Speculating on transverse grooves in African elephant tusks

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Introduction

This Field Note arose from a request from the Editor of *Pachyderm* for opinions on what might have caused the distinctive black bands on the right tusk of an elephant (Fig.1) photographed by Erwan Theleste (ET), Director, Loango and Ozouga Chimpanzee Projects. The elephant was one of four male forest elephants (*Loxodonta cyclotis*) that were photographed in the Batéké Plateaux National Park in south-eastern Gabon crossing the Mpassa River, on 29 December 2022 (Fig. 2). ET expanded the scope of the Editor's request by augmenting the initial photograph with 12 more of all four members including aspects of both their right and left tusks.

Centuries before taxonomists separated African elephants into two species—forest *Loxodonta cyclotis* and savannah *L. africana*—ivory traders knew there was a difference. Tusks of the former in equatorial and western lowland rain forests were classified as 'hard' or 'yellow' ivory, and the latter from the rest of Africa as 'soft' or 'white'. A cline of hybrids between the two forms existed wherever the two species met: a fact established from their different market values that forced traders to assess which was the greater influence when offering prices. Forest elephant ivory is pale yellow, light yellow-brown on the tusk surface, but commonly stained black under the lip where emerging

Figure 1. The photograph of dark bands that gave rise to this Field Note. © *Erwan Theleste*

Figure 2. The four male forest elephants, subjects of this paper. © *Erwan Theleste*

from the gum and often far down the exposed tusk. Occasionally, almost the whole tusk was black. Such dark colouring occurs on savannah tusks but tends to be confined to the upper end of the tusk, close to and under the lip area. Assumed to be staining from vegetable saps etc., this is speculation for the black stains have not, to our knowledge, been objectively analysed. Yellow ivory, the extent of blackness and forest elephant tusks being more or less straight with relatively less twist, make them readily distinguishable from savannah tusks. From the location, the tusks of the elephant photographed by ET, together with the absence of an upper-ear fold-over we are certain that they are the forest species.

Observations

The four heavily stained transverse dark bands on the right tusk of Elephant 1 are regularly spaced (guessed approximately at ~10 cm apart) where the tusk emerges from the lip. There is a possible indistinct fifth in the shadow of the lip fold. The first question we address is whether these bands are ridges, rising above the tusk surface or grooves into that surface? Projecting the tusk surface by a line across the bands in Figure 3 they are clearly round-bottomed grooves. The dark colour is assumed to be accumulated staining in these sumps because they afford protection from wear. Figure 4 is of Elephant 1's left tusk which, in shadow and against a dark background, grooves are not clear (while the right tusk's grooves are clearer against a pale background). When magnified x 10, grooves are present in both Elephant 1's left tusk and detectable in both Figs. 3 and 4 but are too indistinct for us to be certain they match one another. However, they confirm that in this elephant the condition is bilateral.

Figure 3. Photograph illustrating dark bands associated with grooves in the tusk surface of Elephant 1. © *Erwan Theleste*

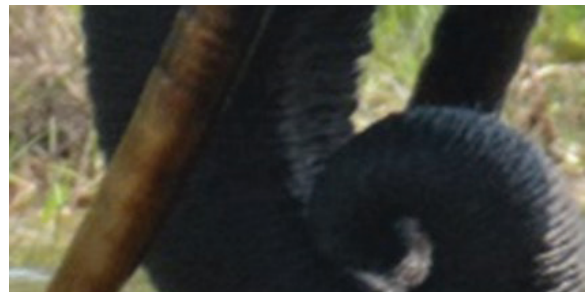

Figure 4. Elephant 1's left tusk. This is in the background to the right tusk in Figure 3. and combined we believe that both tusks are grooved, but the pictures are not of high enough quality to be sure that the grooves match one another. © *Erwan Theleste*

The rounded depressions on the right tusk of Elephant 1 indicate periods where growth in tusk circumference but not length, had been reduced during tusk formation. We considered whether these depressions might be variants of tip-notching: a process occurring around tusk points. These arise when vegetation dragged across a tusk while feeding catches in cuts or nicks in its surface, gradually creating a progressively deeper notch or groove that eventually results in the tip breaking off (Fig. 5). This purely mechanical process is common in East African savannah elephants (Parker in prep). An obvious difference is the grooves in Elephant 1's right tusk are circumferential whereas the tip-notches are not. However, while not tip-notching, *in sensu stricto*, the grooves illustrated in figure.1 would deflect vegetation dragged across the upper tusk into them and develop a secondary groove along the path of contact. We suggest this may have produced the thin darker lines obvious in Figure 3.

