	Proximal phalanges and adjoining areas of palm.	Preserved skin of upper and lower limb.
How many identical imprints of this type can exist?	Numerous.	Numerous.	Numerous.	Numerous.	Numerous.	One.	One (original, not the imprint).
Advantages from the analysis viewpoint	Most numerous group, long-lasting medium.	Recording of fine details in some amorphous materials (e.g. wax).	2D record.	Without subsequent changes in volume.	Identification of author is theoretically possible.	Possibility of determining assemblages of old imprints – estimating age and sex from skeletal remains.	Possibility of determining assemblages of old imprints – estimating age and sex from skeletal remains
Disadvantages from the analysis viewpoint	Anonymous imprints, usually small-sized, possibility of secondary imprint deformation (in molded figurines).	Rare finds, uncertain time of plasticity ie. origin of imprint, bio- and chemical degradation.	Medium not durable, uncertain time of imprint formation.	Abrasion of paint from surface.	Culturally restricted medium.	Different areas of the hand and fingers compared to other imprints, fragility of corrosion products.	Rare finds, legislative limitations of study, body degradation.

Table 1 Summary of the most important transfer media of ancient fingerprints and the relevant properties of fingerprints as they relate to the transfer media.

1 The question of contemporaneity of the medium being inscribed and the medium used for inscription (paper and ink).
2 The imprint which was formed during the manufacture of the ceramic piece is a trace of its maker. Other imprints can belong to assistants or to individuals present by chance. In each case, the people who left their prints behind were present during the manifacture of the ceramics.
3 The contemporaneity of the creation of the object (e.g. wax seal) with imprints is related to the maintenance of the (medium) plasticity even after the creation of the object.
4 If the ink and the paper are contemporaneous, the author of the fingerprint can be the text writer, but this need not to be the case. It does not have to be related to the manufacture of the paper.
5 The originator of the fingerprints may have been the author of the photographs, but this need not to be the case. The imprints do not have to be related to the manufacture of the photographic plate.
6 Various parts of the hand and fingers, depending on if the imprints are traces of molding or grasping; in the case of amorphous pellets, the imprint of papillary terrain could be a leg imprint.

THE RELATIONSHIP BETWEEN THE NUMBER OF IMPRINTS AND THE NUMBER OF INDIVIDUALS

The number of prints does not speak of the number of individuals; twenty prints on one ceramic artifact can indicate twenty individuals or twenty prints of the same area of the papillary terrain of one person, or any combination of these. Moreover, depositional and post-depositional processes affecting pots can break up natural imprint groups (e.g. 1 pot = 1 potter). This applies to all multiple imprints. Only imprints in corroded metal objects (rings), and the skin of a mummy are always originals. These specific cases also bring about certain complications during the evaluation and use of data when making group comparisons. Although we are evaluating human biological characteristics, it is not quite clear, exactly who should be statistically considered to be a biological and therefore a "natural" representative individual. When making population comparisons using a single parameter it is necessary that every individual is assigned a number. A single individual can only have one femur sinister, while a large number of prints can be produced using a single region of the papillary terrain. One individual should thus be represented by a central tendency value of a given characteristic from all the prints on an artifact (as long as the given characteristic can be averaged). However, we do not have the certainty that all the prints on an artifact belong to a single individual. In this case, the mean value represents two or more individuals which is an unacceptable situation from the viewpoint of biological comparisons and interpretations. Moreover, even artifacts are often incomplete and there is a risk that we are evaluating two unrelated parts of the same pot as two separate artifacts (i.e. individuals), but the prints actually belong to a single individual. On the other hand, a print can be considered as a statistically representative individual. Every print is an independent event and, if not biologically, then at least in terms of traceology, can be considered a "natural" individual. Then we could be comparing assemblages which could have a comparable number of "individuals", but can have completely different number of actual people who left the imprints. This situation cannot be prevented even in the aforementioned situation (1 artifact = 1 individual). The resolution of these difficulties will depend on the needs of the particular research question. It would still be useful to advance some generally acceptable protocol for bridging the blurred hierarchy evident in fingerprint samples. Such protocols include, for example, methods for estimating the maximum and minimum number of individuals (humans) in a sample. In the simplest case, the decision that would need to be made is whether the prints on one artifact belong to one or more individuals. To make this decision, it is necessary to have knowledge of the maximum intra-individual variability of particular dermatoglyphic features.

CONCLUSIONS

Ancient fingerprints can be found on a plethora of different materials. Ceramics is the most prominent transfer media but other media can also be important with respect to specific properties and circumstances of fingerprint formation. With the increasing awareness of ancient fingerprints, the types of materials which record fingerprints is likely to increase. The prerequisite for preservation and discovery of ancient fingerprints is close collaboration of archeologists and museum workers (conservators, museologists). It is these people who are most likely to notice prints during their daily routine activities. A careful approach to cleaning and restoring artifacts and an awareness of the existence of imprints can greatly aid the progress of ancient fingerprints studies. Due to the various properties of the transfer media, collaboration with other specialists (chemists, physicists) is necessary.

