

#### The Origin of Rock Basins.

IN my previous letter I confined myself to one aspect of the controversy relative to the origin of rock basins now occupied by lakes, as all the other arguments adduced by Dr. Wallace—with one exception, of which more hereafter—have already been answered, and the case on either side so fully presented that each one may draw his own conclusions as to which is right. The particular confusion of argument I referred to has not been so fully dealt with, and Dr. Wallace's letter shows that it was one which required to be met, for the heading of his letter itself shows that he has not fully appreciated the particular point at issue, which is the cause of origin of rock basins irrespective of whether they are or have ever been occupied by lakes. Leaving out of question the opinions of other opponents of the glacial erosion theory of the origin of lakes, as this would introduce too large a subject for the correspondence columns of NATURE, and confining myself to the defence of the views put forth in my former letter, I may point out that the preglacial origin of rock basins by deformation is by no means the strongest form of the alternative explanation; on the contrary, it appears to me to be subject to nearly as many objections as the hypothesis of glacial erosion of rock basins. If a rock basin is produced by deformation in a region where the valleys are not filled by glaciers, the ordinary action of the streams will usually be able to prevent a lake from being produced by the erosion of the barrier, the filling up of the hollow, or both combined. When, however, a rock basin is formed by differential movements in a glacier filled valley, it would be filled with ice, and so protected from sedimentation, and on the retreat of the glacier would at first be filled with water, and only gradually filled with solid matter, while the stream, having deposited its solid burden in the lake, would be unable to exert any erosive action on the barrier. From this it appears that there is a probability that rock basins formed beneath the glaciers during their extension in the glacial period should remain to the present day as lakes only partially filled up by solid *débris*.

Seeing then that there is an inherent probability that rock basins formed in non-glaciated regions would never become

lakes, except when the movements were unusually rapid or extensive, the argument from geographical distribution fails; for we have no evidence to show whether rock basins are more or less abundant in regions that have been glaciated, than in those that have not; and seeing, further, that differential movements are known to take place, while it has never been proved that a glacier is physically capable of excavating a rock basin, the *onus probandi* rests with the advocates of the glacial theory; and until they have shown that rock basins are less common in regions that have been glaciated than in those that have not, this argument is not logically admissible. Observations on this point are very desirable, but it must be remembered that filled up lake basins are not the only thing to be looked for; what is desired is evidence of the production of rock basins, or of such differential movements as would have led to their formation, had the erosion of the barrier been less rapid. In the Himalayas such rock basins appear to have been formed in quite as great abundance as in the mountains of Europe, and to correspond with them in position and form; but the elevation of the mountains has been so recent, and the rainfall is so great, that the processes of nature are more rapid than in Europe, and the rock basins have consequently not only been filled up, but the barrier has afterwards in many cases been destroyed, and the deposits largely removed by erosion, so that the fact of their having originally been accumulated in a rock basin is not always easily recognisable.

The one new argument of Dr. Wallace's is that derived from the supposed difference between the outlines of existing lakes and those that would result from the submergence of river valleys. In the selected instances, however, he has compared mountain lakes with submerged lowland valleys instead of with mountain valleys. In the latter, long stretches are frequently found where the slopes of the beds of the side streams are much steeper than that of the main valley; these valleys if submerged would give rise to lakes of great length in comparison with their breadth, and without the numerous deep embayments of the shore line which would be usually found in a submerged lowland valley. As a single easily verified instance to show that a submerged mountain valley need not have numerous deep bays, I may instance the Pangong lake in the Himalayas, which will be found on any good map of India, and is nothing more than a submerged subaërially formed river valley; on a smaller scale the Malwa Tal near Naini Tal and the Pil lake in the hills east of Quetta, both of which are river valleys dammed by landslips, have simple outlines without any embayments. The instances I have chosen are from regions where there has not been a great extension of the glaciers, and where the form of the valley before its submergence was entirely produced by subaërial denudation.

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