ANIMAL AND HUMAN FOOTPRINT-TRACKS IN ARCHAEOLOGY: DESCRIPTION AND SIGNIFICANCE

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Human and animal footprint-tracks and trails (footprint-track sequences) can contribute to many archaeological questions, including human and animal population compositions, hunting practices and husbandry, seasonal occupancy and exploitation, and behaviour in/modification of an environment. A descriptive nomenclature suitable for general archaeological use is outlined, in order to encourage a more systematic approach to the gathering, analysis and interpretation of this kind of important evidence.

INTRODUCTION

As every hunter and tracker has known, characteristic marks remain behind wherever and for whatever purpose an animal or a human moves across impressionable sediment or soil. These marks recording movement - loosely referred to as 'footprints' - contribute, especially after burial, to what are variously called trace fossils, ichnofossils or *lebenspurren*, the subject of the overarching field of ichnology.

Movement-traces and the various matters on which they depend have been researched within no less than five nominally distinct disciplines, that is, palaeobiology (eg Hitchcock 1858; Thulborn 1990; Lockley 1991; Lockley *et al* 1992; Lockley and Hunt 1995; Lockley and Meyer 2001; Romano and Whyte 2003), archaeology (eg Williams 1952; Cram and Fulford 1979; Faton and Richet 1985; Wall 1985; Price 1995; Roberts *et al* 1996; Clottes 2003), physical anthropology (Alexander 1984; White and Suwa 1987; Crompton and Yu 1997), forensic science (Robbins 1985; Gregory *et al* 1988; Gordon and Buikstra 1992; Giles and Vallandigham 1991), and natural history and ecology (Leutscher 1960; Lawrence and Brown 1973; Liebenberg 1990; Cohen *et al* 1991, 1993; Bang and Dahlstrøm 2001). Significant related research on aspects of human and animal gait has also been carried out in the fields of ergonomics and biomechanics (eg Grieve and Gear 1966; Grieve 1968; Thorpe *et al.* 1998; Li *et al.* 2001; Wang and Crompton 2003). The ecological writings in particular greatly aid the specific identification of extant trace-makers. Those that are extinct, however, present difficulties that increase with geological age. In the case of the older fossil mammals and the dinosaurs, it is generally impossible to establish the specific identity of a trace-maker, with the result that a dual nomenclature has been developed by some investigators.

Unfortunately, there has been little exchange between these fields, and overall syntheses of their standpoints, methods and achievement that might lead to unification have not been attempted. The fields have developed their own particular and frequently conflicting approaches to the description of movement-traces, depending on the animals of interest and the modes of preservation of these features. In archaeology, movement-traces have seldom received systematic attention and in some cases have been treated merely as curiosities. The lack of a generally applicable descriptive nomenclature for movement-traces of archaeological interest is partly to blame for this situation.

Our chief aim in this paper is to propose a descriptive nomenclature for movement-traces suitable for use by field archaeologists with some access to laboratory facilities. This we believe to be a crucial first step toward the wider and more systematic and rigorous use of 'footprints' in archaeology, and toward sound interpretations of their evidence at sites of all kinds. In addition, we very briefly comment on some preservational aspects of movement-traces, and draw attention to their neglected archaeological potential, especially in the case of humans and the larger mammals.

PRESERVATION AND SIGNIFICANCE OF MOVEMENT-TRACES

Marks made by feet have a particular archaeological relevance, and this kind of evidence is arguably much more widespread than reports would suggest. Examples have already been described from a wide range of sedimentary environments, especially coastal (Williams 1952; Van der Lingen and Andrews 1969; Lewis and Titheridge 1978; Behrensmeyer and Laporte 1981; Frey and Pemberton 1986; Leakey 1987; Leakey *et al* 1987; Swinehart 1990; Cohen *et al* 1991; Aldhouse-Green *et al* 1992; Smith *et al* 1993; Politis and Bayon 1995; Lea 1996; Roberts *et al* 1996; Allen 1997), and from caves and rock-shelters (Anon. 1984; Faton and Richet 1985; Bahn and Vertuit 1988; Clottes 2003), ditch fills and wallows (Laury 1980; Smith *et al.* 1981), soils (Smith *et al* 1981; Price 1995), and bricks and tiles (Brodribb 1979; Ryder 1979; Cram and Fulford 1979; Cram 1984; Wall 1985).

Movement-traces are most readily evident where fine and coarse sediments are interlaminated or thinly interbedded, as in estuarine and floodplain silts, and where there is some contrast between the deposit affected by movement and the overlying sediment, for example, sand overlying laminated mud or mud concealing peat. The preservation of traces is especially favoured by substrates that are plastic but not sloppy and by rapid, even catastrophic sediment deposition, creating what palaeobiologists recognize as 'exceptional prevervation'. Common terrestrial examples include the burial of soil by storm-blown sand, or of a river floodplain or lake margin by a flash-flood deposit. Exceptional preservation of movement-traces can also occur in estuarine and coastal wetlands. In the Holocene deposits of the Severn Estuary, for example, human and large-mammal movement-traces are widespread and locally profuse at many levels (Aldhouse-Green *et al* 1992; Allen 1997; Bell *et al* 2001), but are best preserved in distinctively banded sediments that represent exceptional accumulation rates of centimetres to decimetres annually (Allen 1990, 1997, 2004; Scales 2004). 'Normal' annual rates were measured in millimetres during most of the Holocene. Most dramatic, however, are those instances of terrestrial fossilization beneath catastrophic falls of volcanic ash (eg Williams 1952; Leakey 1987; White and Suwa 1987; Baales *et al* 2002; Mietto *et al* 2003).

