Dâures, the burning mountain - issues of research and conservation in the Brandberg of Namibia

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The Brandberg massif, Namibia's highest mountain, is famous for its prolific and beautiful rock paintings. Over 5 000 years of human settlement has left a rich legacy of archaeological remains. This evidence is as crucial to our understanding of the mountain environment and its response to stress and disturbance. Detailed studies of the fauna, flora and physical environment need to be integrated with the history of human activity to provide a balanced understanding of the massif and a well-founded plan for the conservation of its resources.

INTRODUCTION

The highest mountain in Namibia is a vast and rugged massif that dominates the horizon over much of the western desert and scrub savanna. In the setting sun, the western flanks of the Brandberg glow like dull embers, giving sense to the indigenous name, Dâures: the 'burning mountain'. Its circular shape marks the outline of an enormous volcanic pipe crowned by a series of granitic intrusions, and exposed by a hundred million years of erosion which has reduced the surrounding area to a gently undulating pediplain. The mountain is isolated from the broken longitudinal escarpment of Namibia and this, together with its size, compelling beauty and mysterious rock paintings has ensured the Brandberg a special significance.

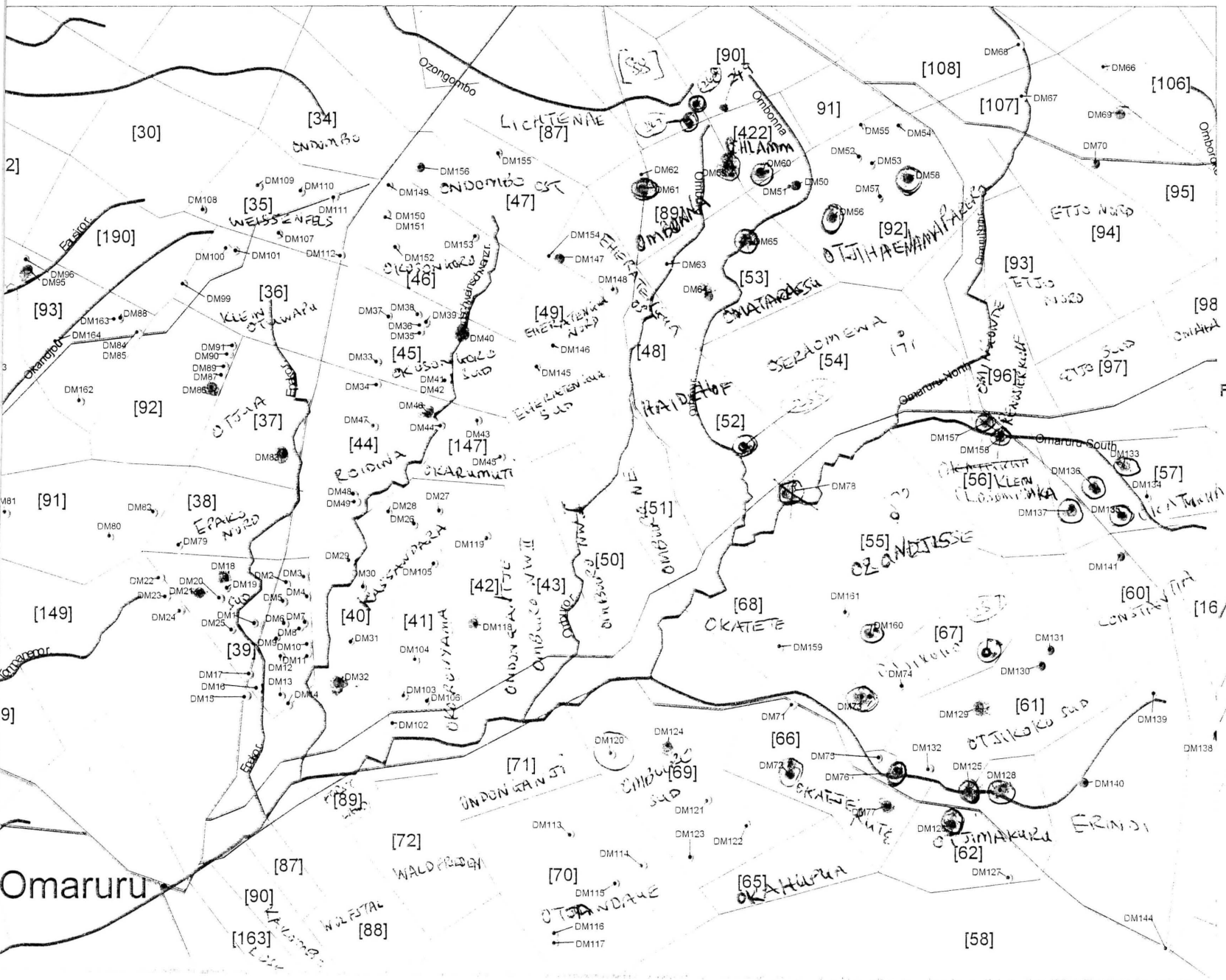
Until now, scientific interest in the Brandberg has been mainly concerned with its archaeological remains, and other aspects of the mountain have received relatively little attention. The intention of the Government of Namibia to seek nomination of the Brandberg to the World Heritage List (UNESCO 1985, 1997) highlights the urgent need for baseline environmental data such as would be used to formulate an appropriate plan for the conservation and management of the mountain. It is entirely appropriate that basic environmental research of this kind is co-ordinated by the National Museum of Namibia. The National Museum has an unrivalled research and publication record in Namibia and this enables it to draw upon the very wide network of expertise represented in this volume.

This paper aims to review the main themes of research relating to the Brandberg and to suggest some directions for future investigations. The paper considers the Brandberg both from the point of view of its unusual research opportunities and the importance of research for future conservation of the mountain, based on an integrated assessment of its natural and human history. Following this brief introduction, I review the historical background to scientific interest in the mountain and then consider the value of the archaeological time perspective on the Brandberg environment, drawing on my own research work there in the 1980s. In the final section of the paper, I discuss some priorities for research and propose the establishment of a Brandberg research unit at the National Museum of Namibia.

A large proportion of the research gathered here concerns entomology, a field that has been all but ignored by previous research in the Brandberg. Entomological systematics is a rather

MAP OF DAM CAPACITIES (cubic m)

SDP DAMS TO SURVEY



opaque field, even to many natural scientists, and those who are attracted to this volume by its geographical focus may be at first disappointed in its content. It is therefore important to emphasise that these studies are crucial to an assessment of the mountain's faunal uniqueness and its potential for further research on biosystematic questions such as endemism, or the localised occurrence of taxa. This last phenomenon may cast light on the isolation of populations due to post-tectonic events, or relatively recent climatic changes, and their subsequent mutation to new and taxonomically distinct forms. Biological uniqueness is in itself a persuasive reason for protection of the mountain, as well as a powerful attraction for further research.

To understand the functional relationships between insects, or any other life form, it is necessary to examine their biophysical environment. In the case of the Brandberg, the pre-eminent contextual feature is the geological setting, discussed in this volume by Miller. Second only in importance are climatic conditions which set the moisture and temperature limits to all terrestrial life, presented here by Olszewski. Thereafter, myriad fields might compete for attention. Among the so-called primary producers, the vascular plants are probably the most strikingly interesting feature of the Brandberg environment. The paper of Craven & Craven provides a review of this subject. Plants, and among the animals, the vertebrates, are sensitive and visible indicators of one central feature of such environments, beyond that of endemism and conservation-worthiness. Plants and vertebrate animals, whether birds, mammals or reptiles, are acutely responsive not only to climatic shifts, but to human-induced disturbance, a critical issue in any discussion of the mountain's future status. The vertebrates are covered here by the paper of Griffin.

