are identical with the curves for HCl or H_3PO_4 in Fig. 1. The explanation of this fact is that at the same pH the same mass of originally isoelectric gelatin is in combination with the same quantity of these four acids and since the anions of these four acids are all monovalent the curves must be identical.

As far as the alkalies are concerned, we notice that the curve representing the effect of the weak base NH_4OH on the physical properties of proteins is the same as that for the strong bases LiOH, NaOH, KOH when plotted over pH as abscissæ, while the curves representing the effect of $Ca(OH)_2$ or $Ba(OH)_2$ on the same properties are considerably lower.

It is obvious that the valency of the ion in combination with the protein has a noticeable influence on the properties of the protein salt formed, while the protein salts with ions of the same valency have all the same properties. The fact of the greatest importance is, however, that the influence of acids and bases on the physical properties of proteins is the expression of the combining ratios of the acids or bases with proteins so that we are able to predict the value of the physical properties from the combining ratios. This fact seems to give a final decision in favor of a purely chemical theory of these influences and against the colloidal theories as based on the Hofmeister or Pauli ion series.

The behavior of the proteins therefore contradicts the idea that the chemistry of colloids differs from the chemistry of crystalloids.

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THE AFRICAN RIFT VALLEYS

A recent article[1] with the above title by Professor J. W. Gregory, of Glasgow, is of interest from the general summary that it presents of a remarkable group of natural features, as well as from the ingenious flight of geological imagination by which it explains them. The term, rift valley, introduced by Gregory in connection with his African studies of 25 years ago, designates a longitudinal depression "caused by the material sinking in mass, so that what is now its floor formerly stood level with the highlands on each side." Such valleys therefore contrast strongly with "ordinary valleys, which are caused by the removal piecemeal by rivers or wind of the material that once filled them." The omission of glaciers from the last clause is doubtless prompted by Gregory's disbelief in their capacity to erode.

His article opens with a general and for the most part an empirical account of the "Great Rift Valley" of Africa, and of the volcanoes that occur along it, with little attention to the structure of the region traversed, and with still less attention either to the erosion that the region had suffered before the assumed rifting or to the erosion that the enclosing scarps have suffered since the rifting. Apart from briefly cited opinions of various authors, form alone in most cases is appealed to in evidence of down-faulting. As a result the reader may not feel convinced that all the depressions described as rift valleys really belong in that class. Some of the limiting scarps may be purely cliffs of erosion. Indeed, the inclusion of the Red Sea, with the narrow Gulfs of Suez and of Akaba at its northwest end and the broad Gulf of Aden to the southeast of it, as rift valleys, and the drawing of several "diagonal tectonic lines" along certain parts of the east African coast that are supposed to have been "cut off by . . . faulting" suggest so open a hospitality to the occurrence of rifts and rift valleys as to make the reader wonder whether they are not overworked. The first part of the article is therefore chiefly valuable as a topographic summary of a remarkable region. A critical discussion of the evidence for rifting, based on a review of the many articles cited in the bibliography, would make an excellent subject for an advanced student in physiography.

[1] "The African Rift Valleys," by J. W. Gregory, *Geogr. Jour.*, LVI., 1920, 13–47, with 6 maps, 7 profiles and 8 half-tone plates, and a bibliography of 65 titles.

The article, although published in a journal from which geological discussions are usually excluded, devotes its second part to a strictly geological discussion of the "age and history" of the African rift valley, with the result of assigning it a relatively modern date. The article closes with an inquiry into the orgin of the rift valley and its relation to contemporary earth movements; and here speculation is given free rein. The following extracts are from the second and closing parts: running comments are added. The length of the valley is "about one sixth of the circumference of the earth. It must have had some world-wide cause." It is "dependent in the main on the volcanic history of the country; the two are connected, as the subsidence of the earth blocks doubtless forced up the lavas along the fractures;" and from this it would appear that volcanic eruptions are to be regarded as caused by the sinking of the rift blocks, although the opposite view, that the eruptions caused the sinking, deserves consideration.

> The first stage . . . was the uplift of a long, low arch [by lateral pressure] with the axis trending north and south. . . . The second stage was the cracking of the sides of the arch as the lateral pressure was reduced, and the top sank as the keystone of an arch sinks if the end supports give way.

But it may be questioned whether there is any true homology between the crest of a very broad and low earth-crust anticline with plenty of subcrustal material crushed up beneath it, and the keystone of an arch of masonry which spans an open space; and moreover the lateral pressure here assumed contradicts the state of tension, mentioned below. "The sinking of the keystones . . . into the plastic material below forced some of it up the adjacent cracks, through which it was discharged in volcanic eruptions." The possibility that the primary impulse was not lateral pressure in the superficial crust, but an upward pressure of deep-seated and crowded lavas is not considered.