A variety of methods are available for recording movement-traces in archaeological contexts, to be selected according to circumstances (Scales 2004). They include single-lens and stereoscopic photography, tracing (with or without prior cleaning of traces in the field), casting using plaster of Paris or dental alginate, and block-lifting followed by dissection at the field base or in the laboratory. Tracing on to large sheets of clear plastic, followed by digitization in order to secure an accurate record at a reduced, practical scale, is helpful where many traces occur together within a substantial area and where traces occur in long sequences. Traces preserved in unconsolidated sand (beaches, aeolian dunes, river bars) or sandy silts (estuaries) can be recorded by making relief-casts from surfaces cut and smoothed in any desired orientation (Allen 1997). Individual traces can be serially sectioned either vertically or horizontally using this technique. Whichever method is preferred, attention should be given in the field to the state of preservation of the traces, in order to ensure sound interpretation. It is especially important to identify the precise bedding surface over which their maker travelled, and to sample the sediment immediately beneath, in order to establish the environment represented. In one unusual case, where human movement-traces dating to the last glacial maximum were preserved in travertine, it even proved possible to estimate the temperature at the time the people lived (Zhang and Li 2002)!

'Footprints' can provide evidence on many archaeological questions, including some, notably intractable using other data sources, previously treated largely theoretically. Perhaps their most obvious contribution is on past populations of people and animals, a source that complements bone-assemblage analysis, and especially important because it covers those animals and people actually present on a part or the whole of an area of activity. In principle, the size of traces and the spacing between them in a sequence can reveal information especially about the height of their maker, a quantity of particular interest in the case of hominids. However, spacing is strongly influenced by the firmness of the substrate and by gait, both of which may to some extent be inferred from the character of individual trace. Finally, it should not be forgotten that 'footprints' can also tell a social story, for example, where different age-groups sharing an activity left a series of traces.

Human movement-traces relate to specific short-term actions. They complement the composite palimpsest picture revealed by most occupation horizons, activity on which frequently extends over centuries or millennia. The age and sex composition of populations may also be revealed. In the case of humans, insights may be obtained into the relative roles of children, women and men in particular forms of past activity, a leading topic in social theory (Moore and Scott 1997). For example, Williams's (1952) remarkable record from tropical Nicaragua suggests that a band of people, apparently with their animals, was in flight from a volcanic eruption. In geologically more pacific Britain, Mesolithic activities on the borders of the Severn Estuary (Aldhouse Green *et al* 1992; Bell *et al* 2001; Scales 2002) and Liverpool Bay (Roberts *et al* 1996; Huddart *et al* 1999) apparently involved almost all sections of the population, including children just a few years old.

Population composition and diversity are also of interest in relation to animals. Cattle, sheep and horse, but badger as well, left 'footprints' in a ditch at Shaugh Moor (Smith *et al* 1981). The traces of horses predominated around a Swedish Bronze Age building, with some cattle/elk being recorded (Price 1995). At the Mesolithic site of Goldcliff, Severn Estuary, bone evidence can be compared with that of contemporaneous 'footprints' from the surrounding mudflat and salt marsh deposits (Bell 2000). Although deer predominate in both, aurochsen are represented only by 'footprints', whereas pig is registered only by bones. This raises questions about the environments in which particular species were living and about possible seasonal changes in wetland animal populations and occupancy. The physical character alone of traces can contribute significantly to environmental interpretations, especially when coupled with data on sedimentary textures and bedding and on microfossil content, for animals sink deeper into the soft deposits of tidal mudflats, low salt marshes and recently inundated river floodplains than into the generally drier surfaces of high salt marshes and of lake margins, river floodplains and fields at the end of summer. The grade of sediment deposited on tidal mudflats and salt marshes is known to change seasonally, at least in Northwest Europe (eg Allen 2004). Where accretion rates were high enough, it may be possible to exploit this fact to demonstrate at what times of year people and animals were active intertidally. Well-preserved movement-traces will occasionally afford evidence on animal health and the presence of physical abnormalities.

Past patterns of animal husbandry may be illuminated by data on age and sex. Traces due to juvenile bovids and ovicaprids found around Bronze Age buildings at Redwick, Severn Estuary, show this site to have been occupied in spring and summer (Bell 2001). Bone evidence from the similar Iron Age settlement at Goldcliff suggests the same seasonal pattern (Bell *et al* 2000), when reduced tidal activity would have allowed domestic as well as wild populations access to lush grazing on salt marshes, not only at this site but in the Estuary generally (Allen 1997; Bell and Neumann 1999). A knowledge of population composition, when combined with other forms of environmental evidence, contributes to an understanding of the effects of animals, wild as well as domesticated, on different types of environments. In particular, it may help to clarify the role of herbivory, as one of several disturbance factors, in shaping the dynamic mosaic of plant communities in wildwoods (Buckland and Edwards 1984; Brown 1997) and partly forested coastal areas (Bell *et al* 2001).