At present, the archaeological resources of the Brandberg are nominally protected under the National Monuments Act No. 28 of 1969 as amended until 1979, while the fauna and flora of the mountain are protected under the Nature Conservation Ordinance No. 4 of 1975. The weakness of these measures has long been a matter for concern. That no major damage has so far occurred is due to the protection afforded the mountain by its isolation and difficulty of ascent, rather than by legislative measures. Cumulative impacts are already apparent in the form of damage to archaeological sites, especially rock paintings, and the over-use of dead timber near well-used campsites. Corollary impacts due to the disturbance of animals, soil erosion on walker's routes and pollution of springs and waterholes, are all becoming noticeable. It is not possible to estimate the duration of effects such as these without careful assessment of the mountain environment, based on a thorough inventory of its resources. This volume represents a major contribution to such an inventory.

HOW THE MOUNTAIN GOT ITS NAME, AND OTHER TALES

In the early 19th century, the Brandberg served as a nameless landmark for vessels plying the Namibian coast, the name 'Dourissa' only making its first appearance on hydrographic charts after the surveying voyage of HMS *Danae* in 1878 (J.H.A. Kinahan 1992: 126). By that time, colonial occupation of the country was an imminent certainty and the first comprehensive map of the interior (Hahn 1879) indicated the mountain with the rough translation Brandberg, by which it has been known ever since. Little notice was paid to the mountain, however, after its apparent lack of mineral resources was confirmed by the geologist Gürich (1891). Although an earlier visit by the adventurer William Messem (1855) is unfortunately not well verified[1] these two sources provide the first written accounts of the small pastoralist communities who lived in the neighbourhood of the mountain.

In the last decade of the century, the *Rinderpest* epidemic swept through Namibia and virtually wiped out large-scale cattle pastoralism (Schneider 1994: 149). This, and a series of disastrous uprisings against German colonial rule (Bley 1996; Drechsler 1980), reduced the indigenous economy to dependence. Early ethnographers seldom recognised the causes of rural poverty and the reduced circumstances of the Brandberg people, known as the 'Dauna-Daman' (Vedder 1966: 111) were assumed to reflect their low evolutionary status rather than the vicissitudes of history. In the 1920s, under South African rule, nomadism was equated with vagrancy rather than appropriate land-use, and the last herders of the Brandberg were settled at government-sponsored boreholes (Köhler 1959). The ensuing degradation of pastures, as well as the rise of mining and other centres, lead to the abandonment of the Brandberg. The withering of this living link was to have important consequences: there were no dissenting voices in the one-sided discussion of the mountain's human history, and no counter to the view that the Brandberg was a pristine wilderness.

There are few recorded visits to the mountain in the early years of German rule, although routine military patrols called at Anichab on the Ugab River, and other points along the desert's edge. It was probably at this time that one Lieutenant Jochmann explored the lower parts of the Tsisab Ravine, where he achieved lasting distinction with the first known act of vandalism at the Brandberg, by inscribing his name in large letters across the face of a particularly fine rock painting site. The rock art was not held in high esteem, even among those who might be expected to know better. Mrs. von Eckenbrecher, the missionary, likened the paintings to the crudest of child art, an observation which particularly irked Reinhard Maack, a painter who sometimes taught at the *Realschule* in Windhoek. Maack wryly pointed out that in his classes, the children of colonial settlers were quite unable to draw even the simplest agricultural implement, much less the animals their parents farmed (Kinahan 2000).

Maack was an unusual man; he appreciated the rock paintings as a fellow artist, and held a deep compassion for the fate of the 'Bushmen' under colonial rule. His attempt to enlighten the administration by means of a report to the government ethnologist, Dr Fourie, (Maack 1921) failed to reduce settler antipathy towards the last hunter-gatherers. Together with Hoffman, the surveyor, Maack had visited a large number of rock painting sites and copied many fine examples. The two friends explored the Brandberg and scaled the highest peak, Königstein (2573 masl) while engaged in the task of mapping the massif in 1917[2]. It was in the Tsisab Ravine that Maack made the discovery that brought the Brandberg to wider notice. Beneath a shady boulder he found a delicately painted frieze of polychrome human figures and strange mythical creatures. His detailed sketch of the paintings eventually reached the doyen of palaeolithic studies, Abbé Henri Breuil, whose extravagant views aroused such controversy that Maack and his contributions were soon forgotten (Kinahan 1995).

Arriving at the foot of the massif, Breuil had the "... impression ... of a great fallen acropolis or palace ... between the granite slabs and boulders there are flat sand covered surfaces like squares of courts between dwellings" (Breuil 1955: 5). In the site discovered by Maack, Breuil found a complex palimpsest of fully eleven separate episodes of painting. The first six he quickly dismissed as 'miserable' precursors of an intermediate stage, over which is painted the final 'symbolical ceremonial procession' (Breuil 1948: 4-5), featuring the now infamous White Lady and twenty-six accompanying figures. In his examination of this group Breuil drew particular attention to the appearance of clothing and accoutrements, telling indications of exotic affinities. "Rosy white from her waist to her feet",

Time	Event - Person			
8:00:00 AM - 9:00 AM	Info desk - Helen	Entrance - Daniella	Pool	Video - Dune - Olavi
9:00:00 AM - 10:00 AM	Info desk - Helen	Entrance - Daniella	Pool	Video - Covering Ground - Olavi
10:00:00 AM - 11:00 AM	Info desk - Mark	Entrance - Helen	Pool - Daniella	Video - Namib - Hartmut
11:00:00 AM - 12:00 AM	Info desk - Mark	Entrance - Helen	Pool - Daniella	Video - Lifelines of Western Namibia - Louise
12:00:00 PM - 1:00 PM	Info desk - Louise	Entrance - Hartmut	Pool - Mark	Video - Dune - Daniella
1:00:00 PM - 2:00 PM	Info desk - Helen	Entrance - Hartmut	Pool	Video - Covering Ground
2:00:00 PM - 3:00 PM	Info desk - Helen	Entrance - Snake	Pool	Video - Namib - Daniella
3:00:00 PM - 4:00 PM	Info desk - Daniella	Entrance - Helen	Pool - Louise	Video - Lifelines of Western Namibia - Thomas P
4:00:00 PM - 5:00 PM	Info desk - Daniella		Pool - Louise	Video - Dune - Thomas P

Helen			Hartmutt	
	8:00:00 AM - 9:00 AM	Info desk - Helen		8:00:00 AM - 9:00 AM
	9:00:00 AM - 10:00 AM	Info desk - Helen		9:00:00 AM - 10:00 AM
	10:00:00 AM - 11:00 AM	Entrance - Helen		10:00:00 AM - 11:00 AM
	11:00:00 AM - 12:00 AM	Entrance - Helen		11:00:00 AM - 12:00 AM
	12:00:00 PM - 1:00 PM	Lunch		12:00:00 PM - 1:00 PM
	1:00:00 PM - 2:00 PM	Info desk - Helen		1:00:00 PM - 2:00 PM
	2:00:00 PM - 3:00 PM	Info desk - Helen		2:00:00 PM - 3:00 PM
	3:00:00 PM - 4:00 PM	Entrance - Helen		3:00:00 PM - 4:00 PM
	4:00:00 PM - 5:00 PM	Entrance - Helen		4:00:00 PM - 5:00 PM

the White Lady "... wears a clinging garment ... from her waist to her neck, with short sleeves and several beaded bands, such as her companions wear, at knees, hips, waist and wrists ... The face is very delicately painted and has nothing native about it" (Breuil 1948: 6-7).

