calling it a 'jacobi,' as all derived units should be related to the fundamental units of length, mass, and time, through simple, decimal ratios.

There is danger, in fact, of the simple elegance of the absolute system being destroyed by excessive ornamentation; and it is well enough to make haste slowly in adding to what has already been done.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Paleontology. — Prof. H. S. Williams, from his preliminary study of the specimens he collected during last season in Genesee and Wyoming counties, N.Y., from the Genesee slate and Portage formations, reaches some interesting conclusions. He is convinced that the black shales which appear in the lower Portage of this region, and continue to appear as thin zones up to a point just below the Portage sandstones, represent merely an interrupted continuation of the deposits called the Genesee slates. After the typical Genesee slate was deposited to some considerable thickness, the Portage fauna made its appearance in the soft, blue, argillaceous shales. A hundred feet higher another black shale appears of several feet thickness, and then olive shales come in; and for several hundred feet this alternation continues, the black shales becoming thinner with each repetition, and containing an increasing amount of impurity, siliceous and argillaceous, so that in the upper part there are only dark-gray bands or streaks of the olive shales, with fine paper-like layers of black. The earlier Portage black slates bear the same fauna as the Genesee, but the specimens are fewer. Although these black slates are interstratified with the olive shales, they do not contain the Portage fauna. It is confined to the olive layers, and, higher up, to the bluish argillaceous shales. Near the top of the Portage series the sandstones come in. They are of a light-gray color, and are generally calcareous. They frequently have a petroleum-like odor. With them the Chemung fauna is associated. The lowest observed appearance of that fauna was in Java township, Wyoming county, in the first of the gray sands lying just above the last-observed black zone, which was bituminous.

Professor Williams also says that some interesting features have been revealed by the study of a large series of specimens of Spirifera mesocostalis Hall. In the representatives of the species from the upper Devonian, there is a well-developed median septum in the ventral valve, as in the genus Spiriferina; but the punctate character of the shell of that genus has not been observed in any of the specimens. The lower forms, at its first appearance in the Ithaca group, very rarely show any trace of the septum. As far as Professor Williams's examination has gone, he finds that the median septum is more fully developed and more generally present, the higher up the specimens are found. In harmony with this observation is the reference, by Mr. Whitfield, of a similar specimen from Wisconsin (Geol. Wisconsin, iv. 332) to Spiriferina under the name of Spiriferina (?) ziczac.

STATE INSTITUTIONS.

New-York state survey.

Rainfall of western New York. — To ascertain how much water is likely in different seasons to flow off of the surrounding watershed into Oak-Orchard Swamp, it was necessary to study with great care the rainfall of the western part of the state for the past fifty years. A careful analysis was therefore made of observations taken at Rochester university since 1830, and by the U. S. signal-service at Buffalo and Rochester since 1870. The result of this discussion of the Rochester rainfall is quite remarkable. It is shown, that from 1830 to 1880, during the very period when the woods were being cut off from the western part of the state, the rainfall steadily increased from a mean annual precipitation of 27.7 inches to 38 inches. The average was 34 inches. From 1868 to 1881 inclusive, there was the greatest average rainfall known for a similar period in that locality: it was 38.73 inches. The greatest recorded monthly, daily, and spring rainfalls occurred between 1870 and 1880. This decennial period is therefore a safe one from which to estimate maximum amounts of water likely to be discharged from watersheds in the western parts of the state; but towns whose future water-supply is estimated from the amounts received into lakes or streams since 1868 may find themselves very short of water, if the mean annual precipitation should decrease to that of the period from 1830 to 1840. Long periods of small average rainfall will doubtless recur in the region near Lake Ontario. The city of Rochester should be prepared for a time when, for ten years, the average yield of water from its present source of supply, the basin of Hemlock Lake, may amount to only three-quarters of the average flow from 1868 to 1881.

Quantity of water evaporated from various watersheds. — While the mean rainfall of this region has increased during the past fifty years, the summer flow of the streams has greatly diminished. This is due partly to the loss of retaining-power in the ground, owing to the removal of the soft forest mould, which in former times readily absorbed the rain and melting snows, and so prevented these invaluable waters from rushing off and wasting themselves in destructive floods, and partly to the enormous increase in evaporation. The proportion of rainfall, which, owing to evaporation, is lost for use in springs, lakes, and streams, is known to but few. In the special

report will be found a collection of observations on evaporation in this country and Europe. They show that large rivers receive in the main channels seldom more than one quarter of the average amount that falls on their watersheds. The remaining three quarters is evaporated. On small watersheds the proportion of loss from evaporation is small. The average flow into Croton Lake is about fifty per cent of the average rainfall on the gathering-ground, the area of which is 339 square miles.

