The terminology of the geo-aeolian environment
especially in relation to Danish landscapes

By Hans Kuhlman

Abstract
Localities with aeolian materials are classified, tentatively on three independent basic principles: 1) dynamic, 2) sedimental, 3) geometric (morphometric). The nominated terms are arranged in a table (II) in order to suggest a system of aeolian geo-environments.

Introduction
Excellent reviews of the geomorphology of Danish landscapes influenced by the wind have been worked out by Warming 1907-1909, A. Schou 1915, 1949 and Niels Nielsen & Schou 1958. However, an attempt of composing a consistent terminology for the geo-aeolian environments in Denmark makes it desirable to link these works together with the newest studies of sand drifting and dunes (Bagnold 1954, Sindowki 1956, Cooper 1958, Kuhlman 1958 and Finkel 1959).

The attempt below does not pretend to be exhaustive; it only tends to outline the fundamental features in a «natural system».

For a geomorphological classification different points of view may be adopted: 1): dynamic; 2): sedimentological; 3): form-descriptive; 4): evolutionistic. A distinction between these four categories is normally not maintained; however, elements from all of them contribute to the explanatory description of the landscapes. The common descriptions bear the stamp of W. M. Davis' ideas of the natural evolution of the landscape; these sometimes imply pseudo-explanations and uncertain hypotheses. Therefore, some modern geomorphologists maintain an attitude of reserve towards Davis' evolutionistic points of view, which may involve scientific pitfalls. In Scandinavia Behrens has recommended to adopt a clear distinction between morphologic description and genesis; this will make it easier to arrive at scientific explanations, which today are further
facilitated because exact observations and experiments are gaining foothold in the geomorphological methodology. Especially the studies of dunes and of wind-erosion have profited from the quantitative measurements, without which it is impossible to elaborate a valid systematism. A form description will be systematic, when it is based both on the geometrical figurations and on their ¥ontogeny¥ and ¥phylogeny¥. The development of the form-shaping processes may be called the geomorphological ontogeny, the basis of the dynamical classification. The descent of the forms is the morphologic phylogeny. Pure descriptions are rare in the dune topography, and often they have a curious ¥two-dimensional¥ character, for instance: ¥white dunes¥ and ¥grey dunes¥.

In the following the landscape influenced by the wind is treated on the basis of the above-mentioned principles.

History

Since the works of Sokolow 1884 and Steenstrup 1894 appeared many geo-aolian papers have been published, among which the present text only refers to those which have dominated the treatment of this subject in Denmark and which are the origin of our modern theories. E. Warming 1907-1909 in his monography of the vegetation on Danish dunes gave a comprehensive review of dune forms and of their birth; his work authorized the opinion that the most important aolian sedimentation in a humid climate is the result of an interaction between vegetation and sand drifting; this has also been mentioned by ancient authors: Viborg 1788, Groos 1847, and Andreasen 1861; however, Warming brought us the understanding of the biology and of the morphological effect of the dune vegetation. He introduced terms which became classic, for instance ¥white dunes¥ and ¥grey dunes¥, ¥grønnings¥ (= green dune valley), see Lemberg, Schou, Kihlström; these terms referred to the plant communities and not unambiguously to the geomorphology — a fact which at times has been overlooked by the posterity. From Warming a clue leads to J. W. van Dieren, whose book from 1934 brought a culmination of the research line of a botanical character, originating in the combating of the anthropogenic sand drifting in Europe in the sixteenth to the eighteenth centuries; see Wessely 1873, Gerhardt 1900 and Braun 1911. The results crystallized in v. Dieren's work had been anticipated by many authors, see Lemberg and Behrmann. The dunes of North-West Europe and their plant communities have had correlative evolutions. Possessing this knowledge,
v. Dieren established a systematism, including a latin terminology. The following dune evolution was fundamental: embryoal dunes (tussock dunes) — bank of dune sand with Ammophila — blow-outs — parabolic dune — secondary barchan. According to v. Dieren this sequence is due to self-degeneration of the vegetation. Such a pessimistic opinion is open to discussion, see Cooper 1958; however, it is not to be doubted that the said development has taken place in Europe and in the United States: Paul 1944, V. Hansen 1957 and Hack 1941, Hefley & Sidwell 1945. Van Dieren introduced a clear distinction between »physical« dunes and »organic« dunes (p. 204-207); in the United States »organic« has been replaced by »phytogenic« (Smith, Cooper). More particularly a distinction is made between desert dunes and coastal dunes, see Schau 1945, p. 148; this distinction is criticized by Cooper 1958, p. 66-68. The present-day standpoint must be that v. Dieren’s classification is misleading, because gradual transitions are seen between »phytogenic« and »physical« dunes, and because the forms in arid zones and in humid zones may be explained by the same »natural laws« as those formulated by R.A. Bagnold 1935-1954.