Breuil's patron, Field Marshall Jan Smuts, the South African Prime Minister, seemed greatly pleased by these observations and when his administrator in Namibia, Colonel Imker Hoogenhout, arrived at the White Lady, he reportedly said, "You are absolutely right, this is no Bushman painting, this is Great Art" (Breuil 1955: 7). By a process of reasoning that seems little short of bizarre, Breuil arrived at the conclusion that the frieze depicted Isis herself, as in the Lesser Mystery of Egypt. This seemed to provide a satisfactory explanation for the prominence of a female figure in the art of a supposedly uncivilised region: the frieze was evidence of a hitherto undocumented journey into the African interior. Despite the fact that Breuil's views were rejected by scholars such as Schofield (1948) more than fifty years ago, the entirely factitious mystery of the White Lady lives on in the literature of popular tourism.

Archaeological research in the Brandberg began in earnest after the Breuil fracas, with a series of test excavations by Mason (1955) and Rudner (1957), followed by a preliminary synthesis of evidence compiled by Viereck (1968). With these pioneering attempts at an archaeological sequence for the Brandberg it was possible to dismiss the Breuil interpretation on solid empirical grounds: there was no evidence of exotic affinities; the archaeological evidence from the Brandberg was entirely indigenous. Nonetheless Breuil's successors relied upon a basically similar hypothesis, that of ethnic succession as an explanation for observed changes in the archaeological sequence. The notion that innovation followed immigration rather than invention or social evolution was deeply rooted in Namibian ethnology (e.g. Lebzelter 1934; Vedder 1966) which was, in turn, integral to government policies of the time (*vide* Gordon 2000). The validity of such models was assumed rather than tested (e.g. Jacobson 1980), and as a result few detailed excavations or surveys were undertaken. Until the early 1980s the archaeology of the Brandberg was very poorly known, in part because field research was considered logistically impracticable (Wendt 1972: 5).

Difficulties notwithstanding, a comprehensive documentation of the Brandberg rock art was undertaken by the late Harald Pager, who died in 1985, having traced with pencil and draughting film 43 000 paintings from 900 sites (Kuper 1996), accounting for more than 90% of the rock art known at the time. The results of this astonishing feat of endurance and exactitude are being published as a series of volumes by the Heinrich Barth Institute in Köln, under Pager's nominal authorship, but extensively edited by Tilman Lenssen-Erz (Pager 1989, 1993, 1995). The Pager volumes are almost entirely given over to the minute details of the rock art, with quarter-size reproduction of each and every documented image, following a conventionalised system for rendering the colour of the pigments as inked copies. Supplementary sections provide some archaeological background, with emphasis on chronology and subsistence, but the avowed aim of the project was to document the rock art for posterity, leaving analytical and interpretative tasks aside (Kuper 1989).

My own work in the Brandberg was carried out under the same conditions as the early exploratory studies, although it was sustained over a longer period, from 1980 to 1984, and involved about 30 ascents, all but one by way of the Hungorob Ravine. My wife, Jill Kinahan, and I had neither backup, in the form of radio communications, nor assistance, since no funds were available to employ or equip porters. All food and equipment requirements were carried up the mountain for periods of about three weeks, at the end of which similar loads of excavation finds

Times	Info/Video	Info/Video	Entrance	Entrance	Pool	Pool	Present	Present	Walk
	Sat	Sun	Sat	Sun	Sat	Sun	Sat	Sun	
8 - 8:30	Inge	Olavi	Olavi	Inge					
8:30 - 9	Inge	Olavi	Olavi	Inge					
9 - 9:30	Inge	Olavi	Olavi	Inge			ThomasP	ThomasN	
9:30 - 10	Inge	Olavi	Mike	Mike			ThomasP	ThomasN	
10 - 10:30	Daniela	Inge	Mike	Mike	Nadia	Daniela			OM/V
10:30 - 11	Daniela	Inge	Mike	Mike	Nadia	Daniela			OM/V
11 - 11:30	Daniela	Inge	Inge	Nadia	Nadia	Daniela	Joh	Joh	OM/V
11:30 - 12	Daniela	Inge	Inge	Nadia	Vilho	Olavi	Joh	Joh	
12 - 12:30	Mike	Mike	Inge	Nadia	Vilho	Olavi			
12:30 - 13	Mike	Mike	Louise	Louise	Vilho	Olavi			
13 - 13:30	Mike	Mike	Louise	Louise	Olavi	Nadia	Petra	Vilho	
13:30 - 14	Mike	Mike	Louise	Louise	Olavi	Nadia	Petra	Vilho	
14 - 14:30	Vilho	Vilho	Daniela	Daniela	Inge	Mike			NM/LI
14:30 - 15	Vilho	Vilho	Daniela	Daniela	Inge	Mike			NM/LI
15 - 15:30	Vilho	Vilho	Daniela	Daniela	Inge	Mike			NM/LI
15:30 - 16	Vilho	Vilho			Daniela	Daniela	Olavi	Nadia	
16 - 16:30	Nadia	Olavi			Daniela	Daniela	Olavi	Nadia	
16:30 - 17	Nadia	Olavi			Daniela	Daniela			

Olavi	OM
Vilho	VM
Inge	IH
Louise	LE
Daniela	DH
Mike	MM
ThomasP	TP
Nadia	NM
Petra	
ThomasN	

and other materials were carried down. We surveyed 123 archaeological sites in the Hungorob, excavating five of these to construct a radiocarbon sequence for the last 4500 years, based on 19 dated samples[3]. Fieldwork began at the start of one of the worst droughts in recent memory and we were often reduced to less than one litre of water per day, and very little food.

As the fieldwork came to an end the drought broke and our last weeks on the mountain saw an extraordinary profusion of plants, birds and insects among rocky pools of crystal-clear rainwater. In the span of a few weeks the mountain environment exhibited a response to climatic variability of an amplitude and duration that must lie somewhere between the long-term shifts of the palaeoclimatic record and the inter-annual variation that marks the passing of seasons. Such event-driven responses are intrinsic to all arid-zone ecosystems and on the Brandberg, these represent one of the key mechanisms in plant, animal and, naturally, human environmental relations.

The question, however, is whether the human presence over these five millennia on the Brandberg was effectively limited by a simple density-dependent relationship to the mountain environment. If it was, human settlement may conceivably have set in train a pattern of localised ecological disturbance that was propagated through the system to influence the overall composition of the fauna and flora as we see it today. To reject this thesis is to question the need for stringent conservation management on the mountain, for it is evidently able to recover from intensive human use just as it recovers from prolonged drought. On the other hand, culturally mediated environmental relations are qualitatively different from all other adaptations and it would be unwise to reduce the human presence to an ecology of permission and constraint. Accepting the notion of human-induced change in the Brandberg environment poses another challenge: to integrate long-term human impact in models of arid-zone environmental relations. The next section considers these issues against the background of the archaeological evidence.

THE PASSING OF TIME, AND THE COURSE OF EVENTS

From the south, the approach to the Brandberg traverses an undulating pediplain littered with stone artefacts and flaking debris. Such scatters may extend for hundreds of metres, although close examination shows that they contain almost no discrete assemblages marking the *in situ* remains of prehistoric activity loci. Evidently, these are lag deposits resulting from the removal by sheet erosion of the sandy matrix of archaeological accumulations dating from at least the mid-Pleistocene. Another feature of the scatters found at the foot of the Brandberg is that they contain relatively little material from the late Holocene. This is in striking contrast to the archaeological sites on the massif itself, which are almost exclusively from the last five millennia, with very few examples of earlier material.