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References

Babler W 1979. Quantitative Differences in Morphogenesis of Human Epidermal Ridges. Birth Defect, Original Articles, Series 15, Alan R. Liss Inc., New York, 199–208.

Bartsocas CS 1982. Paleodermatoglyphics. In: C.S. Bartsocas (ed.) Progress in Dermatoglyphic Research, Alan R. Liss, Inc., New York, 139–143.

Basilidade G, Rişcuţia C 1974. Studiu dactiloscopic şi traseologic pe o serie de fragmente de ceramică neolitică. In: E. Comsa (ed.) Istoria comunităţilor culturii Boian. Bucuresti, 255–258.

Beneteau D 2005. Fingerprints in Bronze, <http://www.fogwells.com/vincesbook/stories/fingerprints.html>.

Bialek I, Brzozowski J, Czubak A 2003. Latent Print Detection on Incunabula – A Case Study. Forensic Science International, 136 (Suppl. 1): 132.

Corey M 2002. 450 year old Fingerprints found from St. John's Bahamas Wreck! Mel Fisher Maritime Heritage Society, <www.melfisher.org/fingerprints.htm>.

Cseplák G 1982. Anthropological analysis of the impressions originating from man's hand on the neolithic pottery fragments. Humanbiologia Budapestinensis, 10: 135–140.

Cummins H 1941. Ancient Finger Prints in Clay. The Scientific Monthly, 52: 389–402.

Cummins H, Midlo C 1926. Palmar and plantar epidermal ridge configuration (dermatoglyphics) in European-Americans. American Journal of Physical Anthropology 9: 471–502.

Einwögerer T 2000. Die jungpaläolithische Station auf dem Wachtberg in Krems, NÖ. Eine Rekonstruktion und wissenschaftliche Darlegung der Grabung von J. Bayer aus dem Jahre 1930. Verlag der Österreichischen Akademie der Wissenschaften, Wien.

Evershed R P, Berstan R, Grew F, Copley MS, Charmant A J H, Barham E, Mottram H R, Brown G 2004. Formulation of a Roman cosmetic. Nature 432: 35–36.

Kamp KA, Timmerman N, Lind G, Graybill J, Natowsky I 1999. Discovering childhood: using fingerprints to find children in the archaeological record. American Antiquity, 64: 309–315.

Koller J, Baumer U, Mania D 2001. High-tech in the middle Palaeolithic: Neandertal-manufactured pitch identified. European Journal of Archaeology, 4: 385–397.

Králík M, Hložek M 2007. Hodnocení otisků prstů na dvou miniaturních keramických nádobkách kultury s MMK z Těšetic-Kyjovic (pilotní studie). Sborník prací Filosofické fakulty Brněnské university, řada M 10, Annus 2005-2006: 21–42.

Králík M, Novotný V 2003. Epidermal ridge breadth: an indicator of age and sex in paleodermatoglyphics. Variability and Evolution, 11: 5–30.

Králík M, Novotný V 2005. Dermatoglyphics of Ancient Ceramics. In: J.A.Svoboda (ed.) Pavlov I Southeast. A Window Into the Gravettian Lifestyles. Archeologický ústav AV ČR Brno, 449–497.

Králík M, Novotný V, Oliva M 2002. Fingerprint on the Venus of Dolní Věstonice I. Anthropologie, 40: 107–113.

Lička M, Musil J 1975. Určování pohlaví a věku na základě otisků papilárních linií v archeologii a kriminalistice. Československá kriminalistika, 8: 185–193.

Mania D, Toepfer V 1973. Königsaue: Gliederung, Ökologie und mittelpaläolithische Funde der letzten Eiszeit. Berlin.

Orton C, Tyers P, Vince A 1993. Pottery in archaeology. Cambridge University Press, Cambridge.

Peška J, Berkovec T Hložek M, Králík M, Selucká A, Richtrová A, Pelíšková R 2005. Konzervace a materiálový průzkum kovových nálezů ze starší doby bronzové z Hulína – U Isidórka. Sborník z konference konzervátorů a restaurátorů 2005, Technické muzeum v Brně, Brno, 49–57 a VI-VII.

Pavelčík J 1958. Úvalno-Šelenburk, okr. Bruntál, sídliště kultury lužické a slezské. Nálezová zpráva Archeologického ústavu Československé akademie věd, Brno.

Primas M 1975. Fingerabdrücke auf Keramik der Eisenzeit im Tessin. Archäologisches Korrespondenzblatt, 5: 129–131.

Prominska E, Dzierzykray-Rogalski T, Grzeszyk C 1986. Dermatogliphics of Pharaohs' Mummies. In: A.R. David (ed.) Science in Egyptology. Manchester University Press, Manchester, 155–170.

Schmidt C W, Nawrocki S P, Williamson M A, Marlin D C 2000. Obtaining Fingerprints from Mummified Fingers: A Method for Tissue Rehydration Adapted from the Archeological Literature. Journal of Forensic Sciences, 45: 874–875.