Bagnold, whose works are epoch-making, introduced the modern aerodynamics in the dune morphology; his results have been confirmed by Chepil and Zingg. On a number of points Bagnold’s studies open a new era; here are only mentioned the most relevant. He demonstrated that the sand drifting is caused by the saltation of the grains and by the resulting surface-creeping, the so-called »reptation«. The movement which takes place across loose sand creates wind ripples, which mark the most frequent points of impact of the saltation grains. Bagnold’s explanation of the occurrence of the ephemeral wind ripples (see also Trikalinos 1928) has encountered difficulties in chasing wrong interpretations, especially the »Helmholtz theory«, which came to life because Baschin considered cirro-cumulus to be homologous with wind ripples; other »wave-theories« too have ravaged the dune morphology, see Exner. Bagnold has given a mathematical expression of the relation between wind, sand and transport quantities. He further demonstrated that it is the wind force in the air layers next to the surface which influences the aelorian deposition and erosion; example: mobile sand sheets in relation to fixed, smooth surfaces are sheltered; i.e. the wind velocity at the same level is reduced. Consequently, a sand spot in a smooth environment will »catch« more sand. This phenomenon has been called by H. T. U. Smith 1953: psammogenic dune genesis, which explains the
growth of many dune forms. In a Western European dune environ-
ment Sindowski and, later, the author have verified some of Bag-
nold's theories; it appeared that the aeolian transport and the dune
genesis here are not essentially different from the conditions in an
arid region; however, certain corrections had to be made of the
formulae, see Kuhlman 1958. W. Walther has also worked in such
terrains; however, with other theories as a point of departure. The
most astonishing factor in relation to sand drifting in our climate is
the feeble restraining effect exercised by rain and humidity. Bagnold
has but a small influence on the recent morphological principal
works, which are important by virtue of the amounts of their observa-
tions: Paul 1944, Schou 1945, Melton 1941 (a systematism) and
Cooper 1958, whereas Landsberg 1956 and Finkel 1959 have probably
initiated a new era of the aeolian geomorphology; their papers con-
tain a lot of quantitative observations and mathematical models; the
pronounced approach to the pure science will be the characteristic
of the future geomorphology, which, otherwise, was bound to stag-
nate.

