

The geology

The Langebaanweg 'E' Quarry sediments form part of the Varswater Formation which is part of the Sandveld Group. The Varswater Formation is underlain by the Middle Miocene Elandsfontyn Formation, or by Neoproterozoic to Cambrian bedrock. Overlying the Varswater formation is the calcareous aeolianite of the Langebaan Formation, or the quartzose aeolian sands of the Springfontein Formation.

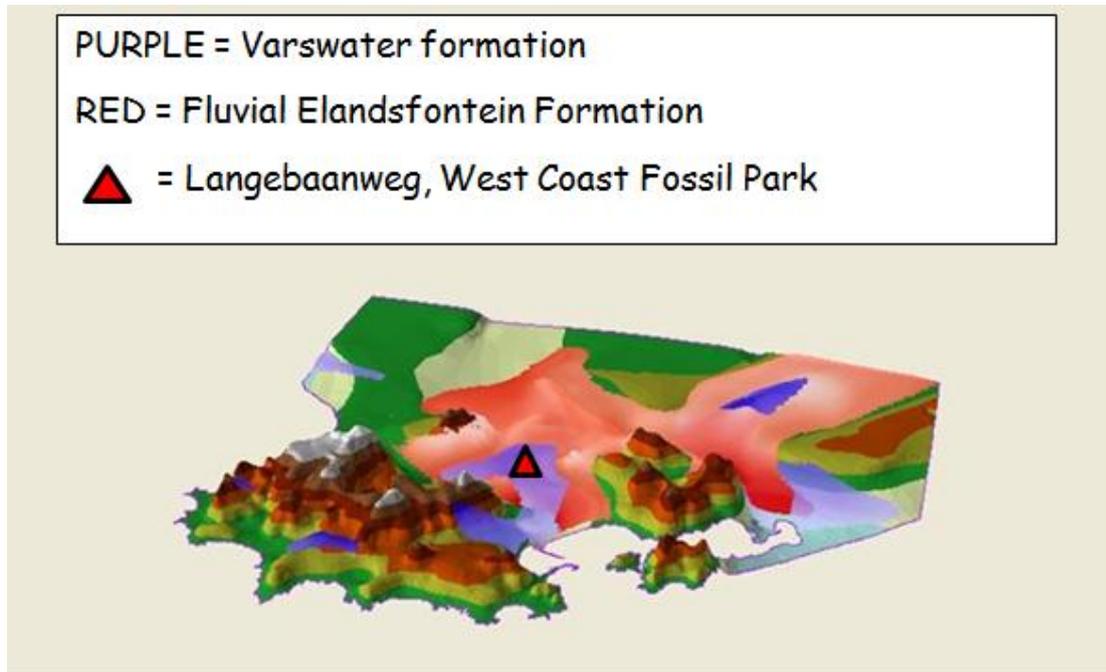


Figure 1: 3D view of sedimentation patterns around the West Coast Fossil Park

The Varswater Formation succession consists of four members, the oldest of which is the Konings Vlei Gravel Member. Above the Konings Vlei Gravel Member is the Langeberg Quartzose Sand Member (LQSM), which in turn is overlain by the younger Muishond Pelletal Phosphate Member (MPPM). The LQSM and the MPPM are the main fossil bearing deposits of the formation. The latter contained the commercially exploitable phosphate ore mined at Langebaanweg.

The LQSM represents a number of different depositional environments, and although some sub-aqueous deposition of fossils does appear to have taken place, the majority of fossils are thought to have been accumulated on a flood plain.

The MPPM deposits are thought to represent sediments accumulated on riverbanks, and in river channels.

The MPPM and LQSM represent two separate, depositional events but the time period over which these two horizons were deposited, and the age difference between them is uncertain as the stratigraphic relationship between the two horizons is complicated and poorly understood. The MPPM has been divided into the fossiliferous bed 3a, which consisted of a northerly and southerly part, namely bed 3aN and bed 3aS, as well as other undifferentiated, largely non-fossil bearing beds. Bed 3aS is thought to have been laid down during a northwards shift of the river's course, and bed 3aN by yet another, later, northwards shift of the river. Bed 3aN has been the main focus of recent research into the ungulates at Langebaanweg and is less problematic than bed 3aS (Bed 3aS deposits may contain some reworked material from the LQSM) in that there is no evidence to suggest that bed 3aN contains mixed LQSM and MPPM sediments.