Sjöquist K-E, Åström P 1985. Pylos: Palmprints and Palmleaves. Paul Åströms Förlag, Göteborg.

Sjöquist K-E, Åström P 1991. Knossos: Keepers And Kneaders. Paul Åströms Förlag, Göteborg.

Sládek V 1994. Keramika a keramické zbytky z mladopaleolitického naleziště Pavlov I. Katedra antropologie, Přírodovědecká fakulta Masarykovy univerzity v Brně, Brno (magisterská diplomová práce).

Spindler K 1998. Muž z ledovce. Mladá fronta, Praha.

Strouhal M 1999. Tvář Brna a Čas. Knihkupectví a nakladatelství Ryšavý Šimon, Brno.

Szilvássy J 1983. Hautleistenbefunde aus der jungpaläolithischen Station Pavlov (Südmähren, CSSR). Mitteilungen der Anthropologischen Gesellschaft in Wien, 113: 61–64.

Šefčáková A 1998. Eneolitické antropologické a archeozoologické nálezy z Pezinka-Tehelne. Zborník Slovenského národného múzea XCII (Archeológia), 8: 27–31.

Šikulová V 1956. Předběžná zpráva o archeologickém nálezu v Napajedlích. Zprávy krajského muzea v Gottwaldově, 19.

Vlček E 1951. Otisky papilárních linií mladodiluviálního člověka z Dolních Věstonic. Zprávy anthropologické společnosti, 4: 90–94.
Vlček E 1952. Empreintes papillaires d'un homme paléolithique. L'Anthropologie, 56: 557–558.
Vogelius Andersen C H 1956. Forhistoriske fingeraftryk. KUML, 151–154.
Wood, J. W., Milner, G R, Harpending, H C, and Weiss, K M 1992. The osteological paradox: Problems of inferring prehistoric health from skeletal samples. Current Anthropology 33: 343–370.
Åström P, Eriksson S-A 1980. Fingerprints and Archaeology. Studies in Mediterranean Archaeology 28, Paul Åströms Förlag, Göteborg.

Unintentional artefacts: fingerprinting material culture

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Abstract

Fingerprints are an incredible resource to archaeologists that remains untapped by the academic community. A technology that has existed for nearly a hundred years may provide considerable information concerning individuals, socio-economic roles, and relationships between communities. As an unintentional artefact within material culture, fingerprints contain intrinsic data and act as a means of identification. Whilst their role as a biometric "signature" has yet to be utilised, current research demonstrates their value to our understanding of material culture.

INTRODUCTION

Material culture is the "meat" of archaeology. For as long as human societies have been documented, their members have been producing tools, weapons, utilitarian objects, ritualistic objects, and objects of aesthetic value. Some archaeologists would argue that the more "civilised" a society becomes, the more "stuff" it produces both in quantity and variety (Kingery 1996). This is material culture and this is what archaeologists depend on in order to piece together the daily lives of individuals. Like evidence to a detective, material culture provides clues to the status, occupation, values, and lifestyles of the people within a particular civilization.

In most instances, the material culture excavated by archaeologists is rubbish. They are the broken objects, objects deposited during ritual or objects abandoned for whatever reason that are later found in the name of academic study. Whilst the recovery of these objects was probably never intended by those who produced them, the objects themselves were certainly intentionally made. Whether it is a stone tool for butchering an animal or a pot made to transport wine, material culture is driven by intention, and to some extent, necessity. There is a need for the tool or a need for a purpose-made container. Material culture is full of intentional artefacts. But what do humans leave behind unintentionally? Are there artefacts produced without a need or intent behind them?

In 1920, Dr. Edmond Locard coined his now-famous Principle of Transference or Exchange. To paraphrase, the principle states that "whenever two things come into contact they leave a trace" (Locard 1920). Applying this to material culture, if an individual comes into contact with an object, he or she will leave an unintentional trace on that object. Such traces include remains of DNA and fingerprints. Whilst DNA is easily contaminated and degraded, fingerprints, if left in the right medium, may be preserved for thousands of years. These unintentional artefacts can provide a wealth of information to the researcher, adding to our knowledge and understanding of material culture.

OCCURRENCE OF FINGERPRINTS IN ARCHAEOLOGICAL CONTEXTS

A fingerprint is a mark left behind by the friction ridges of the hands. There are two types of fingerprints: latent prints that are invisible, left behind in sweat, and plastic prints that are left behind in another medium. An individual's fingerprints develop six weeks after conception and are one of the last things to decompose. Fingerprint patterns and minutiae do not change during life and no two people, not even identical twins, share the same fingerprints.

Latent fingerprints, by their very nature do not survive. Even in a modern crime scene scenario, fingerprints must be collected as soon as possible before there is the opportunity for them to be

wiped away. In an archaeological context, whilst the preservation of a latent print is not completely impossible, the circumstances required make it highly unlikely.

In contrast, plastic prints do have a high survival rate. In the production and interaction with material culture, any tacky substance such as clay, wax, grease, or paint will hold a fingerprint. It is then the depositional circumstances that will determine whether that fingerprint survives archaeologically.

