ARCHAEOLOGICAL SEDIMENTS FROM A SHELL MIDDEN NEAR WORTEL DAM, WALVIS BAY, SOUTHERN AFRICA

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SUMMARY

Excavation of a shell midden in the Delta of the Kuiseb River, uncovered a 1 m sequence of stratified, non-cultural deposits. Sediment analysis indicated that after the basal beach sand, the site microdepositional environment was predominantly fluvial, but that several changes in available energy occurred. These changes reflect events in the complicated geomorphic history of the Delta and would have affected the preservation of evidence for any pre-midden occupation of the site.

INTRODUCTION

Wortel Dam (14°27′E, 23°4′S) is situated in the Delta of the Kuiseb River to the west of the low dunes that dot the complex of poorly defined delta channels. In the Kuiseb embouchure, as elsewhere in the coastal Namib desert (Sandelowsky 1977), prehistoric shell middens are found on small dunes and in the various water courses (Jacobson & Vogel 1977). One of these shell midden complexes has been excavated by Leon Jacobson and John Kinahan (Jacobson & Vogel 1977) and stratified, non-cultural sediments were uncovered beneath the occupation at site KM 2.

Site KM 2 is a small oval mound parallel to an ephemeral channel that now undercuts its eastern side. The occupation surface was radiocarbon dated to between 400 ± 50 (site KM 2) and 200 ± 50 (site KM 3) years BP, or approximately 1 460 and 1 635 AD. Associated cultural materials included ostrich eggshell beads and pendants, bone points, potsherds, quartzite flakes, and utilized quartz pebbles. The site was sectioned approximately 1 m below the occupation surface, and sediment samples were taken from the 12 stratigraphic units noted. The samples, along with comparative samples collected from the nearby beach and lagoon, were analyzed in the University of Chicago Paleoecology Laboratory. It was hoped they would provide information on the complicated geomorphic history of the delta. Specific concerns in-

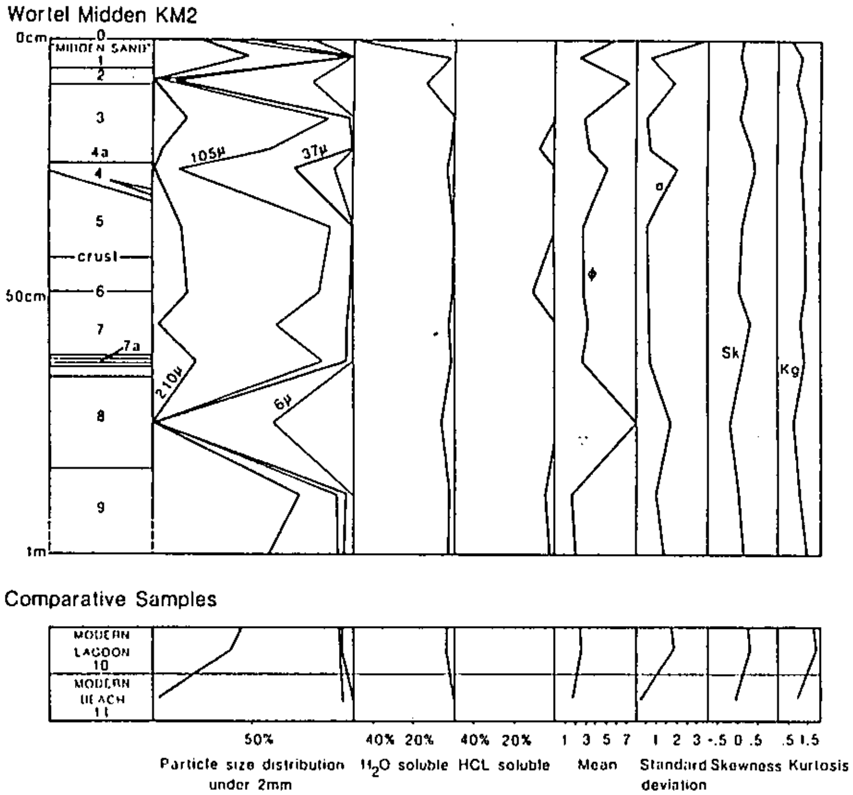

Figure 1. Analytical results from the Wortel Midden.

cluded the relationship of the occupation surface to the development of the channel that exposed the sediments underlying it, and the probability that previous occupations would have been preserved in the geomorphic context represented by the subsurface sediments.

Laboratory processing of the Wortel samples included particle size analysis, examination under a binocular microscope, determination of $CaCO_3$ and water soluble salts and, for the 'midden sand' (unit 1), of organic matter (there was none). Particle size was obtained by hydrometer (when the sample contained sufficient silts or clays) and by dry sieving with a Ro-Tap machine. Preliminary processing included the removal of water soluble salts, decalcification where necessary, and dispersal in a 5% solution of sodium pyrophosphate. Particle size information was used to construct particle size curves which were statistically described. The results of the analytical program are presented in Figure 1.