At a more theoretical level, movement-traces have the potential to yield insights into the dynamics of past landscapes. A major archaeological challenge is to establish how the points on maps called sites were linked together by activities and social networks. Ingold (1993) has emphasized the importance of movement as the essence of perception, and the role which

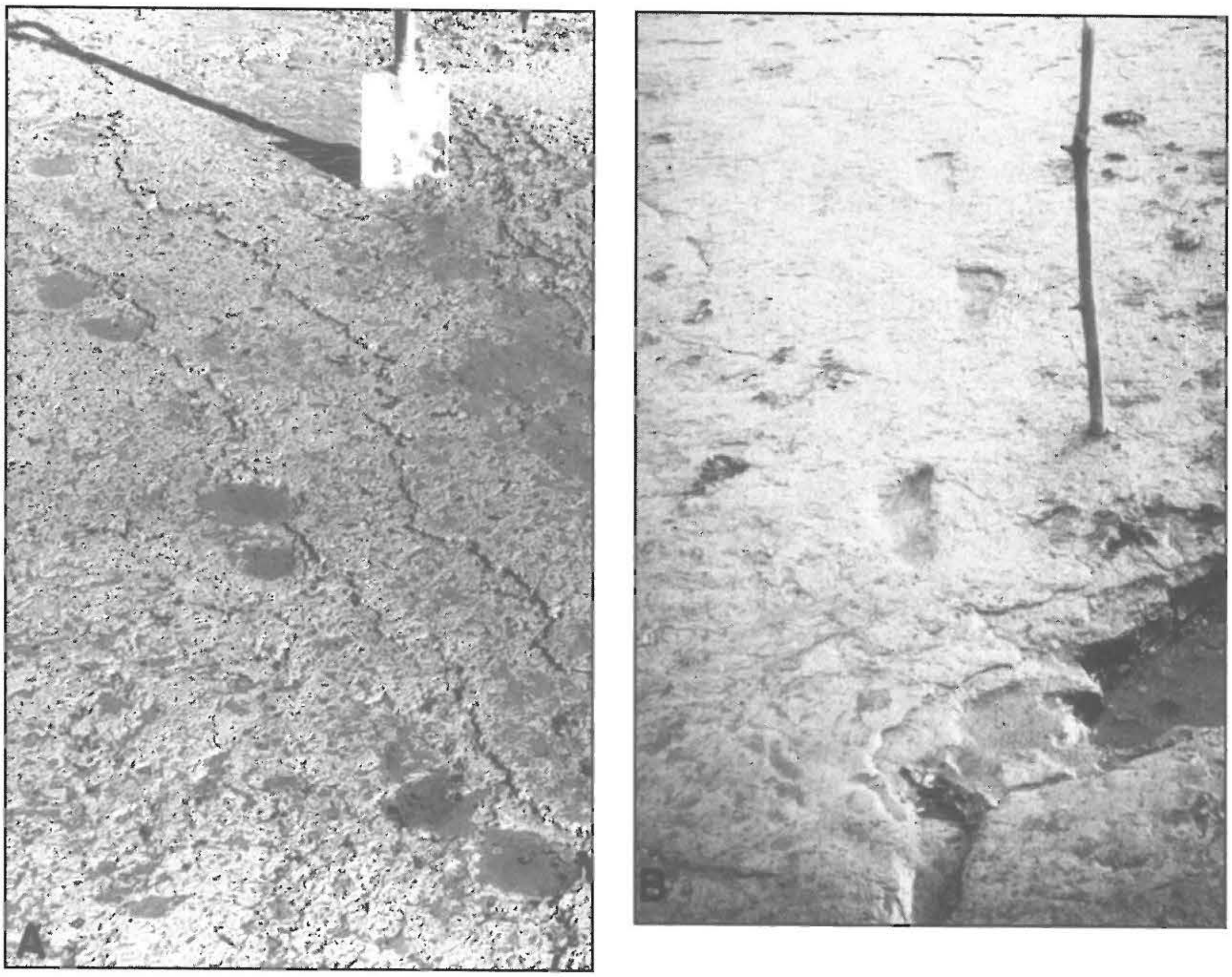

Figure 1: Trails in Holocene sediments exposed intertidally. A - Deer (eroded, deep under-traces), Neolithic, Oldbury Flats, Gloucestershire (National Grid Reference SO 599932). Spade for scale. B - Adult human (slightly eroded shafts and footprints), Mesolithic, Uskmouth, Gwent (ST 337819).

routes and tasks play in the structuring of landscape, which he describes as the 'congealed form of the taskscape'. In this respect, the potential of traces is analogous to that of wooden trackways, but on a much shorter term in that it relates to individual human actions, albeit occasionally habitual.

As evidence, 'footprints' are not without limitations. Their formation and taphonomy are as yet poorly understood, and there is a continuing need for controlled experiments in both the field and laboratory. While movement-traces provide snapshots of past actions, their degree of survival is determined by the existence of suitable preservational conditions at the time and shortly after. In particular, the full potential of movement-traces will only be realized where they are sufficiently well, and extensively, preserved. The issues of representativeness and quantification remain unaddressed. Surfaces thoroughly trampled by animals are often found, but only a small proportion of the traces, probably those most recently formed, may prove identifiable. Those identified may not necessarily be a reliable sample of the population that occupied the site over time. Where trampling has not been excessive, the working out of the sequence of superimposition of movement-traces may reveal the order in which animal species put in an appearance as the seasons unfold.