**The status of the dune terminology**

The modern dune literature (after 1930) has partly standardized
certain dune types, the terms of which may change, whereas their
identity is unmistakable. Among these, the most common are re-
peated here and commented on the basis of the most recent ideas.
Barchan (Dunus falcatus, v. Dieren) is a bounded accumulation of
blown sand of a well-known aspect: crescent-shaped ground-plan,
triangular cross-section with angles of about 10°-140°-30°, the great-
est of which at the dune crest. Less known are the genetic demands
of the barchan: an immobile, even substratum, which by means of
the psammo-genesis transforms into dunes the moderate sand quan-
tities (per area) which blow from an almost constant direction. The
nominal form is known from arid deserts, for instance Peru and
Libya; in humid regions homologous forms are seen, partly ephemeral,
small beach-forms, partly stable, atypical macro-forms: secondary
barchans; German: Wanderdüne; Danish: mile (Kuhlman
1960). Transverse dunes (transverse ridges, Cooper, some Dunus
anticus, v. Dieren) are big sand masses modelled in dense, inter-
facing, barchanoid forms; they constitute a rhythmically repeated
pattern of not very inclined windward sides and steep lee sides
(slip-faces). The dune crests may form long, sinoidal lines trans-
verse to the wind. The creation of these sand seas demands enorm-
ous quantities of mobile, sorted sand. The big transports arrive from
almost the same points of the compass. The repeated >wave-forms< are not the result of wind vortexes attached to definite localities (Cornish, Exner, Matschinsky), but of the self-created shelter and exposition of the superficially transported sand, because the wind behind the slip-faces is morphologically inactive (Cooper). *Longitudinal dunes* are high banks of a partly residual character and with a cross-section whose appearance is changing; this makes the dune-profile more symmetrical than is the case of the barchanoid forms. It is probable that the genesis is strongly affected by a seasonal alternation between two diverging transport directions (Bagnold, Cooper). The *self dunes* mentioned by Bagnold must be classed with this group. *Blow-outs* (German: Windkühlen) are best known from dunes with vegetation. This term covers the hollows and troughs shaped by the wind in the dunes, see fig. 1. The inside of the hollow is corroded and eroded, while the outer side receives the removed material; the development of an erosion hole is very complicated; however, the formation of vortexes and the macro-turbulence are not necessary as a genetic condition, as maintained (v. Dieren, see also Olson 1958). *Parabolic dunes* (Steenstrup, Solger, v. Dieren, Hack,
Schou) — also called U-shaped dunes (Landsberg) or upstloddal dunes (H. T. U. Smith) are asserted to be a dune form particular to humid climate zones. It is a question of long, blown-sand banks, resting on a rather plain substratum, and which in a map, thanks to the contour lines, appear as a U-shaped figure. This pattern stands out more clearly in a map than in nature, where it can only with difficulty be distinguished, because the detail forms, the slip-faces and the blow-outs are more conspicuous. The big, Danish parabolic dunes, when regarded in the field, have a big resemblance to self dunes and secondary barchans; their parabolic axis is said to be dominated by the »wind-resultants«, Schou, Landsberg, V. Hansen; see also Jennings 1957 and Finkel 1959.

A kind of a model

In the following classifications we intend to use a naive model as a condensing agent for notions and explanations. The model fig. 2 represents a bloc of a stylized landscape with the locality A in an environment called O. This primitive figure serves to point out some basic features of the geo-aolian environment. 1): A dune is an accumulation of blown sand rich in reliefs; the words: »rich in reliefs« show that »dune« is a relative concept; a spot with wind-sedimentation is termed (partly) in accordance with the distribution of heights of the environs; Schou 1945, p. 148, remarks that half of the blown-sand covered area of Denmark is avoid »dune-character«. 2): Suppose that a known dune type, for instance the barchan, is sketched in at A; the block-side of the figure could then represent now 1 m., now 1 km.; still, the constructed situation will correspond to conditions existing in nature, independent of the chosen scale. This goes to show that a certain constancy of forms exists, however, not accompanied by constancy of the terms. 3): If, conversely, the model represents a certain landscape the extent represented by the diagram will contribute to determine »what can be seen« and, consequently, a description and denomination. The normal terms are pronouncedly depending on the »observation height« above the aeolian environment. An example of this peculiarity has already been referred to in the comments on parabolic dunes. 4): A contemplation of fig. 2 may lead to think of the problem known from psychology: What is motive, and what is background, here: $\frac{A}{O}$ or $\frac{O}{A}$? When hearing in mind this association, it is possible to study the landscape in a more untraditional way and to jump at discoveries. During the study of
Fig. 2. In general a model of a stylized landscape is shown: an aeolian locality A in the environment O; further information in the text. In particular is demonstrated a schematic outline of a psammogenic shield-dune on a beach.

the development of the blow-outs this manner of treating the problem is useful; for instance, a small deposition of material is discovered in localities where we would immediately have foreseen an erosion. 5): The presentation of this model also is an indication — perhaps not needed — that landscape forms ought to be described in relation to a three-axial co-ordinate system. However, many authors in such descriptions use terms which in reality are surface denominations: White dune and grey dune. For the contemplation of Danish dunes from a solid geometric point of view we refer especially to A. Schou 1945 and 1949.

