ment Station, Hawaiian Sugar Planters' Association, and *Councilor-ex-officio,* Dr. Chester K. Wentworth (geology), Board of Water Supply.

A CANCER INSTITUTE will be held at the Medical School of the University of Wisconsin, under the auspices of the Alumni Research Foundation, from September 7 to 9, inclusive. The general outline of the program, which will be available upon inquiry after July 1, follows: I. *Etiology of Cancer.* (A). Intrinsic Factors: Drs. Kreyberg, Oslo; Little, Bar Harbor, Me., and Macklin, London, Ont. (B) Extrinsic Factors: Drs. Allen, Columbia, Mo.; Andervont, Boston, and Murphy, New York City. II. *Cytology.* Drs. Ewing, New York City; Lewis, Baltimore, and Reimann, Philadelphia. III. *Irradiation.* Drs. Coutard, Paris, and Failla, New York City. IV. *Surgery.* Dr. Novak, Baltimore.

THIRTY exceptional students, selected from thirteen Canadian universities, have been awarded postgraduate scholarships for the year 1936–37 by the National Research Council at Ottawa. The policy of assisting exceptional students to pursue postgraduate work in Canadian universities has been followed since the inception of the council, the object being to build up in Canada a supply of well-trained scientific men capable of undertaking and carrying through any research investigations required in the promotion and development of industrial processes looking to the better or more profitable utilization of Canadian raw materials and the expansion of markets for Canadian products. Awards are of three classes: bursaries, $500; studentships, $600; fellowships, $700. The council has announced that the grants this year include two fellowships, eleven studentships and seventeen bursaries.

DISCUSSION

SUBMERGED VALLEYS ON CONTINENTAL SLOPES AND CHANGES OF SEA LEVEL

IN an article with the above title Hess and MacClintock proposed a new explanation for submarine canyons.[1] They suggested that there was a sudden change in the shape of the hydrosphere which depressed sea level in low latitudes and raised it in high latitudes and that this was followed by a reshaping of the lithosphere which brought the sea level back to normal. As a cause for such shifts they suggested, somewhat hesitantly, that there might have been a sudden change in the rate of rotation of the earth.

Probably astronomers will agree with Professor Russell (as quoted by Hess and MacClintock) that a sudden change in the rate of rotation is almost out of the question, but it is worth considering what would happen if some unknown force did suddenly decrease the rate of rotation. The hydrosphere would, of course, react first and send the water to the polar regions and away from the equator. There would be neutral lines in between, along which there would be no change in level. These would appear at about 35° north and south latitude.[2] The canyons would be cut at depths increasing from zero at the neutral lines to a maximum at the equator. Hess and MacClintock state that the facts available are compatible with the hypothesis, but they state also that canyons are found off Newfoundland, Vancouver Island and Ireland, all in latitudes well north of this neutral line.

While these authors have (as just shown) disproved their own contention there are some aspects of their arguments which need further consideration. The statement that canyons grow shallower going away from the equator is certainly a surprise to one who is familiar with the soundings of the canyons in various parts of the world. It is quite true that soundings have not revealed canyons off the Arctic coasts as yet, but this might be explained by the scarcity of soundings in those areas and might also be due to the presence of ice caps in the Arctic during the canyon-cutting episode. Canyons are found, however, at 55° latitude in Bering Sea and perhaps farther north. The deepest thoroughly authentic canyons are located around 34 to 40 degrees of latitude, including the deep canyons off California, Japan and Portugal. Hess and MacClintock based their statement of the tracing of a canyon to 14,000 feet below sea level on a survey which would not be considered adequate to any one familiar with the hydrographic work.[3] From older, more reliable soundings it seems not unlikely that the deep depressions of the Bahamas are fault troughs.

Hess and MacClintock make another statement which requires discussion. They refer to my tentative suggestion that the canyons were the result of locking of sea water in glaciers formed in polar regions, stating that the idea is impossible, since the ice would have to reach a thickness of 50,000 feet. This statement shows unfamiliarity with the idea so summarily dismissed. I have never claimed that the canyons owed their greatest depths to glacial lowering of sea level, but I have suggested that lowering of several thousand feet could have been produced by polar ice caps. For a

[1] SCIENCE, April 3, 1936, p. 332.

[2] This figure was supplied by Dr. H. R. Brahna and its correctness is affirmed by Dr. H. N. Russell.