One of the best substances for preserving fingerprints is clay. On pottery numerous instances of fingerprints have been documented. Fingerprints are left under two circumstances: either unintentionally as the clay is moulded into the desired shape or as fingertip or fingernail impressions, utilised as a form of decorative design.

Another high volume object made in clay is mud brick. In the ancient Near East, the majority of all structures utilise mud brick construction. Often bricks are stamped with the name of the authority responsible for the erection of the new structure. In the same way, fingerprints will "stamp" the brick with the individual responsible for shaping it. A good example is an Elamite brick dating from the Middle Elamite period, 1450 – 1100BC (Bailey 2003). The faint friction ridge impressions occur along the edges of the object only; the top of the brick contains cuneiform writing. As is the case with many clay artefacts, whilst the object may have been completely covered with fingerprint impressions as it took shape, the finishing of the item with either text or a seal impression will eradicate some or all of the fingerprints. This is particularly true in the case of sealings and tablets. Whilst the potential for fingerprint remains is very high, any fingerprints that do survive the process of writing or sealing tend to be located on the edges of the object. However, if the object is deemed unimportant, such as a practise tablet or a seal thrown together quickly, less finishing occurs and therefore more fingerprints.

As mentioned earlier, fingerprints are one of the last things to decompose. One of the reasons for this is that the ridges of the hands and feet are present through every layer of the epidermis and are also visible via the papilla of the dermal layer. Mummified remains, such as those from ancient Egypt, have a very high potential for fingerprint remains. Whilst very few cases have been documented in archaeology (Lambourne 1984), the use of fingerprints with desiccated or mummified corpses and cadavers is wide-spread in forensic science.

Finally, a remarkable case is a jar of Roman face cream unearthed in 2003 in Southwark, South London (BBC News 2003). The jar itself was sealed and had remained unopened. Inside, the cream was still moist and contained a clear fingerprint. Whilst this is an exceptionally rare case, it perfectly illustrates both an unintentional artefact and the possibilities within plastic fingerprint preservation.

Plaster is a common substance found in the archaeological record and has the right qualities for fingerprint preservation in that it is a tacky substance that hardens as it dries and can last for thousands of years. However, to date, no record of fingerprints found in plaster exists. Other substances found in archaeological contexts and containing the potential for fingerprints include ink, paint, and one widely used in forensic scenarios: blood. Most plastic prints from crime scenes are found in blood. Blood residue certainly survives into the archaeological record, but no documented cases of bloody fingerprints exist. With any substance, the lack of noted fingerprints does not necessarily mean that fingerprint remains are not present or could not be found in the future. As will all the mediums noted above, mention of fingerprints is the exception, not the norm, mostly due to a lack of awareness on the part of the archaeologists. However, as the field of forensic science has gained general popularity in the past decade, the mention of fingerprint remains on archaeological objects has greatly increased.

FINGERPRINTS – WHAT CAN THEY TELL US?

Fingerprints on an object can provide a wealth of information. However, the fingerprint itself does not actually contain as much data as one might expect. Whilst many studies have been conducted attempting to define gender and ethnicity through fingerprints, the research has proven inconclusive and at times almost suspect. Studies into intelligence level based on fingerprint patterns, when linked to those of gender and/or ethnicity, can lead to dangerous assumptions (Asbourne 2005).

Fingerprints, on their own, can reveal a few details about their owners. One such detail is handedness. The arc of the friction ridge flow will indicate which hand was used in the making of the object. The dominant hand of the individual is the "doer" of an action and the non-dominant is the "supporter." Some simple deductive reasoning will then indicate which hand was being used and thus the handedness of the individual.

Ridge pattern and flow will also determine what part of the hand the imprint is from, which finger, or what part of the palm.

Finally, a fingerprint impression may provide an estimate of an individual's age. Whilst a fingerprint pattern does not change during life, it does expand. The distance between ridges will increase over time, and some studies suggest that certain ages have a standard width between ridges (Králík & Novotny 2003). However, this does assume an average hand size that might not apply to people in antiquity. Also, in the case of clay objects, the fingerprint may be distorted by the movement of the clay.

The main power of fingerprints lies in their ability to act as the surest means of identification, even more accurate than DNA. As mentioned before, no two people will have the same fingerprints, but identical twins will have the same DNA. The uniqueness of fingerprints lies in the variations of the ridge paths, known as minutiae. Minutiae provide the "points of comparison" used to compare two sets of fingerprints. The possibility that two different fingerprints would share the same four points of comparison in the same position is 1 times 10 to the 27th power (Wade 2003). In addition, only a partial fingerprint can provide a match as long as there is sufficient quality of mi-

nutiae present.

The ramifications for archaeology and our understanding of material culture are huge. Imagine if an unearthed artefact is found with a label on it saying, "made by Joe Smith, 25, scribe responsible for recording king lists." Essentially, that is what a fingerprint could do. The fingerprint is a signature. It can indicate age. And if several objects are found with the same fingerprint, it can reveal the individual's role, employment, status, and life span. If two objects with the same fingerprint are found at different sites, then there is concrete evidence that the two sites have some sort of relationship with each other, whether it is through trade, people migration, etc.