The amount of water flowing from Cochituate Lake watershed, of 18.75 square miles, is, on the average, forty-five per cent of that which falls; but the proportion varies greatly from year to year. In 1866 only twenty-five per cent of the rainfall flowed into the lake; while in 1857, with almost the same rainfall, seventy-four per cent of the precipitation entered the lake. The difference in the amount evaporated in 1866 over that of 1857 was equivalent to a depth of thirty inches of water over the whole gathering-ground. Experiments made in Denmark and England show that the mean annual evaporation from soil and grass land is from twenty-six to thirty inches, or from fifty-six to sixty-seven per cent of the rainfall. The tables of rainfall and flow of the Sudbury River and Cochituate Lake show, also, that the summer evaporation amounts to eighty per cent of the rainfall on these basins; and that in March and April all the rainfall may flow off, together with a large amount of water from melting snow accumulated during the winter. The Sudbury River tables show that on this watershed the loss of water by evaporation between May and December is from three to four times the quantity lost in spring floods.

Effect of woods on the flow of streams. — The facts given prove that evaporation from the ground is the most effective cause controlling the summer and autumn flow in our streams: therefore whatever tends to retard evaporation will increase the summer flow of springs and streams. The great promoters of evaporation are heat, dryness of atmosphere, and wind. Woods, especially when the trees are large, act in three ways to prevent evaporation from the ground: they keep the surface cool, the atmosphere moist, and the lower stratum of air so still that the powerful drying-action of the winds is felt comparatively little. The amount of water which will be lost from any watershed by the removal of the woods must depend on the steepness of its slopes, the character and depth of soil, and the nature of the underlying rocks.

The greater part of the basin of the west branch of the Croton River is wooded. Its area is about twenty square miles. It yielded for four years an average flow of sixty-three per cent of the rainfall. The mean precipitation was 50 inches. The yearly evaporation was as follows: 15 inches, 11 inches, 23.6 inches, 15 inches. The Sudbury River basin in Massachusetts, containing seventy-eight square miles, is wooded over only from one-sixth to one-eighth of its area. From 1875 to 1879 inclusive, the mean annual rainfall was 47.7 inches, and the amounts of water lost, principally by evaporation, were 25 inches, 26 inches, 19 inches, 27 inches, 23 inches. The Cochituate basin is only partially wooded. Its average rainfall, 50 inches, is about the same as the West Croton and the Sudbury. The average yearly loss from the watershed is 27 inches, while in certain cases the evaporation alone must have exceeded 35 inches. The West Croton appears to yield in its flow some eighteen per cent more of the rainfall than the other watersheds mentioned; but the dissimilarity in their topography and geology makes it impossible to say how large a part the woods play in the differences of flow. Yet the result bears out the ordinary rule deduced from observations taken in Europe, that the average flow in streams draining wooded and swampy basins will be from sixty to eighty per cent of the mean rainfall, while those draining watersheds of undulating pasture and woodland generally receive into the main channel only from fifty to seventy per cent of the mean rainfall. Should the rule prove applicable in this country, the average increase of evaporation by the removal of woods from a district may amount to ten per cent of the annual rainfall. This loss will occur mainly in summer and autumn, so that the flow during this season will be diminished in far greater ratio.

With almost equal rainfalls (22.5 and 20 inches), more than two and a half times as much water (8.3 inches) flows from the wooded basin of the West Croton as is discharged from the comparatively unwooded watershed of the Sudbury River (2.9 inches) between June 1 and Nov. 1. During the remainder of the year the discharge from these two watersheds is almost the same. These results, being deduced from only four years of observation, would be modified by further measurement. The great difference in the flow from these two basins, since it is shown to occur between June and October, is undoubtedly due to a difference in the amount of water evaporated; and this is only partly accounted for by differences of topography and soil. The woods are surely playing an important part in maintaining the summer flow of the West Croton. Cutting them off might easily reduce the summer and autumn flow twenty-five per cent. While it must be understood that the facts are too limited to base any final results upon them, yet they indicate the probability that the summer and autumn flow of streams may be reduced in volume twenty-five per cent by cutting off the woods from their watersheds. If the summer and autumn flows in the upper Hudson, the Mohawk, and the Black Rivers, were lessened twenty-five per cent from their present average volume, the navigation of the Hudson and the canal would be doubtful; and certainly the loss in hydraulic power for manufacturing-purposes would be very great. While the people of New-York City are wisely taking an active interest in the protection of the northern forest, they should not forget that the preservation of the woods on the Croton watershed is of great importance in maintaining the summer water-supply of New York.