IS THE KILLARNEY GRANITE DIFFERENT IN AGE FROM THE ALGOMAN?

IN a recent address[1] entitled "Certain Aspects of Geologic Classifications and Correlations" Professor Rollin T. Chamberlin makes two statements in his discussion of pre-Cambrian correlations, which interest me as a rather sweeping expression of a theory which is important if true, but which is contradicted by some easily observable facts. He says: "For a given province, such as the southern margin of the Canadian Shield, or at least important portions of it, the granite method of classifying rock systems is theoretically sound. In this particular province the three granites of widely different ages, the Laurentian, Algoman and Killarney, are practically and potentially of great assistance in unravelling and delimiting the pre-Cambrian systems." Again: "From geologic evidence, the Laurentian, Algoman and Killarney granites appear to be so different in age that radioactive age determinations should distinguish between them."

The important matter in these statements is the recognition without question or doubt of the Killarney granite as distinct from the Algoman. The proponents of this view regard the Killarney granite as of Keweenawan or post-Keweenawan age. Counter to this belief are the facts that a herd of olivine diabase dykes, presumably Keweenawan in age, cut the Killarney granite, and that north of Sault Ste. Marie the lavas of the Keweenawan were poured out on the deeply eroded surface of the Killarney granite. In view of these facts, set forth in my paper on "Some Huronian Problems,"[2] it is somewhat surprising to see in textbooks and authoritative reviews like Chamberlin's dogmatic statements of the distinction between the Killarney and Algoman granite. In so far as I have been able to discover in the field and in the literature of the subject the Killarney granite is the Algoman granite; and it would be of interest if the "geologic evidence" as to their difference in age to which Professor Chamberlin refers might be set forth so that, if necessary, it might be checked up in the field.

ANDREW C. LAWSON
UNIVERSITY OF CALIFORNIA

GINKGO

RECENT news reports of monoecious growth in a century-old Ginkgo near Philadelphia can not be trusted direct. Could such a phenomenon result from injury instead of earlier unknown grafting? Possibly the most extraordinary anomaly in Ginkgo is a growth of microsporangia directly on the foliage leaves, "usually near their bases." This appears to be a true recessiveness, recalling an older seed fern condition, precedent even to the Cordaites. But evidence bearing on the morphologic as well as physiologic nature of sex in the seed plants is much wanted, and discussion must long fall short of final analysis. We must long search and search through the rocks and the forests before the origin of the conifers and their relationship to the Cordaites and flowering cycads can be better discerned.

In a few weeks (early May) the Ginkgo tree will blossom. For any fruit of a seed plant—dicot, monocot or gymnosperm—begins as a "blossom" or in an absolute sense a "flower." Though not alone in common usage but by definition a "flowering plant" means a higher seed plant which has advanced far toward a relative specialization of stem and foliar structure and which may bear round its fertile organs an inclosing husk of large and beautiful vari-colored cataphylls, soon wilting away or sometimes fusing into the mature fruit. Essentially, however, the flower is an axial prolongation beyond the series of modified protecting foliar organs consisting in a subtending cyclic or spirally set series of microsporophylls or stamens, as followed by a terminal megasporophyll or series of such, but with the seeds always inclosed—the angiospermous condition. Since, however, these seeds are inclosed within the megasporophylls which may bear many seeds or but one, and may be single or numerous and either cyclic or spirally set, flowers so readily assume an infinite variety of form, size and color. The much modified foliar structures characteristically bear the nectaries haunted by insect and bird. Where flowers are *unisexual* the implication is that they were once *bisexual*—in fairly recent geologic time, "complete," "perfect," *hermaphrodite*. While in the foliar fusion about the ovule and fruit there is seen a late reflex of the far simpler course of growth and fusion which at least as far back as Devonian times resulted in the large seeds of Pteridosperms and Cordaites, often with heavy bundle-supplied integuments. In this sense there is a fundamental analogy between seed and flower.