A CASE STUDY FOR FINGERPRINTS

A new, and still unpublished, study provides an excellent example of how fingerprints can contribute to our understanding of material culture (Jägerbrand). 3,000 pot sherds from a Neolithic site in Sweden were examined for fingerprint remains. The sherds are from a pitted-ware culture meaning that the ceramics are characterised by pits or hollows as a form of decoration. These hollows are made by applying pressure with the tips of the fingers. The pits vary in size from 3 mm to 8mm.

By applying fingerprinting techniques, the researchers have determined that the pits are predominately made using the index finger; however, some utilised the ring finger. Other fingerprints on the vessel indicated that the maker would hold the vessel with his left hand, wipe the vessel smooth, and then make the decorative pits with his right hand. Eleven of the fingerprints were then selected for age determination. By measuring the distance between ridges, eight of the fingerprints were found to be made by someone between the ages of 11–18, two were of an 11 – 12 year old, and one was 19. This indicates that ceramic making, or at least the decorative aspects, was a role for teenagers.

CONCLUSION

Whilst the role of fingerprints as a means of identification has yet to be exploited, the intrinsic data within fingerprints is beginning to be utilised. As researchers spread the word of the value of fingerprint information, there is hope that, in time, more and more archaeologist will recognise, note, and record any fingerprint remains as part of their data collection. As the case study above demonstrates, exciting findings may result.

References

Ashbourn, Julian 2005. "The Social Implications of the Wide Scale Implementation of Biometric and Related Technologies." Institute of Prospective Technological Studies, DG JRC, Sevilla. http://cybersecurity.jrc.es/docs/LIBE%20Biometrics%20March%2005/SocialImplications_Ashbourn.pdf

Bailey, James A 2003. "Fingerprints from Antiquity: Casting Impressions on Elamite Brick." Minutiae, vol. 76: 8.

BBC News 2003. "Capsule reveals cream of Roman society" http://news.bbc.co.uk/go/pr/fr/-/1/hi/england/london/3101701.stm

Jägerbrand, Mikael 2005. (unpublished dissertation) University of Stockholm.

Kingery W. David (ed.) 1996. Learning from Things: method and theory of material culture studies. Smithsonian Institution Press, Washington, D.C.

Králík, Miroslav & Novotny, Vladimír 2003. "Epidermal Ridge Breadth: an indicator of age and sex in paleodermatoglyphics." Variability and Evolution, vol. 11: 5 – 30.

Lambourne, Gerald 1984. The Fingerprint Story. Harrap, London.

Locard, Edmund 1920. L'enquete Criminelle et les Methodes Scientifique. Ernest Flammarion, Paris.

Wade, Colleen (ed.) 2003. Handbook of Forensic Services. FBI Laboratory Publications, Quantico.

Documentation of fingerprints on ancient artefacts

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Abstract

Archaeologists often find fingerprints on ancient artefacts. But they are seldom properly documented and thereby useless for other scientists.

This lack of documentation depends on lack of standards and methods. In this article several new standards, methods and even forms are suggested.

INTRODUCTION

Fingerprints is one of the most used pieces of evidence in criminal forensics. It has been used in courts for over a century to convict thousands of criminals all over the world. The patterns formed by the papillar lines on fingers and palms are unique. Not two patterns are the same on two persons, twins or even on two fingers of the same hand (von Schultz 1924:143, Eriksson & Rispling 1964:34, Olsson 2000:6). The probability for two fingerprints to be exactly the same is 1 in 2 980 232 769 250 000 000 000 000 000 000 000 000 (Ljungqvist 1991:6).

Fingerprints are mostly found in ceramics and if the clay have the right texture and consistency they will be preserved all over the surface. If no fingerprints are found on ceramics it is most likely that they were removed by the potter in the final phase before the actual burning (Cummins 1941:401). In the archaeological material there are vast quantities of preserved fingerprints (Lindholm under production. Unfortunately only a handful have been properly documented. The reason for this is most probably that the archaeologists don't know any methods and has no standards to do the documentation properly. In this article some standards and methods are suggested.

HISTORY

The very first archeologist who documented fingerprints in ceramics was William Frederic Badé during his excavations in Tell en-Nasbeh 1927 in present day Israel. The excavation uncovered so vast quantities of ceramics that the dig was described as "chaotic" and no layers could be defined. On the handles on pots and on the inside of lamps a criminal forensic expert hired by Badé found hundreds of fingerprints. These were so well preserved that the expert could show that all the ceramics was made by the very same potter. This made it possible to conclude that the whole site only was occupied during a short time (Åström 1969:1, Branigan & Papadatos & Wynn 2002:49).

In the field of archaeology the most successfull use of fingerprints have been in the study of the working methods of potters. The different patterns formed by the papillar lines are more frequent on some fingers than on others, thus makes it possible for an expert to positively conclude which finger that made the imprint (Eriksson & Rispling 1964:172). When the archaeologist knows which finger that was used the working methods of the potter can be shown (Mohr 1981:23).