THE SEDIMENTS

The samples were all sands or silts. The sand fraction was composed predominantly of quartz, secondarily of mica. In all samples, the largest quartz grains represented a small percentage only, and differed in quartz micromorphology from the smaller size grades. Variation among samples was found in the size distribution statistics and in the semiquantitative estimates of mineralogical composition, particle form, and oxide stain.

The 12 samples from KM 2 fell into three major facies:

a. Facies 1 includes only sample (9), a coarse-grained sand that is moderately sorted, with a nearly symmetrical distribution. It is statistically very close to sample (11), a modern beach sand; it is even more similar to wind-worked, fossil beach sands collected at Melkbosstrand, South Africa, by Professor K.W.Butzer. Sample (9) however contained more frosted and rounded sand than (11) and probably represents nearshore sand reworked by eolian (and fluvial?) processes.

b. Facies 2 includes samples (0), (2), (4) and (8), silts and clayey silts that are poorly sorted and have fine micaceous sands. Since mica tends to disintegrate rapidly in eolian environments and seems to be uncharacteristic of eolian deposits (Kukal 1971:128), these probably are fluvial, suspended load sediments. Their deposition indicates very low energy conditions as typical of overbank discharge or the ponded waters in a vlei. Sample (0) is the thin modern salt crust, representing stability of the modern surface. The relatively high, coarse sand component includes shell fragments and probably reflects a combination of mixing with unit (1) sand and longterm eolian surface creep.

c. Facies 3 includes the remaining samples, all medium grade sands. These are channel deposits, but they are sufficiently dissimilar to require separation into 'transitional', 'dominant' and 'coarse' variants of the same facies.

Samples (4a) and (7), the 'transitional' variant, are relatively fine sands, well sorted and positively skewed; they have micaceous, medium to coarse sand fractions and a predominance of angular to subangular grains in the fine quartz fraction, suggesting fluvial transportation and deposition, under circumstances that allow a large proportion of silts and clays to remain in suspension.

Samples (3), (5), (6) and (7a) comprise the 'dominant' variant of facies 3, and about a third of the entire vertical sequence. These are medium sands, well sorted with nearly symmetrical distributions. The group contains low percentages of mica, but their similarity to (4a) and (7) in appearance and size distribution and the presence of horizontal laminasets of sand and clay (7a), make it most likely that this variant represents bedload sands, fluvially transported and deposited. Sample (6), and presumably the crust 6.5 cm below it, is about 12% $CaCO_3$ enriched, indicating that the dominant variant of facies 3 was interrupted by two depositional breaks.

Sample (1), the 'coarse' component of facies 3, is a well-sorted, medium grade sand. As the 'midden sand' (1) could have received additions in the

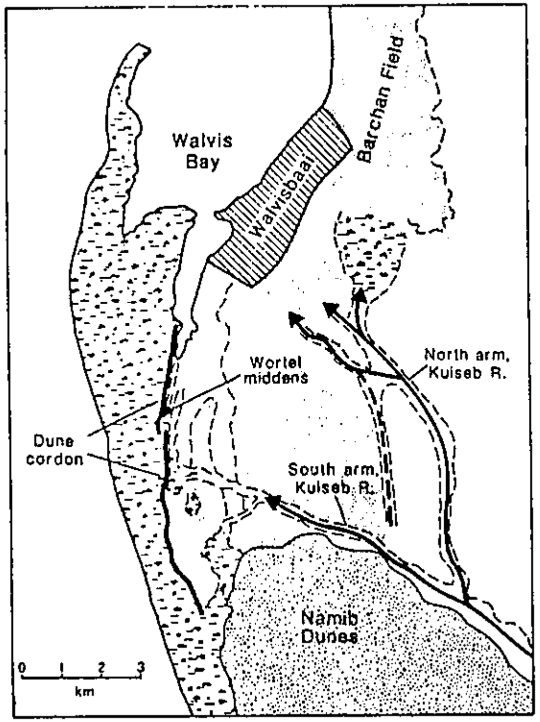

Figure 2. Branches of the Kuiseb Delta.

course of human occupation, e.g. beach sand inadvertently transported with shellfish; however, its normal particle size distribution and good sorting, indicate that human intervention was not intense. Sample (1) most closely resembles the medium-grade bedload sands below it, and is best interpreted as a coarser bedload variant.

DISCUSSION

The argument that the KM 2 sequence above the basal beach sand is of fluvial origin is consistent with expectations for a site situated in a delta, and with the descriptions of the area by Stengel (1964). There are alternative scenarios for the formation of KM 2 but these can be discounted.

One hypothesis entertained early in the investigation was that the sequence represented an alternation between an interdunal vlei and eolian accretion during periods when no Kuiseb discharge reached this area. Against this hypothesis stands all the evidence that facies 3 is fluvial, including: (a) the horizontal laminasets in (7a); (b) the continuity between the micaceous, finer

sands and the medium sands of the 'dominant' component of facies 3; (c) the overall agularity of fine and medium quartz grains, in contrast to the rounding of the eolian grains in the coarse 'tails'; and (d) the fact that there is a channel at the site today.