One reason for this sharp differentiation in archaeological characteristics might lie in the greater erosion potential of the massif. Its combination of steep gradients and the runoff from exposed bedrock may have accelerated the removal of earlier occupation traces. The preponderance of early material at the foot of the mountain might therefore be explained as the result of a lower energy erosion regime, as well as the fact that the duration of the late Pleistocene would in any case have resulted in a greater accumulation of archaeological remains. However, this would not account for the relative scarcity of more recent material at the foot of the mountain. To explain the significant concentration of Holocene sites on the massif it is necessary to examine the archaeological evidence in more detail.

Figure 1. Upper Hungorob aggregation site with human figures in monochrome red-brown. The frieze depicts a ritual healing, or trance dance, with men shown in conventionalised postures including raised knees and arms cast back or upward. Some men are prone or on all fours, indicating a full state of altered consciousness. Healers, or shamans, are shown with perspiration streaming from the belly and arms as they approach the dancers.

Excavations in the Hungorob Ravine have revealed that intensive and repeated occupation of the higher elevations only began about five thousand years ago (Kinahan 1984, 1986, 1990). Sedimentological analyses showed that the beginning of this period coincided with the onset of increasingly arid conditions. The basal deposits in the rock shelters consisted mainly of hydrolized granite, derived from the weathering of the rock shelter walls, and indicating moister climatic conditions than exist today. The more recent deposits consisted mainly of aeolian sediments, consistent with the dry conditions that now prevail in this area. It is likely that increasing aridity lead to the Brandberg becoming an important focus of human settlement as is evidenced by the anomalously high number of recent archaeological sites concentrated on the mountain itself.

Further light is cast on this phenomenon by a remarkable paradox in the archaeological evidence. The remains of animals hunted by the people of the Hungorob, and the depictions that appear in the rock art at the same sites have essentially no species in common. Osteological material is particularly well preserved in the dry conditions of the Brandberg rock shelters. The presence of leather objects in the basal deposits indicates that the representation of faunal remains would be relatively complete. It is therefore of interest that the proceeds of hunting very closely reflects the relative abundance of the most common species, Rock Dassie *Procavia capensis*

OBJECTIVES OF SDP 12

SDP is a research-training course aimed at enhancing environmental problem solving capacities for sustainable development amongst Namibian tertiary students

- *The overall objective of SDP is to contribute toward sustainable use of Namibia's natural resources through appropriate research training with an emphasis on research approaches, critical thinking and problem solving. Through this course, SDP participant gain experience in conducting scientific research, gain knowledge regarding sustainable development and use of natural resources, and learning about current environment issues*

Specific objectives are to:

- *How to carry out field work using identified approaches*
- *Analyse the gathered information, interpret the results obtained and to write and present a scientific re-*

SDP 12 Participants and Facilitators

ATLAPA SHEKUPE
AUSIKU PETRUS
ASHITSE KATRINA
ENDJALA TOMAS
!GANEB KENNETH
HARASEB BERNHARDT
IIFO FILEMON
KAATURA ISRAEL
KANGOOTUI SAM
LUNDGREN MARK
MASWABI RODRICK
MBANGULA ERNEST
METZLER WALTO
MOSES MOSES
MTULENI VILHO
NANTANGA KOMEINE
NATHINGE ISAAC
NCUBE NTANDOZENKOSI
PETTERSEN SILJA
SHADUKA MIRJAM
SEELY MARY
SHEKETA VERONICA
THAMINA DINA

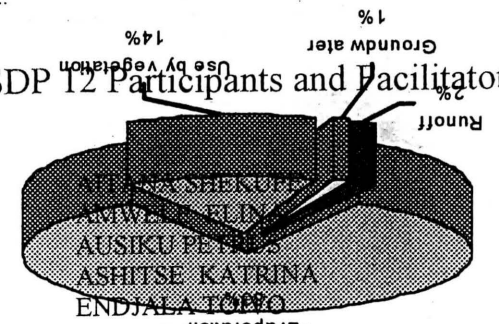
SDP in a nutshell

Although the primary objectives of the SDP emphasize the training for participants, the topic of the course have always been selected to reflect current, environmental issues in Namibia.

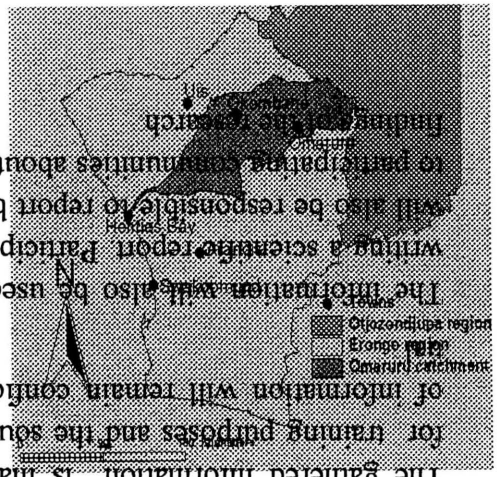
This year's topic focus on the water balance of the Omaruru catchment, how it is influenced and influences large and small-scale farmers, large and small urban areas and users of water from the lower alluvial aquifer.

Participants would conduct socio-economic and technical survey of the area including talking to farmers about their water use and investigating water availability and consumption rates.

What is water balance



Water balance, sustainable use and management of Omaruru basin



The information will also be used in writing a scientific report. Participants will also be responsible to report back to participating communities about the findings of the research

Writing and sharing the results

The gathered information is mainly for training purposes and the sources of information will remain confidential.

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(Pallas, 1766) (Procaviidae), Klipspringer *Oreotragus oreotragus* (Zimmermann, 1783) (Bovidae), and Jameson's Red Rock Rabbit *Pronolagus randensis* Jameson, 1907 (Leporidae). Bone fragments from larger species that do not occur in the higher parts of the mountain were evidently carried up as useful raw materials for artefact such as awls and hide scrapers.

The rock art, on the other hand, is mainly devoted to human figures, but it includes a wide variety of animals, with medium and large antelope of the desert plains and dry river valleys clearly predominant among these. Thus, Springbok *Antidorcas marsupialis* (Zimmermann, 1780), Oryx *Oryx gazella* (Linneaus, 1758), Eland *Taurotragus oryx* (Pallas, 1766), Greater Kudu *Tragelaphus strepsiceros* (Pallas, 1766), and Red Hartebeest *Alcelaphus buselaphus* (Pallas, 1766) (all Bovidae) figure prominently, alongside Giraffe *Giraffa camelopardalis* (Linnaeus, 1758) (Giraffidae), Zebra *Equus* spp. (Equidae), African Elephant *Loxodonta africana* (Blumenbach, 1797) (Elephantidae) and Rhinoceros *Diceros bicornis* (Linnaeus, 1758) (Rhinocerotidae). Felines, primarily Lion *Panthera leo* (Linnaeus, 1758), as well as reptiles and occasional domestic animals also appear, although these are an unimportant component. The essential point is that the animals portrayed in the rock art do not provide a compendium of local fauna. While a large number of the animals did occur in the region of the Brandberg, there are sufficient examples of apparently mythical creatures to effectively caution against such naïve interpretations of the rock art. Evidently, the selection of species and the particular combinations in which they are shown was governed by cultural preference.