The peculiarities mentioned above make it difficult to compose a "natural" dune terminology.

**Dynamical classification**

From Bagnold, Chepil and others we know that the wind transports material by means of suspension, saltation and reptation. It is possible, in most cases, to identify these transport types each with its delimited grain-size interval: dust (loess), fine-medium sand and coarse-sand/gravel. The dust is suspended in the air-flow, is moved far away and to high altitudes, until the wind dies away. During the movement the sand and the gravel are linked to the surfaces of the terrain; this superficial transport, which is analogous to the hydro-dynamical expression "bed load", contributes to inducing the morphologists to give "two-dimensional" descriptions. If supposing that the model in fig. 2 represents a locality with active wind it may serve to give an answer to the question: What is the result arrived at in a locality with aeolian activity? The effect of the wind on the landscape may be temporary or definite; however, at any
rate it is useful to classify the result in relation to the transport of material, whether superficial or suspensive. Both in A and O a net loss of material may take place: erosion; or an increase of the sedimentation: deposition. If the passage of the sand drifting over the localities does not alter the quantities of material, this is designated by the term: transit. Finally, as another possibility should be mentioned that the given localities are not affected by a transport: neutrality. It is proposed to reserve the term: »deflation« for a definite kind of aeolian erosion: the removing from non-aeolian sediments and rocks. If the possible combinations of A and O are composed in respect to the four dynamical effects mentioned above we shall be able to make the terminology indicated in table I.

When deposition/erosion occurs in a locality it is because here is found shelter/anti-shelter. Both in common and in scientific usage the term »shelter« indicates a relativity: wind-force reduction in proportion to a »standard forces«; therefore, an aeolian terrain-form is created as a natural consequence of a neighbourhood. The shelter/anti-shelter of a locality is ascribable to exterior or interior factors. It may be situated in a wind-shadow from isolated objects sticking out into the air; or it may constitute in itself an obstruction exposed to the wind. The local lee situation may also be conditioned by differences in the structure and contents of neighbouring areas. The

