

The environment at Langebaanweg 5-5.2 million years ago

During the course of her doctorate, Tamara Franz-Odenaal did stable isotope analyses on many of the teeth of the ungulates from Langebaanweg in order to identify the photosynthetic pathway used by the vegetation in the environment. This would indicate whether C₃ or C₄ plants dominated at Langebaanweg, which would in turn indicate the prevailing climatic conditions at Langebaanweg 5 million years ago.

One of the issues Franz-Odenaal hoped to investigate was if the world-wide expansion in C₄ grasslands which began between 8 and 6 million years ago (and continues to the present day) extended as far south as Langebaanweg during the Mio-Pliocene. C₄ grasses dominate in areas where there is summer rainfall, and C₃ grasses in areas of winter rainfall.

Franz-Odenaal's (2002) research indicated that both grazing and browsing ungulate species showed $\delta^{13}\text{C}$ values which indicated that Langebaanweg was a C₃ dominated environment. As fynbos and the type of grasses found at Langebaanweg all had a C₃ signature, it was impossible to tell if animals were grazers or browsers. If the grasses found at Langebaanweg had been C₄ grasses it would have been easy to distinguish between grazing and browsing ungulate species as the browsers would have had a C₃ signature, and the grazers a C₄ signature, and mixed feeders something in between. This is not too much of a problem however as paleontologists have another trick up their sleeves and are able to distinguish between grazers, browsers and mixed feeders by looking at the microwear on the teeth of the various ungulate species.

Prior to the research done by Franz-Odenaal there was no direct evidence to indicate whether the main rainfall season at Langebaanweg was in winter (as it is today) or in summer. The fact that Langebaanweg was dominated by C₃ plants indicates that a winter rainfall pattern was established on the west coast by the Mio-Pliocene.

Charcoal, fossil wood, seeds and pollen grains can be used to identify the type of trees and plants that grew in an area thousands or millions years ago. Pollen grains are amazingly durable, despite their tiny size, and the earliest recovered fynbos pollen from the western Cape region were found in some of the Langebaanweg sediments.

The pollen spectrum from Langebaanweg indicates a variety of environments. Swamps/marshes were certainly present in the Langebaanweg area, as indicated by the dominance of pollen (92%) from the aquatic, or semi-aquatic Ranunculaceae. The existence of coastal plains were inferred from the presence of plant families such as the Ranunculaceae, Cyperaceae, Asteraceae and Umbelliferae, and areas of relative dryness by the Asteraceae, Chenopodiaceae, and Amaranthaceae. The presence of trees in the area is indicated by the presence of *Podocarpus*, *Olea* and Proteaceae pollen. Very few diagnostic elements of open vegetation were found (Scott 1995).

Table 1 shows the vegetation suggested for various areas of southern Africa, as indicated by pollen studies from fossil sites in South Africa and Namibia.

Table 1: Vegetation in southern Africa during the Neogene according to the Pollen data (After Scott 1995, Table 5.2, page 75)

Period	Southern and southwestern Cape	Namaqualand	Interior plateau	Marine area of Namibia off the west coast
Quaternary	Fynbos (macchia)	Succulent rich dwarf shrub-land or grassland	Woodland savanna or upland grassland or moist mesic woodland	Desert vegetation or dry grassland
Pliocene	Fynbos	-	Similar to Quaternary vegetation	Open desert or dry woodland or shrubland vegetation or dry grassland
Late Miocene/ Pliocene	Transition from sub-tropical woodland to fynbos	Karoid shrubland with fynbos and woodland elements	-	Development of desert elements like Chenopodiaceae
Miocene	Subtropical woodland with swamps	Subhumid subtropical woodland	-	-

Key: - = no information available

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