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SUMMARY: THE CLIMATE AND THE CLIMATIC-GEOMORPHIC ZONAL SCHEME OF THE CENTRAL NAMIB DESERT

The climate of the central Namib desert is rather constant throughout the year. Essential factors are:

1. the contrast between frequent fogs caused by the upwelling of cold water within the Benguella current, reaching far inlands from NW and practically no rain at the coast; and on the other hand short true rainy seasons - the most westerly remnants of the SE trade winds - and missing fog below the Great Escarpment in the east.

2. the gradual changing of all climatic elements (mean annual temperature and humidity, mean daily extremes of temperature and humidity, diurnal range of temperature and humidity) from the coast towards the east, especially a linear dependency on the coastal distance up to Swartbank (appr. 40 km from the coast). Within this area extrapolation of all climatic data is possible for each locality of which the distance from the coast is known.

3. the strict dependency of temperature and humidity conditions on the prevailing winds. High temperatures and extremely low relative humidities are caused by winds from easterly directions (katabatic winds), which become more frequent towards the east but very rarely reach the coast ruled by SW winds.

A division into three different climatic zones results after the classification by Köppen:

1. the cold foggy coastal desert, up to Rooibank: BW kln
2. the warm foggy desert, in the middle near Gobabeb: BW hn
3. the warm inland desert with summer rains, below the Escarpment: BW hw.

Aridity factors by Capot-Rey support this division, giving

"mésoaride" values for the zones 1 and 3 and "plioaride" ones for the middle.

An additional factor for the Thornthwaite formula (PE) was developed to calculate potential evaporation. The thus improved formula delivers values rather well corresponding with reality for areas with more than 5o % mean annual relative humidity. The surface phenomena of weathering, erosion, and vegetation show a gradual change from the coastal region to the eastern marginal region below the Escarpment which have practically nothing in common, whereas superimposing takes place in the middle.

After a critical survey of all existing boundaries in weathering and erosion the application of the method of "crowding boundary lines" (Grenzlinienscharung) results in a subdivision of the central Namib desert into three zones of different climatic-geomorphic processes and physiognomy, approximately parallel to the coastline. The following zones correspond within a range of a few kilometers with the climatic zones after Köppen and the zones of aridity after the formula of Capot-Rey:

1. The cool fog desert at the coast
   (BW kln, mésoaride, 2o - 4o km)

The cool fog desert is characterized by widespread growth of lichens on the weathering detritus and conservation of micro-relief because of a salt-consolidated soil surface. Inspite of this wind action is remarkable as rock corrasion and deflation. Innumerable salt pans interrupt the almost everywhere existing gypsum crust. This thick and widespread gypsum armour most probably develops by reaction of sulphur - of oceanic (H_2S) or terrestrial origin - and/or sulphuric acid (resulting from it) with the soil salts. Fog precipitation is the most important medium for the necessary oxidizations and the contact with the soil surface. Near the boundary to the middle zone under more extreme conditions of temperature and humidity polygonal

structures form in very pure gypcrete (with more than 8o % of gypsum). According to various aspects the gypsum crust seems to be very old, having developed before the formation of conglomerates and canyons in the eastern Namib.

2. The desert steppe in the east
(BW hw, mésoaride, appr. 8o km)

The desert steppe is characterized by a vegetation cover of grasses and lines of shrubs which - contrary to the other zones - allow a higher fauna to live there (antelopes, ostriches). Enormous layers of conglomeratic cap rock - everywhere in the state of destruction - and abruptly rising inselbergs accentuate the character of a vast plain, for the originally existing differences between the pediments of the inselbergs on one hand and the broad funnel valleys of the great rivers on the other hand were levelled by the formation of conglomerates. Thereafter only canyon erosion took place, cutting through the plain but preserving its character. - Almost all rocks show a reddish brown patina which consists of montmorillonitic weathering products containing Fe-pigments but no iron or manganese oxides. So this patina is not a true but a pseudo - desert varnis or coating (Pseudorinden) and does not cause any case hardening at all.

3. The alternate fog desert in the middle
(BW hn, plioaride, 2o - 3o km)

A new type of desert is introduced: the alternate fog desert (Nebelwechsel-Wüste). Its climate is characterized by frequent morning fogs together with high diurnal ranges of temperature and humidity, contrary to the coastal area. As a consequence rather effective present-day granite weathering takes place. Cavernous hollows are differentiated into honeycombs (Kleintafoni), crummbling holes (Bröckellöcher), and dew pits (Taunäpfe). Basal weathering in the shade is responsible for the formation of pittoresque "stilted rocks" (Stelzenfelsen). True tafonis

cannot develop because of missing case hardening. Exfoliation, onion weathering, and desquamation (no granular disintegration) take place with measurable velocity. Humid weathering plays a most important part whereas insolation may be neglected.

In this desert there grow no grasses and no lichens either; it is absolutely barren. Here the surface types of Serir (gravel desert) and Hammada (rocky desert) find their main distribution. So this type of a desert shows all indications of a desert proper according to W. Meckelein except desert patina and case hardening (not even pseudo-coating) the formation of which is prevented by the high frequency of fog. Thus the various weathering structures in rocks - rather easily destructable because of missing case hardening - are typical for the prevailing "alternate fog weathering" (Nebelwechsel-Verwitterung).