TRAILS

Adopting a previously informal term (Aldhouse-Green *et al* 1992; Roberts *et al* 1996), Figure 1

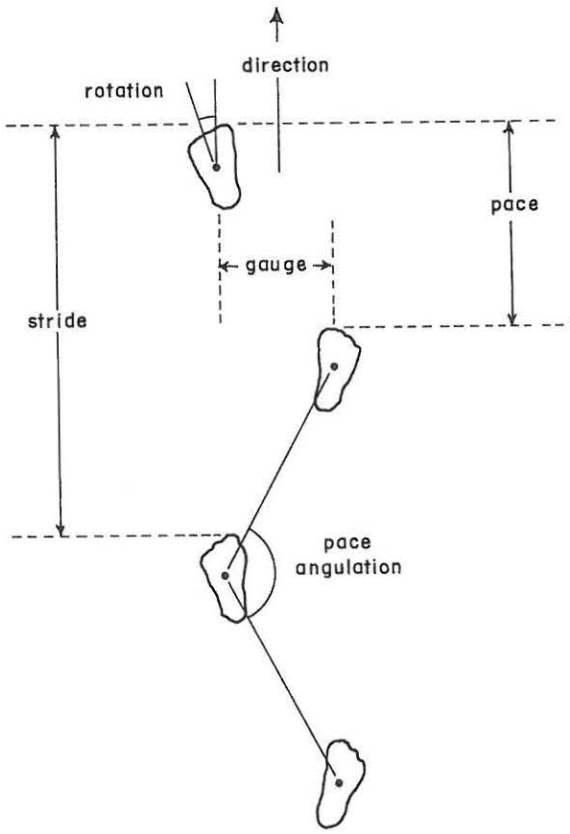

Figure 2: Descriptive scheme for trails.

illustrates two examples of a *trail*, that is, a spatio-temporal sequence of traces made as the limbs of a moving animal encountered an impressionable substrate (eg Williams 1952; Leakey *et al* 1987; Cohen *et al* 1993; Clottes 2003). For movement-traces at this level, we avoid the term trackway which, although firmly established in palaeobiology (eg Thulborn 1990; Lockley 1991), has long been pre-empted archaeologically for wooden structures serving as routeways (eg Coles and Coles 1986).

Figure 2 shows how a trail may be described, basing ourselves partly on Thulborn (1990) and Lockley (1991). Every trail has a *direction of movement* (compass bearing), shown by the orientation of the individual traces of which it is composed. *Stride length*, describing one complete cycle of limb movements, is the spacing in the direction of movement of successive positions of the same foot, whereas *pace length* is the distance between successive traces due to opposite limbs. Both measurements are made between suitable *corresponding points* on the individual traces. For two other measurements the centres of individual traces are most appropriate as corresponding points. The trail may then be assigned a *gauge* or width, measured perpendicular to the movement-direction, and a *pace angulation*, the angle subtended at the trace due to one foot by successive traces due to the opposite limb. Occasionally helpful is the *rotation* of individual traces, that is, the angular extent to which the feet turned either inward or outward relative to the general direction of motion.

In the cases of hominids, the character of a trail will be affected by whether or not a load was being carried and whether the load was positioned symmetrically, on the head or attached to a yoke, or on one or other side of the body, on one shoulder or in a hand. In a soft substrate, an asymmetrical position could lead to the formation of deeper traces on one side of the trail than the other.

FOOTPRINT-TRACKS

Although in palaeobiology the term track has long been applied to marks made by individual limbs, we prefer *footprint-track* for archaeological use, so avoiding possible confusion with track in the sense of some kind of routeway. Footprint, sometimes used palaeobiologically instead of track, and invariably used forensically, we reserve in a strict sense (see below) to describe a specific part of a footprint-track.

A footprint-track results from a more or less forceful encounter between the descending limb of a moving animal and an impressionable substrate below, the event lasting from a fraction of a second to a few seconds depending partly on the animal's size and gait. The character of the resulting trace is also influenced profoundly by the nature of the substrate, but an instructive general mechanical model (Allen 1989, 1997) for its production is the intrusion of a punch or indenter (the limb) into an elastic-plastic material (the sediment/soil). Intrusion creates a three-dimensional zone of permanently deformed substrate material around the site of the limb, and can leave within this zone a faithful impression of the face of the indenter (sole of foot).

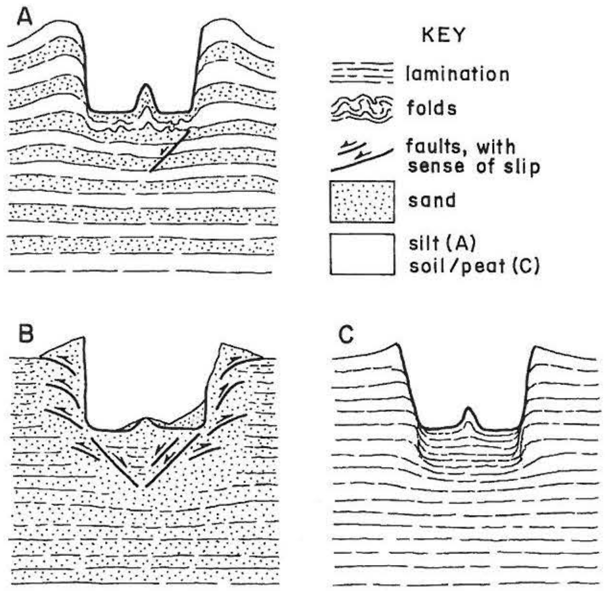

Figure 3: Influence of substrate bulk physical properties on footprint-tracks (two-toed track-maker). A - mud. B - sand. C - soil/ peat.

