

The combined system of movements forms as it were an orbital revolution in a vertical plane, but the movement is confined entirely to the surface, the interior of the mass being immovably stationary. The movement of the dune-mass as a whole resembles that of a viscous porridge rolling on over itself again and again.

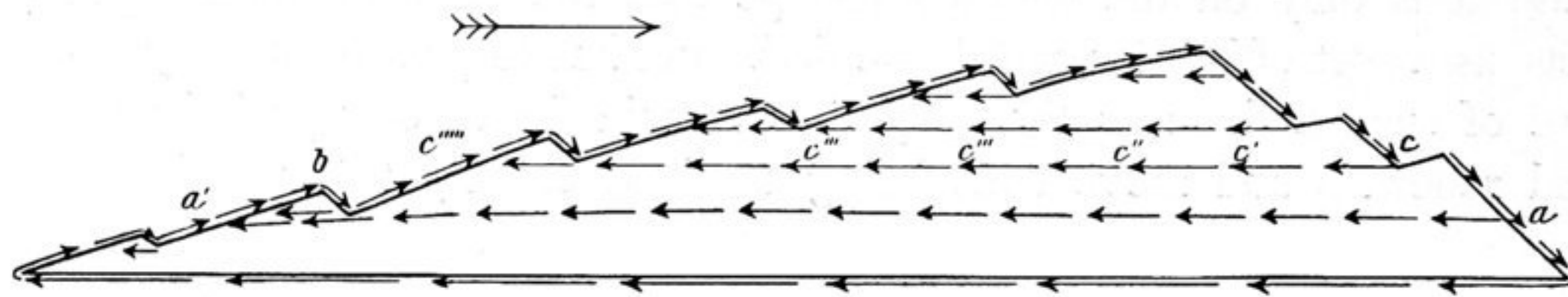


Fig. 243.

Fig. 243 illustrates the progress of individual particles of sand in different parts of the composite dune. A particle which happens to fall at the base of the leeward slope has to remain there until the whole of the dune-mass has travelled on over it. A particle which comes to rest at *a* becomes again involved in the revolution when it gets to *a'*, and no sooner does it attain to the crest *b* than its movement becomes greatly quickened; nor can it again penetrate to the interior of the dune-mass until after it has traversed a great number of triangular paths. And it is not until after

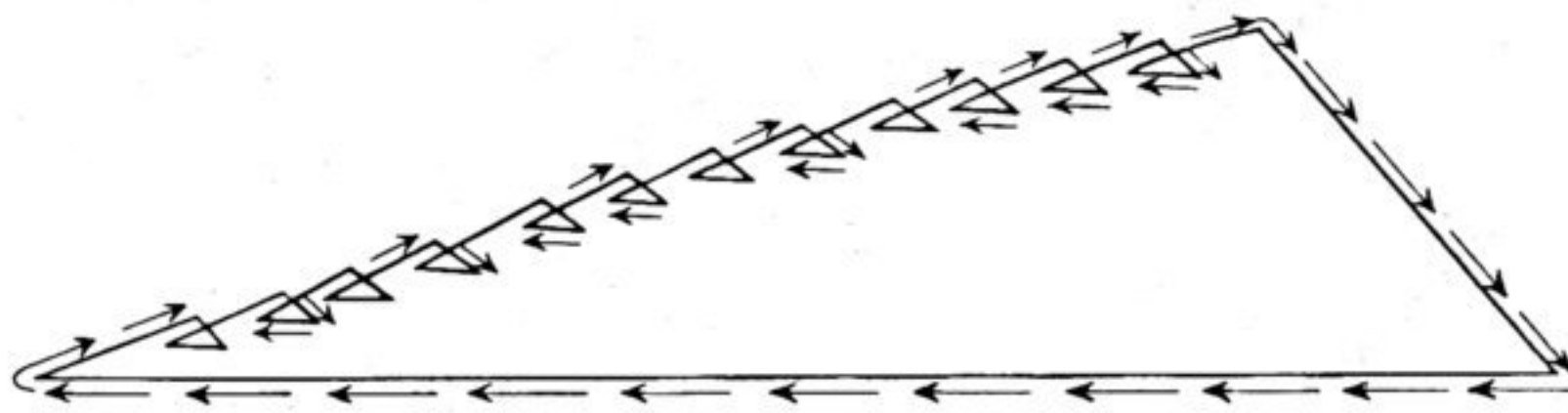


Fig. 244.

the crest *b* has passed the culminating-point that our particle definitively comes to rest on the main leeward side, and there lies for a longer or a shorter period motionless in the interior of the dune. Suppose it to rest in the position *c*, then the successive positions it assumes relative to the general forward movement of the dune-mass are represented by *c'*, *c''*, *c'''*, *c''''*, *c'''''*. Upon reaching *c''''*, it again enters upon the long series of triangular paths, until eventually it once more attains the summit or culminating-point. The nearer therefore the particle lies to the substratum, the longer will be the period during which it will remain at rest. Within the mass of the individual dune to which it belongs, say for instance *b* in fig. 243, the movement of each particle coincides exactly with its movement in the dune-accumulation as a whole. In a dune which has a slope of  $9^\circ$  on the windward face and a slope of  $33^\circ$  on the leeward face, and which stands upon a perfectly horizontal base, the path pursued by an individual particle will be as follows — (1) upwards and forwards at an angle of  $9^\circ$ , and that with almost the speed of the wind; (2) downwards and forwards at an angle of  $33^\circ$ , with the speed of natural gravitation, or rather of a slide; (3) at a standstill, which as compared with the general movement of the dune-accumulation may be likened to a retrogression on a horizontal plane, though at an inconceivably slow rate. If the leeward slope of the dune overhangs a lake, as it does