The evidence in the right tusk of Elephant 1 is similar to four cases recorded from 3,169 savannah elephants (*Loxodonta africana*) culled from six populations in East Africa (Parker and McCullagh 2021). These were: i) Murchison Falls NP, South female GMU 285, age 10, right tusk; ii) Murchison Falls NP, South female GMU 327, age 24, left tusk; iii) Murchison Falls NP, South male GMU 336, age 8, both tusks; and iv) Tsavo East NP 12, male age 8.5, both tusks.

Figure 5. Illustrating tip-notching in four East African female tusks. © *Ian Parker*

The grooves were of the same approximate dimension as in Figure 1, were apparent in the upper section of the extruded tusk within ~30 cm of the lip, but without dark colouration. The condition was not only apparent in the tusk out of the head, but internally, confirming the grooving developed within the alveolus.

Ian Parker (IP) has also seen similar grooves while examining many thousands of tusks from all over Africa while researching the international ivory trade (Parker 1979). However, no measurements or notes on the condition were recorded; it was simply referred to as ridging. From this subjective recall the condition occurs widely, albeit occasionally.

From Elephant 1 and our small sample the following points emerge:

- The condition occurs in both sexes.
- It may arise both unilaterally or bilaterally in tusk pairs
- The four culled GMU cases were from different family units, in which no other members exhibited the condition.
- The condition occurs both in savannah and forest elephant species, with Elephant 1 presenting a bilateral case in the latter.

The second point challenges the idea that the grooves reflect straightforward seasonal fluctuations in nutrition quality (McCullagh 1969) since, if this were so, they would likely appear synchronously in both tusks of a pair and not unilaterally as in cases i); and ii) above. In the same vein, this condition might be expected to be present in other members of the same herd, which was not the case in the four savannah elephant cases quoted above.

Laws (1952) working on the elephant seal (*Mirounga leonina*) developed an accurate aging system from growth rings from variation in tooth calcification. Such rings are apparent in all elephant tusks, which allowed him to calculate the average annual tusk length growth for savannah elephant (Laws 1970). Figure 6 illustrates such growth rings. Visually, in 39 photographs taken at the same time as Figure 6, there is no evidence that these growth rings are associated with changes in tusk circumference. While magnification of these photographs may change this perception, pro tem, the development of grooves within the alveolus does not seem to be an aberration of the normal tusk ring formation, but a different phenomenon.

At this point we considered such evidence as was apparent in the three other bulls that were with Elephant 1. While the photographs of elephants 1, 2, 3 and 4 are

Figure 6. Illustrating the growth rings that are present in all elephant tusks, most obvious in the base sections within the alveoli. This is the right tusk of male elephant GMU 1,443 aged 38 years. © *Ian Parker*

clear enough to exhibit transverse dark tusk bands in all, they were taken at too great a distance and/or because they are in deep shadow, resolution is inadequate to see grooves with certainty. While the dark bands are most obvious close to the elephants' heads, those on Elephant 4's right tusk extend faintly along its entire length out of the water (Fig. 7). Further, the regularity and dimensions of the bands seem unique to each elephant. If reactions to seasonal variation in food quality, we would expect a greater degree of symmetry. In overview, while familiar with the dark staining as a feature of forest elephant tusks, IP had no recall of seeing transverse bands as on the elephants photographed by ET.

Figure 7. Illustrating transverse banding along the entire length of the visible right tusk of Elephant 4.

New to science is the phenomenon that grooves in the upper portions of tusks, in contradistinction to tip-notching, occurs in both species of the African elephant. Its aetiology remains obscure and until good supporting data become available, we cannot proceed further than the foregoing speculations.

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