Archaeologically, three broad kinds of substrate are significant, as the following brief comparisons, although undoubtedly over-simplified, make clear. Moist to water-saturated muds of lacustrine, fluvial or intertidal origin, while deformable, are effectively incompressible. What is displaced from one part of the space must move into some adjoining part. In the case of these materials, the descending limb displaces and deforms a relatively large volume of sediment around and beneath its final position (Figure 3A). Such cohesive and markedly plastic sediments deform chiefly by folding, thickening and thinning, as may be evident from distorted patterns of banding or lamination in the substrate. Any faults (fractures) produced are small and localized. River, dune and beach sands are also effectively incompressible, but cohesionless when dry and of low cohesion when damp, and thus of no or little plasticity. These deform chiefly by rupturing, expressed by the development of microscopic to small-scale faults (Figure 3B). Water-saturated sands, however, may display a more plastic-like response. The third kind of material - peats and aerated soils with a well-developed ped structure - is typified by a low value of the quantity known as Poisson's ratio. Like cork, they can be strongly compressed beneath the forcefully descending limb, but show little or no simultaneous lateral expansion. The deformed zone then lies largely or wholly beneath the foot at the end of the limb (Figure 3C).

Footprint-tracks (Figure 4) are most complex in plastic muds (see also Cohen *et al* 1991; Allen 1997), and this context serves well to illustrate the general descriptive scheme we advocate for all substrates (Figure 5). A more or less vertical *shaft* commonly with *striae* on the walls is cut by the limb as it descends into the substrate, at the same time deforming the sediment to the side and beneath (Figure 5A). Substrate type and consistency, body weight, foot size and gait determine the relative depth of the shaft. The deformation can be expressed on the sediment surface by a raised *marginal ridge* on which both *radial* and *circumferential fractures* may be evident. Other surface features include *drag marks*, *ejecta* and external *pits* due to suspended toes (Figure 5B). In vertical slices through the footprint-track (Figure 5A), the marginal ridge is seen to be underlain by a circumferential, *marginal fold*, whereas beneath the shaft, where sediment was partly squeezed out sideways, an *axial downfold* or *basin* appears. *Microfaults* and *microfolds* may be developed in this zone.

At the base of the shaft lies the *footprint*, that is, the surface in direct contact with the underside of the foot at the moment of limb-retraction. This is the most critical part of the footprint-track. Given the right consistency of substrate, it will faithfully record the size and shape of the sole of the foot, of great taxonomic significance, as well as suggestive of sex, age and health. In the case of sufficiently firm substrates, the footprint is preserved on precisely the same surface as that over which the animal walked. Occasionally, movement takes place across a soft layer overlying one that is more firm, when the foot may punch through the former to leave the footprint in the layer below. In soft substrates, the footprint may be become badly distorted as the result of adhesion, suction and lateral inflow consequent on the withdrawal of the limb.

Anatomical evidence of lesser quality is provided in two ways. With banded or laminated sediments, the axial downfold will reveal a downward sequence of *undertraces* (Figure 5A), called 'transmitted prints' by some