The speculative character of the views here exposed reaches its climax on the closing page:

> The essentially different character of the contemporary earth-movements of Africa and of the Pacific borders is explained by their antipodal position. Africa was antipodal to the Pacific, and it is in accordance with the well-known antipodal relation of ocean to continent that while the Pacific was sinking and the crust beneath it undergoing compression, its antipodal land should be rising and subject to tension. . . . The subsidence of the Arabian sea and the outflow of the vast quantities of lava to the east and west [in India and Abyssinia] left the east African arch insufficiently supported, and the top of it sank between parallel fractures. . . . Africa was in tension, and torn by north and south fractures, along which the sinking of a strip of the crust formed the longest meridional land valley on the earth. . . . There are two great regional disturbances in the Eastern Hemisphere with which they [the rift-valley faults] may be correlated; the foundering of the Indian Ocean . . . and the movements which raised the Alpine-Himalayan Mountains. . . . The Great Rift Valley . . . owes its unique character to its position antipodal to the Pacific, and its course to the wrench in the crust of the Eastern Hemisphere between the segment pressing northward against Europe and that pressing southward in Asia toward the deepening basin of the Indian Ocean.

These are truly far-reaching generalizations, but whether they will endure is uncertain. If they are correct their prophetic power is great, for the evidence to demonstrate them is not yet fully collected.

The doubts that are aroused by a reading of Gregory's article are re-enforced by the protest published a month later by Ball, of the Geological Survey of Egypt.[2] He points out that, as large sections of the supposed rift valleys are submerged in the Red Sea and the Gulf of Aden, and as not a hundredth part of the rest has been examined by competent geologists, much uncertainty must still remain as to their structural interpretation and physical origin. He adds that, as a result of Gregory's early work on the subject, some of

[2] "The African Rift Valleys," by John Ball *Geogr. Jour.*, LVI., 1920, 234–238.

the members of the Egyptian Geological Survey "became obsessed by the notion that the Nile Valley and the Gulf of Suez were parts of the rift system," and that a later interpretation of both these features as valleys of erosion—one of them moderately submerged—was much retarded by that premature conclusion. He rejects Gregory's correlation of the Pacific basin and the African plateau, doubts the production of rift valleys by tension, suggests that their structure may be due to compression, and notes that their form may have been much influenced by erosion, especially in those African depressions which have a scarp only on one side. He therefore wisely urges that the whole problem should be regarded as needing much further investigation before a safe conclusion can be announced.

Ball is, however, over-conservative in asserting that "the only sure proof of the existence of a trough fault is to be obtained by tracing across the floor of the trough the same strata as occur at higher levels in the bounding scarps." This overlooks the competent physiographic evidence of faulting that is provided when a nearly rectilinear scarp truncates a series of deformed strata or a body of massive rocks, as pointed out by Gilbert in his studies of the Great Basin ranges. For example, the trough of the Rhine from Basal to Bingen rarely shows rock outcrops on its floor; evidence of its depression between subparallel faults is derived chiefly from the topography of its enclosing scarps. Similarly, the Limagne, a broad rift-depression in central France, drained northward by the Allier between the highlands of Auvergne on the west and those of the Monts du Forez on the east, is floored with lacustrine or fluviatile sediments of modern date, while the enclosing highlands consist of ancient crystalline rocks. The existence of marginal faults here has long been accepted by French geologists, although the kind of evidence dmanded for faults by Ball is not forthcoming. Crystalline rocks are not seen on the floor of the depression, and even if they were, they could not be proved to be down-faulted. The evidence of down-faulting is found in the nature of the enclosing scarps. It may be noted in passing that the Limagne is not strictly a rift valley, but a resequent rift valley, in that since its first production by down-faulting, when it was truly a rift valley, it has been filled with inwashed sediments to the level of the enclosing highlands at a time when the whole region stood lower than now, and later on, after a broad elevation without faulting, the inwashed sediments have been washed out as deep as river-grade permits, thus again leaving the enclosing scarps in relief. The evidence of this succession of events is clearly furnished by the presence of isolated volcanic necks in the midst of the depression, and of surviving spurs of the weak sediments capped with lava flows, that project into the depression about at the level of the adjacent highlands. A resequent rift-valley of this kind must evidently differ from an initial rift-valley in having the height of its enclosing scarps determined by the depth of recent erosion, not by the drop of the original faulting.

To return to Africa: If so great a series of rift valleys really exists there as is represented on Gregory's map, some of them should show scarps that truncate the structures of the enclosing highlands, and the evidence that such scarps provide for down-faulting should not be overlooked. The possibility that some of the African rift valleys have been filled and excavated again in resequent fashion like the Limagne should also be inquired into.

W. M. Davis

Cambridge, Mass.,
October 31, 1920

SCIENTIFIC EVENTS

THE SIXTEENTH ANNUAL NEW ENGLAND INTERCOLLEGIATE GEOLOGICAL EXCURSION

The sixteenth excursion of the New England geologists was taken in the vicinity of Middletown, Connecticut, October 8 and 9, under the direction of Professors William North Rice and Wilbur G. Foye. About twenty-five persons were in attendance, among whom were representatives from Harvard, Massachusetts Agricultural College, Mount