Profile of the Varswater formation



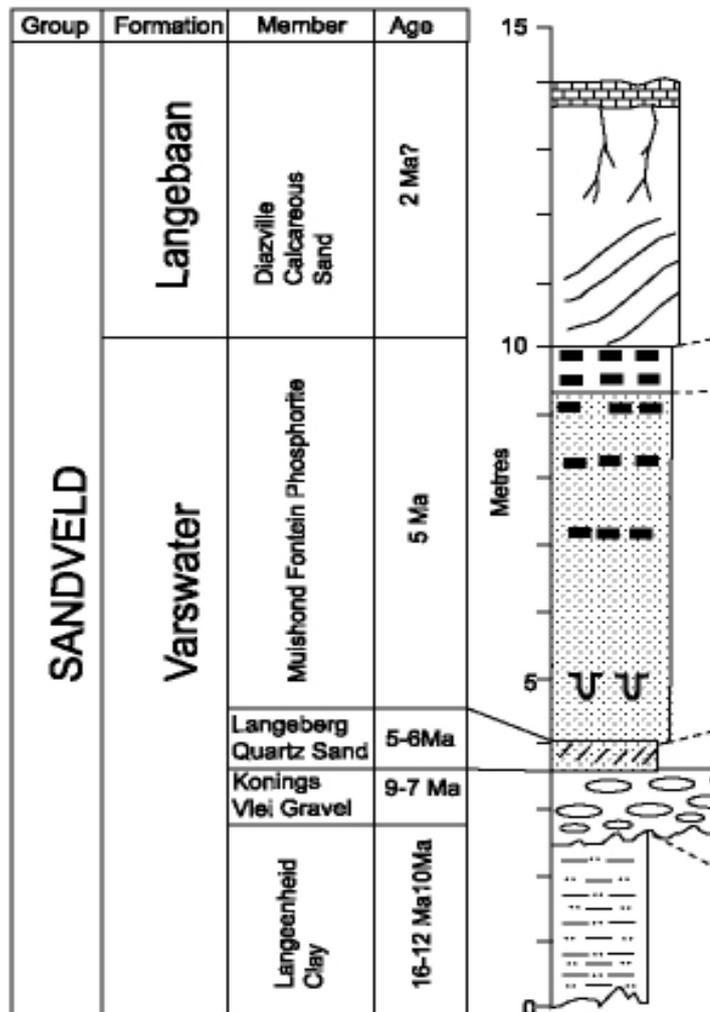
Figure 2: Excavations at the Fossil Park in bed 3aN

The LQSM and MPPM deposits were probably laid down during a global, early Mio-Pliocene transgression (a transgression is a time of rising sea-level, which has been linked to global sea level changes. The Varswater Formation occurs at ± 90 m at the nearby farm of Elandsfontyn, and this provides evidence for the sea level reaching ± 90 m at the time of deposition of the LQSM and MPPM. These units are found only between elevations of 30 m and 40 m at Langebaanweg, however, a feature which may probably be attributed to post-depositional erosion. The maximum elevation of the Varswater Formation is ~ 45 m amsl and the thickness ~ 40 m. The late Pliocene regression truncated both the MPPM and LQSM in 'E' Quarry to the north and east (Hendey 1981).

Figure 3: The geological succession of the Langebaanweg area

Profile of the Varswater Formation

The West Coast Fossil Park was established at the site of the abandoned Langebaanweg phosphate mine in 1994, and, under the direction of the park, excavations were resumed in "E" quarry in 1998 in an area which is thought to represent an extension of the river channel deposits of bed 3aN of the MPPM.



References:

Dingle, R. V., Lord, A. R., and Hendey, Q. B. 1979. New sections in the Varswater Formation (Neogene) of Langebaan road, south-western Cape, South Africa. *Annals of the South African Museum.* 78:81-92.

Hendey, Q. B. 1981a. Palaeoecology of the Late Tertiary fossil occurrences in 'E' quarry, Langebaanweg South Africa, and a reinterpretation of their geological context. *Annals of the South African Museum.* 84:1-104.

Hendey, Q. B. 1981b. Geological succession at Langebaanweg, Cape Province, and global changes of the Late Tertiary. *South African Journal of Science.* 77(1):33-38.

Matthews, T. 2004. The taphonomy and taxonomy of Mio-Pliocene and late Middle Pleistocene micromammals from the Cape west coast, South Africa. Unpublished Ph.D. thesis, University of Cape Town, South Africa.

Roberts, D. L. In press. Lithostratigraphy of the Varswater Formation (Including the Langeenheid Sandy Clay, Konings Vlei Gravel, Langeberg Quartz Sand and Muishond Fontein Pelletal Phosphorite Members). *South African Committee for Stratigraphy.*

Roberts, D. L. and Brink, J. S. 2002. Dating and correlation of Neogene coastal deposits in the western Cape (South Africa): Implications for Neotectonism. *South African Journal of Geology.* 105:337-352.

Rogers, J. 1980. First report on the Cenozoic sediments between Cape Town and Elands Bay. Report for the Geological Survey of South Africa. 165:1-64.