<table>
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<td>Aeolian-dynamic terms for a locality (A) in a given environment (O).</td>
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<tr>
<th>O</th>
<th>A</th>
<th>Dynamical effect in A</th>
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<tr>
<td>erosion</td>
<td>O &gt; A: erosion residue</td>
<td>deposition</td>
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<tr>
<td>A &gt; O: erosion focus</td>
<td>residual area</td>
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<tr>
<td>transit area</td>
<td>residual area</td>
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<tr>
<td>neutrality</td>
<td>neutral area</td>
<td></td>
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<tr>
<td>deposition</td>
<td>erosion area</td>
<td>O &gt; A: retarding deposition area</td>
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<tr>
<td>A &gt; O: deposition focus</td>
<td>transit area</td>
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<tr>
<td>neutral area</td>
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<tr>
<td>transit</td>
<td>erosion area</td>
<td>deposition area</td>
</tr>
<tr>
<td>transit area</td>
<td>refuge area</td>
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</tr>
<tr>
<td>neutrality</td>
<td>erosion area</td>
<td>deposition area</td>
</tr>
<tr>
<td>(impossible)</td>
<td>(non-aeolian)</td>
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different causes of the shelter indicate two types of deposition and erosion: the type conditioned by obstruction and the one conditioned by roughness. The morphologic effect of the obstruction (obstructogenie) is due to the influence which a terrain-element of but small extent exercises on the air-current, in which it is a relatively isolated obstruction. Hedges or plant tussocks cast a limited wind-shadow, which may be filled with aeolian material, fig. 3; or, as a result of an isolated elevation of the terrain the stream-lines are situated close to the top of this hill, causing the material of the locality to be exposed to the wind. We would call a deposition caused by a marked wind-shadow umbratogenie. The effect of the roughness (asperitogenie) is attributable to the frequent difference between the transport capacities of neighbouring areas at a given wind, see Bagnold 1934, p. 83, and Kuhlman 1938, p. 68. The amount of the transported material in a given surface is determined by the nature, size and distribution of the roughness-elements. Immobile, smooth surfaces have an extremely big, optimal transport capacity, even if the surface is moist. In Denmark the pseudo-hygrophyb of the saltating sand is of fundamental importance. We have learned with astonishment that wet dune surfaces are erosion areas, and that moist material does not inevitably bring the drifting to a standstill. The optimal, equivalent transport is smaller on a dry, loose sand surface than on a smooth, firm surface; this is why the psammogenie dune formation takes place (H. T. U. Smith; Schou 1945: Physical dune formation). We have only with difficulty understood the observation according to which sand could be accumulated without a pronounced shelter. The transport conditions of a rough, semi-mobile surface are of a peculiar nature; at gentle winds the equivalent transport is smaller here than on a loose sand surface, whereas it is bigger at strong winds. A mobile sand-spot in a pebbled locality will act as an erosion area at moderate wind forces and as a deposition area at strong winds. The surfaces grown with plants have only a small sand movement or none at all; almost invariably they are deposition areas. The capability of certain plants for regenerating the surface type after the deposition of the sand is well known. The optimal growth of Ammophila arenaria demands sanding-up. Although plants often create stable sediment-sections, and in spite of the fact that dunes characterized by vegetation have a complicated evolution the author does not see the practical in pointing out the shelter of the plants as a specific, odd phenomenon: the organogenie (phytogenie) dune formation; the vegetation functions as shelter in the same manner as do the
inorganic terrain elements, and the aeolian landscape forms which the vegetation develops have a striking resemblance to physical types.

**Grouping of wind-sediments**

In Denmark several kinds of wind-sediments occur; it is not intended here, when commenting upon these sediments, to use the traditional groupings according to texture, composition and the like, whereas we recommend a classification based on the nature and the effect of the transport. This classification has previously been dealt with in the present periodical (1957, 1959). We propose the following denominations: suspension-, saltation-, reptation-, slip- and residual sediment and corroded material. Observations in nature have shown that these terms are closely associated with the textural terms. *Aeolian suspension material* is rarely found deposited in appreciable quantities in this country, see *S. A. Andersen* 1935 and *S. Hansen* 1948, whereas every year in numerous plough fields in Jutland a rise takes place of suspensive, aeolian material, whose future fate is only incompletely known. The *saltation material*, whose predominant grain size is 0.15 - 0.40 mm., forms the bulk in the
numerous dunes and blown-sand covers the position of which is
given in »Atlas of Denmark« (Schou 1949); their total area is said
to be about 1,400 sq. km. (Schou 1945). The reptation material forms
an integrating part of the »blown sand« in dunes and covers; how-
ever, it may have grain sizes six times as big as those of the local,
saltating sand; this leads to the formation of sporadic dune material
which is so coarse-grained (10 mm.; commonly: 1-5 mm.) that
hurricanes have been considered as necessary for their accumula-
tion; however, this is not the case (see Kuhlman 1980, fig. 3). Sepa-
rated, coarse reptation material is especially found in the dunes in
Western Thy, at Grindsted and on Anholt. In our climate wet, steep
erosion slopes of aeolian material are not unusual; when slidings
happen in these slopes and at slip-faces an aeolian slip-sediment is
formed, characterized by being situated low in the terrain and by
being relatively poorly sorted. The land-slides and slips steered by
gravitation make it difficult to identify the aeolian environment
descriptologically. Residual sediments consist of pebbles and cob-
bles, left by the wind in a process of deflation; we meet »pavements«
just as in arid deserts — a phenomenon which may be observed at
many places along our recent beaches, for instance at Skallingen and
Blåvands Huk. At Kandestederne, near the Scaw, are also found
planes with pebbles, resulting from a wind-erosion in elevated, marine
sediments. Many agrarian fields in Jutland may in spring have the
same wind-ravaged aspect. Among the materials influenced by corro-
sion we know from Jutland numerous occurrences of faceted pebbles/cob-
bles, which lie in the field-soil on glacial material from the Riss
 glaciation; the period of their shaping is probably Würm (Tubant-
tian, Weichsel). The best opportunity of studying these polished
field pebbles is found in the district between Holstebro and Ring-
købing, and Grindsted-Hejnsvиг. In Bornholm have been observed
wind-sculptured rock surfaces (Mattsson 1957).