Detailed examination of the Hungorob paintings (Kinahan 1990) shows that the same general explanatory approach used in other parts of southern Africa (Lewis-Williams 1982) can be applied here. The Brandberg rock art (Figure 1) belongs to a regional cognitive tradition in which the metaphorical potency of certain animals was harnessed for the purposes of ritual healing. By extrapolating from the ethnography of healing among southern African hunter-gatherer communities it is possible to arrive at a more comprehensive explanation for the remarkable number of rock paintings in the Brandberg and their apparent concentration at particular sites. The ethnographic work of Lee (1979) and Barnard (1992) among Kalahari hunters shows that ritual healing is greatly intensified when resources are strained and few alternative options exist. These are precisely the conditions that would have existed in the Brandberg at the end of every dry season.

Such observations suggest that sites in the upper Brandberg, where water and shelter were found in convenient proximity, would have served as aggregation areas for otherwise dispersed groups of hunter-gatherers. The increase of ritual activity during aggregation would have resulted in the accumulation of rock art at these sites. Thus, despite the different array of species in the faunal remains and the rock art, the sites form part of the same human response. If it is assumed that with the onset of summer rains the hunter-gatherers would have dispersed beyond the Brandberg to follow the game across the plains of the Namib, the resources of the mountain would have been left to recover.

Unrelieved human pressure on the small and widely scattered waterholes and springs that dot the upper Brandberg would have had significant ecological consequences. Human disturbance in the form of hunting and snaring must have depressed animal populations, including that of the Rock Dassie which is remarkably resilient under heavy predation. The other principal mammal prey species, Klipspringer and and Jameson's Red Rock Rabbit would also have been affected. If these pressures are combined with heavy utilisation of fuel wood, localised

clearing of vegetation and intensive gathering of plant foods, parts of the upper Brandberg environment would have been placed under considerable stress, for periods of several months at a time. If these periods of stress coincided with the late dry season the impact on plant and animal communities would be magnified accordingly, especially if the onset of summer rains was delayed. Successive years of intensive human pressure might have served as the chronic precursors of environmental degradation, albeit confined to localised parts of the mountain. If the Brandberg environment was unable to sustain these pressures, there may have been fairly long periods in which it could not sustain human settlement.

The archaeological evidence does not allow detailed examination of this scenario. The excavated sequence does not have sufficient resolution to indicate whether and when there were changes in the continuity and intensity of human settlement. The postulated use of the upper Brandberg as a dry season aggregation area is no more than a strong inference; it is not supported at this stage by clear evidence that hunter-gatherer groups spent the rest of the year elsewhere. There is evidence in the form of bone and other materials from the base of the mountain, and even of marine shell from the Atlantic shore, but this only demonstrates that wider contacts existed; it does not sketch out a subsistence model that can provide a measure of the degree to which the resources of the upper Brandberg were relied upon. However, such telling limitations of the archaeological evidence need not mean that the environmental relations of hunter-gatherer subsistence must remain a matter for conjecture alone. There are at least two threads of evidence from the Hungorob ravine which suggest that hunter-gatherers may not have placed unsustainable demands on the mountain resources.

In the first place, the existence of putative aggregation centres at nearly every reliable waterhole is a suggestive indication that not all of these could have been used at the same time. Indeed, the very richness of the Brandberg rock art corpus, and its general distribution over the whole of the upper mountain implies that it is the result of successive occupations, both overlapping and adjacent, stretching over several thousand years. In view of the small and evidently fragile resource base it would be extremely unlikely that the mountain ever supported a dense population, even for short periods of a few months at a time. Osteological evidence from the Hungorob sites provides further support for the inference that only some parts of the mountain were under pressure at any one time. All three of the main mammal species represented in the Hungorob excavations show the full range of dental eruption and wear classes that would be expected under conditions of normal population growth. Under conditions of persistent stress, these species might have become scarce, with an increased representation of older dental wear classes due to disrupted breeding. This evidence suggests that hunter-gatherer resource use was patchy and episodic, and that it exacerbated the effects of climatic variability only to a limited degree.

In the widely held view that hunter-gatherers represent the very apotheosis of ecological knowledge this conclusion is perhaps uncontroversial. Of course, this is in marked contrast to the equally common view that pastoral land-use, particularly in arid environments, is the prime agent of environmental degradation. During the last one to two thousand years, the Brandberg, as with most other parts of arid southwestern Africa, saw the introduction of domestic stock and the adoption of pastoralism as the basis of subsistence. Evidence from the Hungorob shows that while pastoralism replaced the hunting and gathering economy it retained and indeed intensified some of its major components. The seasonal use of waterholes in the upper Hungorob by pastoralists is very clearly demonstrable. Pastoral land-use was based on autonomous

4. PRODUCTIVITY

4.1 Is there a difference in productivity between individual trees of the same kind?

4.2 How do you measure productivity, i.e., by bags or in other ways?

4.3 How many bags/tins of fruit in considered high and low productivity for each tree species?

4.4 Do you sell fruit tree products? What types and who do you sell them to?

4.5 Are there other uses for these fruit trees?

4.6 Does the amount of flowering indicate a good or bad crop?

5. HARVESTING/PRODUCTIVITY/USES

5.1 How much fruit yield do you usually get from your fruit trees?

5.2 How often do you harvest?

5.3 Who does the harvesting?

5.4 What are the harvesting methods?

5.5 How do you decide when it is time to harvest fruit?

household production which ensured the flexibility to regulate the distribution of stock. Large aggregations of households formed at the foot of the Brandberg in summer if adequate pasture was available within grazing distance of waterholes there. These rather ephemeral annual pastures probably could not sustain aggregated groups for more than a month or two. After a short stay, the households would disperse to dry season homesteads, some in the upper Hungorob and others on the banks of the Ugab River where there was sufficient browse to sustain the herds until the next rainy season. Due to the unpredictable distribution of the rain, subsequent aggregations might have formed elsewhere until, by chance, rain fell again at the foot of the Hungorob (Kinahan 1986).

Rainfall in the upper Brandberg is consistently better than it is on the Namib plains, and this ensures a good standing crop of pasture almost every year, albeit restricted to relatively small areas. Much of the mountaintop consists of large exposures of bedrock, or rocky slopes that support low bush rather than grass. The upper reaches of the various ravines have many sandy basins and it is these that support most of the grass and trees, due not only to the more suitable soil, but to the existence of subsurface moisture. Waterholes and springs tend to be located in the same places as the pastures, and almost every one of these bears some traces of repeated use as a dry season pastoral homestead. The grass communities in the vicinity of these sites are noticeably diverse and consist largely of perennial species that have a high pasture value. Estimated stocking rates for the upper Hungorob are as high as twelve small stock units (sheep or goats) per hectare per six months (Kinahan 1986). This is approximately sixty times higher than the pastures at the foot of the ravine which consist of relatively low value annual species. The contrast in stocking potential clearly shows that the altitude of the massif (nearly 2 000 m over less than 10 km) effectively compresses longitudinal distance of approximately 150 km, by pro-