A fingerprint close to the base of a Cypriotic Bronze Age bowl from Enkomi showed the archaeologist that the potter held the bowl with his hands when it was dipped in paint (Åström 1969:3).

Another area in archaeology where fingerprints have been used successfully is in the determination of the age of the potter. Even though the patterns formed by the papillar lines are exactly the same from birth until death, the distance between the ridges of the papillar lines changes. This ridge breadth widens from during childhood and stabilizes when we are adults (Kamp et al 1999:309, von Schultz 1924:171).

By carefully executed measurements the average ridge

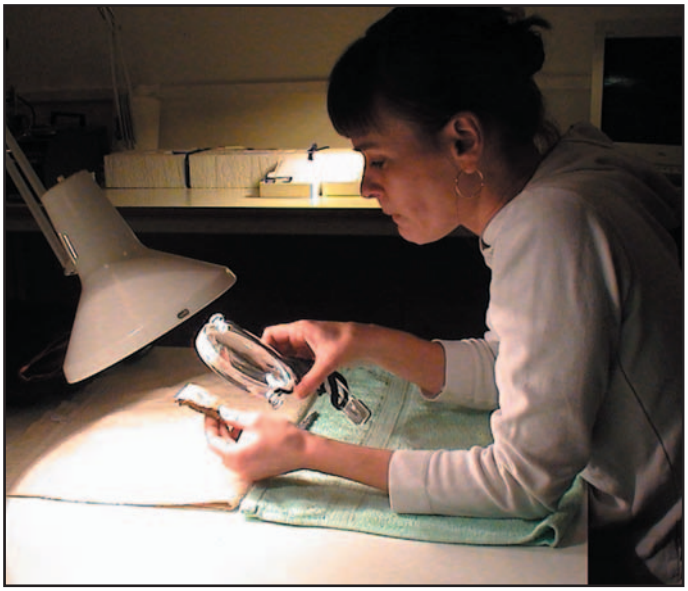

Figure 10. When searching for fingerprints on ancient artefacts it is important that the light source is in a 45° angle. An ordinary office lamp is sufficient.

Figure 11. Closeup image of a imprint of a finger on a ceramic sherd from the Stone Age-site of Gullrum in Sweden. This image was taken with a Sony digital camera.

breadth can be calculated and by inserting this into formulas it is possible to get the estimated age of the person who made the imprint (Králík & Novotny 2003B:129).

This method has been used on the world's oldest ceramics, ca 25 000–35 000 BP, from Dolni Vestonice. Measurements on 56 fingerprints from 29 sherds showed that the imprints had been made by 12 year old children (Králík et al 2004:21).

These measurements can be made on fingerprints as small as 3-5 mm (Kamp et al 1999:309ff). This means that even the smallest trace of papillar lines on archaeological material is important and should be documented.

DOCUMENTION OF FINGERPRINTS IN CRIMINAL FORENSICS

It is in the justice system and in criminal forensics that the best experiences of documentation of fingerprints have been made. Most of the fingerprints that forensic experts document are actual "prints", substances from the pores of the fingers which has been left on objects. These prints are only preserved for days or months (Åström & Eriksson 1980:18).

The most important documentation method used by the police is photography. The fingerprints are photographed wether they are developed with the help of powder, chemicals or secured with tape or casts. It is always these photographs that then are used to make identifications. When photographing a print it is always in natural scale 1:1 (Kriminalteknik nr 4:2000:13).

During the photography it is important that an "id-tag" is included in the picture with a scale, reference-number, date, initials of the photographer and where the print was discovered (Wade 2003:71ff).

When it comes to imprints, which is made by the finger in plastic materials, the police usually make a cast. A widely used material is Mikrosil which has a chewinggum-like consistency. In other cases silicone, plaster or dental material are used (Rajs et al 1990:10ff). The majority of these materials contaminates or destroys the object where the imprint was found (Miroslav Kralik mail 041123).

The fingerprints found by archaeologists are, with some unusual exeptions, imprints and not actually prints.

DOCUMENTATION OF FINGERPRINTS IN ARCHAEOLOGY

In archaeology there are no standards or methods to document ancient fingerprints. In an excavation everything is methodically documented: exactly where the artefacts were found, the size and shapes of the artefact and often numerous photographs. In some cases the objects found are photographed next to a measurement-scale or ruler which shows centimeters or inches.

During excavations of a Minoan gravefield and a small village on Crete 97 fingerprints was found on some of the 16 000 ceramic sherds. The fingerprints was documented with forms where information about every fingerprint was registered. The prints was also photographed with a mm-scale (Branigan & Papadatos & Wynn 2002:50f).

The swedish archaeologist Paul Åström have made several welldocumented studies, starting in the late 1960s. Most of the investigations have been done in cooperation with leading experts on fingerprints from the swedish police. During a study of 1 400 myceanian writingtablets made of clay, fingerprints was found on 80% of the tablets. The expert Karl-Erik Sjöquist documented the fingerprints with photographs, he placed a mm-scale and a id-tag next to the prints (Sjöquist & Åström 1985).