It is worth noticing that only the two last-mentioned sediment
types may be interpreted stratigraphically as having been caused
by wind-erosion. If the other types are embedded in a stratification
a later researcher will undoubtedly conclude that a deposition has
taken place in an aeolian environment. Much of what we characterize
to-day as erosion localities cannot, at a later embedding, be given
this name. The plains surrounding the parabolic dunes are termed
by some authors as: deflation plains; however, this expression is
not too well chosen, because from a stratigraphic-dynamic point of
view they are most often underdeveloped deposition areas. This is
one of the reasons why the author recommends only to use the term: deflation when the wind removes foreign material.

**Geometrical grouping**

The geometric figuration of a locality in the landscape influenced by the wind may be divided into a few elementary forms. Such a division in constituents is known from other dune topographies; however, our system is perhaps of a greater simplicity and consistency.

The first sort to which we are drawing the attention may seem to be a truism: a locality non-specific in relation to the environs; however, it is overlooked that the wind-ravaged spot often forms a vaguely marked element of the landscape. In Denmark it is common that ancient or recent wind-activity cannot be immediately deduced from the shape of the terrain; it is necessary to observe the very transport or to study the soil more closely. In Vendsyssel-Thy and in Himmerland the soil-drifting hits big field-areas every year without leaving any distinct morphological effects; further, cultivation and road-work eliminate most of the small traces. The geological
mappings (Milthers, Jessen) have shown that moraine hills in Western Jutland and in Central Jutland at places are conformably covered by Late-glacial aeolian sand; this corresponds to the cover-sand from Holland and Germany, of which descriptions have been given (cf. Kuhlman 1959). From the aeolian-non-specific localities there are continuous transitions to planes with aeolian material. The deflation planes with »pavements« known from arid regions exist, as mentioned, in our country too; however, plains with blown sand are much more common. Initial deposition areas are more easily found than embryonal erosion spots; the umbrogenic deposition has an outstanding initial form: the tongue dune; as the name indicates, the material adopts a shape resembling a cleaved cone resting on the cleave plane in the shelter of a wind-obstructing object (compare Cooper's »lee projection«). Behind a onesidedly extended shelter tongue dunes may grow together so as to form prismatic drifts: prismatic dunes. The commencing asperitogenic deposition forms lenses more or less asymmetric, fig. 4; we suggest the term: lense dunes. Usually, they are called embryonal dunes, primary dunes, tussock dunes and other names. When it is a question of isolated
occurrences this initial form rarely has a thickness of more than a few decimetres, whereas its ground area may be big. At Danish coasts two sub-types are frequent; one of them is seen in planes with no vegetation: shield dune; it has a slightly curved shape which, if the material is moist, is provided with a steep micro-slope against the wind (fig. 2). The other sub-type appears in places where there is some vegetation; its shape is expressed in the name: cushion dune (fig. 4). Both are embryos of a later stable dune formation; they consist of semi-hygrophobic sand, which becomes the source material of the future drift. It is most probably a question of shield dunes, mentioned by Schou 1945, p. 151, and by Cooper 1958, p. 46.