Nevertheless, by some strange ratiocination the simpler forms of sex-perfect flowers seem to have been long regarded by geologists as being little older than Cretaceous time. And this deception long found its way into botany, despite the presence of the vestigial flowers of Gnetaleans, and obvious reasons for the failure of a fossil floral record in the Permian and older Mesozoic rocks. Could the evidence in view be taken so superficially, accepted so directly? As apposed to the ordinary or higher types of flowers, the "cones" of the conifers differ mainly in a uniform unisexuality, with much fusion of parts and a high

[1] SCIENCE, February 22 and March 1, 1935.
[2] *Bull.* G. S. A., Vol. 40, pp. 361–384, 1929.

degree of sclerotization and persistence, easily leading to fossilization. Hence not alone the fossil record, but cone structures and old types must be far more closely scanned before it is assumed that cones are older than flowers. Where then may sporophyll fusion and sex variation of an instructive form be first expected? Certainly in Ginkgo, perhaps even more primitive than the cycads, although the reverse view has been commonly held. Both are in fact very primitive, considering the lengthening out of geologic time; but we see neither until after the organization of unisexual cones, and the cycads are much out of the easy observation range.

Ginkgo, if not even recessive, is but little in advance of the Cordaites, and like them bears long-stalked seeds tending to run into bunches of three to five with much fusion, the normal number being two. These bunches appear sparsely grouped on the somewhat persistent short or spur shoots. They are hence seen in an open or sub-inflorescent stage. The same is true of the staminate cones. The conditions appear simpler than in conifers, and one of the first questions any one who has the opportunity to see Ginkgo in free fruiting may seek to answer is whether abnormal bisexual axes of any kind may ever occur as in conifers. For while botanists have seemed even to prescribe the possibility of varied types of ancient flowers, a trend of change from separate to united sexes has not once been proven in all the range of seed plants. Uniformly late separation of the sexes affords the first explanation of dioecism and usually also of monoecism. Though what actually constitutes separateness of sex in a tree as compared with an animal is very little seen or understood.

G. R. WIELAND

CARNEGIE INSTITUTION

SCIENTIFIC BOOKS

THE ICE AGE

The Changing World of the Ice Age. By REGINALD A. DALY. Yale University Press. Large octavo. 271 + xxii pages, 149 figures. $5.00.

DARWIN, Dana, Davis, Daly—delvers in the deep and doughty disputants! In this book the century-old problem of the genesis of coral reefs has its latest serious discussion; but not its last.

The debated subject is an excellent example of changing theory with increase of knowledge. When Charles Darwin brought the romantic topic of coral islands to public attention glacial science was yet unborn. And when, toward half a century later, James D. Dana revived scientific interest by his charming work on "Corals and Coral Islands" the fact that sea levels had been effectively changed, up and down, by the waxing and waning of the Pleistocene ice-sheets was not clearly recognized. But now pelagic science is involved with glaciology, and the latter closely with geophysics.

Darwin believed that the relation of coral growth and the building of barrier reefs and atolls implied submergence. Deepening of the ocean basins with subsidence of the reef-bearing floors was the simple and fully satisfactory explanation. This was accepted and emphasized by Dana and recently amplified by Davis. But they were in error in attributing the vertical oceanic-surface movement entirely, or even largely, to diastrophic movements of the earth's crust. The important factor in the shifting of sea level in later or Pleistocene time was the transfer of water between sea and land by the production and the destruction of the continental ice-sheets.

The "Glacial Control" theory has for more than twenty years been championed by Professor Daly. A student of glaciology and geophysics, he has traveled widely, studied the coral reefs at first hand, and with his active imagination and boldness in presentation of new views he has, by numerous writings, become the apostle of the later theory. A word of exposition is desirable.

The mass or volume of the two great existing ice caps, Antarctica and Greenland, is fairly estimated. The melting of those ice fields and the return of the water to the sea would lift the ocean surface by about 164 feet. During the recent Ice Age or Pleistocene vast areas of Europe and North America were deeply covered by solid water abstracted from the sea, and sufficient in volume to lower the ocean surface about 345 feet, in careful estimate. Taking into the account the involved diastrophic factor, the deformation of the globe by shifting of loads, Daly estimates an actual lowering of relative sea level of 90 meters or 295 feet. The final melting of the ice caps, a few tens of thousands of years ago, returned the borrowed water to the sea and lifted the ocean surface to practically its present position.

Whatever were the changes in glaciation and deglaciation of the lands during the Ice Age it is now apparent that the volume of the ocean was correspondingly altered. For clearer presentation of his theory the author groups the four generally recognized glacial stages into two major periods, with a long intermediate stage of deglaciation (interglacial) with