[3] In 1932 the U. S. Navy kindly loaned the use of a submarine and tender for gravity work in the West Indies. Unfortunately the only vessels available were not equipped with adequate echo-sounding machines. As a result, while the gravity work constituted a notable contribution, the soundings were clearly unreliable.

necessary thickness for these caps I have estimated 20,000 feet, which is by no means out of the question, both in view of the thickness of the present Greenland cap and of the necessary thickness of a cap which covered Mt. Washington near its outer margin. In the near future I expect to publish considerable evidence in support of the glacial lowering as one of the factors in the production of canyons.

The paper by Hess and MacClintock represents an unfortunate tendency among scientists to jump hastily to conclusions without a careful examination of the facts of the case. New suggestions of this sort are often valuable and frequently should be set forth without too much delay, but if the authors do not have time to check the factual basis for their ideas should they not at least consult some one who is familiar with the subject?

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STELLAR DISTANCES AND THE EXPANDING UNIVERSE

I WOULD draw attention to a fallacy in the fashionable concept of an "expanding universe"; linked as it is to the older and even more widely held illusion as to stellar distances—errors due to faulty thinking.

For we can not tell the present position of any star or nebula. And thus can not tell their distances from each other or from us. So that through lack of any possible spatial relations—of expansion, contraction or relative motions of any kind—all talk of the "expansion" of the "island universes" system of nebulae, each with a "light-years" value differing by many millions of years, is folly. The "red-shift," that we tentatively interpret as a swift recession from us of this nebula at so many kilometers a second so many million years ago, and of that other at so many more kilometers a second so many more million years ago, lacks the "whole" in a common time-setting that would make such an expansion intelligible.

Obviously, a thing must exist, or be in time, before it can occupy any place in space. And thus two or more things must be contemporaneous, or coexist in the same instant, before there can be any spatial relation in that instant between them. An imaginary triangle, say, connecting the earth with two stars—one, say, 60 light-years away and the other 100—is wholly fictitious, since its three apices—the earth and the two stars—are given us in widely separated time-settings. A man in a Chevrolet motor car was driving eastward from 18th to 17th Streets, along Pennsylvania Avenue in Washington, D. C., at forty miles an hour at 10:30 A. M. of the forenoon of January 30, 1936, and another man was similarly driving a Ford westward along the same section, from 17th to 18th, at 30 miles an hour at 4 P. M. of the afternoon of August 10, 1913. How swiftly are the two cars approaching? The question is obviously meaningless. The two cars are not approaching, nor in any way spatially related, for they are not in the same time-setting.

Again, taking the distance from 17th to 18th as, say, 900 feet, you were standing, at noon of March 15, 1936, on that same section of Pennsylvania Avenue, 300 feet from the 18th Street crossing, and thus 600 feet from the 17th one. You know precisely how far you are from where the two cars were, six weeks, and 23 years previously, corresponding exactly to the "light-years" determinations for various stars. But it would be folly to assert that you were therefore 300 and 600 feet, respectively, from the two cars; or that those cars were 900 feet apart; either now, or six weeks, or 23 years ago. Quite similarly we can calculate that, say, 100 years ago a certain star was blazing at a point 100 light-years distant (or the equivalent number of miles or kilometers) from where we are now. But it is impossible to interpret this as meaning that we are that number of miles or kilometers from the said star; either now, from the point where we are at present, or 100 years ago from the unknown point where we then were.

If the heavens were static it would be permissible. But, unfortunately for our purpose, the stars and nebulae are all traveling at dizzy speeds along unknown and unpredictable paths; and each in a different direction, whereof we can merely deduce the radial component at some long past instant.

Were we to limit ourselves to our "home grounds"—the solar system—we can, in that simple "frame of reference," approximately plot, with no great difficulty, the elliptical paths of our planetary family, and thus determine our rapidly varying several positions at any given common instant, so that our distances from each other, and from our sun, can have a real meaning. But when we pass to the starry heavens as a whole, with our solar system as itself a star, all sweeping with terrific velocities along their several complicated and compounded unknown paths, there is no longer any possibility of our being able to evaluate relative positions, at some common instant, for lapsed hundreds, thousands and even millions of years. And yet unless we could, in this manner, or some other, secure relative positions at the same moment, all talk of distances is meaningless, and the popular statements as to the distances of stars and nebulae, the size of the galaxy, and especially the "expansion of the universe" as a whole, are foolish.

We can trace the origin of the blunder to the quite human error of wrongfully applying in the heavens concepts that are quite valid in the widely different terrestrial sphere. For from the dawn of life until