Big, asperitogenic accumulations of saltation material acquire by and by the figuration which is usually associated with the term »dunes«. The characteristic of these accumulations is the presence of slip-faces, slopes of 25°-30° with loosely packed material, and the opposite orientated slopes of 5°-12°. As a result of this the vertical profile becomes »barchanoid«, i.e. triangular with constant angles. Leaving out of consideration the figuration of such dunes in the horizontal section, we name them all: profile dunes (fig. 5): a basic
form comprising a series of common names, for instance the beach barchan, the secondary barchan, elements of sand seas, Dunes antiquus, and parabolic dunes. The barchan is a well defined sub-type and, perhaps, the real primary form; however, we need more observations for being able to pronounce a judgment. The height of profile dunes is generally said to be 10-30 m., rarely 100 m. In this country no dune is rising more than 25 m. above its bed; however, it may sometimes be difficult to establish the level of the dune basis. In fig. 6 is shown the distribution of the heights of the dune tops (found during studies of map 1:20,000) in two Danish dune areas: The Scaw — Frederikshavn and Blåvand — Rømø. The approximate top constancy, which is dimly seen in the figure, has dynamical causes. The wind force increases with the height above the terrain; at a certain level the force will be equal to the suspension threshold of the local sand (see Kuhlman 1960), and if an isolated accumulation of sand grows to such a height that the normal winds of the region have a suspensive effect at this level the »dune-hat« is blown off; a suspensive transport does not create any topography rich in reliefs, only covers. The theoretically maximum dune height is positively correlated with the grain size of the material, but negatively correlated with the degree of isolation of the dune and the usual local wind forces.