Fig 12. Fingerprint on a Stone Age sherd from Siretorp, Sweden. The arrow shows where the imprint is located.

Fig 13. A photo of the backside of the sherd in figure 12. This photo shows the typical pitts of vessels from the Pitted Ware culture.

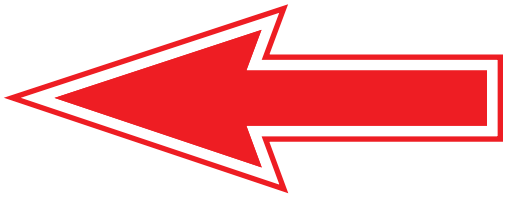

Fig 14. An arrow is a good graphic symbol to show where on the artefact the fingerprints is located.

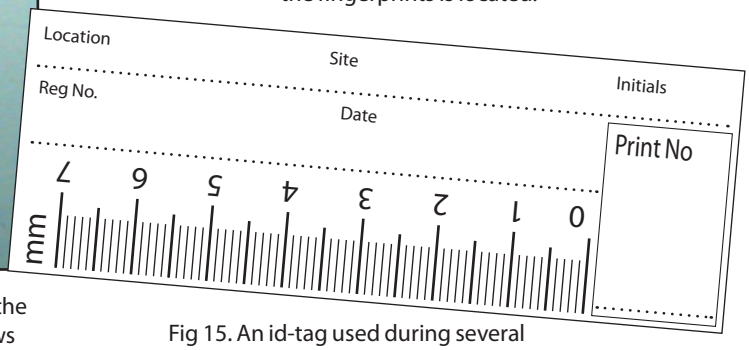

Fig 15. An id-tag used during several studies of fingerprints in Sweden.

SOME STANDARDS WHEN DOCUMENTING FINGERPRINTS

The documentation of ancient fingerprints must begin in the field, during the excavation. This means that the archaeologists must start looking for fingerprints the second the artefact are unearthed. To search all the finds after the dig simply takes to much time. Searching through five kilograms of ceramics takes about one hour for two persons. An excavation which has yielded 200 kilograms would take at least one week, probably two, to search.

And since one single fingerprint can give more information about the ancient human than most other artefacts the importance of seraching for, and documenting, fingerprints cannot be stressed enough.

It is important that every artefact with a fingerprint, whether it is made of gold or clay, are registered as a find and given a number. If a sherd is documented and then just put among thousands of other sherds it is extremely difficult for another scientist to find it in order to verify it.

Every fingerprint that is found should be photographed and in the picture there must be a scale which is detailed, the best scale to use is millimeter. Of equal importance is to have an id-tag, figure 15, in the picture which shows location, date and the reference/registration number.

The photographs can be taken with a 35 mm system camera or a digital camera. It is important that the picture is taken directly from above and that the print is in the center of the picture, this prevent the image from distortion of widescreen lenses.

The higher resolution the image have the better it is. In a well preserved imprint it may be possible for the expert to find details in the pores that forms the papillar lines. These are smaller than 0,1 millimeter. This precision are presently not even used by criminal forensics but may be used by archaeologist in the future.

When there are many fingerprints to document it is important to write information about every picture taken in a photo-journal. When photographing ceramic sherds this is even more important as many sherds are nearly identical.

Every fingerprint should be documented with 4-5 images; several closeups of the print, several images where the whole artefact is shown (put an arrow which points to the exact location of the fingerprint, figure 12) and one final picture showing the "backside" of the artefact (figure 13).

It may not seem important to take photos of the back of the artefact but in one study of pitted ware ceramics it proved vital. The ceramics were from the Stone Age location of Siretorp, Sweden. In the study, a large number of imprints of fingers were found on a large number of sherds. Furthermore, all the imprints on the sherds were found on the inside of the vessels. When studying the photos it became obvious that the imprints were located exactly were the characteristic pitts of this ceramics had been made (Jägerbrand & Lindholm & Sjöquist 2006:1ff).

Arrows (figure 14) makes a good visual effect to illustrate exactly where on a artefact the imprint was found. Arrows can be made of paper or purchased by suppliers of forensics products. The arrows used by the police are 60 mm long. Be sure to place

Fig. 16

Documentation of fingerprints

Print No:

State:

County:

Site:

Reg No:

Closeup
photo in scale 5:1 (500 %)

[this frame is 150 mm x 100 mm]

Date:

Excavator:

Scale of photo:

In charge:

Artefact stored:

Other:

photo of artefact

[this frame is 85 mm x 60 mm]

Scale of photo:

[this frame is 70 mm x 60 mm]

Prints Date: Expert:

Left thumb	Left index finger	Left	Left	Left
Left thumb	Left index finger	Left	Left	Left

Notes:

the arrow on the same height as the fingerprint when you take photographs as it is easier to focuse the lens on the arrowhead than on the print itself.