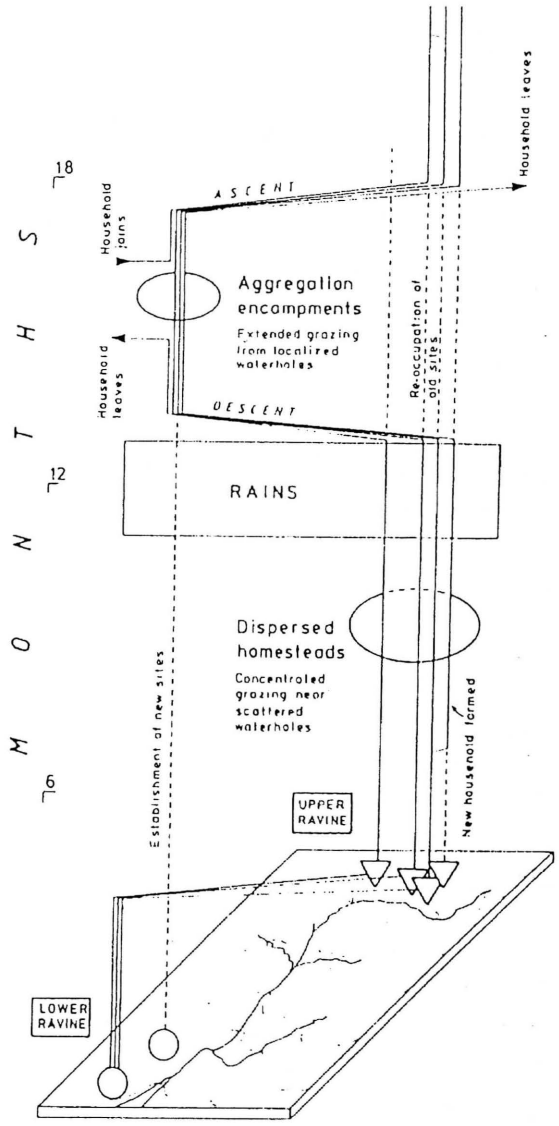

Figure 2. Simplified time-geographic model of pastoral transhumance in the Hungorob Ravine. The model proposes a short period of aggregation at the foot of the ravine after the summer rains, followed by a rapid movement to dispersed homestead sites in the upper ravine. The homesteads are occupied until the onset of the next rains. The model allows for flexible membership of pastoral alliances, leading to the construction of new aggregation encampments, as well as repeated occupation of dry season homestead sites, as indicated by he archaeological evidence.

2.3 How did they gain ownership?

2.4 If there is ownership of trees, do the owners share the fruits?

2.5 Is there any permission needed to harvest the fruits of trees one owns, or trees owned by someone else?

3. FARMING PRACTICES AND MANAGEMENT

3.1 Is soil from areas where fruit trees grow better, the same or poorer than soil where crops grow?

3.2 Do fruit trees interfere with other crops?

3.3 Do you ever find seedlings of young fruit trees that started to grow by themselves?

3.4 Do you plant or encourage new fruit trees?

3.5 Do men or women work more often with and look after the trees?

3.6 Is there any management of trees outside the farm?

3.7 In managing fruit trees, does the entire community participate?

3.8 What is the relationship between farming practices and fruit trees?

3.9 Do you clear all the fruit trees when preparing land for cultivation?

viding pasture conditions similar to those found at Omaruru in the thornbush savanna.

Herds confined to the upper Hungorob in the dry season had to rely on diminishing pastures and uncertain rainfall. The dry season homestead sites served as key resource areas and if these became degraded by over-intensive grazing their value may have been reduced for several years. Two common strategies for pasture conservation could have mitigated these effects. Firstly, grazing of the high mountain pastures would have been delayed as long as possible, thus ensuring maximum rest for the pastures and timing the commencement of grazing until the grasses had begun to seed. Delayed grazing maximises above ground biomass, increasing the bulk of available pasture, while seeding ensures that mortality of plants due to trampling can be recovered in the following season. The second strategy would involve centripetal grazing from a maximum daily range, in this way ensuring that the animals only return to the high value pastures near the homestead at the end of the day when they have finished grazing. Predators, especially leopard and caracal, were certainly a threat to small stock on the Brandberg and animals must have been taken in at night. At the end of the dry season lambing ewes would have been particularly vulnerable, and it would have been advantageous to maintain a reserve of high value pasture close to the homestead. In this system of transhumant herding, early summer rains were the cue to bring the herds down to the Namib plains (Figure 2).

Evidence from the summer aggregation sites in the Namib shows that one important activity at this time of the year was the gathering of grass seed from the underground caches of harvester ants *Messor tropicorum* Wheeler, 1922 (Hymenoptera: Formicidae). Annual grasses in the Namib, mainly *Stipagrostis* L. spp. (Poaceae) begin to germinate with as little as 20 mm precipitation (Seely 1978) and it is not unusual to see narrow swathes of grass marking the passage of a downpour over the otherwise barren desert. The succulent new pastures attract herds of antelope, granivorous birds, and harvester ants which accumulate significant volumes of seed. Grinding equipment on the aggregation sites, as well as the excavated remains of seed caches form part of every summer aggregation locality. It is not possible to estimate the effect of this activity on the potential seed bank, save in one unusual case. A large group of aggregation sites, with associated seed cache diggings, in the Zerrissene Mountains 40 km west of the Brandberg has apparently not been re-occupied for more than one hundred years. It is possible that the scale of seed exploitation in this area reduced the potential for the pastures to recover (Kinahan 1991: 82-83). Contributing to this is the fact that the seeds of annual grasses in the Namib are mainly dispersed by the wind and in the Zerrissene Mountains the prevailing wind is from the south-west, on the cold and barren Atlantic coastline where no pastures exist.

Apart from the gathering of seed, Brandberg pastoralism incorporated another practice that may have had localised environmental consequences. At the end of the summer, probably just before removing to the dry season pastures, bees' nests in rock crevices and in the hollow trunks of *Moringa ovalifolia* Dinter & Berger (Moringacaeae) trees were systematically raided. There is clear evidence that the enlarged holes in the trees were partially closed with stones, to ensure that the nest remained in use. This practice parallels the evidence that the stones covering harvester ant nests were also replaced, indicating that these resources, together with the pastures were managed rather than merely exploited. The fact that seed gathering is still practised in this area shows that it is sustainable (Sullivan 1999). Taken together with the high diversity and productivity of perennial grasses on the higher parts of the mountain, this suggests that Brandberg pastoralism was pursued

5.6 Are fruits ever harvested before they are ripe?

5.7 Are some fruits used only when food is scarce?

for several hundred years (Kinahan 1991) without depressing the resources of the mountain below the point of recovery.

The effect of pastoralism on the Brandberg vegetation is difficult to estimate. If it is assumed that grazing, trampling, as well as the consumption of fuel wood and building timber resulted in patchy degradation around waterholes, little trace of it remains today. But there are nonetheless some features of the present vegetation that show the persistence of human-induced changes. One of these is the occurrence of *Tribulus terrestris* L. (Zygophyllaceae) which in the upper Brandberg is largely confined to dry season homestead and grazing areas. The plant is unpalatable to livestock and often grows in great profusion near livestock enclosures that have been denuded of grass. Its thorny seeds are widely distributed in the hair and hooves of small stock and it is probably by this mechanism that the plant was established on the mountain. Sandgrouse, *Pterocles* spp. (Pteroclidae) and Rock Pigeon *Columba guinea* L., 1758 (Columbidae) eat the green seeds of *Tribulus terrestris* and may have helped in its dispersal, although only livestock could have produced the particular distribution that is visible today.

