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Paleowind directions in the Central Namib Desert, as indicated by ventifacts

by

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ABSTRACT

Ventifacts cut from dolerite boulders are exposed along the flanks of the Swartbankberg in the Central Namib Desert. Approximately 93 per cent of all ventifacts studied have facets indicating that the dominant sand-bearing wind has been from the north-east. It is therefore, concluded that this wind has played some part in preventing the extension of the Southern Namib dunes across the rock platform of the Central Namib.

CONTENTS

1 INTRODUCTION

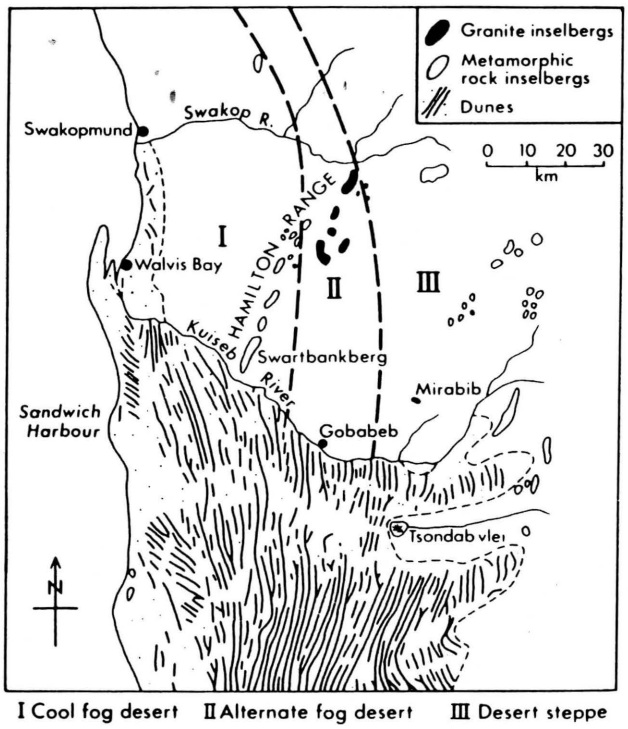
The main dunes of the southern Namib Desert trend approximately south to north, and extend northwards as far as the Kuiseb River which forms a sharp boundary of the dune field (Map 1). Goudie (1972) lists five main hypotheses which may account for why the dunes terminate so abruptly at the Kuiseb channel:

(1) big dunes move so slowly that the almost annual floods of the Kuiseb remove sand encroaching into the channel and only at the coast, which the river rarely reaches, can sand drift further northwards;
(2) rare northerly winds of high velocity play a rôle in keeping dunes from crossing the River;
(3) a large volume of sand would be required to fill the river bed and this would require a considerable period of time;
(4) it is possible that the dunes are still growing northwards and that their northern boundary coincides purely fortuitously with the Kuiseb River;
(5) the River may have shifted its course northwards under the influence of the advancing dunes.

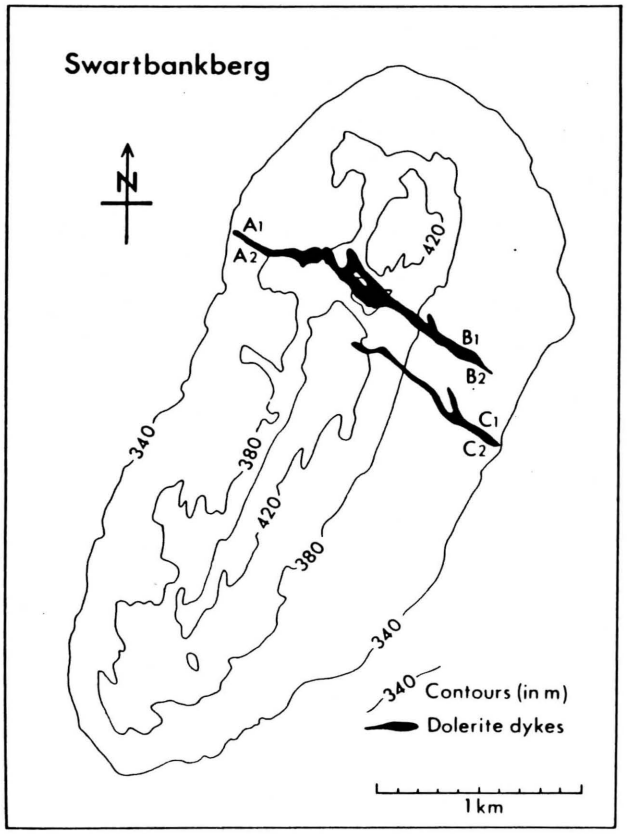
It is difficult to test these hypotheses in the absence of long-period records but the presence of ventifacts in parts of the Central Namib suggests that some indication of the direction of dominant sand-bearing winds may be obtained. On the open gravel plains north of the Kuiseb River many quartz pebbles appear to have been polished smooth, and are not facetted, by sand abrasion, and the pebbles derived from the common schists weather too rapidly to preserve evidence of abrasion by wind-driven sand. In the area of the Swartbankberg and Hamilton Range, however, dolerite dyke rocks and, more rarely, some marble boulders preserve evidence of wind-cut facets and oriented excavation pits (Allen, 1971). Experience in Antarctica (Selby *et al.*, 1973) has shown that ventifacts are usually aligned so that the abraded facets face the direction of the wind which was responsible for their formation. If, therefore, the facets of ventifacts are found to have a uniform alignment it can be assumed that these facets indicate the direction of a dominant sand-bearing wind, and it seems probable that this same wind would be a dominant one in transporting sand in neighbouring dune fields.

