cus Hook but only about 250 ppm at Philadelphia-Camden Bridge.

From a sanitary viewpoint, the quality of the river water improved during this period; the number of samples with low dissolved oxygen has decreased. However, the water contains less dissolved oxygen as it flows downstream, indicating that oxygen is being consumed by oxidizable matter. From Philadelphia downstream, there are periods, particularly in the late summer, when dissolved oxygen is barely sufficient to meet the oxygen demands of the pollution load.

Maximum water temperatures are observed in July and August; the highest observed was 88°F. The minimum temperature observed, in January, was 32°F. There is practically no difference in temperature of the river from shore to shore and usually is within 1°F from top to bottom.

C. N. Durfor
W. B. Keighton

U.S. Geological Survey, Philadelphia, Pennsylvania

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The Chemical Quality of Surface Waters in Devils Lake Basin, North Dakota

For many years the decline in level of Devils Lake in northeastern North Dakota has been a matter of concern. Once a popular resort area in the state, the total area of lake surface had shrunk from about 90,000 acres in 1867 to about 6500 acres in 1940, and had become a shallow body of stagnant, brackish water, unsuited for game fish. A plan of the Department of Interior related to the utilization of Missouri Basin waters includes a proposal to restore Devils Lake to a higher level by indirect diversion of Missouri River water.

The investigations by the Geological Survey of the quality of water in Devils Lake basin from November 1948 to December 1952 included the following considerations: the present salt concentration and properties of lake waters; the extent to which salinity of the waters could be reduced by inflow of fresh water from outside the basin; the volume of inflow and outflow that would be required to maintain tolerable salt concentrations; and properties of the inflow waters.

Scattered records from 1899 to 1923 and more comprehensive data from 1948 to 1952 show a range of salt concentration from 6130 parts per million (ppm) to 25,000 ppm in Devils Lake water. Although the concentration has varied, the composition of dissolved solids has not changed appreciably. Lake waters are more concentrated in the lower part of the basin; for periods of record, the salt concentration ranged from 19,000 to 106,000 ppm in East Stump Lake. The computations show that the probable minimum and maximum concentrations to be eventually reached at lake level 1425 ft are 600 to 1050 ppm for Devils Lake and 690 to 1500 ppm for Stump Lakes. The amounts of dissolved solids in all lakes might total as much as 8 million tons before water is released in the Cheyenne River. It was also observed that because many waterways in this basin have no surface outlets at normal stages, runoff collects in depressions, is concentrated by evaporation, and forms saline or alkaline lakes.

During several years of average precipitation, temperature, and evaporation, Devils Lake and lakes upstream should receive nearly a quarter of an inch of runoff annually from the drainage area of about 300 mi^2. However, the amount of runoff in the basin and the amount retained in upstream lakes varies greatly from year to year; therefore, annual inflow to Devils Lake is extremely variable.

H. A. Swenson
B. R. Colby

U.S. Geological Survey, Lincoln, Nebraska

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Modification of the Glacial Chronology of the San Juan Mountains, Colorado

Atwood and Mather (*1*) recognized till of three different ages in the San Juan Mountains of Colorado: the Cerro, of pre-Wisconsin age, the Durango, now believed of early Wisconsin age, and the Wisconsin, now believed of late Wisconsin age. Remapping in the drainage of the East Fork of Dallas Creek, west of Ridgeway, suggests that Atwood and Mather's Durango and Wisconsin tills each represent two glacial advances, and that deposits of two still younger glaciations lie in the cirque heads.

In the area examined, the Cerro till is about 400 ft thick. Its position on an isolated divide, about 1000 ft above the creek, and its very strongly developed profile of weathering are the basis of its correlation by Mather and Atwood with the deposits of the Buffalo stage of Wyoming.

The Durango till comprises two sets of well-developed lateral and partly preserved terminal moraines, each with associated outwash deposits. The outer terminal lies at an altitude of about 7900 ft; the inner at about 8000 ft. Deposits associated with the inner moraine trench the outer moraine in such a way as to suggest that the moraines represent two advances of the ice separated by an interval of erosion. The moraines may, therefore, be considered as upper and lower units of the Durango till and are here correlated with deposits of the first and second advances of the Bull Lake stage of Wyoming (*2*), which I believe to be of Iowan and Tazewell ages.

The Durango till has a relatively strongly developed soil profile that is locally overlain by deposits associated with the next glacial advance. The profile is less well developed than that on the Cerro till but is more mature than soil profiles on younger tills. It is believed equivalent to the Brady soil of Nebraska.

Atwood and Mather's Wisconsin till also comprises two distinct terminal moraines, separated by an interval of erosion. The outer moraine lies at an altitude of 9100 ft, the inner at 9350 ft. They appear to represent separate advances of the ice and may be considered as upper and lower units of this till. I correlate them with deposits of the first and second advances of the Pinedale stage of Wyoming (*2*), which I believe to be of Cary and Mankato ages.

