in *Phytopathology* quite a eulogy regarding some one who had hit upon the wonderfully useful term inoculum. I forget now who made this wonderful innovation. But I do know that for several years prior to that time I had been using the word inoculum and that many others also had done so.

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# SCIENTIFIC BOOKS

*Living Africa. A Geologist's Wanderings through the Rift Valleys.* By BAILEY WILLIS. New York: Whittlesey House, McGraw-Hill Book Company, Inc., 1930, pp. xv, 320, illustrated.

THE unique geologic feature of eastern Africa is its rifted plateaus with their rift valleys and their rift lakes. On no other continent are the ancient geologic formations so markedly split asunder, so torn apart, and so deeply cracked, and as a result it is one of the greatest regions of the earth for upwellings of molten rock from the heated interior. The rift valleys begin with the Dead Sea trough of Palestine, continue on through the deep Red Sea, and thence somewhat disconnectedly through eastern Africa to Lake Nyasa. In other words, the rift structures continue for 4,000 miles south of the Jordan.

The problem of the cause of this unique fault system has long fascinated geologists. Is it the consequence of tension, due to the deep subsidence of the Indian Ocean, which in late Mesozoic time began to pull down and break apart eastern Africa north to the Jordan? There is no agreement as to the answer, and it is therefore well that an American geologist who is fully conversant with the grand faulting of the Great Basin and California should take a good look at the rifting of eastern Africa and Palestine. This Willis has done under the fostering care of the Carnegie Institution of Washington, examining the rift valleys for a length in excess of 1,500 miles.

Central Africa is not only the land of high plateaus and long narrow lakes, but the place where the Congo and Nile rivers now have their origin; the country of active and recently extinct volcanoes, some with snowy tops; of much earthquake movement; of great mammalian game; of the deadly tsetse fly; and of nightly ice formation within the tropics. Amidst these interesting but frequently difficult conditions, Willis traveled more than 6,000 miles in six months, climbing volcanoes and walking twenty miles a day on safari, and all this in his seventy-second year!

"Living Africa" (living, because Africa is still growing geologically) is Willis' narrative of what he saw of the natural history, physical and organic, with accounts of the natives and the white people who helped him on his way, sprinkled with descriptions of the geological phenomena and what he thought about them from day to day. Later we are to get his technical report of the geologic structures and his final explanation of their causation. The present volume opens with "The Question" (pp. 1–15): How does the crust of the earth move?, continues with twenty-one chapters of narration (19–286), and closes with "The Answer" (287–310). It is a wonderfully interesting book, written in a clear, spirited, optimistic and humorous style, and why not, since the author was accompanied everywhere by his "Solomon"?

The Scottish geologist, J. W. Gregory, also visited the rift valleys of East Africa, first in 1892–1893 and again in 1919, and two years later published his book, "The Rift Valleys and Geology of East Africa." Willis agrees with Gregory that the Eastern or Great rift "is a crack, an effect of tension in the earth's crust," but adds, "We see the cause of tension from different points of view." The Great Rift valley of Africa is 650 miles long and from 20 to 30 miles wide; the superficial rocks are lavas and volcanoes piled upon a Precambrian crystalline basement. The Western rift is far more complex geologically than the eastern one and has a length of 850 miles. In Ruwenzori the old basement, here in the form of a wedge, has been squeezed upward through horizontal compression to 16,794 feet above sea-level, and other similarly shaped blocks have either risen or been depressed by the same forces. "The mountains said it, the rivers roared it, and the lakes acquiesced" (p. 96). It is the physiography of the plateaus, the curiously changed stream pattern, the nature of the crystalline basement on which rest the strings of volcanoes with their lava flows that guide Willis in his interpretation of the rifting and its causation.

"The recent uplift of the African plateaus and the development of the rift valleys constitute the group of facts that we have to throw against the background of the ancient history of Africa as a relatively modern expression of the forces that have created and shaped the continent since the beginning" (p. 291). These movements, in Willis' opinion, began in the late Mesozoic, and the first major upwarping, with differential movement of as much as 3,000 feet, may have taken place in the early Cenozoic. "The great western rift shows evidences of horizontal compression throughout its entire length" (p. 295). The Lake Victoria "disk" is 450 miles across, a high plateau with a saucer-like lake depression, and with margins that are upraised

mountain blocks and erupted molten masses. These marginal features are evidences of pressure exerted around the margin, pressure seemingly due to expansion of the disk.