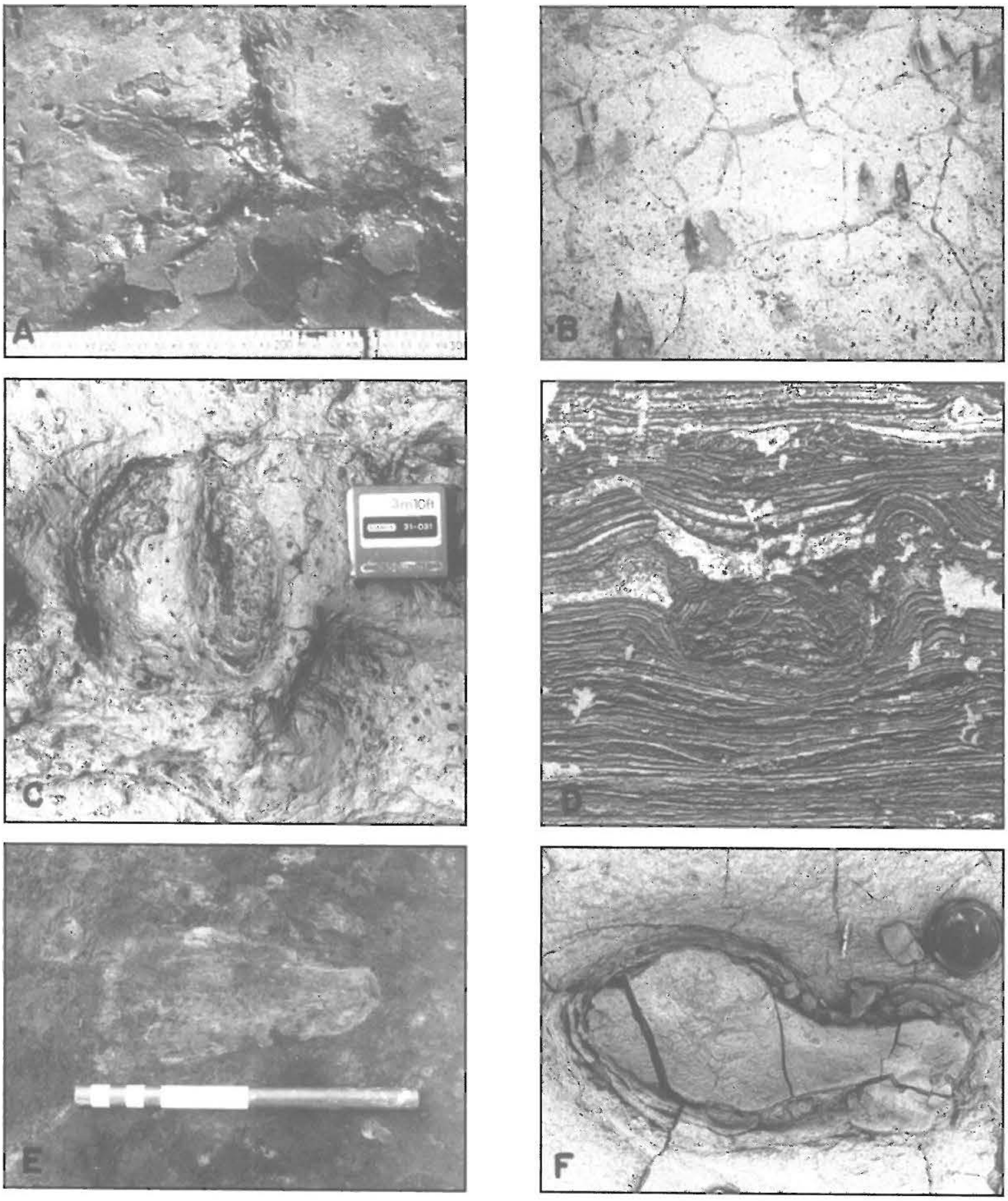

Figure 4: Footprint-tracks in Holocene silts and sandy silts exposed intertidally. A -crane, Mesolithic, Goldcliff, Gwent (ST 376819). Scale in centimetres. B - red deer (slightly eroded shafts and footprints), Mesolithic, Uskmouth, Gwent (ST 3381). Coin for scale. C -domestic cattle (shallow undertraces, interdigital ridge, marginal fold), early modern, Plusterwine, Gloucestershire (ST 604990). Scale box 55 mm wide. D - domestic cattle (cellulose acetate relief-cast, vertical section through deformed zone, interdigital ridge, and infilled shaft), modern, Rodley, Gloucestershire (SO 730116). Approx. 40x40 cm. E - human child c. 7 years old (right foot, transverse section low in infilled shaft cut in peat), Middle Bronze Age, Redwick, Gwent (ST 424837). Scale 20 cm long. F - adult human (left foot, overtraces and eroded marginal fold), modern, Westbury-on-Severn, Gloucestershire (SO 709135). Lens-cap for scale.

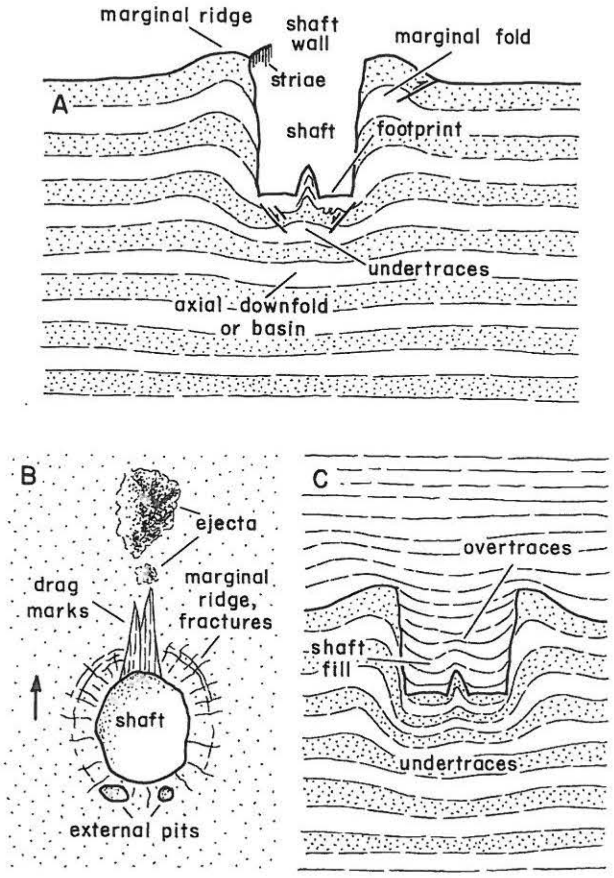

Figure 5: Descriptive scheme for footprint-tracks (two-toed track-maker). A, C - vertical sections. B - surface view. Key as Figure 3.

palaeobiologists, in which the shape of the footprint becomes progressively more blurred downward, as Hitchcock (1858) was the first to note. Often the shaft became quickly infilled with additional laminated sediment (Figure 5C). Smothering the footprint, these layers may form a sequence of *overtraces* which, in terms of the stratigraphically changing quality of the record, mirror the undertraces (Allen 1997). Infilling of radial and circumferential surface fractures, as well as unrelated fractures due to desiccation, may also be expected to occur during burial. Prior to their final, permanent entombment, environmental factors such as storms and floods may lead to the partial erosion and even to the repeated exhumation and burial of footprint-tracks.

Many of the above features can be quantified, providing not only taxonomic and ecological evidence but also insights into substrate consistency. While as many aspects as possible of a trail or footprint-track should be the subject of measurement, quantification is essential for footprints which, at the minimum, should be assigned orientation, length and width.