In a second hypothesis, one favored at the time of excavation (Jacobson & Vogel 1977), the KM 2 sequence was tentatively linked to shifts between fine, lagoonal deposition, the enclosure of the lagoon through coastal change, the formation of salt-flat crusts and, finally, of predominantly eolian landforms. This type of geomorphic cycle, discussed by Kensley (1978) for the Namib coast, is improbable for KM 2 because: (a) the facies 2 silts from KM 2 were quite dissimilar to the modern lagoonal sample (10); (b) the lower crust (6) in the sequence was calcareous rather than salty; and because (c) the facies 2 sands are distinctly fluvial, as argued above.

The most likely source for the fluvial sediments at KM 2 (facies 2 and 3) would have been the Kuiseb River. The modern Kuiseb sediment load at the Gobabeb Research Station has been described by Scholz (1972) as a well sorted, light colored, slightly micaceous sand. Marker (1977) states that the sands of the middle and lower Kuiseb are dominantly reworked from the dune field south of the river; these dunes have a characteristic 'reddish-brown' color (Scholz 1972) and flank the river channel from Gobabeb downstream. Some mixture of these sediment components may account for the composition of all the fluvial sediments at KM 2.

The magnitude of geomorphological change sufficient to produce the KM 2 stratigraphic sequence from Kuiseb discharge is no greater than that represented in maps from the last 100 years as reproduced by Stengel (1964) (see Figure 2). Facies 1 could correspond to a time when KM 2 was a near-shore dune and the southern branch of the Kuiseb was inactive or located farther away from Wortel Dam, as in Stengel's maps for 1885, 1913 and 1914. Facies 2 probably reflects the situation of the 1965 map, when the southern branch of the Kuiseb ended in a vlei or marsh during times of unusually great discharge. A more detailed reconstruction of this landform configuration might show the vlei at KM 2 as the end-point of a Kuiseb distributary that had insufficient energy to break through to the east because of limited discharge, an aggrading coastline, or the barrier posed by the coastal dunes. A similar situation was envisioned by Marker & Müller (1978) for a relict silt in the middle Kuiseb valley. Facies 3 could represent a landform configuration like that of the 1911 map, in which KM 2 was a distributary of the southern branch of the Kuiseb, and when exceptionally strong discharge left only bedload sediment in the vicinity of KM 2.

One further feature connects the KM 2 sequence with regional geomorphic events. Vertical changes in oxide staining, which did not correspond to changes in energy facies, are suggestive when viewed as changes in the proportion of Namib dune sands in the Kuiseb bedload. While not rigorously quantified, the proportion of reddish quartz grains was higher in the most recent units (1), (2) and (3). This indicates that the dune field, which currently provides a large proportion of the lower Kuiseb bedload (Marker 1977), was equally important as a source of sands for some time prior to 1460 AD. It further implies that there was a previous period during which sediments from the higher, igneous and metamorphic catchment – e.g. the light micaceous sands described by Scholz (1972) – were not overwhelmed by dune sand at Gobabeb as they are today.

CONCLUSION

The sequence of events recorded at KM 2 can be summarized as follows. A beach sand (9) was covered by ponded waters of a Kuiseb distributary (8). After a time, the distributary lengthened and left a mixture of bedload and suspended sediments at KM 2, its former endpoint (base of 7), while probably ending in a vlei downstream. This new regime was interrupted by several events of alternating bedload and vlei deposition (7a), but was reinstated (top of 7). Runoff energy then increased (5), depositing bedload sediment at KM 2, but the recurrence of discharge events was erratic, and $CaCO_3$ crusts formed at times when discharge was infrequent or failed entirely (6 and the upper crust). Subsequently there was lateral cutting of the channel bed, followed by at least two episodes of suspended-load sedimentation with low-energy discharge. Stronger floods again followed upon (3), to a point well downstream. Unit (2) represents a time when the Kuiseb discharge again terminated near KM 2, but thereafter the Kuiseb south branch appears to have reached the Atlantic (1). Unit (1) was occupied and abandoned after this sequence of events and then covered with a veneer of flood silts (0). A salt crust subsequently formed during a time span when the south branch began to entrench a little.

It is apparent that KM 2 records an interesting segment in the history of the Kuiseb south branch, that also reflects the climatic history of the upper river catchment. Further field work, both around Wortel Dam and along the middle stretches of the Kuiseb is evidently called for.

In answer to the specific questions for which this study was undertaken, we concluded that:

(a) The south branch of the Kuiseb predates the occupation of KM 2 in c.1460 AD; since this site was abandoned, the channel has tended to undercut the site, probably in relation to cumulative channel scour, possibly as a result of a minor, negative trend in relative sea level.

(b) Although Stengel (1964) has documented a rapid succession of distributary changes over about a century, the depth of the deposit, the number of major depositional events represented, and the breaks due to erosion or non-deposition, could represent more than a millenium. The absence of evidence for human occupation until the end of that period could be archaeologically significant but may also reflect lack of preservation. So, for example, archaeological materials could have been removed by erosion between units

(5) and (4), whereas units (9), (7a), (6), (5) and (3) represented conditions too active for good preservation. However, preservation would have been relatively good during the deposition of (8), (7), (4), (4a) and (2), so that the lack of archaeological evidence for these periods probably indicates an absence of human occupation.

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