2 SWARTBANKBERG VENTIFACTS

The hills of the Swartbankberg and Hamilton Range are composed of marbles and schists of the Precambrian Damara System (Smith, 1962). The rocks have the same general strike as the trend of the hills and are intruded by younger dykes of fine-grained dolerite. Few of the dykes extend to the edges of the hills and into the plain where a sand supply for wind abrasion exists, but on the northern end of Swartbankberg one



Map 1. The Central Namib Desert.



Map 2. Swartbankberg with the location of the dolerite dykes which were studied.

dyke does extend into the edge of the plain and a second dyke south of it extends eastwards (Map 2). The dolerite boulders at the surface of these dykes bear evidence of wind abrasion.

On Swartbankberg dolerite boulders, or parts of boulders, which have not been exposed to wind erosion nearly always have rounded edges and have a dark brown patina covering their exposed surfaces, and lichens grow on some surfaces. The wind-cut facets are dark grey in colour, have no patina, and have characteristically plane or smoothly curved faces with sharp edges on all sides of the facet. Some boulders have a triangular cross-section but few exhibit einkanter or dreikanter forms. The boulders vary in diameter but most are within the range of 10 to 50 cm.

In order to determine the direction faced by wind-cut facets a traverse was carried out along both edges of the dykes (A, B, C in Map 2) on either side of Swartbankberg. The traverse was limited to a length of 100 m from the lower ends of the outcrops in order to eliminate the possibility of including in the sample boulders etched by winds which had been deflected around spurs of the hills, and which were therefore, not reflecting the general wind direction. Along each traverse, at one metre intervals, the direction faced by the facet on each ventifacted boulder was measured, thus altogether 600 boulders were sampled. With few exceptions boulders had only one facet, and only those on the flanks of the dyke were wind-cut for within the dyke outcrop itself the sand supply was insufficient to permit abrasion. Many boulders on the downwind side of the dykes had only slightly cut faces as the sand supply in the lee of dykes is also limited. All other dykes on Swartbankberg terminate in areas with no sand supply.

TABLE 1: Directions faced by wind-cut facets

Study Area	Number of boulders, out of 100, facing wind from directions			
	NE	SW	both NE and SW	Other directions
A1	94	2	4	0
A2	93	7	0	0
B1	92	5	3	0
B2	95	5	0	0
C1	89	1	9	1
C2	93	3	2	2

The results of the traverses are given in Table 1, which indicates clearly the importance of north-easterly winds for carrying abrading sand, for approximately 93 per cent of the boulders sampled have facets facing that direction. Confirmation of this evidence was obtained from a dyke in one of the hills in the centre of the Hamilton Range and from a number of marble boulders, which bear facets and aligned excavation grooves. No evidence was found which conflicts with the trend indicated by the ventifacts on Swartbankberg.

3 CONCLUSION

There seems to be little doubt that winds from the northeast have been, and are still, very important in the transport of sand. There is no available evidence to suggest how long it takes for a dolerite boulder to be facetted by the wind, but it is probably thousands of years. It seems likely therefore, that the northeast wind has been effective for at least much of Holocene time and has played some part in preventing sands of the main dune field from crossing the Kuiseb River and invading the gravel plains of the Central Namib.

Plate 1. Typical ventifacts from Swartbankberg.

Plate 2. A marble boulder showing evidence of ventifaction and excavation pits.

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