FOOTPRINTS

Only generalized schemes can be proposed at this critical third level, because of the very many animal species of archaeological interest likely to be represented by trails and footprint-tracks at or near a site. What is suggested below, in general zoological use, may require modifications and additions for particular species.

Birds are bipedal with feet highly adapted to habitat and behaviour. Typically, four *digits* are present (Figures 4A, 6A), except in the case of the two-toed running birds, although the posterior toe may be small, lie high up, and fail to appear in a footprint-track. *Claws* of very variable shape and relative size terminate the digits. A membrane or *web* joins the toes of swimming birds and its outer edge is occasionally preserved as a faint groove in footprint-tracks. The feathered legs of birds subject to cold could leave a distinctive impression. Of particular diagnostic value are the size and relative position of the digits and the presence/absence of a web.

The carnivores, such as the dog (Figure 6B), are four-legged and pawed. Their feet differ between front (*manus*) and back (*pes*), especially so in plantigrade forms, and are each of five *digits*, although that to the rear is so much reduced and high up on the leg as to seldom register in footprint-tracks. The digits are tipped by *claws* and those lying at the front of the foot are each underlain by a soft, rounded *toe pad*. Between these pads lie *interdigital furrows* which, in footprints, are best expressed as sharp *interdigital ridges*. Beneath the rear of the foot lies another, larger pad, the *central pad*. It has a different shape in the case of the cat family.

The quadripedal, even-toed ungulates (herbivores), or artiodactyls, include deer (Figure 4B) and the long-standing domesticates cattle (Figure 4C, D), goats, sheep and pigs. We discuss their footprints using a generalized cloven hoof formed by the two largest digits, on either side of

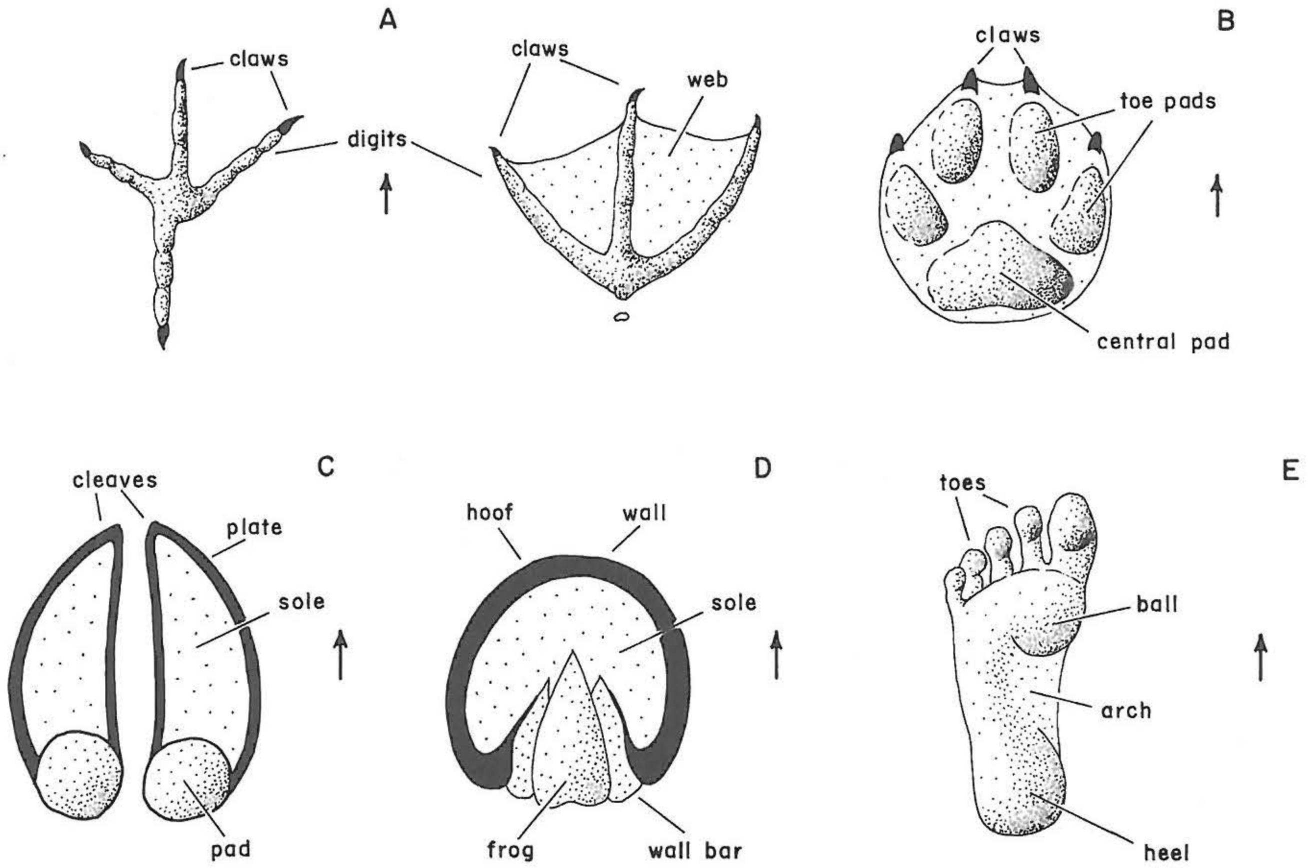

Figure 6: Descriptive schemes for selected footprint types A - birds (unwebbed, webbed). B - dog. C - generalized cloven hoof. D - horse. E - modern adult human.