Large dunes with vegetation may have a more symmetrical cross-section than is normally the case of profile dunes; when regarded from a certain distance, they have the aspect of banks with a curved, elliptic cross-section. These bank dunes, unsatisfactorily defined, are especially seen at progressive coasts with nutritious sand, for instance Rømø and the Scaw. In mobile material the wind may form big erosion areas with bizarre micro-forms; big, steep slopes are shaped, sculptured by corrosion. In North-Western Europe the erosive effect is pronounced because of the frequent weather changes and the resulting big fluctuations of the degree of moisture of the material; moist sand may stand in vertical inclinations, which slide when dried in fine weather. Moist surfaces between dry areas are strongly corroded on account of their great transport capacity, which, in addition, accentuates an adjacent accumulation. In our dunes the erosion areas and the deposition areas stick together, just as the front and the back of the paper, see v. Dieren 1934, p. 198. The characteristic initial form in a deflation area is the somewhat oblique wind-hollow or wind-trough; when old dune-material is eroded, hollow-dunes and trough-dunes are born (fig. 1).
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<tr>
<td><strong>non-specific</strong></td>
<td>residual gravel + pebbles</td>
<td>asperitogene/obstruk-</td>
<td>fields with wind erosion</td>
<td>North Jutland</td>
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<td><strong>moist</strong></td>
<td>residual grus + stone</td>
<td>togenic definition</td>
<td>jordfjæde agre</td>
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<td><strong>aspektifik</strong></td>
<td>salination/reptation + gravel</td>
<td>asperitogene/obstruktogen</td>
<td>drifts covers</td>
<td>Near</td>
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<td><strong>acolik plan</strong></td>
<td>salinations + vegetation</td>
<td>asperitogene</td>
<td>darkh deriner</td>
<td>Omkring</td>
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<td><strong>acolisk plan</strong></td>
<td>layer of residual gravel + pebbles</td>
<td>asperitogene deposition</td>
<td>pavement sheets</td>
<td>Kandestederne</td>
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<td><strong>tongue-dune</strong></td>
<td>salination + vegetation</td>
<td>asperitogene</td>
<td>with pebbles</td>
<td>at the Seaw</td>
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<td>salination + vegetation</td>
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<td><strong>prismatic dune</strong></td>
<td>salination + vegetation</td>
<td>asperitogene</td>
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<td><strong>prismelt</strong></td>
<td>salinations + replications</td>
<td>asperitogene</td>
<td>definitionstette</td>
<td>West coast</td>
</tr>
<tr>
<td><strong>small lensedunes</strong></td>
<td>salinations + replications</td>
<td>asperitogene</td>
<td>blown-sand sheet</td>
<td>At Blyvand</td>
</tr>
<tr>
<td><strong>smal lensedt</strong></td>
<td>salination + vegetation</td>
<td>asperitogene</td>
<td>figuresandelstete</td>
<td>Kalsens Heath</td>
</tr>
<tr>
<td><strong>schock-dune</strong></td>
<td>salination + vegetation</td>
<td>asperitogene + unmodified</td>
<td>primary dunes</td>
<td>Kandestederne</td>
</tr>
<tr>
<td><strong>schockd</strong></td>
<td>salination + vegetation</td>
<td>asperitogene + unmodified</td>
<td>frostbalt</td>
<td>Skillingen, Fang</td>
</tr>
<tr>
<td><strong>schockd</strong></td>
<td>salination + vegetation</td>
<td>asperitogene + unmodified</td>
<td>frostbalt</td>
<td>Forstomden, Fang</td>
</tr>
<tr>
<td><strong>store insett</strong></td>
<td>salination + vegetation</td>
<td>asperitogene + unmodified</td>
<td>frostbalt</td>
<td>Skillingen, Fang</td>
</tr>
<tr>
<td><strong>store insett</strong></td>
<td>salination + vegetation</td>
<td>asperitogene + unmodified</td>
<td>frostbalt</td>
<td>at the Seaw</td>
</tr>
<tr>
<td><strong>profile dunes</strong></td>
<td>salination + vegetation</td>
<td>asperitogene + unmodified</td>
<td>frostbalt</td>
<td>Skillingen, Fang</td>
</tr>
<tr>
<td><strong>profilt</strong></td>
<td>salination + vegetation</td>
<td>asperitogene + unmodified</td>
<td>frostbalt</td>
<td>Skillingen, Fang</td>
</tr>
<tr>
<td><strong>low-salt</strong></td>
<td>salination + vegetation</td>
<td>asperitogene + unmodified</td>
<td>frostbalt</td>
<td>Skillingen, Fang</td>
</tr>
<tr>
<td><strong>trickl</strong></td>
<td>salination + vegetation</td>
<td>asperitogene + unmodified</td>
<td>frostbalt</td>
<td>Skillingen, Fang</td>
</tr>
<tr>
<td><strong>trickl</strong></td>
<td>salination + vegetation</td>
<td>asperitogene + unmodified</td>
<td>frostbalt</td>
<td>Skillingen, Fang</td>
</tr>
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<td><strong>trickl</strong></td>
<td>salination + vegetation</td>
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<td>frostbalt</td>
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</tr>
<tr>
<td><strong>windlow</strong></td>
<td>mixed, mostly mobile</td>
<td>asperitogene</td>
<td>frostbalt</td>
<td>Skillingen, Fang</td>
</tr>
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<td>mixed, mostly mobile</td>
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</tr>
<tr>
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</tr>
</tbody>
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**An outlined system and a summary**

An exhaustive systematics in Danish aeolian landscapes cannot be established until more quantitative observations are available; however, it is possible to give a summary of the terms mentioned in the preceding paragraphs, ranged according to an outlined system; this has been done in table II.

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**LITERATURE**


*Behrens, S. E. 1952: Morphemertiska, morfogenetiska och tektoniska studier av de nordvästskånska urbergssåarna, särskilt Kullaberg. Lund.*


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Wessely, J. 1873: Der europäische Flugsand und seine Kultur. Wien.