Both moraines of Atwood and Mather's Wisconsin till have a moderately developed soil profile that is locally overlain or truncated by younger deposits. It is believed to have formed during the "altithermal" interval.

Deposits of two even younger glacial advances, not recognized by Atwood and Mather, are found in all the cirques in the Dallas Creek drainage. The older is typified by a bouldery moraine on the lip of the cirque northeast of Mount Sneffels at an altitude of 11,300 ft. The moraine is trenched about 20 ft by the stream. The soil profile on the till is thin, azonal, and very weakly developed as compared with that on adjacent till of late Wisconsin age. It supports scrub spruce and grass. Overlapping this moraine is a younger, large and well-formed rock glacier, which I believe to be of glacial origin and to have formed during the latest glacial episode. This and other rock glaciers in the region were mapped by Atwood and Mather but were considered of landslide origin. The deposit appears stagnant and supports some lichen, though no soil profile is developed on fine-grained till exposed at its surface. It grades into active talus at the cirque headwall. The deposits of these two youngest glacial episodes are both of Recent age, and are both included in the "little ice age" of Matthes (*3*). Deposits of the older advance are correlated with those of Hack's Temple Lake stage of Wyoming (*4, 5*), which I consider of post-"altithermal" Recent age. Deposits of the younger advance formed during the latest glacial episode from about A.D. 1640 to 1860. Reconnaissance shows that this glacial succession is widespread throughout the San Juan Mountains.

GERALD M. RICHMOND

U.S. Geological Survey
Denver Federal Center, Denver, Colorado

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On the Growth of Root Hairs

In a recent article on the growth and osmotic conditions of root hairs, Ivar Ekdahl (*1*) rejects my views and formulates a new hypothesis concerning the growth of these structures. Because of the fundamental importance of the problem, it seems that a comment on Ekdahl's article is in order.

At the end of a long series of experiments I (*2, 3*) concluded that the root-hair wall consists of cellulose and calcium pectate continuous with corresponding layers in the hair-forming cell. The presence of calcium pectate in the maturing hair walls renders them harder and less subject to distortion. During growth, the wall of the root-hair tip remains active and more yielding than that of the sides, and hardening is brought about by the gradual formation of calcium pectates from the tip of the hair to the base. The progressive hardening of the pectic layer confines this softer spot to a narrow area at the growing tip where new wall material is being constantly laid down, and this determines the narrow diameter of the full-grown hair.

Ekdahl explains the hardening of the growing root-hair wall in another way. He stresses the importance of pectic substances at the root-hair tip but ignores them entirely in the hardening process. In his opinion, "the hardening of the wall from the very tip to the sides may . . . take place through a gradual formation of cellulose strands, which are first dispersed, but, as the wall is thickened and matured, will be oriented in the direction of the long axis of the hairs." In rejecting the calcification theory of root-hair growth, he offers the hypothesis that elongation is brought about by the continuous softening of the growing apical wall by action of pectic and cellulosic enzymes.

The evidence marshalled by Ekdall in support of his hypothesis does not withstand critical examination. His chief argument in opposition to the formation of calcium pectates in the maturing hair wall is that little change in the rate of root-hair elongation took place within a wide range of calcium-ion concentration in the external medium. This observation, based on the rate of root-hair growth, is no proof that calcification did not occur. The *rapidity* with which root hairs elongate depends entirely on other factors and has no place in the argument.

Ekdahl's other argument, that root hairs develop vigorously in moist air where no external calcium supply is available, lacks creditability also. There is no evidence that root hairs grow any differently in moist air than they do in an aqueous medium, or that there is any difference in their cell walls (*2, 3*). In moist air, the calcium for cell-wall formation comes from that originally stored in the seed. A little calcium under moist-air conditions could go a long way in affecting the necessary linkages for the production of calcium pectates. Experiments *in vitro* with pure pectic acid (*2*) showed that there are weakly and strongly calcified pectates; and the more recent work on the chemistry of pectic substances reviewed by Ekdahl (*1*) serves to strengthen this opinion.

In discussing my calcification theory, Ekdahl makes no attempt to explain the fact that anything that prevents gradual calcification (whether ammonium oxalate, excessive acidity, or excessive alkalinity) also prevents the development of root hairs, at the same time bringing about the exact results one can foretell, assuming this hypothesis to be correct (*2, 3*). Neither does he take into account the marked cessation of abnormalities and the sudden burst of long, straight hairs that occurs when roots grown in ammonium oxalate solutions are transferred to a calcium solution (*2*).

Recent experimental findings by Dale (*4*) on root hairs, Facey (*5*) on leaf abscission, Weintraub (*6*) on leaf movement, Northcraft (*7*) and Anderson (*8*) on the separation of free-living cells, and Burström (*9*) on calcium as a growth factor emphasize the importance of calcium as a cell-wall constituent. This fresh evidence and the frailty of Ekdahl's supporting argu-