the axis of the foot (Figure 6C). This consists of two, generally symmetrical toes or *cleaves*, mostly of hard tissues, separated by a deep *interdigital groove* represented in footprints by an *interdigital ridge*. Splaying of the toes in soft sediment widens these ridges considerably and evidence for it is often seen in deep footprint-tracks. From between the toes small masses of sediment may be forcefully ejected onto the ground in front of the foot, and the toes themselves can leave drag marks on the surface as the limb is retracted. The outermost part of each cleave above ground level is sheathed by a thin layer of horny tissue which projects as a *plate* or wall below the softer *sole*, and is registered by a *circumferential groove* in well-preserved footprints. The plate can be removed, however, by deliberate trimming by a husbandman and by wear on hard ground. Toward the rear of each cleave is an oval *pad*, especially conspicuous in deer. The two smaller toes (*dew claws*) do not normally touch the ground - they are relatively largest and hang closest to the surface in pigs - but they can be registered in association with deep shafts (soft substrate) as variously shaped *pits*, either on the surface to the rear or part way down. Species identification rests primarily on the size, relative proportions and shape of the cleaves. In domesticates, the character of the foot is strongly influenced by husbandry practices and the kinds of surface over which animals are allowed to wander. In post-medieval times, cattle driven long distances to market (eg Armitage 1982) not uncommonly were temporarily shod. These shoes are known archaeologically and their presence should be evident in footprints.

Horses are archaeologically the most important of the perissodactyl ungulates, a group in which the body weight is carried by the outer and rear parts of a single, enlarged toe (the third) on each foot. As with the artiodactyls, the single-toed *hoof* (Figure 6D), largely of hard and rigid tissues, is shrouded to the front and sides by a stout layer of horny tissue called the *wall*. This can become worn down on hard ground or may be deliberately trimmed off. Extending from the centre to the rear of the foot is the wedge-shaped *frog*, an elastic mass, with hard *wall bars* ranged along the sides, which is normally the first part of the hoof to touch the ground. The wall, walls bars and frog extend slightly below the softer *sole*, which usually comes into contact with the ground only when the latter is either irregular or soft. The practice of shoeing domesticated horses is more than two millennia old, and should be recognisable in well-preserved footprints. The changing pattern of shoes may allow such footprints to be dated.

Bipedal hominids are of especial archaeological importance, and their relatively slender footprint-tracks (Figure 4E, F) are known from deposits spanning many hundreds of thousands of years (eg Williams 1952; Leakey *et al* 1987; Aldhouse-Green *et al* 1992; Clottes 2003). The general character of the external anatomy of the foot may be judged from that of a modern adult human (Figure 6E). Gradually expanding forward, the foot is roughly 2.5-3 times longer than wide, the ratio being racially dependent but lowest in the case of feet that are habitually unshod. The five unequal *toes* are separated by *interdigital grooves*, represented in footprints by *interdigital ridges*, that are widest on normally unshod feet. Between the toes and the swollen *ball* of the foot is a shallow, irregular *postdigital furrow*, appearing in a footprint as a low, irregular *postdigital ridge*. At the rear of the foot occurs the rounded, swollen heel, the curving *arch*, a feature which gradually develops during childhood, lying between the heel and ball. In walking, body weight is gradually transferred from the heel, touching the ground first, to the ball and toes, in contact with the ground last as the leg is raised. All or most of the weight while running is carried by the ball and toes, and some footprints made on relatively firm substrates may present only these features.

CONCLUSION

Current discoveries in the Severn Estuary, Liverpool Bay and elsewhere have highlighted the extensive preservation of a substantial variety of sub-fossil footprint-tracks. We note that these have the potential to contribute to a wide range of archaeological topics, including human and animal population compositions, animal husbandry and hunting practices, seasonal occupancy and exploitation, especially of coastal and riverine areas, and the behaviour of both animals and humans in an environment.

To facilitate a consistent and more systematic approach, we propose an anlytical descriptive nomenclature which takes account of the particulars of this form of evidence, as preserved in archaeological and environmental contexts. The more important of the descriptive terms we advocate above may be summarized as follows.

Trail: the spatio-temporal sequence of traces left by an animal as it moves across an impressionable sediment or soil.

Footprint-track: the three-dimensional body of deformed material created when the limb of a moving animal descends into an impressionable substrate, together with the immediately adjacent overlying material which finally preserves it.

Footprint: the surface of the impressionable substrate that was in direct contact with the underside of the limb of a moving animal at the time the limb was withdrawn, and which potentially preserves the anatomical form of the underside of the foot.

Undertraces and overtraces: partial representations of a footprint preserved in material lying stratigraphically either below or above the level of the footprint itself.

We also propose a large number of other terms which are valuable in the description and analysis of traces.

The adoption of a systematic approach, and the application of a consistent nomenclature such as we introduce and explain above, will ensure that the recording and reporting of the increasing number of sites with animal and human trails and footprint-tracks will enable proper comparisons to be made between contexts and sites. They will also ensure that rightful consideration is given to the potential contribution of this ichnological evidence, not only in the Holocene environments of the Severn Estuary, where research is ongoing, but in other places where movement-traces have attracted archaeological attention.

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