When the fingerprint is properly photographed, all the information about the print must be documented on a form. You are free to use the form shown in figure 16 (front) and figure 17 (back). The front is designed to be used by the archaeologist in the field, and on the back there is plenty of room for a fingerprint expert to write down his observations. On this form the photos can be glued on the paper or digitally inserted with photoshop.

If the documentation is made with a digital camera it is important that the date is properly set in the camera. If you keep a detailed photojournal you will know when the picture is taken and with an accurately timelined picture it is easy to find it on your computer.

COOPERATION WITH THE POLICE

When large amounts of fingerprints are found, there is a real possibility that many of them are made by one individual. This cannot be determined by an untrained archaeologist but must be done by an expert with years of experience. These experts are only found in the police force.

This makes it necessary for excavators and other archaeologists to cooperate with the local or national police. In some cases it is possible to get the help of a retired police expert who may have a interest in history and in other cases a more formal cooperation between the police authority and the excavator is necessary.

When it comes to search for fingerprints on artefacts there is no real need to hire experts. This can be done by archaeologists in the field or in the vast collections of the museums. How to learn to identify a fingerprint on an artefact only takes minutes, but to learn to identify a specific pattern and then to determine the exact finger takes years.

In an ideal situation the archaeologists gather all the fingerprints they have found during a dig and then consults an expert for a day or two. This is how we an build a team who investigates the mystery of ancient fingerprints, a team that I would like to name “CSI BC”...

References

Branigan, Keith & Papadatos, Yiannis & Wynn, Douglas 2002. Fingerprints on early minoan pottery: a pilot study. The annual of the British school of Athens No 97 - 2002. London.

Cummins, Harold 1941. Ancient fingerprints in clay. Scientific monthly 52. New York.

Eriksson, Sven Arne & Rispling, Olle 1964. Identifieringslärans grunder. Stockholm.

Jägerbrand, Mikael & Lindholm, Christel & Sjöquist, Karl-Erik. 2006. Fingeravtryck på gropkeramik från Siretorp i Blekinge och Gullrum på Gotland. Fornvännen 101. Stockholm

Kamp, Kathryn A & Timmerman, Nichole & Lind, Gregg & Graybill, Jules & Natowsky, Ian 1999. Discovering childhood: using fingerprints to find children in the archaeological record. American Antiquity 64(2) 1999 s 309-315. Washington DC.

Králík, Miroslav & Novotny, Vladimír 2003 B. Paleodermatoglyphics: retrospective application of friction skin biology. Forensic science international 136, suppl 1. Turku.

Králík, Miroslav & Novotny, Vladimír 2003 C. ”Epidermal ridge breadth: an indicator of age and sex in paleodermatoglyphics”. Ur Variability and evolution Vol 11:5-10. Posnaf, Polen.

Králík, Miroslav & Novotny, Vladimir & Vancata, Václav 2004. ”Paleodermatoglyfika - analyza otisku prstu na praveke keramice: teoretická vychodiska, metodologicke problémy a praktická doprucení”. Brno.

Kriminalteknik 2000. Digitala fingeravtryck via GroupWise. Kriminalteknik 2000:4. Stockholm.

Lambourne, Gerald 1984. The fingerprint story. London.

Ljungqvist, Michael 1991. Fingeravtryck. Dess historia och varaktighet. Specialarbete Polishögskolan. Stockholm.

Mohr, Anna 1981. Arkeologins fingeravtryck. Brottstycken – notiser om arkeologiskt och kulturhistoriskt detektivarbete. Stockholm.

Morse, Edward 1879/2539. Shell mounds of Omori. University of Tokio. Tokyo.

Olsson, Jan 2000. Myter, dogmer och vetenskap. Kriminalteknik 2000:2. Stockholm.

Olsson, Jan 2004. Personidentifieringens historia. Kriminalteknik 2004:1. Stockholm.

Petré, Bo 1990. Arkeologisk undersökningsteknik – exempel på metoder och dokumentation vid arkeologiska undersökningar. Stockholm.

Rajs, Jovan & Kullman, Leif & Hansson, Håkan 1990. Användning av ett odontologiskt avtrycksmaterial för identifiering av föremåls som orsakat en dödlig skallskada. Kriminalteknik 1990:1. Stockholm.

Sjöquist, Karl-Erik & Åström, Paul 1985. Pylos: Palmprints and palmleaves. Göteborg.

Sjöquist, Karl-Erik & Åström, Paul 1991. Knossos: Keepers and kneaders. Göteborg.

Thorwald, Jürgen 1967. Spåren som avslöjar – fingeravtryck och kulmärken. Zürich.

Wade, Colleen 2003. Handbook of forensic services. FBI Laboratory. Quantico, USA.

Von Schultz, Rudolf 1924. Kriminalpolis. Undersökning och spaning i brottmål; signalementslära och fingeravtryck. Uppsala.

Åström, Paul 1969. Finger-prints on cypriote Bronze Age pottery. Praktika tou proton Diethnous Kyprologikou. Leukosia.

Åström, Paul 1980. Arkeologiskt detektivarbete. Surte.

Åström, Paul & Eriksson, Sven A 1980. Fingerprints and archaeology. Göteborg.