

different. In the ensuing pages I propose to discuss briefly one or two of the most important problems connected with the formation of dunes.

Let us in the first place consider the movement of continental dune-masses. With regard to this there exist, as is well known, two divergent opinions — one that such dunes do travel, the other that they do not. The defenders of the latter opinion go to the Sahara for their illustrations. There certain drift-sand areas have from the remotest times occupied the same positions that they occupy now, and neither names, oases, nor wells have changed their situation for as far back as the

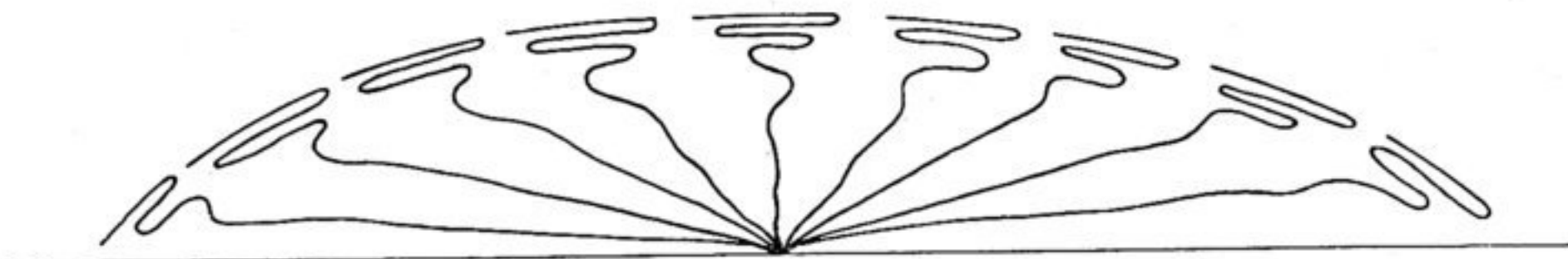


Fig. 181.

memory of man can reach. So far as I understand, the individual dunes in a sandy region such as that are however subject to precisely the same laws as those which obtain, for example, in the Desert of Tschertschen. That is to say, they must move in the direction of the wind, and often at a rapid rate; but the whole of the secret is this, that at another season of the year they are driven back by winds blowing from the opposite direction. They do travel therefore, but instead of travelling always in identically the same direction, they move backwards and forwards. The area upon which these oscillating movements take place, that is to say the continuous mass of drift-sand itself, is however motionless, because its borders are little if at all crossed by the migratory dunes. The particles or grains of sand which make up the lowest and the central parts of a drift-sand area such as this have for centuries upon centuries been quiescent and stationary; on the other hand their superficial or exterior parts, exposed as they are to the wind, are incessantly in movement. Figs. 181 and 182 will make the situation clear. In the former the curved lines indicate the oscillations of the sand-grains, and they become rapidly shorter towards the centre; while the latter shows distinctly, how the separate dunes change their form and direction, without however altering their position.*

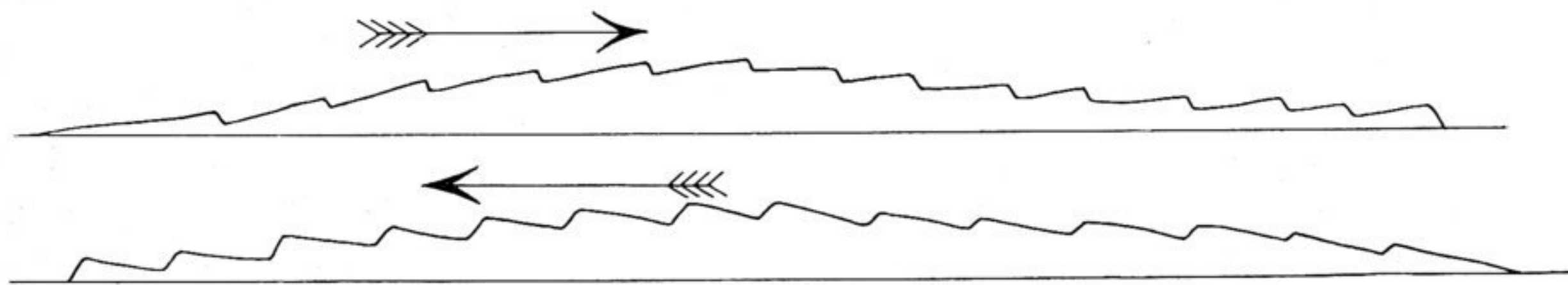


Fig. 182.

* I cannot help citing a very interesting passage from Rolland's excellent work, which illustrates in the minutest detail what I have said above regarding the desert-type of, for instance, the Kum-tagh of Luktschin: »L'ouragan le plus violent, au milieu des grandes dunes, les fait *fumer*, mais ne les remue que sur une bien faible épaisseur. Le spectacle est effrayant, l'impression des plus pénibles, le danger réel; les sables obscurissent l'air et cinglent le visage; ils remplissent les yeux, la bouche, les oreilles; ils altèrent le gosier et dessèchent les peaux de bouc des caravanes indigènes, menacées de périr de soif. Mais quand le calme renaît, on retrouve les choses en l'état, et les mêmes hauteurs aux mêmes