Letters

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zations, like some college professors, that he is afraid to declare his loyalty.

The usual argument of those who so emotionally oppose the oaths is that their personal liberties are being threatened. Just what do they think is going to happen to their precious "personal liberties" if the communists continue to win the cold war? Name calling, such as speaking of "the stale aroma of McCarthyism," is not going to help our youth face the facts. When they fulfill their military obligations they will be taking the oaths and signing the affidavits. When they do the scientific work for the government for which they are to be trained at government expense—the purpose of this act—they will be taking the oaths and signing the affidavits! If they are unwilling to do so, it is best to find out now and not waste the taxpayers' money on them.

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Science and Public Education

There appeared in the 21 November 1958 issue of *Science* [**128**, 1290 (1958)] an advance notice, as it were, of a paper on Ice Age History, which was to be presented at the December meeting of the AAAS, by Richard J. Lougee, of Clark University, Worcester, Mass. The paper was obviously fantastic in its purported new concepts of ice age history and should not have found its way into the columns of *Science* without being referred to a geological authority. The claim that was made in the first paragraph, "that abundant new data have been collected at the department of geography of Clark University during the present International Geophysical Year" should have been enough to "flag" attention.

It did attract the attention of public-relations people, for press bureaus were waiting for the presentation of the paper to broadcast what they seem to have regarded as new vibrant scientific thoughts. Early the following week I arrived on the Pacific Coast and, in due time, friends handed me a clipping of a news article which had been taken from the Los Angeles *Times* of 27 December 1958, bearing a Washington date line of 26 December and prominently headed, "New Theory of Ice Age Presented." It contained the following lead: "A revolutionary new concept of the Ice Age today depicted one great glacier that temporarily buckled the upper United States to great depths."

Papers all over the country carried write-ups. The Washington *Post* of 27 December listed the paper on its front page as the number one feature of "yesterday's events in the sessions of the American Association for the Advancement of Science." The paper also carried on its first page an account written by a research professor of physics and a consultant to the National Science Foundation. In that, the physicist reported, "The theory demands a change in glaciological thinking as radical as that caused by Copernicus' theory that the earth is not the center of the universe."

Surely the prodigious labors of Chamberlin, Geikie, Leverett, and other pioneers of glacial geology and of the scores of workers today who have helped to build a formidable literature of monographs, professional papers, bulletins, and journal articles, confirming over and over again the verity of the doctrine of multiple glaciation, cannot be set aside by a writer's flight of imagination or by venturesome commentators.

It is evident that there is dire need for public education in science, but to be worth while, science must make its guidance effective. Specialization in geology has developed to such a degree that the untenability of the views entertained by Lougee would not necessarily be sensed by all geologists, let alone other scientists, and this emphasizes the need for correct handling.

It is my feeling that a disservice has been rendered to education and that the time has come for careful consideration of these matters.

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Leighton rightly says "the time has come for careful consideration of these matters." They attracted my attention in 1927 when, with Stuart Weller and L. C. Conant, I first observed iceberg-dropped Canadian granite erratics at Ozora, Mo.; last summer state geologist Sigurd Hansen of Denmark and I traced them northward into the Dakotas to elevations a thousand feet higher, at Pierre and Bismarck.

In 1954, Hansen and I mutually confided our belief that there is some basic misinterpretation of Ice Age history which is preventing normal correlations across the Atlantic, or even over short distances. Antevs estimates, from his studies of varved clay, that twice as much time has elapsed since the Ice Age as others have claimed on the basis of carbon-14 dates on supposed tills in the Middle West. To a few American geomorphologists, the glacial history of the Middle West and its "formidable literature" have long been suspect.

The trouble started in the days of Chamberlin, Geikie, and Leverett, in failure to recognize that certain widespread stony clays—which looked like bedded tills and sometimes contained perfectly preserved shells and black layers of organic matter—were deposits dropped by icebergs floating in open water, in the manner claimed by Sir Charles Lyell. Marine shelly drift of this sort reaches high elevations in British Columbia, as described and illustrated by J. E. Armstrong, and I have observed it blanketing portions of coastal Denmark, Sweden, Norway, and the British Isles, far above younger Yoldia shorelines.

On 29 April 1959, at the Naturalists' Forum of the Philadelphia Academy of Natural Sciences, I proposed the name "lyell" for these water-laid deposits, to distinguish them from till, which is spread by land ice. My type example of lyell is the Kansan-Illinoian complex, overspreading a true till, "Nebraskan," known to the north as "Wisconsin." It is apparent that many so-called tills on this continent—such as "Jersian," "Iowan," "Valders," "Toronto," "Cochrane", and "Vashon"—are lyells.

Twenty-five years ago I was instrumental in preventing a mass movement in geological thought toward a concept that claimed no unwarping in New England and retreat of thin stagnant ice from *north* to *south*! Using the clay-measuring and surveying techniques of DeGeer and J. W. Goldthwait, I found that the elevations of delta deposits, rising northward, show a history of immense crustal depression followed by intermittent upwarping as thick live ice melted away from *south* to *north*.

In the course of many years' association and field work with Leverett, Taylor, Upham, Hubbard, and D. H. Chapman, I found in the East that the earliest and greatest upwarping movement, "Hubbard uplift," commenced after 2000 years' crustal stability of Lake Hackensack and was followed in turn by 4000 years' stability of Lake Hitchcock, the latter coinciding with Maumee-Whittlesey stability in Great Lakes history. The discovery localities for Hubbard uplift are in Connecticut, but this uplift has now been impressively demonstrated in the Middle West, where the widespread submergence that preceded it has been mistaken for "multiple glaciations."

It is not my intention to combat all claims of multiple glaciations regardless of the region under consideration, but I hope to show that such claims are completely groundless in the classic localities in the Mississippi basin.

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