The primary causation of all crustal movement, Willis thinks, is heat. The earth is "a heat engine, but I do not know how it works." Heat is the "tricky sprite that is forever playing with the established order of things," while the "great, primal, all-pervading force is the attraction of gravity" (p. 10). It appears, then, that the heat engine is at work when the deep-seated molten magmas rise into the thick crust or lithosphere and elevate large blocks into plateaus, while the subsequent crystallizing forces of the cooling intrusions plus gravity bring about horizontal pressure, rifting, and differential block movements.

Willis does not believe that there ever was a Gondwana continent, which foundered into oceanic depths in late Mesozoic time, making the Indian Ocean. He may be correct, but the reviewer prefers to continue his belief in theoretic Gondwana, and all the more so after reading "Radioactivity and Earth Movements" by Arthur Holmes (Trans. Geol. Soc. Glasgow, vol. 18, pt. 3, 1928–1929, pp. 559–606). Here also is to be found another hypothesis explaining rift valleys (see pp. 595–598).

The reviewer heartily recommends the reading of "Living Africa" to all geologists and graduate students in geology. The narrative illustrates how a master geologist works in the field, what he thinks about the phenomena seen, and how his conclusions change from time to time as observations increase. Students of structural geology are especially advised to study the first and last chapters in the book, so that they may learn more of the rise of certain geological theories, of the earth's primary internal forces, and of the "heat engine" of Willis. All in all, "Living Africa" is an interesting book, which stimulates thought along the line of multiple hypotheses.

CHARLES SCHUCHERT

# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## A METHOD OF STAINING THE OOCYSTS OF COCCIDIA

ALL who have worked with the coccidia are familiar with the difficulties involved in studying the internal structure of the spores inside the mature oocysts. The refractive character of these bodies is often so pronounced that it is often next to impossible to observe for a certainty the number, size and shape of the sporozoites and the nature and size of the sporocystic residual body, if one is present. A study of the internal structures of the sporozite (nucleus, refractile bodies, granules) is often out of the question—a statement attested to by the frequency with which recent authors have omitted these structures from their figures. We have stumbled onto a technique which has proved extremely useful to us in some of our researches upon the coccidia.

The fecal material from the culture is strained through a double layer of cheesecloth. The filtrate is centrifuged in ordinary pointed centrifuge tubes, the supernatant liquid drawn off, more water added, and the mixture thoroughly shaken. This process is repeated three times in order to remove as much débris as possible. After the last centrifuging, concentrated salt solution is added to the sediment in the tubes, and the mixture is again shaken and centrifuged. The oocysts come to be present in the surface film and are transferred onto a glass slide by means of a platinum loop. The drop is covered with a No. 1 cover-glass.

A few drops of glacial acetic acid are placed on one end of the slide and barely in contact with one edge of the coverslip. The salt solution is withdrawn by absorbing it with a blotter at the other edge of the cover, and the acid follows the solution through the narrow space beneath the cover. Most of the oocysts are held in place by contact with the glass above and below when the proper care is taken in applying the cover. When it is certain that all the salt solution has been replaced by the acid, the slide is warmed gently over a light bulb for five or ten minutes. The acid is not permitted to evaporate, however.

At the end of this time the glacial acetic acid beneath the cover is replaced by a fresh Janus green solution made up in the proportion of one part of the dye to a thousand parts of distilled water. The dye solution is drawn beneath the cover by means of a blotter as explained above. The dye remains for ten minutes, and at the end of this time the oocysts are thoroughly washed by drawing distilled water beneath the cover-glass. The water is replaced by a concentrated solution of eosin in water, and this dye is left for five minutes.

Then follows a washing with distilled water as before. The entire process of staining may be followed under the low power of the microscope. If all the excess water at the margins of the cover-glass is removed by blotting, the edges may be sealed with amber vaseline or glycerine jelly. The stained oocysts should be studied under the oil immersion lens.

The oocyst jelly stains red, and sometimes the