of these purposes, the committee has decided to postpone making a definite choice until a later date and it is hoped that American scientists who are interested in this proposition and who have delayed in making their contributions, will do so at an early date.

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SCIENTIFIC BOOKS

The Surface History of the Earth. By JOHN JOLY. Pp. 192, 13 plates, 11 text figures, and a colored oro-bathographical chart of the world. Oxford University Press, 1925.

IN this good-looking and fascinatingly written book, by an author with a wealth of imagination, we learn that the causes of the earth's changing surface features are (1) radioactivity, and (2) isostasy, both of which "are recognized to-day by most men of science as facts." Looking down the corridor of geologic time with the author, we see the earth's surface periodically heaving and subsiding, each cycle enduring about forty millions of years. There appear to have been about six of these great cycles, punctuated by the revolutions of Dana and LeConte.

This increasing and decreasing of the earth's radius is due to radioactive substances that in their disintegration are continually generating heat deep within the earth. This heat accumulates within the "substratum," which is essentially of basalt, until it attains the melting point. At present, this substratum is solid, and yet we are living on the surface of an "underworld lurid and tremendous." After sufficient heat has been generated to melt the substratum, Joly considers that the lighter continents, essentially of granitic rocks, float upon it. Then the pull of the moon sets up tidal action in the liquid basalt, the continents shift very slowly to the west, the oceans begin to spread more and more widely over the lands, due to the sinking of the latter deeper into the molten substratum, and, finally, the accumulated heat begins to discharge through the substratum (mainly through the oceans), which again congeals and in shrinking presses together the geosynclines into mountain ranges. In the author's own words: "At long intervals in the world's history the moon becomes the main source of those tides in the liquid substratum which enable the accumulated radioactive heat of the ages to escape harmlessly into the ocean, and life to survive from one revolution to the next."

The loss of heat from the basaltic substratum and its consequent change back to solidity take place, Joly thinks, in about five million years. Accordingly, the loss of heat is so slow as to affect appreciably neither the climate of the earth nor the temperature of the oceanic waters.

Then there comes a reversal of the previous state of affairs, the continents begin to rise, the transgressing seas vanish more and more, the rivers lengthen and flow out into the oceans, the greater and heavier oceanic depressions press against the smaller and lighter continents, and the weaker regions, the geosynclines, are pushed together into fold and overthrust mountains which accordingly take up most of the periodic shrinkage of the earth. In the equatorial belt this amounts to about forty miles. The mystery of it all "deepens when we are told that these great folding forces proceed from the ocean, and that their magnitudes are measured by the ocean span."

The average depth of the granitic continents appears to be about twenty miles, but they are thickest where most protuberant and in the ratio of 1 : 8.

The substratum is finally completely reconsolidated. "Great isostatic forces now act on the newly formed compensations, and the whole crushed and folded mass above rises yet higher. This final vertical movement is a characteristic event attending the close of orogenesis." However, the author makes it plain that "the mountains are not built by one grand compressional effort, but by successive efforts of a substratum whose volume changes fluctuate over long intervals of time."

It is well known that Professor Joly is distrustful of the widely accepted calculations of the age of the earth based on the present rates of downbreaking of the minerals uranium and thorium. This comes about because of his long and detailed studies of haloes (pleochroic rings) in micas, which "afford evidence of the remote antiquity of radioactivity in the earth, and of the former existence of yet other radioactive elements." Furthermore, the uranium responsible for the primary ring in the most ancient of these ancient haloes "decayed about fifty times faster than recent measurements indicate. . . . If the offered explanation is correct, it would follow that the chronological reliability of uranium-lead ratios diminishes with the antiquity of the rocks." On the other hand, thorium-lead ratios give much lower readings than do those of uranium-lead. "If thorium-lead ratios are trustworthy, we should divide the uranium-lead ages, as determined for very old rocks, by four." Accordingly, the author falls back on the rates of denudation and the sodium content in the oceans. "By making certain assumptions the sodium method may be stretched to 175 millions of years." He is even willing to stretch the age of the earth to something like two hundred to three hundred millions of years.

In the light of facts like these, the events of the past cease to be mysterious, and become the natural

outcome of the physical structure and the ceaseless change of the earth's mass. Eventually "the earth itself will have ceased to breathe. And the mind of Man, which alone comprehends it, will have become part of the forgotten past."

We congratulate the author on his inspired and inspiring work, and conclude with the advice that no geologist can afford not to make this book a part of his theoretic and basal knowledge.