Another vegetation feature that is almost certainly of anthropogenic origin is the tobacco plant *Nicotiana africana* Merxm. (Solanaceae). It is remarkable that while smoking pipes are commonly found on Brandberg pastoral settlements dating to within the last three centuries, there is no earlier evidence of smoking. Equally interesting is the fact that although the plants are relatively uncommon, they are almost always found in the near vicinity of old pastoral settlements. This raises the possibility that the plant is not indigenous, as argued by Merxmuller & Büttler (1975). It is probably an early cultivar of the domestic American species, introduced overland *via* Angola (*vide* Ozanne 1969), and maintained as a small crop. Evidently, the plant failed to establish itself as successfully as it close relative, *Nicotiana glauca* R.C. Grah. which is now classed as an invasive alien plant (Barnard 1998: 170).

On the summer pastures, livestock impact was evidently limited by the scarcity of water, not grazing. The scarcity of water-points is such that the vast extent of grazing on the Namib plains was far beyond the reach of domestic stock, and their effect on these pastures was therefore negligible. This contrast between the dry season grazing regime, controlled by density-dependent relations, and the summer pastures where grazing pressure was limited by water, indicates a dual strategy which closely mimicked the dynamics of the environment (*vide* Illius & O'Connor 1999). As key resource areas, the dry season pastures were vulnerable to degradation but awareness of the risks attached to overstocking probably ensured the use of conservative grazing strategies. It is almost eighty years since independent herding on the Brandberg collapsed, as a direct result of government policies to reduce nomadism by establishing fixed water-points (Köhler 1959). In this time, the grass cover of the upper Brandberg has to all appearances fully recovered. Since there are no other sites in Namibia where a comparably long period of effective livestock exclosure has occurred the Brandberg provides an interesting reference point for estimates of pasture responses to major shifts in grazing pressure.

Previous work (Mason 1955; Rudner 1957; Viereck 1968) revealed the great wealth of archaeological material and the potential for research on the Brandberg. The spectacular qualities of the rock art inevitably drew more attention than the archaeological deposits, and it is noteworthy that while rock art documentation continues (Pager 1989, 1993, 1994, 1995), no surveys and excavations have been carried out in the Brandberg for more than ten years. The archaeological interest of the Brandberg is not

exhausted; indeed the foregoing discussion has shown that sustained human impact on the mountain must form an essential part of any attempt to understand the response of this environment to disturbance, and therefore the degree to which it must be protected in the future. The natural history research potential of the mountain has been dimly apparent until the concerted effort represented by the papers in this volume. The way forward, especially if the Brandberg is to be nominated as a World Heritage Site, appears to lie in an integrated research programme.

THE PRIORITY OF RESEARCH IN THE CONSERVATION OF THE BRANDBERG

The Brandberg represents an asset of inestimable natural and human scientific value. Its great interest and research potential has long been recognised but there has been no co-ordinated attempt properly to evaluate its resources and consider how best they might be managed and conserved. Until now, the mountain has been protected by its relative inaccessibility rather than the various items of legislation that have a bearing on its archaeological, plant, animal and mineral resources. A detailed inter-disciplinary study of the Brandberg should form the basis of an application for World Heritage listing, by providing a comprehensive audit of the mountain's scientific resources as well as a framework for a continuing programme of research and management.

This volume provides a more than sufficient demonstration of both the scientific value of the mountain and the need to continue research in every field represented by these papers. Continued research requires co-ordination and support; collaboration of scientists from diverse countries and institutions is essential, but it is necessary to provide for collaboration throughout the planning and execution of research. This will reduce many of the logistical costs of field research on the mountain and also help to generate a research synergy in which new directions of enquiry will become more readily apparent. The most practicable way of creating this sort of research environment would be to establish a Brandberg research unit based at the National Museum.

With the present volume of papers the research planning and co-ordination capacity of the National Museum is amply demonstrated. In Namibia, the Museum is unique in its multi-disciplinary structure, combining natural history and humanities in one institution. The continuing research effort in the Brandberg would generate a large number of specimens requiring identification and storage, a rôle that the Museum has fulfilled for almost fifty years. It is also of importance that curatorial and research staff at the National Museum do not have conflicting administrative and teaching functions. The housing of a Brandberg research unit at the Museum will not reduce its educational value, since the institution already plays an important rôle in this area. In contrast to the University of Namibia and other similar institutions, the National Museum's educational efforts are not confined to particular age groups or vocational groups.

It is unrealistic to propose that the National Museum should establish a Brandberg research unit to be funded and staffed from its own resources. This volume, together with a supporting proposal, should form the basis of an application for core and project funding from international donors. The diverse array of collaborating scientists and institutions involved in the Brandberg research will be a strong inducement to donor agencies. This diversity also underlines the importance of placing the Namibian co-ordinating rôle on a sound institutional footing. There should be no possibility of the National Museum becoming a mere conduit for specimens and research results to enhance the status and influence of collaborating institutions at the cost of the Namibian counterpart. In the

case of the Brandberg this has already occurred with the rock art documentation project of the Heinrich Barth Institute in Köln. The entire body of documentation is in Germany and, consequently, the benefit of the project to science in Namibia and the conservation of Brandberg rock art has been negligible. Clearly, there is a need for ethical guidelines.

The research results presented here suggest some particular needs in the protection of plants, mammals and reptiles, but this document should not be seen as a baseline environmental study or as a substitute for an environmental impact assessment. On the contrary, the volume points to the urgent need for such studies. If the Brandberg achieves World Heritage listing, a comprehensive management plan will have to be put in place. This will require a careful assessment of potential threats to the mountain environment, by a multi-disciplinary study. Preparation of this document should be the first task to be co-ordinated by the proposed research unit. World Heritage listing will increase the flow of visitors to the Brandberg, and a management plan should provide for routing of visitors, permissible campsites, a maximum volume of visitors, as well as a general code of behaviour on the mountain. Training of mountain guides would be an undoubted priority. A baseline study should also provide the detailed information required for periodic audits of visitor impact. These are specialised tasks that are well beyond the ability of the National Monuments Council and should be delegated accordingly.

Research activity itself has some environmental impacts. It is important that these are assessed as part of the screening process for projects to be co-ordinated by the proposed Brandberg research unit. Assessment must be understood as part of a continuing process within the research project, rather than a single step in the evaluation of project proposals. The assessment and monitoring of all such impacts will quickly generate a database of measurements that can be used to predict the likely impacts of activities such as research and recreation, as well as the time required for the recovery of vegetation, soils and water. In the case of the assessment of impacts from projects co-ordinated by the National Museum it is important to employ a system of impartial review, using outside expertise.

The scope of research that can be carried out in the Brandberg is immense. Some basic research and data collection should be given priority, however. An automatic weather station needs to be installed on the mountain before any long term monitoring of animal populations and plant communities begins. In view of the logistical difficulties involved in the management of such a remote station, the National Museum would have to enlist the help of mountaineers and mountain guides for periodic downloading of data. A series of simple rain gauges, temperature and wind recorders on some of the main hiking routes on the mountain would help to provide a more detailed picture of local variation in climatic conditions. Selection of sites for weather monitoring should be made with other research interests in mind. Study sites could, for example, be used for simultaneous collection of weather data, insects in pitfall traps, periodic soil moisture measurements, permanent vegetation relevés, and a variety of other needs. As the technical competency of mountain guides improves, the range of monitoring tasks could be increased.

Other basic research that is urgently required includes detailed soil and vegetation mapping. The relationships between soil, vegetation, altitude and aspect is not well understood on the Brandberg and it is important for botanical research to move beyond taxonomy if it is to contribute fully in studies of the mountain environment. Phytosociological studies will help to define broad plant associations or alliances which are an important key to understanding variation due to terrain and variation due to other factors such as disturbance. It is not inconceivable that detailed phytosociological research

Methodology of Dam Surveying

Dam Surveying is a method used to study the parameters of the dams (e.g. depth, surface area and capacity). Techniques like leveling and Geographical Positioning System (GPS) are used in this method.
Leveling is the method that compares two points on the surface of the earth, whereby the height of one point can be given only relative to another. GPS is an instrument used to determine geographical positions and map routes.

