

## ON THE GENESIS OF BIPEDALISM\*

by

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## ABSTRACT

Bipedalism is the hallmark of the Hominidae, past and present. Only against this fundamental adaptive background could cerebral, dental and manual modifications develop to change ape into ape-man, and ape-man into man. Yet surprisingly little is known of its origin, of the variety of forms of locomotor behaviour it has encompassed, or about the sequence of postural refinements which has led to our modern pattern of stance and gait.

In an attempt to trace the Plio-Pleistocene history of two-footedness, lower limb fossils of early hominids are examined here. South and East African sites are covered, with special reference to the period 3,6 to 1,5 My ago.

Numerous structural challenges had to be met so that uprightiness could evolve successfully. Several are considered of special interest here, including sacroiliac joint consolidation, a lumbo-acetabular weight transfer mechanism, acetabular remodelling and femorotibial alignment. These features have contributed to the attainment of balance over two limbs, minimal eccentric joint movements and a flow of body weight close to or through joint centres.

A primary palaeoanthropological question is then discussed: the time period during which cladogenesis brought about the emergence of earliest *Homo* from an *Australopithecus* stock. Lower limb evidence is used to evaluate whether *A. africanus* postdated this split, and in so doing the possibility is considered that southern African australopithecines exhibited parallel evolution to *Homo*, rather than having been ancestral.

Finally, comparisons are drawn between certain East and South African features of pelvic and lower limb evolution. A chronology of osseous aspects of such evolution is proposed.

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## INTRODUCTION

Excavations at Border Cave in 1970-5 were partly directed at obtaining all pertinent data bearing on the age of the human bones found there (BC 4 and 5) and previously (BC 1-3). The purpose of this paper is to detail the various data sets that have been accumulated to date in connection with this specific aspect of the investigation.

## Site and setting

Border Cave is situated in northern KwaZulu about 365 m from the Swaziland border at 27°1'19"S, 31°39'24"E (Cooke *et al.*, 1945). It cuts back into a cliff-face high up on the steep western scarp flank of the Lebombo Mountains over 400 m above the Swaziland lowveld and some 2 km north of the Ngwavuma River gorge. By direct line the site is 5 km east of the small agricultural settlement of Nsoko, 12 km north of the district centre of Ingwavuma and 82 km west of the Indian Ocean (fig. 1).

Ongoing cave development is due to the preferential weathering of an agglomeratic zone within the local Stormberg System rhyolites (Cooke *et al.*, 1945). Plan-form is roughly semicircular with a

maximum width at mouth and depth from drip-line of c. 50 and 30 m respectively (fig. 2). Roof height is very variable with a greatest established reading from bedrock of about 7.5 m (fig. 3). Deposit surface slopes down fairly regularly towards the talus edge at a mean angle of 15-15° (fig. 2).

## Excavation history

Border Cave has been excavated on three occasions by persons variously associated with the University of the Witwatersrand. Pre-1970 information is based on details recorded in the Archaeological Survey file B20/1/2, unless otherwise stated.

The site was first investigated in July 1934 by R.A. Dart assisted by A. Galloway, J.H. Gear and G.F. Berry. A fortnight was spent lowering a strip of ten yard squares down to bedrock at a maximum depth of 168 cm (Exc. 1 of fig. 2). This trench yielded MSA throughout except for superficial Iron Age (IA) but no account of that material was ever published (Cooke *et al.*, 1945).

During 1940, W.E. Horton of Nsoko commenced digging in the cave with the object of extracting the fine ash-rich fraction of the sediments for sale as agricultural fertilizer (Horton's Pit in