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SPECIAL ARTICLES

THE DIFFERENTIATION OF HERPETOMONADS AND LEISHMANIAS BY BIOLOGICAL TESTS

THE question of possible insect or plant hosts of the leishmanias is one of considerable practical importance in the study of the mode of infection in kala-azar, espundia and oriental sore. The identification of leishmanias among the very large number of flagellates of the herpetomonad type which live in insects and plants is, however, difficult of accomplishment by the methods hitherto employed. A new method of attacking the problem, which promises to give more reliable results, is the comparison of the serological and carbohydrate-fermenting properties of cultures of these organisms. This method has been employed with interesting results in connection with a group of herpetomonads isolated in pure culture by the writer and Miss Tilden[1] from flies, mosquitoes, milkweeds and milkweed-feeding insects. Twelve strains were cultivated, as follows:

From latex-feeding insects:	*Oncopeltus fasciatus*	1 strain
	Lygaeus kalmii	2 strains
	Oncopeltus sp.? (Peru)[2]	1 strain
From milkweeds:	*Asclepias syriaca*	2 strains
	Asclepias nivea[3]	1 strain
From mosquitoes:	*Culex pipiens*	1 strain
	Anopheles quadrimaculatus[4]	1 strain
From flies:	*Musca domestica*	1 strain
	Calliphora sp.?	2 strains

Once obtained in culture, all the strains grew well on the semisolid "leptospira" medium, yielding within 72 hours at 26° C. a layer of heavy growth 1 cm. deep. Rabbits were immunized by repeated injections of flagellates, the layer of maximum growth being pipetted off and utilized for this purpose. The results brought out by testing the effect of the various immune sera on the individual strains were of considerable interest. Among the seven strains of flagellates of milkweeds and milkweed-feeding insects, two immunologically different species were distinguished. The two mosquito strains were serologically identical, while each of the fly strains was serologically distinct. The cultures were also compared in their effect on a number of different carbohydrates, and in these tests the same relationships and differences manifested themselves which had been demonstrated by the serological reactions.

Morphologically it was impossible to differentiate the milkweed flagellates from one another, either in the plant latices or in culture, except perhaps for slight differences in size, nor could the flagellates of the different latex-feeding bugs be separated morphologically. On the other hand, it was extremely difficult to identify the characteristic twisted, ribbon-like flagellates of the plant latex with the slenderer, more actively motile insect herpetomonads with their enormously long flagella. By means of agglutination and complement fixation tests, however, it was possible to identify as a single species strains cultivated from three insects (*Oncopeltus fasciatus, Oncopeltus sp.?* (from Peru), and *Lygaeus kalmii*), and from two plants (*Asclepias syriaca* and *A. nivea*). This organism has been named *Herpetomonas oncopelti.* By the same method this flagellate species was differentiated from another which had been isolated from a second plant of the species *Asclepias syriaca* and from another individual of the species *Lygaeus kalmii;* to the latter strain the name *H. lygaeorum* has been given. *H. oncopelti* ferments 13 carbohydrates, *H. lygaeorum* ferments only 3.

The three strains of fly flagellates showed some morphological differences, but their species entity was clearly brought out by serological and fermentation tests. The house fly strain (*H. muscidarum n. sp.*) ferments 14 carbohydrates, one Calliphora strain (*H. media n. sp.*) ferments 7, the other (*H. parva n. sp.*) ferments 6.

The herpetomonads from *Anopheles quadrimaculatus* (adult) and *Culex pipiens* (larva) were found to represent a single species. This flagellate (*H. culicidarum n. sp.*) fermented most of the 17 carbohydrates tested, including amygdalin, which was not attacked by any of the others. Serologically this organism has no relation to any other strain isolated.

Cultures of *Herpetomonas ctenocephali* and *Trypanosoma rotatorium,* which were obtained through the courtesy of Dr. E. E. Tyzzer, of Harvard University Medical School, were found to be serologically different from all the other flagellates and from the

[1] In press.

[2] Obtained through the courtesy of Dr. T. S. Battistini, of Lima, Peru.

[3] Plant presented by Dr. F. O. Holmes, of the Boyce Thompson Institute for Plant Research, who had infected it by allowing infected specimens of *Oncopeltus fasciatus* to feed on the seed pods.

[4] Material obtained through the kindness of Dr. M. F. Boyd, of Leesburg, Ga.