The following procedure were used to survey the dams:

a) Identification of Dams
b) Instrumentation
c) Measurement
d) Changing Instrument Position
e) Documentation

a) Identification of dams

Dams in the study area were identified using Air photographs and Topographic maps. Farmers and farm-workers also aided with giving the correct directions to the dams.

b) Instrumentation

Point leveling was used to survey dams. This requires an instrument itself (i.e. the dumpy level and tripod) and the staff (this is a graduated meter of about 5m in length and it should be held upright for correct measurements).

It is important to set up the instrument at a position where one can see large portions of the dam, so that one changes the position of the instrument as infrequently as possible. This helps to prevent confusion during the analysis of data.

When setting up the instrument, the tripod should stand firm and it should not be moved or bumped against, once it is put up. The dumpy level can then be screwed on the tripod. After that the bubble on the dumpy level can be leveled using the three knobs to adjust the bubble. Only two knobs should be moved at a time, these should run parallel to the dumpy itself. When the bubble appears leveled, the two knobs are aligned perpendicular on the dumpy.This can be repeated until the bubble is always in the middle of the circle when viewed from all directions. The instrument is then leveled.

The dumpy level has a protractor, which measures the degrees at which the instrument is changed to (giving direction of the position where the reading is taken). The protractor should be set at zero degrees in the beginning of the survey.

N.B The protractor should not be moved when the reading is being taken.

would reveal hitherto unnoticed effects of human disturbance in the past. Inselberg environments in Namibia are a potentially interesting field of research, with a high degree of endemism. The degree to which this has been influenced by human disturbance is highly relevant to the management of these unusual features. Mapping of detailed vegetation and soil distribution patterns on a complex terrain such as the Brandberg requires a high degree of accuracy. A Global Positioning System ground station would greatly improve not only the resolution of mapping but also the capacity to manage large numbers of measurements.

The field research on the Brandberg shown in the contributions in the present volume indicates that relatively short expeditions, on foot, with logistical support either by porters or helicopter, is probably the most viable approach. This evidently provides an abundance of material although it is difficult to evaluate such results against the background of unknown climatic variability. More extended data collecting efforts are required in almost all fields, each posing a number of practical difficulties. Small mammal trapping would, for example, provide many insights into population variability in relation to rainfall but data collection would need to be carried out at frequent intervals to assess demographic trends. This may be one further example of a research task that could be carried out by local mountain guides or other enthusiasts. Reptile and, possibly, bird population studies could be augmented in the same way. Such collaboration with local communities will enhance the research effort as well as promoting community involvement in the conservation of the mountain environment.

There is probably no field which does not require further research in the Brandberg, and as knowledge advances in one field it will as part of the inter-disciplinary effort, raise new questions in other fields. As a closing example one might consider the geological mapping of the Brandberg. On the scale of regional geology the mapping of the mountain is sufficiently detailed to establish its geochronological and lithostratigraphic relationships. The evolution of the mountain is also well understood, with reference to the emplacement of the granite, its subsidence and the process of erosion that has exposed the mountain over the last 100 million years. The more detailed structural characteristics of the mountain may be of little interest to the regional geology, but they are of crucial importance to an understanding of water circulation *via* the open sheet joints of the granite, through fault lines and over the upper surfaces of buried granite masses. The distribution of water in relation to the geology of the Brandberg could be investigated by means of isotopic tagging, a technique that would yield much useful data without any appreciable impact on the mountain environment.

Questions as to the legal status of the mountain, the rights of local communities, as well as the demands of various tourism ventures have dominated all discussion of the Brandberg in recent years. The approach taken in this paper and in the volume as a whole, is that a scientific assessment of the mountain is long overdue. The implicit view of the contributors to this volume is that the interests of all stake-holders in discussions of the Brandberg will be served by a more informed appreciation of the mountain environment. This is not to say that this scientific assessment has no attached value judgements; most scientists would view tourism on the mountain as an unnecessary and disturbing activity that should be confined to less sensitive and scientifically interesting places. Some might even view with suspicion and apprehension the efforts of local communities to gain greater control over the mountain that overlooks their daily lives. A new consensus is needed and there could be no better start towards this than an official decision to abandon the place-name Brandberg, and reintroduce the term Dâures into general use.

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END NOTES

[1]According to Andersson (1861), Messum travelled inland from Cape Cross and came upon a sizeable encampment of people at the foot of a great massif, and it is on Andersson's authority that the Messum River is so named. Messum's own account (Messem [sic!] 1855: 211) is less well known and states that he penetrated no more than 20 km from the coast.

[2]An earlier attempt by Burfeindt and Carstensen in 1914 had to be abandoned due to thirst and hunger. Hoffman and Maack's ascent of 1917 was repeated for the first time by Donald Woods in 1943. Although the mountain has been climbed many times since then, the surveying equipment which Burfeindt left behind remains to be found.

[3]Materials and documentation for these sites are deposited in the Archaeology Collection of the National Museum of Namibia.

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To: <hartmutk@drfn.org.na>
Cc: "joh" <jhenschel@drfn.org.na>
Subject: Contributions to draft agreement

From: Rudolf

30 November 2003

Dear Hartmut
Comments:
The hydro form machine: as you are aware this machine gave problems in the past and I feel it should be a shared responsibility if we experience problems with the machine.
I also proposed some modifications on the machine based on the unreliable control of pressure exerted on to the bricks. This still needs to be looked at.

Based on delays due to the problems experienced with the machine I feel it will be unfair to blame this on the contractor alone. Otherwise provision should be made for a stand by machine to prevent delays in production.

Payment for water: It is my opinion that this is a natural resource available in the area and is not used for our benefit but for the benefit of your institution as it is an important component for brick production.
Please note that you are not paying any fees for the natural material used for the project.

I question the rational behind the payment of water used?

Number of workers on site: I indicated to employ at least ten or less workers depending on the work load, it might happen that we need additional staff to speed up delivery.
For this reason I think it is wise to make room to employ additional workers **only** if needed. I will make sure that any addition to my work force will be communicated to you.

The upgrading of infrastructure at GTRC is a well designed program with plans for all constructions to be done I assume. For this reason I would like to have an idea how many bricks we are to produce in total for the project next year before we enter into a new contract.

These are the contributions from my side and will appreciate if you consider this before finalizing the agreement.

I thank you
Rudolf

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To: <hartmutk@drfn.org.na>
Cc: "joh" <jhenschel@drfn.org.na>
Subject: Contributions to draft agreement

From: Rudolf

30 November 2003

Dear Hartmut
Comments:
The hydro form machine: as you are aware this machine gave problems in the past and I feel it should be a shared responsibility if we experience problems with the machine.
I also proposed some modifications on the machine based on the unreliable control of pressure exerted on to the bricks. This still needs to be looked at.

Based on delays due to the problems experienced with the machine I feel it will be unfair to blame this on the contractor alone. Otherwise provision should be made for a stand by machine to prevent delays in production.

Payment for water: It is my opinion that this is a natural resource available in the area and is not used for our benefit but for the benefit of your institution as it is an important component for brick production.
Please note that you are not paying any fees for the natural material used for the project.

I question the rational behind the payment of water used?

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