

CANYON COUNTRY. By JULIUS F. STONE. With more than 300 illustrations and a map. London and New York: Putnam's Sons. Price \$5'00.

THE justification for the publication of this book lies in the wealth of beautiful illustrations with their explanatory text; for the rest it is an account of a boat trip through the canyons of the Green and Colorado rivers, and there is little information that can be classed as scientific.

G. L. E.

CHEMICAL ANALYSES OF IGNEOUS ROCKS, METAMORPHIC ROCKS AND MINERALS. pp. v + 166. *Mem. Geol. Survey*, 1931. Price, 3s. 6d.

SOME years ago the Director of H.M. Geological Survey consulted a number of petrologists as to whether such a work as the present would be useful: the replies were encouraging and the work of compilation was duly carried out by Miss E. M. Guppy, very brief petrographical descriptions by Dr. Thomas being appended to each analysis. A work of this kind is in no need of review, since all the analyses have been published before. We can only say that its appearance is most welcome and it cannot fail to be highly appreciated, as it contains, in a handy form, all analyses of igneous and metamorphic rocks and minerals recorded by the Geological Survey in its very numerous publications. A final section by Messrs. F. R. Ennos and R. Sutcliffe gives an account of analytical methods. It is to be hoped that there will be a similar volume dealing with the sediments.

CORRESPONDENCE.

SCREE SLOPES.

SIR,—I have often heard it said that a scree rests at the angle of repose; that is, the steepest angle such that friction is capable of maintaining the material at rest. This is clearly untrue. If it were so the scree would be indefinitely easily disturbed; a fly alighting on one of the stones would set the whole slope moving, and motion could not stop until there had been a uniform reduction of level everywhere. Actually all screes have a definite margin of stability, though this is often small.

A different criterion emerges if we consider the actual mode of formation of a scree. It is a dynamical process, not a statical one.

A stone falling near the top of the slope rebounds and travels downwards. At the first impact it acquires a rotation, and its velocity is reduced. Between any two successive impacts there is a gain of energy equal to the work done by gravity. But at every impact there is a loss due to friction and imperfect restitution; this depends on the relative orientation of the surfaces that actually come in contact. If the slope is so steep that the gain of energy between two impacts is greater than the loss at an average impact, the stone will, on the whole, gain energy as it proceeds, and will travel to the bottom, thereby reducing the slope at the foot. If the loss on impact is the greater, a certain number of impacts will suffice to bring the stone to rest near the top of the slope, thereby increasing the slope at the top. There will be a critical slope such that the rolling stone will, on the whole, neither gain nor lose energy. If the slope is less, new material will build up the top; if it is greater, new material will build up the bottom. Thus this critical slope will be approached, and when attained will be stable.

The stones already in position will be oriented in a variety of ways, and there is accordingly a considerable range of variation in the circumstances of the individual impacts. But since we are considering the variation of the energy of the stone over several impacts, the losses of energy at many different orientations are averaged. The mean loss of energy per impact over several impacts will vary from stone to stone much less than the losses at single impacts, by the usual statistical principles. This provides an explanation of the observed uniformity of scree slopes.

HAROLD JEFFREYS.

Notice to Contributors.

It would often save time and trouble to the Editor if contributors would be kind enough to write on the back of the last page of their MSS. the address to which proofs should be sent. The reason for this request is that proofs are often sent out by the Editor when away from Cambridge and he does not always remember to take all the necessary records with him. If contributors expect to go abroad at any definite date this should also be noted.
